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HYDRODYNAMIC AND HYDROCHEMICAL INVESTIGATION OF THE TRANSBOUNDARY AQUIFER SYSTEM IN PRESPA – OHRID WATERSHED

DISSERATION THESIS

THESSALONIKI
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Declaration of Authorship

I, Emanuela KIRI, declare that this thesis titled, “HYDRODYNAMIC AND HYDROCHEMICAL INVESTIGATION OF THE TRANSBOUNDARY AQUIFER SYSTEM IN PRESPA – OHRID WATERSHED” and the work presented in it are my own. Specifically, I confirm that:

• This work was done wholly or mainly while in candidature for a research degree at Aristotle University of Thessaloniki.

• Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.

• Where I have consulted the published work of others, this is always clearly attributed.

• Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.

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ABSTRACT

Ohrid and Prespa lakes transboundary aquifer is shared by Albania, Greece and North Macedonia. These lakes are among the oldest lakes in the world, with tectonic origin, belonging to the Pliocene epoch or upper Miocene. These two lakes have interested specialists for a long time.

Hydrodynamic and hydrochemical investigation leads to the scope of these surveys, directed towards understanding factors that can cause the Prespa Lake's water table decreasing to the lowest levels known in recent years. The hydraulic connection has always existed between these two lakes. Water movement changes that occurred in this watershed, led to the necessity of detailed hydrogeological studies, along with other science.

In order to draw a scientific conclusion about hydrodynamic and hydrochemistry of the water in this transboundary aquifer, an interaction among different sciences like: hydrogeology, geology, geophysics and hydrochemistry was required.

Ohrid and Prespa lakes regions construct the transboundary aquifer system. From a hydrogeological point of view they are very heterogeneous, forming different hydrogeological complexes.

So, this material was mostly handled among other geophysical methods (resistance and shallow seismic), and hydrochemical methods with Stiff diagrams construction and ionic ratio evaluations. The results of the analysis of both sciences mentioned above were very significant. As predicted, the water flow from Prespa Lake toward Ohrid Lake was dynamic not only during the dry period of time, as it was expected, but even during the wet period of the hydrologic year as well. The statistical analysis (Factor and Cluster analyses) were used to support the above mentioned researcher.

One of the main application fields of stable isotope abundance was concerned with the origin and mixing of groundwater. In order to support the idea of the water supply's origin in this region, the stable isotopes (δD and $\delta^{18}O$) in the water are also applied in this research. Stable isotopes analysis supports the results of the geophysics and hydrochemistry sciences.

In conclusion, the hydrodynamic and hydrochemical investigation of the transboundary aquifer Ohrid and Prespa Lakes brings new data and results, which appear to be significant from the hydrogeological point of view. This process is impossible to eliminate, but it can be decelerated. The bad impact will be very soon reflected in many aspects of life in this region, especially in the economy. Finally, based on results of SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis, a set of measures and recommendations are proposed for the sustainability of the transboundary aquifer and dependent ecosystems under climatic changes.

Future research should investigate in detail the climate changes and its impact on this area. This can be achieved by monitoring the water balance of the transboundary aquifer Ohrid and Prespa Lakes.

The hydrogeological map construction, in the GIS program, associated with a database (Appendix A and Appendix B), was one important achievement which helped represent the final product of all the work done. In this database general hydrogeological and chemical data are given. The map was built at scale 1:50,000 and attached to the material.

The Appendix C and Appendix D contain climatic daily data of the Ohrid Region, level of the Big Prespa Lake and Ohrid Lake and Tushemisht Spring quantity of the last 10 years.

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First and foremost, I would like to express my gratitude to my advisor Prof. Konstantinos Voudouris for the continuous support of my Ph.D. study and related research, for his patience, motivation and immense knowledge. His guidance helped me in all the time of research and righting of this thesis. He suggested many important additions and improvements. It has been a great enriching experience for me to work under his supervision.

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I am grateful and honored to be part and study in the Aristotle University. A special thanks to Prof. Gregory Tsokas for helping me to become a part of this.

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Symbols and Abbreviations

ALB	Albania
N M	North Macedonia
GRE	Greece
AutoCAD	Program used for hydrogeologic map digitized
GIS	Geographic Information System
HG	Hydrogeology
ETR	Electrical Resistivity Tomography
GPR	Ground Penetrating Radar
EM	Electromagnetic
L	Litre
%	Percent
a.s.l.	Above sea level
$L/s/km^2$	Litre per second per square kilometer
q	Specific discharge e.g. [$l/km^2/y$]
Q	Discharge [m^3/s]
WQ	Water quality

Geological age

N_2-Q_1 -	Deposits of Upper Pliocene – Ancient Quaternary
Q_4 -	Deposits of today's Quaternary
Q_4al -	Alluvial
Q_4al -	Prolluvial
Q_4kl -	Colluvial
N_1 -	Deposits of lower Miocene
N_1^1a -	Akuitanian
N_1^1b -	Burdigalian

N_2p -	Deposits of Pliocene
Pg_3^3 -	Upper Oligocene
Pg_2^2 -	Middle Eocene
Pg_3^2 -	Middle Oligocene
Cr_2 -	Upper Cretaceous
J_3t – Cr_1 -	Tithonian – Lower Cretaceous
J -	Jurassic
J_1 -	Lower Jurassic
J_{2-3} -	Upper and Middle Jurassic
T_3-J_1 -	Upper Triassic – Lower Jurassic
T_2 -	Middle Triassic
C-P-T_1 -	Cambrian-Permian-Lower Jurassic
D -	Devonian
Pz -	Paleozoic
σJ_{2-3} -	Ultra basic rocks
ν –	Gabbro

CHAPTER 1. INTRODUCTION

The water in general and groundwater in particular are actually under strong human pressures in many countries. The degradation of groundwater resource can be quantitative and qualitative, if the abstraction exceeds the natural recharge rate. As a result, a negative water balance is established in the different aquifers system (Voudouris 2011).

In addition, water is chemically linked with many minerals, staying in them for a long geological time. So, water it's very important even to different geological processes as well as in the formation of the earth's crust, the creation of its surface, the formation of minerals, ores and of sedimentary and magmatic rocks (Dakoli and Xhemalaj 1977).

Lakes are a vital supply of water since they can be used for public water supply, industry, and agriculture, etc. This important ecosystem, when respected and cared for, can sustain a healthy balance of aquatic life. It is our responsibility to continue taking care of our lakes.

In this context one can mention Ohrid Lake and Prespa Lake (study area). Formed 2-3 million years ago, these lakes are among the oldest lakes in the world. They are formed in the last glacial period, Tertiary period (Watzin et al. 2002). Both lakes are isolated by the surrounding hills and mountains, which makes them very interesting and unique. These lakes are situated between Albania, Greece and North Macedonia (Figure 2.1).

This research studied the water dynamics of the transboundary aquifer Ohrid - Prespa watershed with the aim to achieve conclusions verified by specialists. Climate change has an important impact in this region, where open water surfaces cover considerable space. Temperature rising undoubtedly has its impact on surface water, as well as on groundwater levels. In recent years there has been a noticeable decrease of Prespa Lake's water level.

From the hydrodynamic investigation of this research appears a new phenomenon (from a hydrogeological point of view) that was an unexpected outflow from Prespa Lake toward Ohrid Lake during the wet period of the year. All these lead to the establishment of different hypotheses. Given that the study in question has to do with a particular region which is characterized by a hydraulic connection. This was an issue studied, in addition to other studies, by specialists of hydrogeology in collaboration with the science of geophysics and hydrochemistry. The treatment of these two water basins (Prespa Lake Basin and Ohrid Lake Basin) as a single one was presented as important based on hydrogeological and hydrological terms. In this work, the effectiveness of the geophysical method of ERT together with the geochemical methods provides a significant and important conclusion on the scope of this thesis.

This study aims to a detailed analysis of the transboundary aquifer system Ohrid - Prespa watershed from the hydrogeological, geophysical and hydrochemical aspects. This material provides a clear overview of how water resources are used for vital needs and the impact that is directly influenced by the hydrodynamic of the study area. Moreover, the research and studies that have been done for the improvement, management and conservation of this region from the impacts of anthropogenic activities were described.

The original elements of these reserche was the integrated and combined methological (geophysical, hydrological, hydrochemical, isotopic) investigation of the hydraulic communication of the lakes through the transboundary karst aquifer.

The detailed diagnostic analusis using appropriate indicators and SWOT analysis to determine the pressures and opportunities for the rational ans sustainable management of the tranbounadary karst aqufer in the study area is another original element as well.

1.2 AIMS AND OBJECTIVES OF THE Ph.D. THESIS

The main goals and objectives of this Ph.D. thesis are:

1.2.1. The Main Goals

- To evaluate the hydrogeologic and hydrologic data in separate watersheds and otherwise, for the study region.

- To use geophysical methods and to interpret the data collected from the hydrogeologic point of view.
- To collect chemical data from Ohrid and Prespa lakes, in order to construct Stiff diagrams and ionic ratios evaluation.
- To use stable isotope (δD and $\delta^{18}O$) abundance combined with hydrochemical analyses in order to distinguish between different kinds of groundwater, concerning the origin and mixing of groundwater.
- To construct a hydrogeologic map of Ohrid - Prespa lakes region representing all the data collected for this study.
- To study the general characteristics and the hydrodynamic behavior of the transboundary karst aquifer developed between the lakes Ohrid and Prespa.
- To apply the SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis in order to optimize the water resources management.

1.2.2. The Main Objectives

- Investigation of the hydrodynamics' and hydrochemical data of the transboundary aquifer system in Prespa – Ohrid Watershed.
- Testing the Geophysical method of ERT near karstic springs to create a database of all the data collected from using this method. The database will be jointed to the map mention above (dry and wet period of a hydrological year).
- Collecting the water samples in booth lakes and springs around the Ohrid Lake, in order to achieve the comparison of results by using Stiff diagrams and ionic ratios evaluation (dry and wet period during two years).
- Collecting the water samples in different water point of watershed to analyze the stable isotope, in concern of the origin and the groundwater's mixed (once during a hydrological year).
- To build the hydrogeologic map of the Ohrid - Prespa Region in the scale: 1:50,000, and enriching this map with the hydrogeologic database created.
- In the end, the interpretations and conclusions of this thesis will reflect a clear idea of the hydrodynamic regime as well as the sustainable management of the transboundary aquifer Ohrid - Prespa Region.

1.3 THESIS STRUCTURE

This work was based on hydrogeological, geophysical, geochemical study. All the material collected was presented in the hydrogeological map, constructed in the GIS program. Initially one has to do with the recognition and presentation of various problems which this study undertakes to treat. The material started with the presentation of a summary of the performed work, continued with the aims and objectives.

In the second chapter are reflected the work performed in the region over years. The previous works by different authors are studied, in order to have a clear vision of the region in hydrogeological and hydrochemical terms. Geophysical methods were used mainly in the field of hydrogeology and wider, which serve to our material for the study of developed karst areas located between two studied lakes.

In the following chapters are treated the scientific and specific data for the purpose of the region recognitions in which the research will take place. These data consist in the field of hydrochemistry, geophysics, geology and hydrogeology.

The methodology used in this material is explained in the following chapters too. It starts with Stiff diagrams which will be used to make a hydro-analysis of groundwater and surface water of the area, as well as a comparison between water samples taken in different places in the region. In addition, ions ratio and appropriate indices were used to determine the water quality in the study area. This is done for the sole reason of achieving a conclusion and delineating the recharge areas, where samples were taken. In this way, it is thought to reach a conclusion based on hydrochemical data to continue subsequently with the geophysical data. So geophysical methods used in this study have to do with the collection of other data related to the development of the karst area in the southern riparian part of Ohrid Lake.

In addition, the field work is explained, where and how this work consists. As mentioned above, this work is focused mostly in the southwest shoreline of the Ohrid Lake in two periods of the year. During the wet period of the year, when is the maximum of the groundwater level (May), and during the dry period of the hydrologic year (October). The field works during these two periods of year was important not only from the hydrogeologic point of view but even for the geophysical studies. It is important to have water samples during the dry period of the year, which is the proper time when the water quantity that flows from Prespa Lake toward Ohrid Lake is in its maximum. In this period all the water reserves in the karstic area are supposed to be at their minimum. So, due to the geographic position of the lakes and well developed karst of the mountain positioned between them, the outflow from Prespa Lake toward Ohrid Lake is at its maximum. The results achieved from this work are given among each chapter.

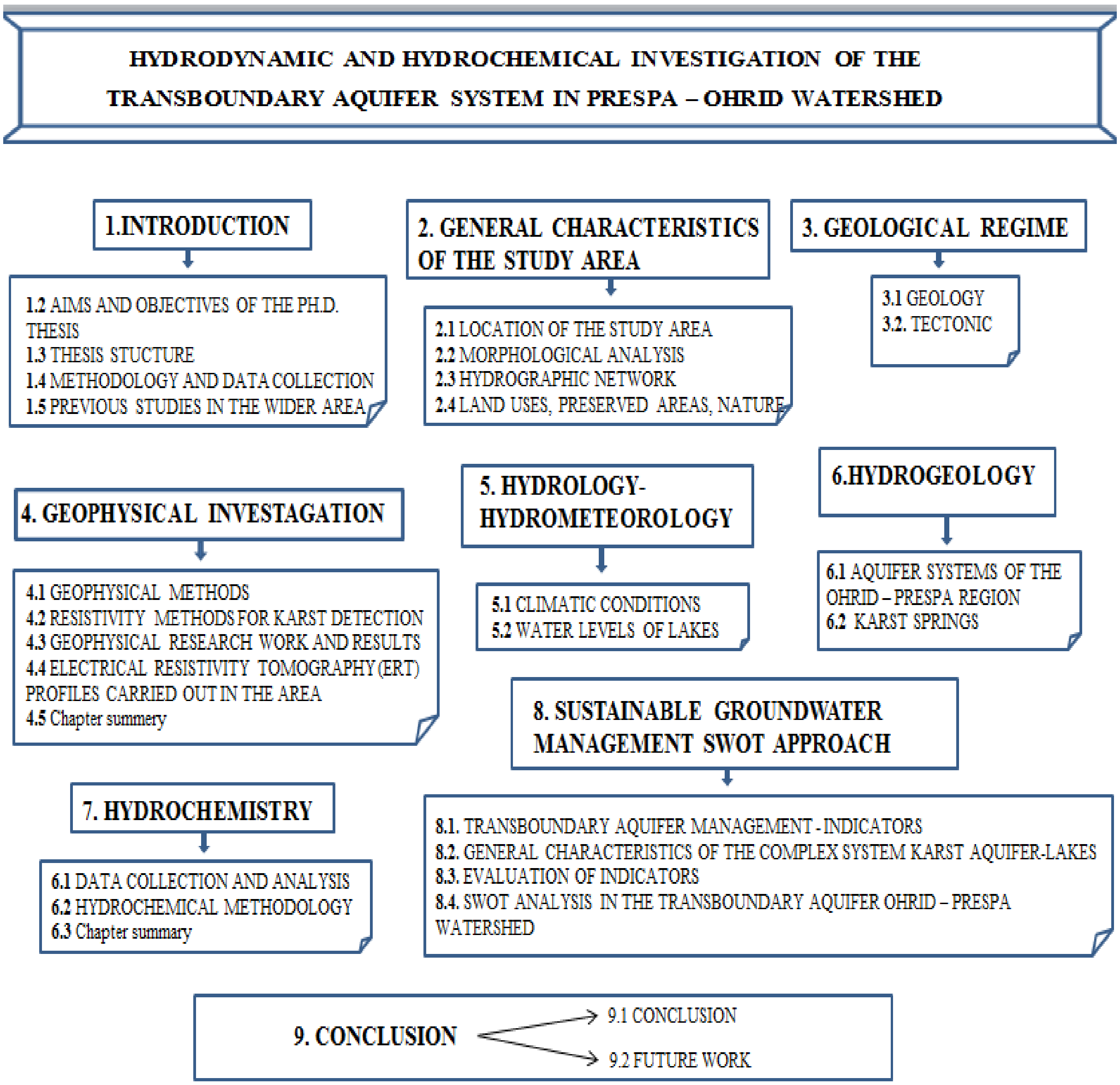


Figure 1.1. This diagram represents an overview of the Ph.D. thesis structure.

The results of the hydrochemical and geophysical investigation are given in addition supporting what was mentioned above. This point clarified the groundwater's dynamism of the region based on existing hydraulic connections. The chemical database of water samples was adapted for the construction of the aforementioned map. All the conclusions and future work are explained in the last chapter.

In order to explain the usage of the GIS program which was used to represent the hydrogeological map of the Ohrid-Prespa Region different authors were studied. This was done to evaluate how this method is used in various fields of science and for more in the field of geology and hydrogeology. The appendix (A and B) which represent detailed hydrogeologic data and the construction of the above mentioned map were added in this material. The appendix (C and D) represent daily climatic data for the last 10 years in the Ohrid Lake, the daily data of the Prespa and Ohrid Lakes' level measured for the last 10 years, by Institute of Geosciences, Energies, Water and Environment, and the daily data of the Tushemisht Spring's quantity for the same period of time, measured by the same institute.

1.4 METHODOLOGY AND DATA COLLECTION

In order to achieve the aforementioned goals, previous work carried out in the Ohrid-Prespa transboundary aquifer over years, from three different countries, were collected. General geological and hydrogeologic data gives a clear view of the study region.

The AquaChem program was used for chemical data processing in this thesis. The program helped build stiff diagrams using 46 water samples collected all over under study's transboundary aquifer. These diagrams will be used to see and compare the visual similarity of water samples in both lakes, mainly those taken in the Ohrid Lake. Herein would be focused on the hydro-chemical study of the material. Chemical analysis taken in Prespa Lake will be compared with those obtained in Ohrid Lake. Prespa lake water has the ability to be mixed, as a result, wherever the water samples will be taken in the lake shall have the same chemical composition (Kiri et al. 2011). In the southern part of Ohrid Lake, water samples have been taken at different depths in order to construct Stiff diagrams for hydrochemistry purposes. Water samples were taken in the mainsprings that emerge on the south and southeastern part of the Ohrid Lake too. Additionally, the water samples were taken in Prespa Lake.

Stable isotope analysis was conducted in concern of the groundwater's origin and its mixed (17 water samples). The statistical analyses results were a great support to the work done with the Stiff diagrams and stable isotopes.

The geophysical studies in this material appeared to be very important. The results achieved by the method of Electrical Resistance Tomography (ERT), depict the presence of karstic areas which serve as groundwater movement from Prespa Lake toward Ohrid Lake. These results are compared with the results received from the hydro-geochemical methods mentioned above. In addition, the material is enriched with pictures and graphics obtained as a result of a spacious database, collected in the region during recent years.

All this material was presented simultaneously on the digitized hydrogeological map in the AutoCAD program and then processed in a GIS program at scale 1:50,000.

1.5 PREVIOUS STUDIES IN THE WIDER AREA

Numerous studies have been made in the transboundary aquifer Ohrid-Prespa watershed from the three countries that share this natural richness (Albania, Greece and North Macedonia). These studies are focused at different aspects of science and economy but, in a separate way. This means that many of them conducted regarding fauna, environmental studies, the influence of anthropogenic factors, etc., represent Prespa Lake or Ohrid Lake issues not Prespa-Ohrid lakes. It is crucial that the two watersheds be represented as one on this transboundary aquifer.

This work was focused on the studies performed in geological and hydrogeological aspects at this region, also the hydrochemical studies of the both lake's waters and the waters of the surrounding area, for one watershed which is Ohrid - Prespa Region. Geophysical methods were used to enhance the hydrogeological study. By observing the results achieved through this method one may see how it has been implemented in these areas.

1.5.1 Review on Hydrogeological, Hydrochemical and Hydrological Studies

Hydrogeological studies in this area have been mostly generalized. The studies performed in this science were conducted separately for Ohrid and Prespa Lakes regions.

General data on the geology and hydrogeology are provided for this area (Spirkovsli et al. 2000). Due to the fact that in recent years the water level of Prespa Lake has been continuously decreasing, studies have been focused on this critical issue of the region. The works of Meçe (2000) and Melo (2001) provided a clear picture of the geological structure of the Ohrid Region. Furthermore in the research of Tafilaj (1977) is given a generalization of a hydrogeological classification based on the geological structure of the region. The data based on the geology of the Ohrid and Prespa Region can also be found in the works of Tyli (1971), Vranai (1997), Xhomo (2002), and Watzin (2002).
Another aspect of the study is the movement of groundwater through the karst. Several studies have been conducted in this subject (Mandel et al. 1967, Eftimi and Zoto 1997, Anovski et al. 1992).

Studies related to groundwater and surface water's chemistry have been conducted as well. For Ohrid Lake, the following work and investigations could be mentioned: Petrovic (1975), Appelo and Postma 1999, Demiraj and Mucaj 1996, Jordanoski and Lokosk 2002, Kostoski (2000), Loffler and Schiller 1998, Petrovic (1975). Previous studies represent an overview of the Ohrid – Prespa transboundary aquifer about the geology, hydrogeology, hydrology, economy, fauna, flora, etc., as two different regions. Treating this area as one region was significant for this research. Hydrodynamic and hydrochemical investigations for this complex transboundary watershed associate the researches made from different sciences including but not limited to hydrogeology, geophysics, and hydrochemistry.

1.5.2 Review on Geophysics Methods

Conventional techniques for characterizing or monitoring the hydrogeological properties that control flow and transport typically rely on borehole access to the subsurface. For example, established hydrological characterization methods (such as pumping, slug, and flow meter tests) are commonly used to measure hydraulic conductivity in the vicinity of the wellbore (e.g., Freeze and Cherry 1979, Butler et al. 2005, Molz et al. 1994), and wellbore fluid samples are often used for water-quality assessment (e.g. Chapelle et al. 2001). Unfortunately, data obtained using borehole methods may not capture sufficient information away from the wellbore to describe the key controls on subsurface flow. The inability to characterize controlling properties at a high-enough spatial resolution and over a large-enough volume for understanding and predicting flow and transport processes using borehole methods often hinders our ability to predict and optimally manage associated resources.

The field of hydro-geophysics has developed in recent years to explore the potential that geophysical methods have for characterization of subsurface properties and processes relevant for hydrological investigations. Because geophysical data can be collected from many different platforms (such as from satellites and aircrafts, at the ground surface of the Earth, and within and between wellbores), integration of geophysical data with direct hydrogeological or geochemical measurements can provide characterization information over a variety of spatial scales and resolutions. The main advantage of using geophysical data over conventional measurements is that geophysical methods can provide spatially extensive information about the subsurface in a minimally invasive manner at a comparatively high resolution. The greatest disadvantage is that the geophysical methods only provide indirect proxy information about subsurface hydrological properties or processes relevant to subsurface flow and transport.

Generally, hydro-geophysical characterization and monitoring objectives can often be categorized into the following three categories:

1) Hydrological mapping of subsurface architecture or features (such as interfaces between key geological units, water table, or contaminant plume boundaries);

2) Estimating subsurface properties or state variables that influence flow and transport (such as hydraulic conductivity or soil moisture); and

3) Monitoring subsurface processes associated with natural or engineered in situ perturbations (such as infiltration through the vadose zone and tracer migration).

CHAPTER 2. GENERAL CHARACTERISTICS OF THE STUDY AREA

2.1 LOCATION OF THE STUDY AREA

The transboundary aquifer of Ohrid-Prespa Lakes' watershed is situated in south-western Europe (40°40'- 41°2'N latitude; 20°23'-21°16'E longitude). It is shared between three countries; Albania, Greece and North Macedonia (Figure 2.1). Prespa Lake is composed of two lakes; the larger Prespa Lake and smaller Prespa Lake. These lakes are located at an altitude of 846 m above sea level (a.s.l.) and the Ohrid Lake of about 693 m above sea level; the water level of Ohrid Lake is 153 m lower than Prespa Lake. Both large and small Prespa Lakes are positioned in the southeastern Mediterranean mountainous area, which is characterized by cold winters. The water resources of the entire basin are of great economic importance to the shared countries.

The Prespa Lake surface (both big and small) is 254 km^2 (in 1984 the lake's surface was 329 km^2, Pano et al. 2008). Ohrid Lake is positioned on the north of the Big Prespa Lake. Both these lakes are separated by Dry Mountain with highly developed karst. Mount Galicica rises as a horst between Prespa Valley in the east and Ohrid Valley in the west (Watzin et al. 2002). There is a link between Ohrid Lake and Prespa Lake, the hydraulic connection; water flowing through porous rock.

The Ohrid Lake surface is 362.6 km^2, 111.4 km^2 are located in Albanian territory and 251.2 km^2 in North Macedonian (Pano et al. 2008). The Ohrid Region hydrographic network is more complex than that of Prespa Region, due to the unknown water quantity that flows from Prespa Lake toward Ohrid Lake. This phenomenon is attributed not only by its geographical position, Prespa Lake is located approximately 160 m above Ohrid

Lake, but also by the highly developed karst of Galicica Mountain situated between these two lakes (Eftimi et al. 1997, Popov et al. 2009). Outflows from Ohrid Lake feed the Drin River which discharges into the Adriatic Sea.

Figure 2.1. The location of Prespa–Ohrid Watershed, (40°40'- 41°2'N latitude; 20°23'-21°16'E longitude); (Source A: Esri, Mazar, GeoEye, Earthstar Geographics, CNES/Airbus Ds, USDA, USGS, Aero GRID, IGN, and the GIS User Community, Source B: Google Earth.)

2.2 MORPHOLOGICAL ANALYSIS

Lake Ohrid and Lake Prespa form a unique system in the southwest Balkans region. The general characteristics of both lakes are shown in Table 2.1. Prespa Lake watershed as well, is located in the midst of the mountainous terrain. The average depth of Big Prespa Lake is 18 m and the maximum depth 54 m (Pano et al. 2008). Prespa's water level is approximately 846 m above sea level. The fluctuation of the water level of both lakes is described in the next chapter.

Ohrid Lake watershed belongs to the geotectonic zone on the western part of North Macedonia. This zone represents a segment of the interior Dinaric Alps, with a bedrock structure that includes rock masses of different types. Their compositions and ages go all the way back to Paleozoic, Mesozoic and Cenozoic eras. Tectonic regimes formed much of the terrain in the Ohrid and Prespa Lake watershed, which has been shaped by both Hercynian and Alpine orogenesis. In the later phase of the alpine orogenesis, the Ohrid, Prespa and Debracka grabens were formed (Krstić et al. 2012).

Table 2.1. General characteristics of lakes Prespa and Ohrid

	Parameters	Prespa Lake	Ohrid Lake
1	Surface area (km^2)	254	362.6
2	Mean Depth (m)	14	155
3	Maximum Depth (m)	54	288
4	Elevation (m a.s.l.)	846	693
5	Catchment area (km^2)	1300	2610
6	Water volume (km^3)	≈3	≈55

Ohrid Lake is located at an altitude of 693 m (a.s.l.), with a mean and maximum depth 155 m and 288 m, respectively. Ohrid Lake watershed is characterized by high and medium high mountains, since this lake is surrounded by mountains. The high mountains include those with peaks greater than 2000 m. The medium-high are those with peaks lower than 2000 m. Lake Ohrid itself is formed over one graben structure with meridian orientation and horizontal pulling along the main tectonic, separator bend: Bilisht – Korce – Diber. The general extent of the lake has been limited by the horst of dry mountain (in the East) and Mokra Mountain (in the west). The form of the lake and its shoreline were determined by neo-tectonic movements along faults that remain active today (Watzin et al. 2002).

Based on the geological composition of Prespa Region (the most important deposits are presented by Triassic carbonate rocks), karstic, glacial and periglacial are the dominant morphogenetic processes that have configured modern relief on this mountain. The karstic features are the dominant genetic type of relief forms on Galicica Mountain, which is a typical karstic area. Being exposed for a long time these surfaces were influenced by external factors, which have strongly initiated the process of karst (Photo 2.1 and Figure 2.2). Relief karstic forms, such as numerous karst sinkholes and karstic dry flows, as well as karstic fields, are frequent (Krstić et al. 2012).

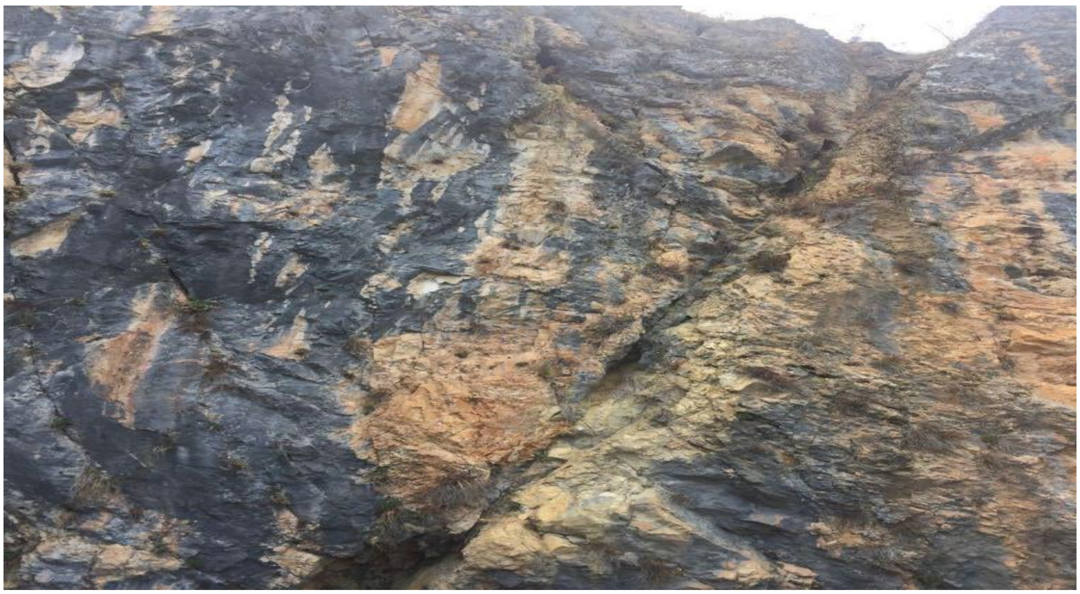


Photo 2.1. Karstic rocks in Ohrid – Prespa Region, Dry Mountain (Photo 2017).

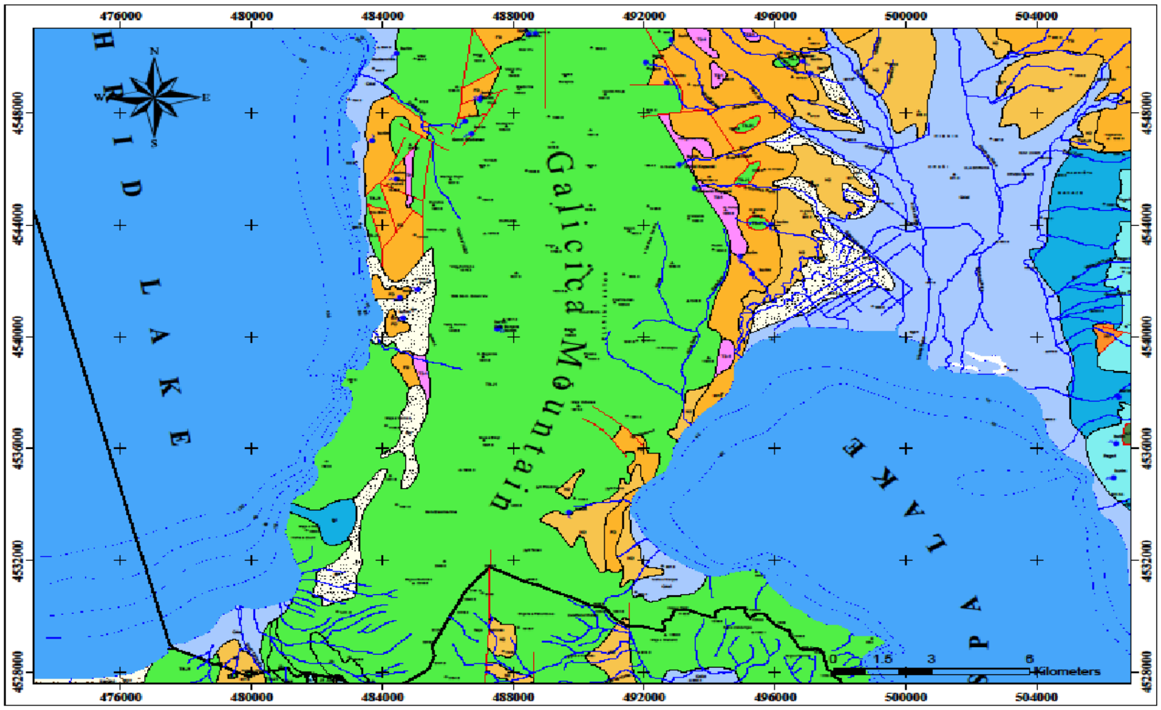


Figure 2.2. The karstic mountain (Galicica) that separates Ohrid Lake from Big Prespa Lake.

The altitude of Galicica Mountain and its favorable morph-plasticity enabled the accumulation of snow and ice during the Pleistocene resulting in glacial relief formation. In this area the dominant landscape is formed by the periglacial processes resulting in stony horseshoes, slide blocks, grassy terraces, loose glacial residues, etc. (Photo 2.3).

Photo 2.2. Periglacial landscape on Galichica Mountain (Krstić et al. 2012).

Photo 2.3. Zaveri Bay- Prespa Lake, High side, rocky with cliffs (September 2017).

The surface area of Ohrid Lake is 362.6 km^2; meanwhile both Big and Small Prespa Lake are 253.6 km^2 and 47.4 km^2, respectively. The two Prespa lakes are connected by a small channel, which passes through alluvial deposits (this part is located in Greece). The surface outflows of Small Prespa Lake are controlled by an artificial weir, which stabilizes the water level of the lake. Although the upstream Lake Prespa has no surface outflow, waters from Lake Prespa are being transferred to Lake Ohrid through underground karstic channels.

The highest mountains are: Mali Thate (Dry Mountain) 2,287 m, Galicica 2,262 m (Figure 2.2) and Petrinska 1,660 m. These mountains separate Big Prespa Lake from Ohrid Lake. All this leads to the creation of many seasonal brooks and streams. On the north part of Prespa Basin the highest point of the relief is Mali Biges (Biggest Mountain) reaching 1,657 m, on the east and southeast part is Kalo Nero reaching 2,156 m, while Ivani reaching 1,769 m is located on the south part of this region (Demiraj and Mucaj 1996).

In Ohrid Region, besides the mountains that separate the Ohrid from Prespa Lake, other mountains can be mentioned as well like: Stogovo Mountain (2,242 m) situated on northern and northwestern part of the Ohrid Lake Watershed, Karaorman Mountain (2,145 m) stands as a natural continuation of Stogovo Mountain. Jablanica Mountain (2,257 m) is situated on the west part of Ohrid – Struga Valley. Ilinska Mountain (1,909

m) stands on the northern part of the Ohrid Lake watershed. The Plakenska Mountain (1,999 m) is situated on the eastern side of the lake. Bigla Mountain (1,933 m) is situated on the lowest southern part of this watershed.

There are three major valleys in our study area; Ohrid – Struga Valley on the central part of the watershed, Prespa Valley on the east and Debarcka Valley on the north part.

Ohrid – Struga Valley is bounded by Galicica and Plakenska Mountains in the east, Jablanica and Mokra Mountain in the west, and Karaorman and the boundary of Plakenska – Mazatar Mountain which divides this valley from Debarcka Valley, in the north. This valley is formed as a terrain descending along two radial faults; Ljubanista – Kosel fault in the east and Struga – Starovski fault on the west side (Watzin et al. 2002).

Prespa Valley was formed by terrain declining along two parallel faults. The eastern fault extends alongside the Pelister and Bigla mountains, and the western fault follows the eastern sides of Galicica Mountain on the south part of Albania.

Debarca Valley is located in the northern part of Ohrid – Struga Valley. It is separated from Kicevo Valley by high and medium high mountains in the northeast, from Prespa Valley in the east and River Drini Valley in the west. The entire valley belongs to the River Sateska watershed. This river flows into Ohrid Lake (Eftimi et al. 2007).

The geomorphological feature of the study area includes abrasive formation (cliffs, sapping, shoreline and sub - lacustrine terraces), fluvial forms (rivers valley, riverbeds, erosive and accumulative terraces), karst formation (sinkholes, potholes and karst fields at the surface, and underground hollows and caves), glacial features (fossil sinks and marine materials).

Abrasive fossils and recent erosive and accumulative relief forms are found alongside the east, north and west part of Prespa Lake and alongside the east, north and west part of Ohrid Lake (fossil and recent sapping, cliffs and shoreline).

Fluvial erosive and accumulative relief forms emerge in the river valleys, which have ravine-like features that are the results of the mountain's character of the surrounding terrain. The rivers open up broadly into the valley and assume the feature of a plain (River Golema in Prespa Valley, Sateska, Dalian and others in the Ohrid – Struga Valley) (Eftimi and Zoto 1997, Watzin et al. 2002).

The lakes shorelines are divided in two main types:

- High side, rocky with cliffs
- Low side, with field and beaches.

In general, the cliffs are no longer tectonically active and they are located inland far from the water (cliffs of Lin and of Saint Naum). Rocky shores dominate on the Albanian side of the Ohrid Lake, meanwhile in the Prespa Lake dominate mostly on the north and east side of the Prespa Lake (Photo 2.4, 2.5). Low side of Prespa Lake is located mostly on the west and south part of this lake (Photo 2.6). The beaches in Ohrid Lake receive their sediments from the rivers.

2.3 HYDROGRAPHIC NETWORK

The hydrographic system of the surface water flow in the study area is showed in the Figure 2.10. Ohrid and Prespa Lake’s water system is complex because of the existing underground links between them. The karstic mountains; Dry Mountain in Albania and Galicica Mountain in North Macedonia are highly porous, with a high capacity of water transport. Due to the porosity and water content, the rocks of Ohrid-Prespa Region are classified as porous aquifers, karstic and fissured aquifers (Krstić et al. 2012).

Photo 2.4. Spring on the border (Albania – North Macedonia) on the left, and Saint Naumi Spring on the right (May 2017).

Photo 2.5. Prespa Valley, Liqenas Village on the Albania side (September 2017).

Photo 2.6. Low side of Prespa Lake **(**in Albania).

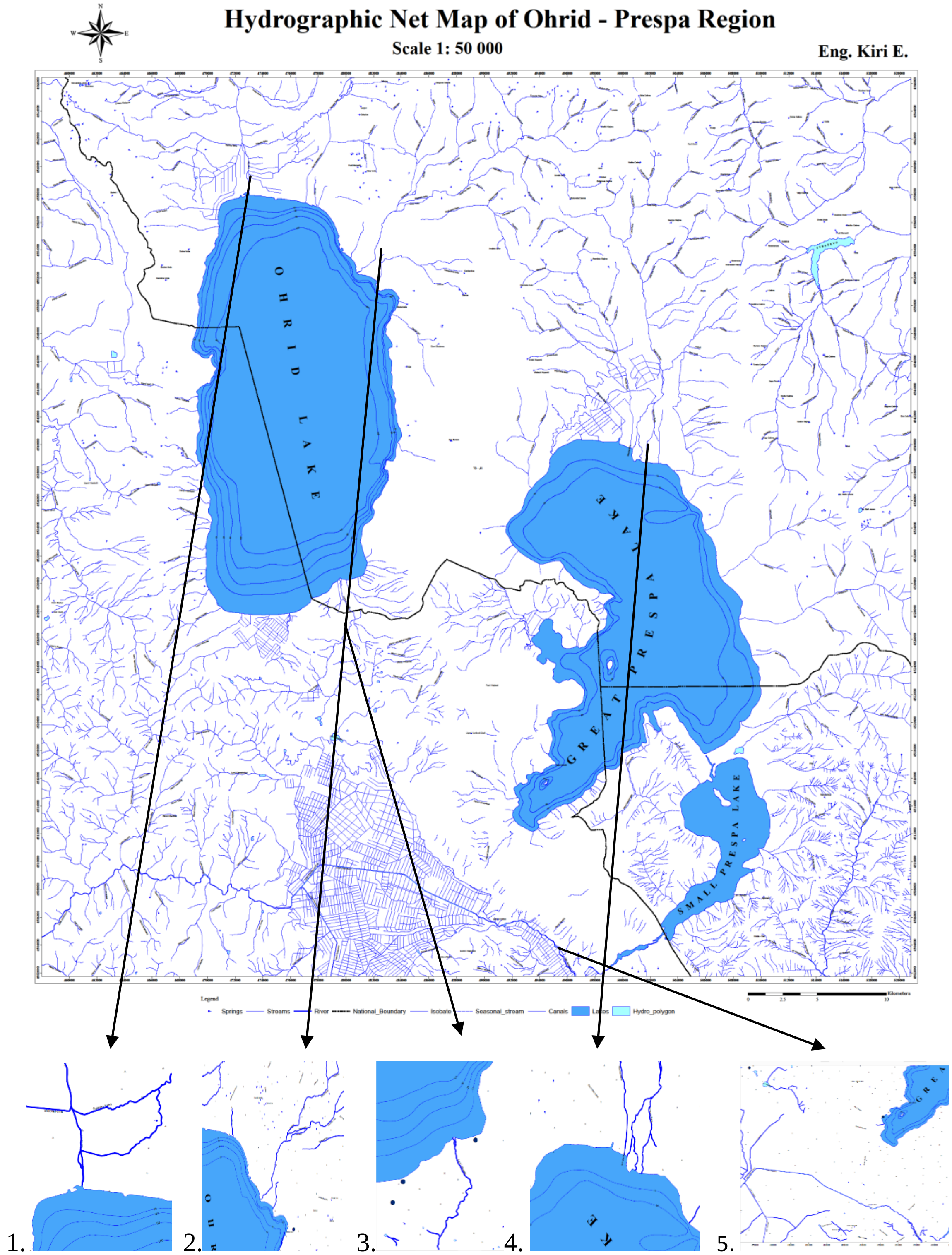


Figure 2.3. Hydrographic Net of Ohrid – Prespa Region.

Explanation:

1.Drini River and Stateska River, 2. Koselska River, 3. Cereva River, 4. Oteshevo River and Istocka river, 5. Devolli River

Main springs and rivers

Along the western side of the Galicica Mountain, numerous karst springs arise, recharging directly Lake Ohrid. The main springs (location is shown in Figure 6.5) are:

1) Tushemisht Spring being the main one in Albania, situated on the south shore of the Ohrid Lake, originates more than 50 % of the water quantity from Prespa Lake and the rest from the karstic water (Dry Mountain). The average discharge of this spring is Q = 2.5 m^3/s.

2) Saint Naum Spring originates in the same conditions. The spring is situated on the east shore of Ohrid Lake Figure 6.5, and has an average discharge of Q = 7.5 m^3/s (KfW Feasibility Study 2004). A few numbers of springs are situated on the coast line of the Ohrid Lake, mostly on the southeast and east part of it. The origin of these springs is both from Prespa Lake plus the precipitation in the karstic mountain.

The Koselska River that discharges in Ohrid Lake has a long-term average amount to Q = 1.3 m^3/s. Sateska River after diversion from its original watercourse into the Drini River, to the present discharge into Ohrid Lake has increased the water inflow to the lake by 25 – 30 %. The average flow rate amount of this river can be counted as much as Q = 6.15 m^3/s. The rivers that can be mentioned in Albania are: Çerava River, Pogradec River and Verdova River.

Çerava River is the biggest river on the Albanian side that flows into Ohrid Lake with an approximate average discharge Q = 1.5 m^3/s. Pogradec River is a small stream that flows through the City of Pogradec. Annual average discharge of this river is Q = 0.25 m^3/s. Verdova River is also a small stream which drains into Ohrid Lake on the southeast section. In the Albanian side there are also temporary springs with the annual average discharge up to 100 L/s.

In Albania, the only river which runs into the Small Prespa Lake is Devolli River with an annual average discharge around Q = 1.7 – 1.9 m^3/s.

Important rivers beside springs even during the dry period of the year flow in North Macedonia. On the northwestern part of the lake emerges a seasonal spring, located on the east part of Oteshevo. Furthermore, in the eastern part, runs the Istocka River (Q =

0.608 m^3/s), which comes down on the northern part of the lake. West of Istocka River and on the north side of the lake runs Golema River (Q = 0.707 m^3/s). On the east of the lake emerges Pretorka Spring and Kranska Spring, running year-round. On the southeastern part of the Big Prespa Lake runs Brajcinska River with an annual average discharge of Q = 0.806 m^3/s (Anovski et al. 1997, Demiraj and Mucaj 1996, Watzin et al. 2002, KfW Feasibility Study 2004).

2.4 LAND USES, PRESERVED AREAS, NATURE

Land uses in Ohrid Lake Watershed, Albanian side, are 23,323 hectares. This area is divided approximately as follows: water (11,140 ha), arable land (2500 ha), pasture (1367 ha), forest (10,248 ha), economic enterprises (1396 ha), built land (672 ha). It is pointed out that one hectare (ha) corresponds to 10,000 m^2. Land use in the North Macedonian side is approximately as follows: arable land (53.303 ha), pasture (27,319 ha), forest (61,225 ha), and water lakes (41,000 ha) (Watzin et al. 2002).

The map showing the land uses in the wider region of the study area is represented in Figure 2.4. According to this map, the study area includes: 1) Discontinuous urban fabric, 2) Industrial or commercial units, 3) Mineral extraction sites, 4) Non-irrigated arable land, 5) Permanently irrigated land, 6) Vineyards, 7) Fruit tree and berry plantations, 8) Pastures, 9) Annual crops associated with permanent crops, 10) Complex cultivation patterns, 11) Land principally occupied by agriculture, with significant areas of natural vegetation, 12) Broad-leaved forest, 13) Coniferous forest, 14) Mixed forest, 15) Natural grasslands, 16) Sclerophyllous vegetation, 17) Transitional woodland-shrub, 18) Sparsely vegetated areas, 19) Salines, 20) Intertidal flats and 21) Water bodies.

2.4.1. Agriculture

Ohrid Lake Watershed, in the Albanian part, from 25,000 ha cultivated land about 1800 ha are situated between Tushemisht village and Pogradec city. The rest of it is situated between Pogradec city and Lin village. The fruits, wheat, corn and vegetables in Albania are the main agricultural products. The water used for irrigation comes 50% from Drilon River and the other 50% from Ohrid Lake through two pumping stations (Watzin et al. 2002). The pasture land is used for a variety of livestock.

In North Macedonia, about 60% of the arable land is used to grow wheat and corn, the rest of it is used for vegetables, tobacco and other crops. The water used for irrigation comes from Ohrid Lake, Koselska and Sateska River. The distribution of forest in Ohrid Lake watershed favors the North Macedonian side, being in a better condition compared to the Albanian side. In Albania the forest is very damaged by cutting trees and fires but, despite the loss of trees the forest still contains the flora and fauna with considerable values (Lake Ohrid monitoring program 2002).

Albania, Greece and North Macedonia have respectively 21 km^2, 28 km^2, and 157 km^2 of cultivated land not including pastures (KfW Feasibility Study 2004) around Prespa Lake.

In Greece, the area of cultivated land has remained the same, about 1100 ha. Meanwhile, in Northern Macedonia, the area that was used for cultivation has considerably increased from 2700 ha to 4000 ha, until 1998 (Kiri et al. 2011, KfW Feasibility Study 2004).

The area used for cultivation lies mainly on the shoreline of the lake. This is most common on the zone of Eserani Bird Reserve, Stenje Marsh, and at the shore of Small Prespa Lake in Greece. Near the shore of the lake the groundwater is easily accessible and also has a high infiltration coefficient (Jordanoski and Lokosk 2002). In Albanian side, the cultivated areas are watered mostly by precipitation, this is because the land is not suited for gravity irrigation.

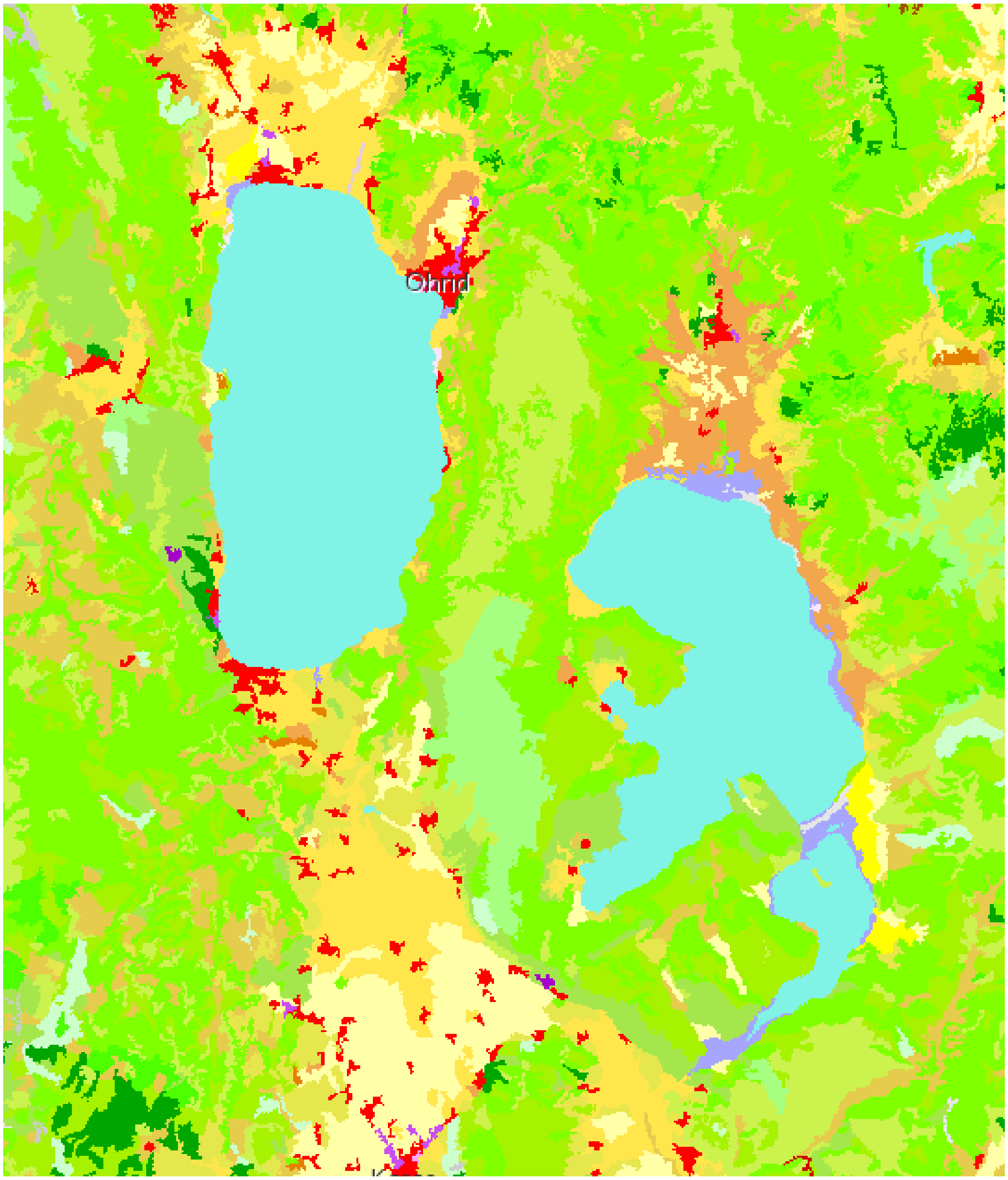


Figure 2.4. Land uses in the wider area of Ohrid-Prespa Lakes based on CORINE LAND COVER 2018. (https://land.copernicus.eu/pan-european/corine-land cover/clc2018?tab=download)

Explanation

2.4.2. Forest land

In Ohrid Lake Watershed the forest distribution favors North Macedonia with about six times more forest than in Albanian part (Figure 2.4). In Albania, the forest has experienced heavy damages from cutting and fires. Despite the huge loss of trees and ground vegetation the forest, as mentioned above, still contains flora, fauna and economic products with considerable value. In North Macedonia the forests are in better conditions. The land area in forest in this watershed; for the North Macedonian side is approximately 61,225 ha (33.5% of land use in NM) and for the Albanian side 10,248 ha (37.5% land use in Albania) (Watzin et al. 2002).

Prespa Lake Watershed (North Macedonia, Albania and Greece) has approximately 27,750 ha of forest land. In the Albanian part are about 13,500 ha of forest land with 49% of the land located within the Prespa National Park. This zone of the park is shared between the state and private individuals.

The land area of 13,500 ha forest on the Albanian part performs a positive function for the environment. At the same time, this forest adds beauty to the lake which is very attractive to tourists.

Wooded areas surrounding Prespa Lake have changed considerably in recent years. In the North Macedonian part, the wooded area is expanding; while in the Greek part, the wooded area is decreasing. The most significant change in forest land is in Albania where approximately 15% of the trees have been harvested.

Most of the people in North Macedonia use woods for domestic purposes. This wood comes from the Prespa National Park. By contrast, in Albania, most of commercial logging was done without state permission (KfW Feasibility Study 2004; Kiri et al. 2011).

2.4.3. Population

The Ohrid Region territory in Albania is administratively organized into 4 communes (Buçimas, Hudenisht, Dardhas, Çerave), the municipality of Pogradec and a number of villages. This region has approximately 60,965 residents. Based on demographic development patterns observed over the last 10 years, the area's population will reach 117,060 inhabitants in 2025 (Watzin et al. 2002).

In North Macedonia, Ohrid Lake Watershed's population is approximately 105,933. This region is divided in six administrative centers. On both sides of the watershed the population growth is a major problem that needs management attention (Watzin et al. 2002).

In the Prespa Lake Region approximately 5,000 people live in the Albanian part of the Prespa National Park, scattered in 12 villages. The density is about 20 inhabitants per km^2. A serious problem here is solid waste management. Within the Prespa National Park in North Macedonia 5,000-6,000 inhabitants' lives across 17 settlements (KfW Feasibility Study 2004). In North Macedonia, solid waste is better managed, however not completely eliminated.

2.4.4. Livestock

The pasture land in Ohrid Region, in the Albanian side, is used for a variety of livestock, including cattle, sheep, goats, pigs, horses, donkeys, and poultry as well. About 30 tons of waste is produced by livestock in the Albanian side of the basin. In North Macedonia the pasture lands are used for a variety of livestock, more or less the same as mentioned for Albanian side (Watzin et al. 2002).

Livestock in Albania is an important source of income for the local residents. Consisting mainly in small farms, owned and managed by the older generation. Grazing area for the livestock is situated mainly in Prespa National Park. In Albania, 35% of the yearly income of this area comes from agriculture, of which, 65% comes from these farms. Part of the agricultural production is used by the farmers to feed the livestock (KfW Feasibility Study 2004, Kiri et al. 2011).

In North Macedonia is used Prespa National Park as a feeding area for the livestock. However, the number of hectares under cultivation is much smaller compared to Albania (KfW Feasibility Study 2004).

2.4.5. Sewage

The existing systems of sewage

Until 2004, in the Albanian side of Ohrid Region, existing water and sewerage infrastructures were largely inadequate to respond to the actual needs. During this year the KFW (German funding) and SECO (State Secretariat for Economic Affairs) build a new sewage treatment plant in Pogradec city and its suburbs, an area of around 54,000 inhabitants, on the Albanian shores of Ohrid Lake.

In North Macedonia, wastewater management was given the necessary importance to protect the Ohrid Lake. This system collects the wastewater from the shore line communities and delivers it to the treatment station. After treatment the water is discharged into the River Crn Drim. The capacity of this system enables the collection, transport and treatment of only 65 % of the wastewater produced in Ohrid – Struga Region (Watzin et al. 2002).

In Pustek village (Prespa Region, in Albania), a sewage treatment facility was installed in 2004, financed by KFW. Other villages do not have such a sewage system, instead, septic tanks are used. Still other villages dump sewage directly into the lake. On the Greek part almost all the villages have sewage systems using evaporation ponds.

There are 6 villages in North Macedonia, Prespa Region, which have a connected sewage treatment facility. While a step in the right direction the facility cannot treat industrial waste. The industrial solids flow directly into the river and lake. North Macedonia as well as in Albania, has a number of villages still using septic systems which over time will adversely affect purity of the groundwater and lake's water (KfW Feasibility Study 2004).

2.4.6. Preserved Areas

The lakes Ohrid and Prespa (Big and Small) represent a unique and very complex water system, where the water from the Prespa Lake drains into the Ohrid Lake through underground pathways. The importance of Prespa Lake has been recognized worldwide because of its high biodiversity; including populations of rare water birds (Dalmatian pelican). In 1999, Prespa National Park was established for the rehabilitation and sustainable protection of critical terrestrial and aquatic ecosystems of the Big and Small Prespa Lake Region. In North Macedonia, Pelister National Park and Galicica Park are protected. Prespa Lake was declared a "Natural Monument" in 1977 (Watzin et al. 2002). In 1975, Greece declared the area "Landscape of Exceptional Beauty" and the wetland system has been declared an area of great ornithological value.

According to the EU Habitat Directive, Prespa Lake is characterized as hard, oligo-mesotrophic waters with benthic vegetation of *Chara*, Mediterranean tall humid grasslands of the *Milinio-Holoscoenion*, Hydrophilous tall herb fringe communities of plains and of the montagne to alpine levels, and Mediterranean deciduous forests *Salix alba* and *Populus alba* galleries (Kagalou 2010).

Lake Ohrid is oligotrophic, deep and one of the most voluminous lakes (55 km^3) in Europe (Table 2.1). In contrast to Lake Prespa, Lake Ohrid is an oligomictic lake (it has a uniform temperature and density from top to bottom at a specific time during the year) with complete mixing occurring roughly once per decade (Matzinger et al. 2006).

State authorities of three countries have enforced the protection status of the Prespa Region through the use of national and international legislative means. A large part of the lakes and catchment basin has been characterized as mentioned above a National Park (Albania and Greece) or/and a Wetland of International Importance under the Ramsar Convention (Greece, North Macedonia) (Popov et al. 2009).

2.4.7. Tourism

The most important and preferred site of Ohrid Lake in Albania, is the area between Pogradec and Tushemisht (7.5 km of shoreline), with sandy beaches. The rest of the shoreline of the lake is rocky and non-suitable for tourism. The infrastructure along Albanian shoreline can accommodate approximately 10.000 tourists per day during the high season. On the North Macedonian side the tourism is very active. Tourism is a vital segment of the economy of the region. In the municipality of Ohrid Region the number of daily visitors varies 100,000 – 200,000 and those overnight stays vary from 569,243 to 1,143,228 or even more (Popov et al. 2009, Watzin et al. 2002).

Tourism in Prespa Lake, as regards to Albanian part, is expected to grow in the coming years. Currently, most tourists are locals from other villages, in a sense, day-trippers, adding to the water pollution problems. In the North Macedonian part of the lake, tourism is much more developed. Beside the accommodation in private houses, there are hotels, restaurants, and camping sites. During the summer months about 8,000 people visit the area adding to the management of the solid waste problem (KfW Feasibility Study 2004).

CHAPTER 3. GEOLOGICAL REGIME

3.1 GEOLOGY

From the geological point of view, Ohrid - Prespa Region is characterized by fairly complex geological - tectonic structures with rocks from the oldest Paleozoic formation to the youngest Quaternary's sedimentary rock.

Ohrid Lake Basin, a graben structure, is located in the contact between Mirdita Ophiolite Zone and Korabi Zone. The Korabi Zone (lake area), is characterized by Paleozoic, mostly metamorphic and magmatic rocks, which are superposed by Mesozoic Triassic to Early Jurassic limestone's, in the horst shape of an anticline structure, developed between Ohrid and Prespa lakes (Hoffmann et al. 2010).

Prespa Lake Basin it is extended westward to Galichitsa and Dry Mountain and south – eastward to Rakicka highland and to peak Vejsovari (Greek border).

The region of Prespa Lake belongs to the west of North Macedonia geotectonic unit (in North Macedonia) or Korabi Zone and Mirdita (in Albania) or Pelagonian zone (in Greece).

The most ancient Deposits are Paleozoic ones. They are disrupted by intrusion of granite magma. Also there are met Triassic Deposits, Jurassic Deposits, Ophiolitic mixture (J_3t – Cr_1), Cretaceous and Quaternary Deposits.

Alluvial Quaternary Deposits (Qal) (Gravels, sands).

Generality Quaternary deposits are dispersed across the region but most prevalent in northern part of both Ohrid and Prespa lakes. In Ohrid Region this deposits can be find as well as along eastern and less in south shore of this lake. On the western part of the Ohrid Lake these deposits are located in small polygons, two to three of them. In Prespa Region, on the western part, these deposits have a limitation distribution in 3 – 4 points of lake's shore, which is surrounded mainly from Triassic-Jurassic depositions (Kiri et al. 2011).

All these deposits are divided morphologically by distinguishing the Pliocene-Quaternary deposits (N_2-Q_1), alluviums, stream sediments, colluviums, glacial deposits and lake deposits. In some cases they are intertwined with one another forming mixed genetic types such as: alluvium, stream sediments, lake deposits (Tyli et al. 1971).

Granite – gneisses of Western North Macedonia (Pzgn$_1$) – petrographic unit occurring in the lower members of the metamorphic system. Gabbros (ν) and Granites take up a considerable part in almost the whole eastern region of the Big Prespa Lake shore, meanwhile on the Ohrid Lake shore one can't find these deposits. They have gneissic to schistose structure and porphyrocataclastic – blastomylonitic texture

Main minerals: quartz, alkali feldspars (microline, albite), acid plagioclases and sericite. Secondary minerals: muscovite, biotite discoloured, leucoxene, epidotes, sphene apatite, allanite, and opaque metallic minerals, altered or not (Eftimi et al. 1985).

Paleozoic (Pz). Deposits of Paleozoic are represented by terrigenious deposits intertwined with volcanic deposits and that in the upper parts of the cut are transformed in carbonic–terrigenious. They lie on eastern part of shores of the Big and Small Prespa Lake and in the island of Agios Ahileas (Ahill) in the Small Prespa Lake. Deposits of Lower Paleozoic (Pzgn) display different characteristics from one region to the other. The deposits of Upper Paleozoic are represented by schist's amphibolite in the studied region. The Paleozoic deposits that lie on the western side of North Macedonia are part of the metamorphic system.

Paleozoic Lower horizon (Pzgn) – consisting mainly of gneisses with schist intercalations in the form of lenses or beds, and of amphibolites in smaller proportion. The gneisses orthorocks are characterized by granuloblastic – porphyroid to augen texture, they are schistose and consist of quartz, feldspars (perthitized microline, acid poikilitic plagioclases), muscovite as main minerals and in smaller proportion of epidotes (pistacite, clinozoisite, allanite), cloritized biotite, sphene, zircon and opaque metallic minerals.

Paleozoic Upper horizon (Pzsch) - contains mainly schists (amphibolite, amphibolite – epidote, mica, graphite, calcite), and in smaller proportions cipolins, marbles, serpentinite and locally quartzite with small or significant amounts of cloritoids and mica presence (muscovite, biotite). In the wider area, it overlies the lower horizon, either conformably or unconformably. The schists members display combinations of granuloblastic – nematoblastic – lepidoblastic texture, oriented and sometimes microfolded structure. The main mineralogical paragenesis is: quartz, acid plagioclase, calcite, graphite on various amounts and combinations which result to the respective schist varieties. Secondary constituents: garnet, sphene, apatite, rutile, tourmaline, metallic grains, healthy or oxidized, and the usual alteration minerals, chlorite in place of biotite and sericite in place of feldspars (retrograde metamorphism).

Devonian Deposits (D). Distribution of the Devonian deposits, on the region, is mainly to the northeastern and eastern part of the Ohrid Lake and western and northwestern part of the Prespa Lake. It is represented in the lower part by the detailed (minute) flyschoide and sandy quartzs intertwining granular and allevrolites layers in dark grey color. In the middle of these deposits one can find layers of biomicritic limestone in grey and dark grey color. Meanwhile, in the upper part of this formation are met basic volcanic rocks.

The Devonian period is the transition between early and late Paleozoic.

Permocarboniferous – Lower Triassic Deposits ($P – C – T_1$). The deposits that represent these geological ages are dispersed mostly on the southeastern part of the Ohrid – Prespa Region and east and southeastern of the Prespa Region.

Slightly metamorphic system: slightly metamorphic rocks with intercalations of crystalline or not, limestone lenses. They start with slightly metamorphic conglomerates, sandstones and arkoses, passing gradually upwards to phyllites, locally greenstones and schists of various type (chlorite, sericite, graphite, muscovite). The upper members of the system are fine – grained meta – sediments of slight metamorphism, containing bodies of basic igneous rocks resulting in greenrocks. They are schistose and consist of quartz, sericite, chlorite, muscovite, albite, the corresponding formations of the wider area, aout of the sheet. Conodonts were found in the limestone lenses that determine the upper Skythian – Lower Anisian.

Ultra-basic rocks (σJ_{2-3}) - are the main components of Ophiolites. Ultra-basic rocks are in tectonic relations with carbonate Triassic–Jurassic rocks. These deposits appear on the western part of the Ohrid Lake, but mostly one can find these deposits on the southeastern part of the Prespa Region (Big and Small Prespa Lake). Among ultra-basic rocks lie hartzburgites and partly dunites. Hartzburgites make up the major part of ultra-basic rocks and are met in their lower part. They are mainly dispersed on the southern, western and southwestern part of the region.

Carbonian deposits (Carbonian-Permian-Lower Jurassic), (C-P-J_1). In the studied region, these deposits are distributed in a limited located zone, on northwestern part of the Big Prespa Lake and on the west of Small Prespa Lake. These are represented by alternations of conglomerates and limestone.

Middle Triassic (T_2). Deposits of this age continue normally upon deposits of Lower Triassic and are met on western part of Ohrid Region and eastern part of Golithica in Scri Han, Kuku Peak and Saint Spas. They are represented by massive limestones with cherts with ammonite and pelagic bivalved siliceous radiolarian facie and, more rarely, sandy and turbidity limestone that intertwine with basaltic volcanic rocks.

Middle Triassic – Lower Jurassic Deposits (T_2 – J_1). Middle Triassic – Lower Jurassic Deposits are represented by limestones and dolomitic limestones: medium bedded to thick bedded, of light – gray to gray colour, passing in dark gray to black gray colour in the uppermost horizons of the serie. Within them karstic bauxite occurrences are observed. These depozits are found on the southern part of Prespa Lake Region, precisely western and southern part of Micro Prespa Lake (in Greek Territory).

Upper Triassic–Lower Jurassic (T_3-J_1) . These deposits continue normally above those of T_2 and are represented by pelagic deposits. Pelagic deposits are represented by carbonate–siliceous deposits and are considerably dispersed on the region.

Neritic deposits of Upper Triassic, which continue in the Lower Jurassic, are situated on the east side of Dry Mountain. These deposits are represented by thick layers up to massifs limestone, stromatous limestone and dolomites. The thickness of deposits of neritic facial is about 1,000–1,200 m (Vranai et al. 1997, Xhomo et al. 2002). Along neritic depositions described above are met pelagic deposits represented by intertwining of limestone with pelagic bivalved siliceous radiolarian, whose thickness ranges 50–100 m. These are met as in T_3-J_1 in bases of placement on deposits of T_2 and under deposits of Titonian–Lower Cretaceous (J_3t-Cr_1). These deposits are dispersed mostly on the eastern part of Ohrid Lake's shore and on the western part of the Big and Small Prespa lakes. On the western part of the Ohrid Lake these deposits are dispersed, but in smaller polygons.

Jurassic (J). In terrain, the passage from deposits of Upper Triassic (T_3) to those of Lower Jurassic (J_1) is often undetectable. In the geological map this border is drawn as a conventional border in which there are situated bituminous layers with thickness ranging from some centimeters to some meters. This horizon is represented by dolomites and limestone dolomites, among which are intertwined bitumen bearing beds and clayish bitumen bearing beds. On the study region these deposits have a little distribution and are represented mainly by limestone, schist and clay schist.

Lower Jurassic Deposits (J_1). Lower Jurassic Deposits are found on Albanian part in Zvezda Village and are represented by limestones and dolomites. Their thickness is 20 – 30 m. It is also limited by the perspective of its laying on the region, and is mainly presented by limestone and dolomites.

Middle – Upper Jurassic Deposits (J_{2-3}). These Deposits are found on Albanian part, near Zvezda Village, extended normally on Lower Jurassic Deposits. They have limited distribution in the region and are represented by pelagic sediments with a relatively small thickness, where is distinguished the intertwining of biomicritic limestone, ashen plates rich with radiolarian and with layers of siliceous. Their thickness is 20 – 50 m.

Upper Jurassic Deposits (J_3). Upper Jurassic Deposits are found on Abanian part in some locations with Lower Jurassic and Middle – Upper Jurassic Deposits, near Zvezda Village and also in Peshkepia Village. They are represented by limestones, cherts, argillaceous schists and radiolaritic cherts.Their thickness is 7 – 10 m.

Titonian–Lower Cretaceous (J_3t–Cr_1) - (Ophiolitic mixture). These deposits are found in many sectors of ophiolites and have relatively limited surface water. They are dispersed on the southern part of Ohrid and Prespa Region.

There are distinguished three lithostratigraphic units in these deposits:

- Clay–detritus deposits or otherwise called heterogeneous ophiolitic mixture.
- Ophiolitic or homogeneous ophiolitic mixture.
- Marley flysch – sandy deposits.

Clay detritus deposits are represented by clay, and siliceous layers, sandy rocks, conglomerates, as well as different dimensions of ophiolitic rocks, also by calcareous, siliceous blocks and Triassic volcanic blocks.

Ophiolitic breccias-conglomerates are represented by thick formations with mainly ultra-basic dispersion or volcanic rocks of ophiolites compounded by all rocky kinds which compound the ophiolites. These deposits are covered by flysch, marl, sandy deposits and rarely are covered by limestone of Cr_1.

Upper Cretaceous (Cr_2) - deposits of this age are found largely in many regions of distribution of ophiolites and more rarely upon carbonate periphery. They come normally on the head of deposits cuts of Cr_1 in many sectors, while in some regions they are placed with stratigraphic interruption. In the region of ophiolites, as for example in the Pogradec area, they are placed on ultra-basic rocks. While on carbonates of Upper Triassic are placed in Dry Mountain. They are placed by means bauxite horizon. Deposits of Cr_2 are represented mainly by neritic, calcareous, breccia-conglomerate of average layer thickness up to thick layer rich with benthonic foraminifers, algae, etc. The thickness of these deposits is 1,000–1,200 m (Eftimi et al. 2007). In the study region these deposits extend on southwestern and southern part of Ohrid and Prespa zone.

Deposits of Middle Eocene (Pg_2^2). These deposits appear on the western part of the Ohrid Region and with small surfaces on the western and southwestern part of the Prespa Region. Transsgresively, the deposits are sitting on ultra-basic rocks with mediation of basaltic conglomerates, rarely with mediation of crusts of transformation of ultra-basic rocks upon rocks of Upper Triassic by means of iron bauxites (Dry Mountain) or upon the rinsed surface of calcareous of Upper Cretaceous.

Some erosion sediments with small surface and thickness are found in the cut of Dry Mountain; these are represented by organogenic–detritic, limestone and less by conglomerates. These are placed transsgresively with stratigraphic and angular unconformity upon calcareous deposits of Upper Triassic.

Deposits of Middle Eocene are represented by flysch deposits: clays, marls, sandstones and are included in group of deposits generally with a high penetration. They are found in the Albanian part, near Zemblaku Village and Zvezda one. Their thickness is 100 – 200 m.

Middle Oligocene (Pg_3^2) - lie further west of (Pg_3^3) of the zone. These deposits are presented lithologically by intertwining sandy-clay and clay–sandy–allevrolites of flysch character. More rarely there are layers of organogenic limestone in the cut. These Deposits are found in Albania, in Korca Region, near Mborje – Drenova villages. Thei thickness is 600 – 800 m (Eftimi et al. 2006)

*Upper Oligocene (Pg_3^3).*These deposits are generally dispersed in a more limited way than those of Middle Oligocene in the study area. Mostly lie on the west part of the Ohrid Lake. Lithologically they are represented by clay, sandy and limestone intertwining with average to thick layers. In the most upper part of the cut there are noticed sandy massifs which are intertwined with flysch mainly clay packets. It is noticed that depositing of Upper Oligocene are rich with foraminifer mainly in the lower part of the cut. Their thickness is 400 – 600 m.

Deposits of *Lower Miocene (N_1)* - have limited distribution in this area. They appear only on the west and southwest part of Ohrid Lake, and in southwestern zone of Big Prespa Lake.

Aquitanian (N_1^1a). These deposits are represented by an intertwining of packets clayish–allevrolites–sandy, sandy massifs and sandy gravel which are added in the upper part of lithological column.These deposits are found transgressively on Oligocene Molasse Deposits in Korca depression (Albanian part). Their thickness is 350 – 450 m.

Burdigalian (N_1^1b). These deposits have a limited distribution in synclinal belts. Deposits of Burdigalian in the lower part still have those lithological characteristics like the deposits of Aquitanian, they have a flysch series–flysch character and are represented by sandy, and sandy– gravely rocks. Going up the column the flysch series which is noticed in the beginning is replaced one after another by massifs of marl and carbonic clays which intertwine with rare sandy layers and limestone. Their thickness is 800 – 1000 m (Mandel et al. 1967, Tyli et al. 1971).

Deposits of Pliocene (N_2p) - are located meanly on the north, west south and east south part of the Ohrid Lake. These deposits have a limited distribution mainly on western and northern part of Big Prespa Lake. Pliocene deposits include all the continental formations, mainly coal-bed. They are represented by conglomerates and soft sandstones which contain rare allevrolites and clay under layers within them (Eftimi and Tafilaj 1985).

Deposits of Upper Pliocene–Lower Quaternary (N_2-Q_1) - Deposits of Upper Pliocene-Lower Quaternary are limited in distribution and belong to the lake's alluviums and stream sediments. This deposit lies on the western part of Small Prespa Lake and southern part of Big Prespa Lake. In the study region they are represented by intertwining clay, sub-clay, sand and gravel.

Quaternary Deposits (Q). Are found throughtout all territory in Korca Depression (Albania), Resen Field (North Macedonia) and Lemos (Greece). They are represented by fluvio – glacial deposits, alluvium deposits, alluvium – stream sediments deposits, stream sediments – glacial deposits, stream sediments deposits and swamp deposits in marshy areas. Quaternary deposits are represented by gravels, sands, subsands, subclays, silts, humid soils, etc.

Quaternary Deposits in Ohrid - Prespa region include:

- Deposits of Upper Pliocene–Ancient Quaternary (N_2-Q_1)
- Deposits of New Quaternary (Q_4)

Depositions of Upper Pliocene–Ancient Quaternary (N_2-Q_1) - are of a limited distribution and belong to the lake's facial. Stream sediments and lake's alluviums depositions are spread on the south western part of Small Prespa Lake and in the south of Big Prespa Lake; meanwhile in Ohrid Region one can't find these deposits.

New Quaternary deposits - occupy the major part of Quaternary deposits. In Ohrid Region there are alluviums deposits which are mostly dispersed on the north, south and eastern part of the Ohrid Lake. In the Big Prespa Lake these deposits are dispersed on the eastern part of the lake. Alluviums are mostly of the character river-lake and are generally represented by gravels, sands, sub-sands and sub-clays. The thickness of alluviums is considerable in this region. Stream sediments in Prespa Region are distributed on the south-eastern part. These deposits, in dependence of lithology of zones, which are rinsed by brooks, have a thickness varying in some 10 of meters (Tafilaj et al. 1977, Vranai et al. 1997).

The Geological map of the wider study area and the sections I-I and II-II are shown in the following Figures 3.1, 3.2, 3.3, 3.4, and 3.5.

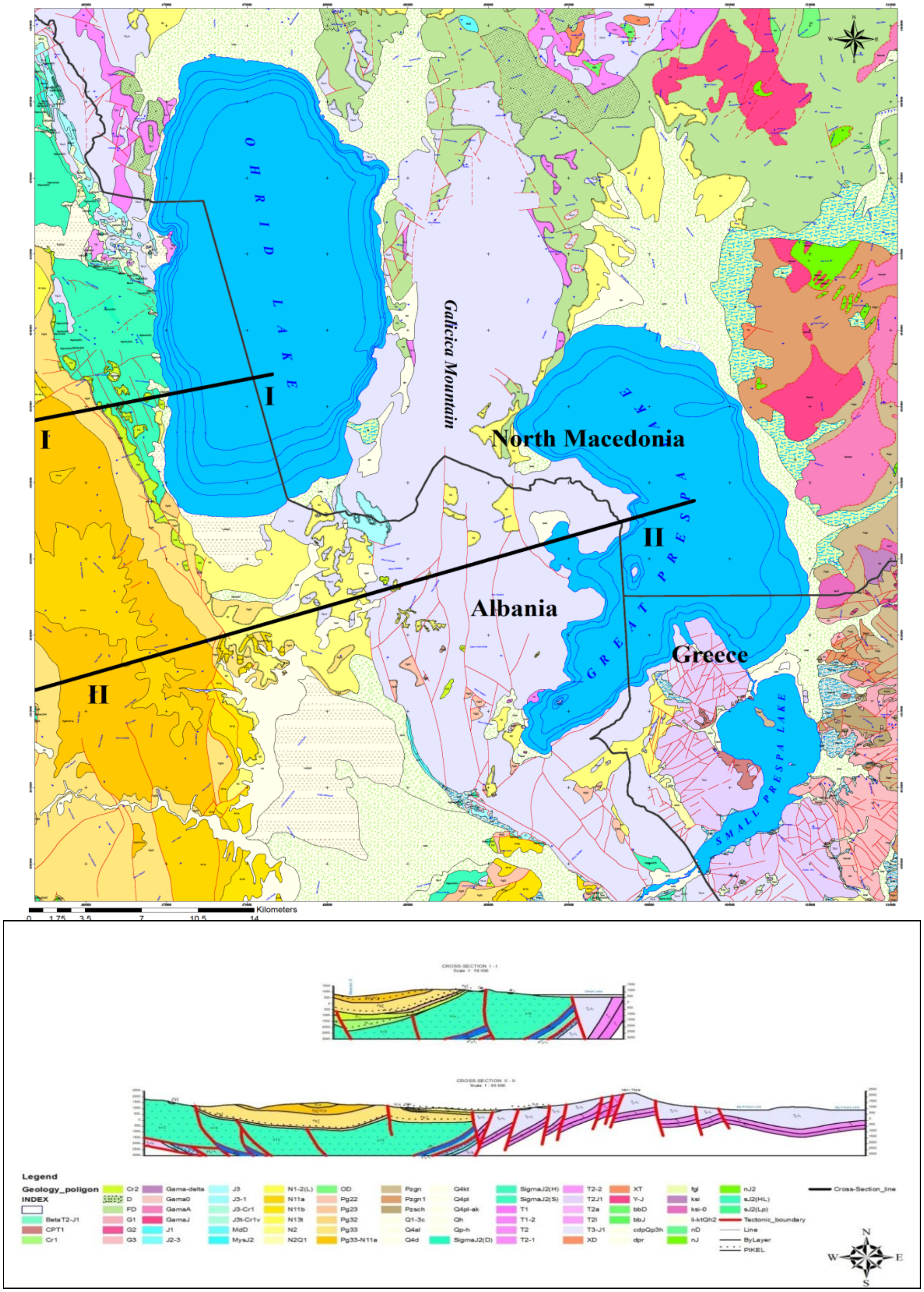


Figure 3.1. Geological map (sections I-I and II-II).

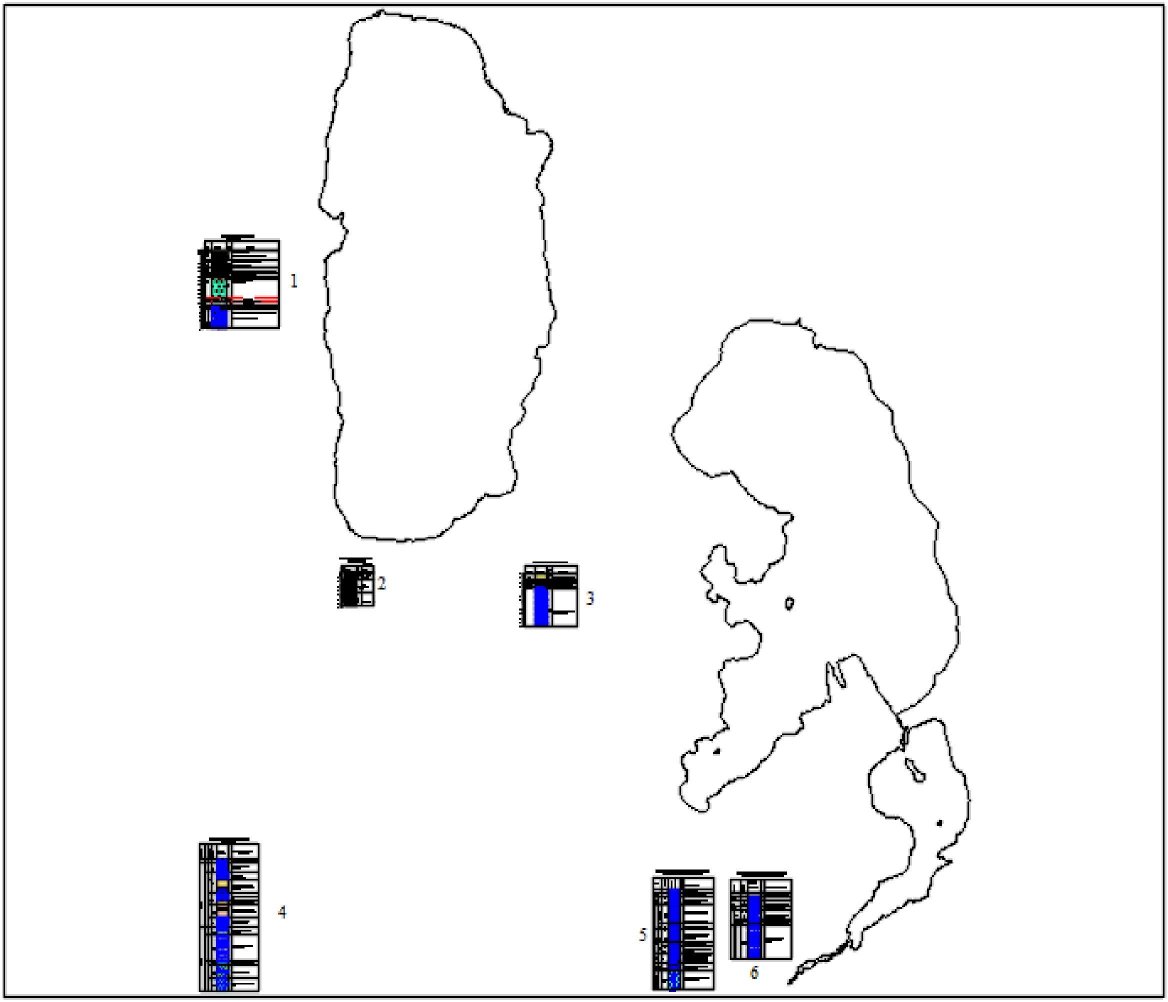


Figure 3.2. Schematic map of the region; where the stratigraphic colons belong (Archive, Albanian Geological Survey).

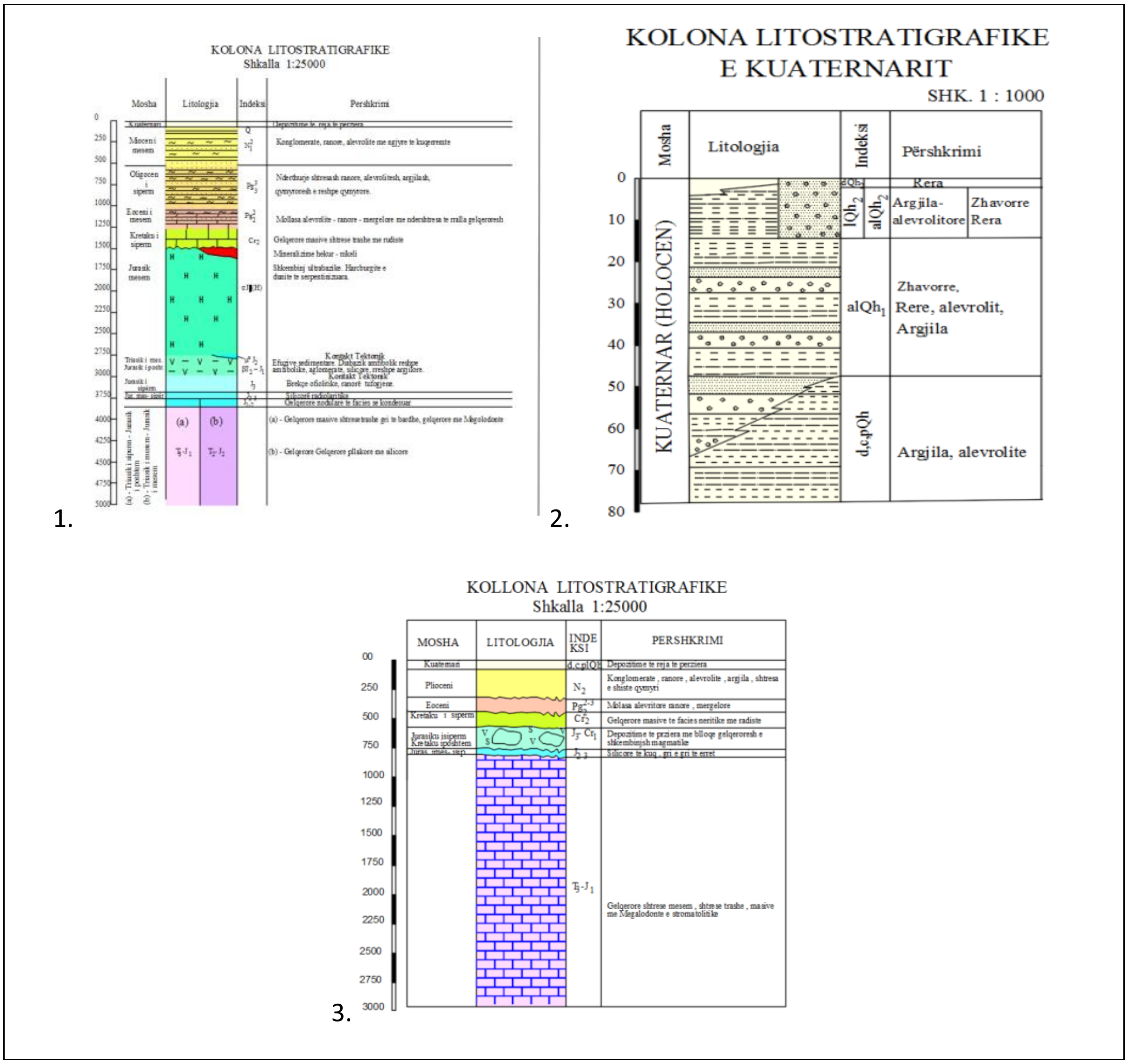


Figure 3.3. Colons 1, 2, 3 as are represented in the schematic map.

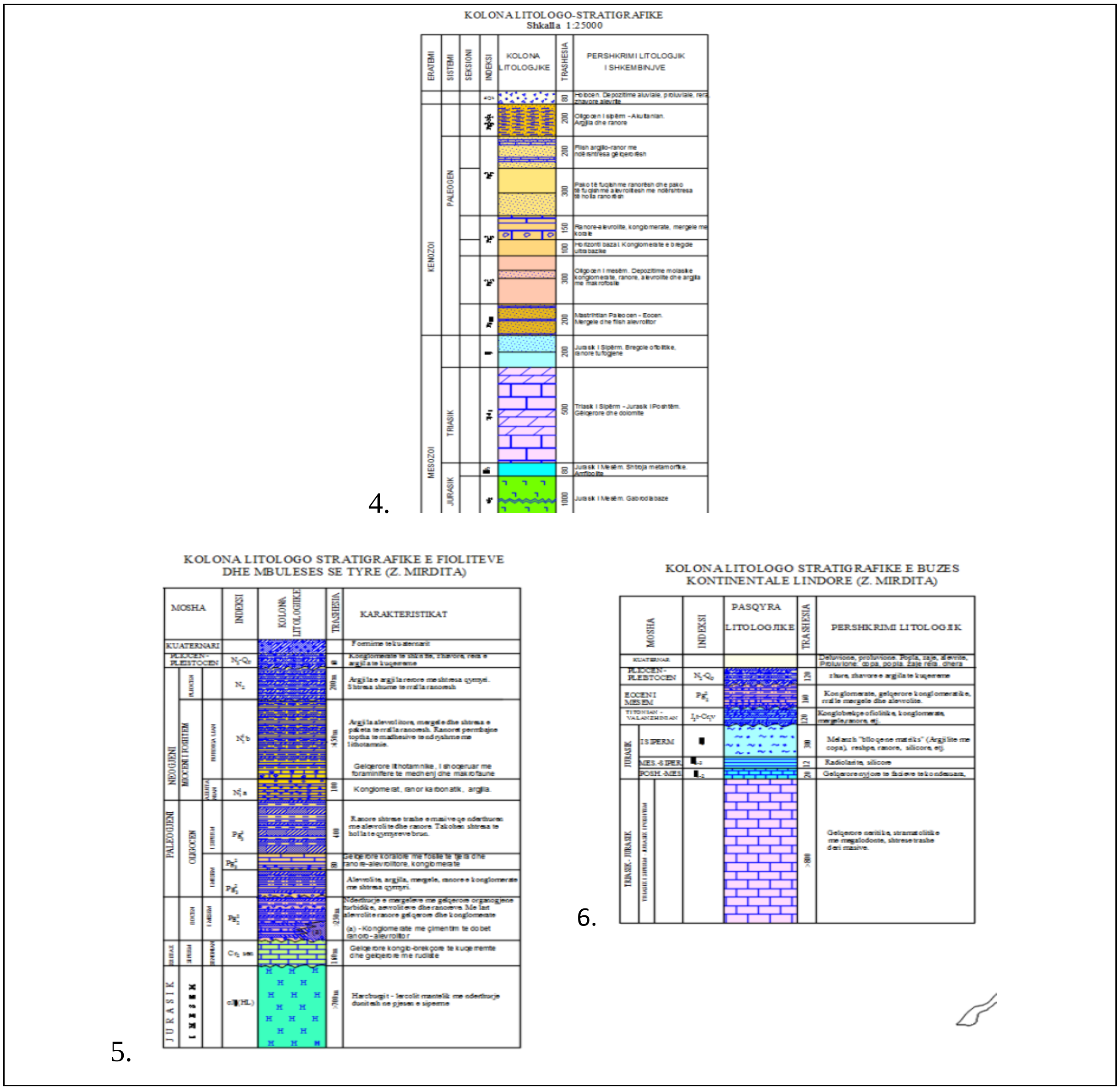


Figure 3.4. Colons 4, 5, 6 as are represented in the schematic map.

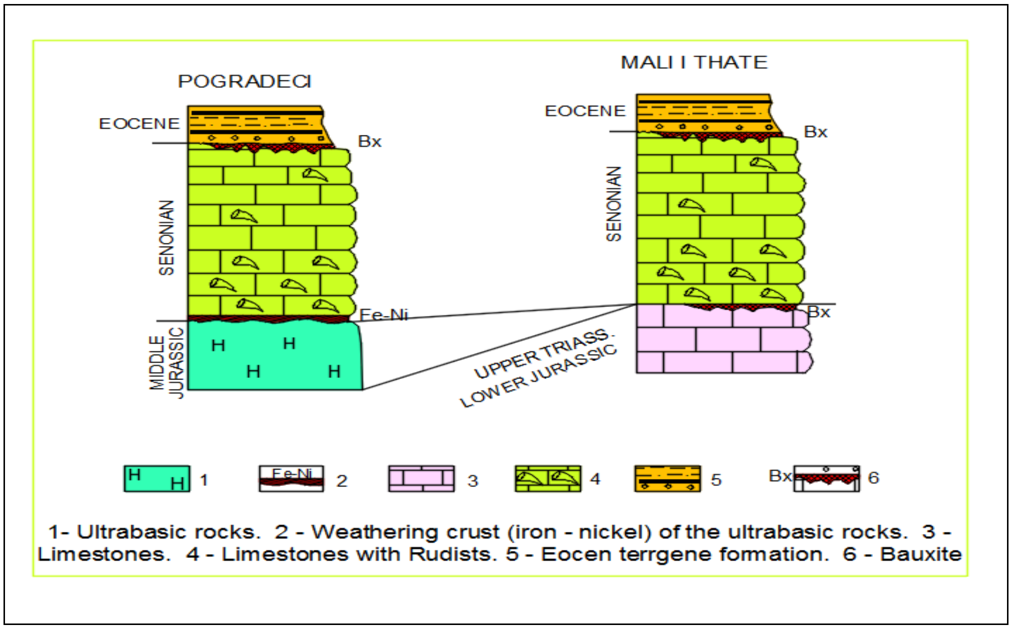


Figure 3.5. Quaternary stratigraphic profiles of the study area.

3.2. TECTONIC

The study area is part of inner Alpine-folding area affected by extensional tectonics since Pliocene era. Some fault systems were delineated by some previous geological investigations (Meçe and Aliaj 2000, Melo et al. 2001, Temovski et al. 2016). The most important conclusion of this investigation concerning the tectonics is that, in the area of Prespa – Ohrid Region, the tectonic faulting is intensively developed and it seems that some tectonic faults nowadays continue to be very active (Figure 3.6).

During the Pliocene-Quaternary the mountains embraced strong and progressive general uplifting, while the depression areas suffered mainly subsidence and partially uplifting. This leads to the formation of big horst - graben areas. In the central part of the studied area there is the very eminent Galicica - Dry Mountain horst. There are two big grabens on both side of this horst: Prespa Lake graben on the east and Ohrid Lake and Korca field grabens on the west.

Significant tectonic occurrences are also the regional faults along the eastern and western edges of Galicica - Dry Mountain mountainious horst, generally extending in North-South direction. The most important regional fault of the western edge of Galicica-Dry Mountain is developed from Ohrid City in the north following to Saint Naum and

Bilishti zone at the south. In the northern part of this fault, from Ohrid City at the north to near Terpeica in the south, the metamorphic rocks of Devonian core of Galicica Mountain outcrop. The vertical shifting bordering Galicica - Dry Mountain with the Ohrid Lake is about 1500 m. In the study area from Saint Naum Springs in the north to Tushemisht - Zagorchan in the south, some other very active faults create a relatively low elevation limestone zone (Melo et al. 2001). This fault zone facilitates the groundwater flow movement to the springs of Saint Naum and Tushemisht. The intensive faulting is developed also in the eastern side of Galicica – Dry Mountain, along the western coast of Prespa Lake. This conducted to the formation of the big graben of the Prespa Lake, which is filled up by Pliocene deposits. Beside this big graben and as a result of some local faults, some other smaller grabens and horsts appeared in the area of villages Gorica and Liqenas (Melo et al. 2001). A fault near Zaveri swallow hole is very clearly expressed where a natural limestone rocky wall falling vertically for more than 30 meters contacts the Prespa Lake.

These rupture tectonics results in the high seismic - tectonic potential of the area of Galicica - Dry Mountain horst and of Ohrid Lake-Korca grabens region (Meçe and Aliaj 2000, Matej and Mateja 2015, Temovski et al. 2016).

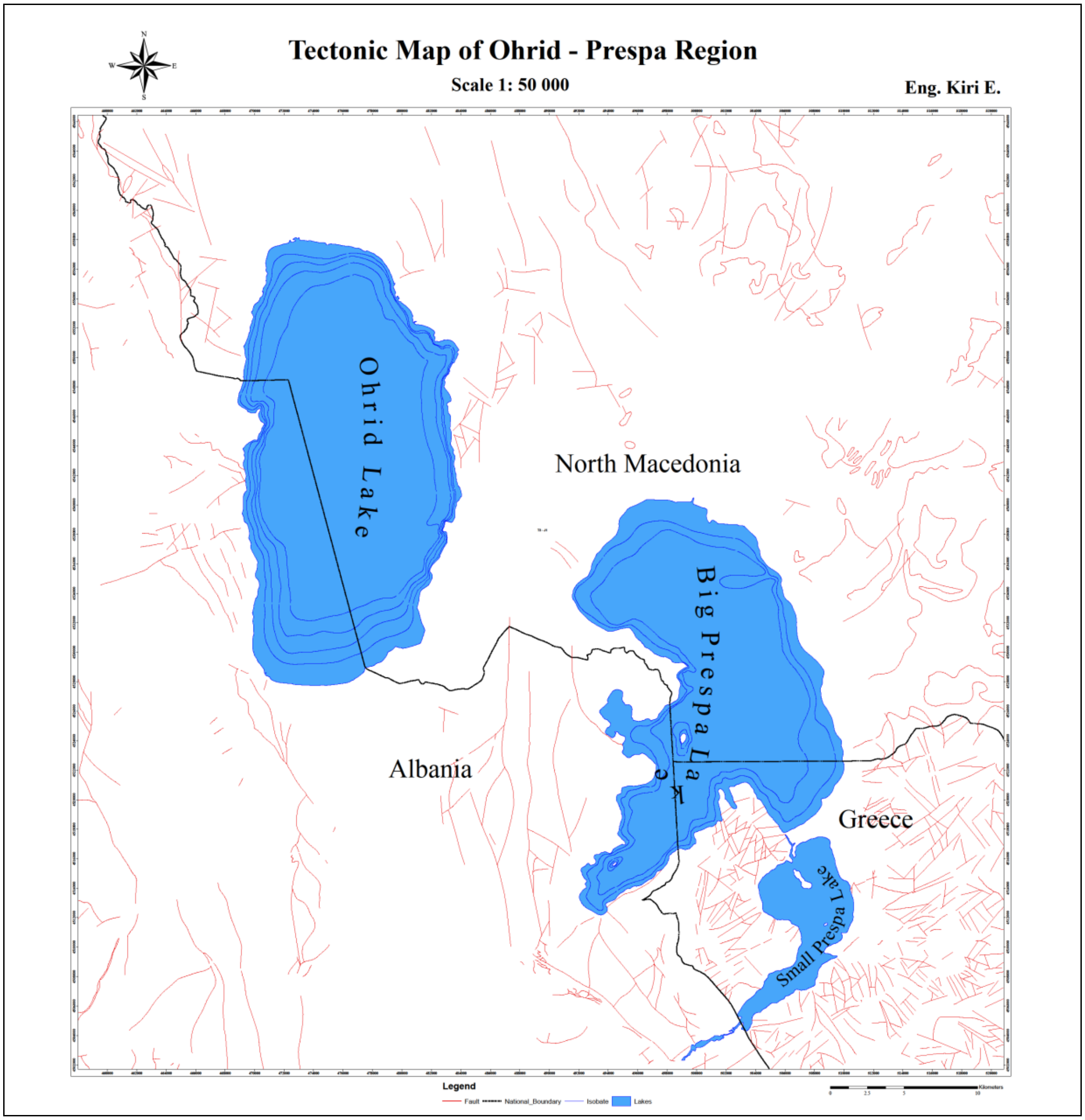


Figure 3.6. Tectonic systems in the Ohrid – Prespa Region.

CHAPTER 4. GEOPHYSICAL INVESTAGATION

4.1 GEOPHYSICAL METHODS

Several geophysical methods components are common to hydro-geophysical studies. First and foremost, it is critical to collect high-quality geophysical data sets using the geophysical method or methods that are most likely to provide data that can help to resolve the hydrogeological characterization or monitoring objective and that works well in the given environment. The corresponding geophysical properties (such as electrical conductivity/resistivity from electrical and electromagnetic (EM) methods or dielectric constant from ground penetrating radar (GPR) methods) can be used to infer hydrogeological properties or underground structures.

Electrical Resistivity Methods

For groundwater studies, electrical resistivity methods have perhaps been more frequently used than any other geophysical method. Resistivity is a measure of the ability to resist electrical current flow through materials; it is the inverse of electrical conductivity and is an intrinsic property of the material. Modern multichannel geoelectrical equipment now includes multiplexing capabilities and automatic and autonomous computer acquisition, which greatly facilitate data acquisition within acceptable timeframes. Such surface imaging, now commonly called electrical resistivity tomography or ERT, allows the electrodes (tens to hundreds) to be used alternatively as both current and potential electrodes to obtain 2D or 3D electrical resistivity models (Gunther et al. 2006).

ERT has proved to be useful for dynamic process monitoring using electrodes placed at the ground surface or in wellbores. A review of surface and crosshole ERT methods for hydrogeological applications is given by Binley and Kemna (2005). This method will be used during this study. Several profiles will be carried out in the area in order to see the spatial distribution of karst water or voids and the flow direction.

SP Methods

SP is a passive method where naturally occurring electric fields (voltage gradients) are measured at the ground surface or in wellbores using nonpolarizable electrodes and a high-impedance voltmeter. Electrical potentials measured with the SP method obey a Poisson's equation with a source term given by the divergence of an electrical source current density (Minsley et al. 2007). The source current density has several possible contributors, including those associated with ground water flow, redox phenomena, and ionic diffusion.

The electrokinetic contribution associated with the flow of ground water in a porous medium (or more precisely, with the drag of charges contained in the diffuse layer that surrounds mineral surfaces) has been recognized for many decades and has been used to qualitatively interpret SP signals in terms of seepage beneath dams or to map groundwater flow (Poldini et al. 1938).

Ground Penetrating Radar (GPR)

GPR methods use electromagnetic (EM) energy at frequencies of 10MHz to 1GHz to probe the subsurface. At these frequencies, the separation (polarization) of opposite electric charges within a material that has been subjected to an external electric field dominates the electrical response. In general, GPR performs better in unsaturated coarse or moderately coarse textured soils; GPR signal strength is strongly attenuated in electrically conductive environments (such as systems dominated by the presence of clays or high ionic strength pore fluids). GPR methods can be successfully applied to hydrogeological applications given by Annan (2005).

Seismic Methods

Seismic methods common to hydrological investigations use high-frequency (100–5000 Hz) pulses of acoustic energy to probe the subsurface. These pulses are generally artificially produced (using weight drop, hammers, explosives, piezoelectric transducers, etc.) and propagate outward as a series of wavefronts. The passage of the wavefront creates a motion that can be detected by a sensitive geophone or hydrophone. According to the theory of elasticity upon which seismic wave propagation is based, several different waves are produced by a disturbance; these waves travel with different propagation velocities that are governed by the elastic constants and density of the material. The surface reflection technique is based on the return of reflected P-waves from boundaries where velocity and density (or seismic impedance) contrasts exist. Processing of seismic reflection data generally produces a wiggle-trace profile that resembles a geologic cross section. However, due to the lack of well-defined velocity contrasts and strong signal interference in shallow unconsolidated and unsaturated materials, seismic reflection approaches to image near subsurface architecture can be challenging. With refraction methods, the incident ray is refracted along the target boundary before returning to the surface.

The refracted energy arrival times are displayed as a function of distance from the source, and interpretation of this energy can be accomplished by using simple software or forward modeling techniques. As with GPR methods, the arrival times and distances can be used to obtain velocity information directly. Refraction techniques are most appropriate when there are only a few shallow (0-50 m) targets of interest, or where one is interested in identifying gross lateral velocity variations or changes in interface dip.

Seismic refraction methods yield much lower resolution than seismic reflection and crosshole methods. However, because refraction methods are inexpensive and acquisition may be more successful in unsaturated and unconsolidated environments, they are often chosen over reflection methods for applications such as determining the depth to the water table and to the top of bedrock, the gross velocity structure, or for locating significant faults. Both reflection and refraction seismic a method gives estimation of the velocity structure that can be used to estimate hydrogeological properties.

Other Geophysical methods use for groundwater prospection and hydrogeological studies

Surface Nuclear Magnetic Resonance.

SNMR is a geophysical method that takes advantage of the NMR response of hydrogen protons, which are components of water molecules, to estimate water content (Yaramanci et al. 2005).

Gravity

Measurements of changes in gravitational acceleration can be used to obtain information about subsurface density variations that can in turn be related to variations in lithology or moisture content (Hinze et al., 1990).

Magnetics

Magnetic methods obtain information related to the direction, gradient, or intensity of the Earth's magnetic field. The intensity of the magnetic field at the Earth's surface is a function of the location of the observation point in the primary earth magnetic field as well as from contributions from local or regional variations of magnetic material such as magnetite, the most common magnetic mineral (Kobr et al. 2005).

4.2 RESISTIVITY METHODS FOR KARST DETECTION

Since several years, electrical imaging surveys have been conducted on karst terrains (mainly in carbonate rocks) to map karst hazards such as voids, conduits, sinkholes, weathered zones (i.e. Guérin and Benderitter 1995, Gautam et al. 2000, Kaufmann and Quinif 2001, Sumanovac and Weisser 2001, Kaufmann and Quinif 2002, Zhou et al. 2002, Gibson et al. 2004). These investigations pointed out the efficiency of electrical imaging to map karst structures due to the strong contrast in resistivities between conduits, voids (higher resistivities) or weathered zones (lower resistivities) and limestone bedrock. The technique mostly used is the surface 2D DC resistivity tomography. The influence of the electrode arrays on karst features reconstruction has been studied by Zhou (2002) and Kaufmann and Quinif (2001).

The combination of Wenner–Schlumberger and dipole–dipole arrays was shown to give the best results in karstic contexts. However, karst terrain is a very unfriendly environment for 2D geophysical exploration because of the great heterogeneity of the subsurface. Karstic features are strongly three-dimensional objects with sharp boundaries. To improve the reconstruction of subsurface conditions, emerging techniques, such as quasi-3D and 3D resistivity tomographies (Deceuster and Kaufman 2003, Chambers et al. 2005), can be carried out.

Electrical Resistivity Tomography

The Electrical Resistivity Tomography (ERT) is a geophysical method to obtain the electrical resistivity of the subsurface. Figure 4.1 shows the measurement principle of a four-point measurement. A direct or a low-frequency alternating current is injected through electrodes A and B and the potential difference is measured at electrodes M and N. The figure also shows the current flow lines and equipotentials for a two layered subsurface. With the availability of multi-electrode systems, the method got more attention as it reduces the time of a survey and its costs.

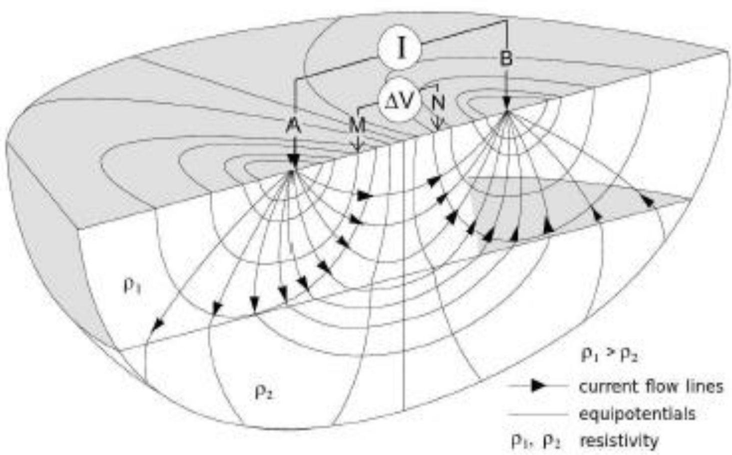


Figure 4.1. Principle of a geoelectric measurement using the Wenner array. Two electrodes are used to inject a current into the ground and two electrodes are used to measure the potential difference. The current-flow lines and the equipotential are shown for $\rho_1 > \rho_2$. (Knodel et al. 2005, modified).

With the improvement of computing capacity, 2D and 3D inversion programs became available. These are needed to calculate complex subsurface resistivity models from the measured data. Furthermore, various electrode configurations can be used in the field procedures which have different response from error sources. Numerous four-point measurement configurations exist that depend on the layout of the current and potential electrodes.

The most common configurations are the Wenner, Schlumberger, dipole-dipole and pole-dipole arrays. Figure 4.2 gives an overview of the named arrays. In the current study, the Wenner, Dipole-Dipole, Wenner-Schlumberger, and Wenner-gamma arrays were used.

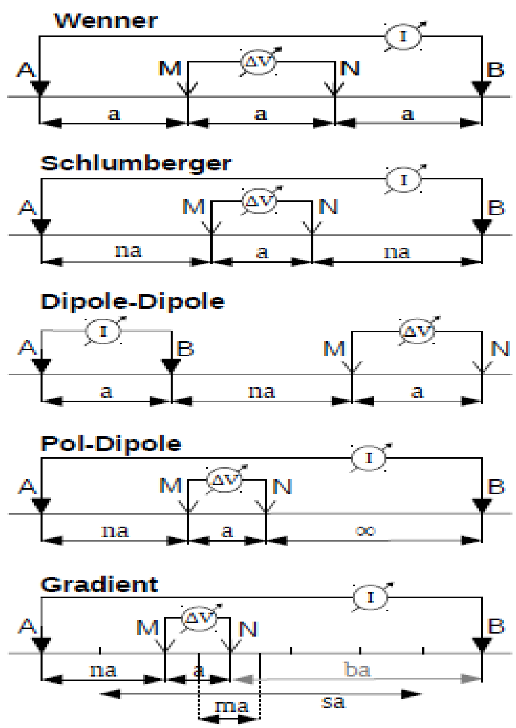


Figure 4.2. Different electrode configurations. Electrodes A and B are used for current injection and electrodes M and N to measure the potential difference: a denotes the minimum electrode spacing. n, s, b and mare (positive) integer numbers. For the gradient array n and m might be defined negative if the potential electrodes are left of the layout's midpoint and positive if they are on the right side (Knodel et al. 2005, Dahlin and Zhou 2006).

The array configurations differ in many aspects such as sensitivity distribution in the subsurface, resolution and signal-to-noise ratio. Therefore, it is important to choose the array according to the research question and local conditions of the measurement area. It describes the degree of sensitivity of the model response to the change of a model parameter. Thus, Figure 4.3 depicts the sensitivity distribution of the subsurface. If the main response of an array is largely flat, it has a high vertical resolution for a layered subsurface (Wenner & Schlumberger). In contrast, the dipole-dipole array, for example, is more sensitive to deep lateral resistivity variations (Reynolds et al. 1997). The importance of the sensitivity is beyond the scope of this thesis; however different arrays have been used in order to compare the results.

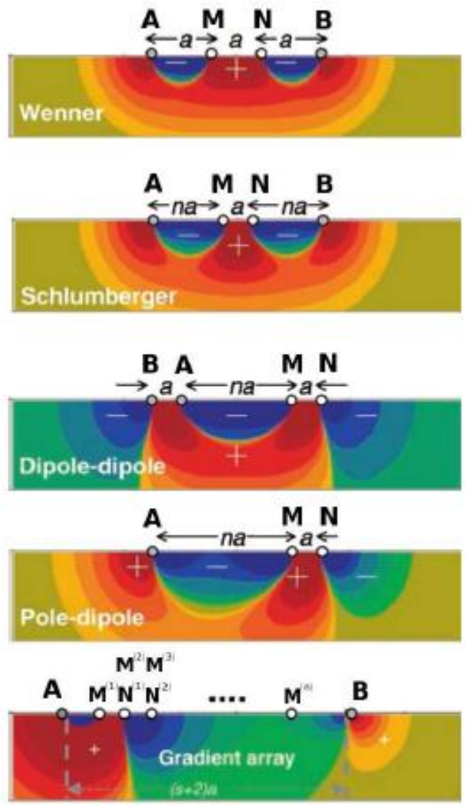


Figure 4.3. Sensitivity patterns for different arrays. A is the positive and B the negative electrode. M and N are the potential electrodes. Red colors illustrate positive and blue colors negative sensitivities. Dark tones represent high and light tones low sensitivities. For the gradient array the sensitivity is shown for M(1) and N(1) (Dahlin and Zhou 2004; modified).

4.3 GEOPHYSICAL RESEARCH WORK AND RESULTS

Geophysical science tock place in the second phase of the field work, carried out in the same period of year. Geophysical works were focused on Gurras Village, above the fountain where water samples were taken for chemical analysis, more specifically above the source.

Another geophysical profile was positioned in the hills of the Tushemisht Village.

The third profile was made at the cemetery of this village on the southeast side of the Ohrid Lake.

So, in the study were carried out 3 ERT profiles, which are located next to the Tushemisht and Gurras springs. The measurements were realized in two periods of year 2016, in June and October, having as scope monitoring the karst phenomenon developed in limestone of that area, and in the meantime the possible connection with ground water movement towards the springs (Photo 4.1).

In the area under study, the resistivity measurements, revealed high resistive values in the upper part of profiles and some lateral zones inside the limestone. Low resistivity values in the upper part are connected with the cover soils of clay content, whereas low resistive values are shown by lateral changes inside limestone, present the karst which can be filled with soils or mainly connected with water ways toward springs.

Photo 4.1. Gurras Village, above Gurras Spring.

Photo 4.2. West part of the Tushemisht Village, Cemetery.

Photo 4.3. South part of the Tushemisht Village, Cemetery.

Field Procedure

The multi-electrode system used for the field survey in this thesis is the WZG multielectrode Instrument, which handles up to two cables: Two linked cables are connected to the switcher, each possess 30 take-outs for electrodes that are spaced five meters apart. For two profiles (profile 1&3), are used 30 electrodes, whereas in one, the number of electrodes is 45 with 5 m separation between them.

The inversion is applied to the measured data, to obtain a model of the subsurface that explains the measured data. For the ERT method the resistivity distribution of the subsurface is sought from the measured apparent resistivities. The topography effect is taken into account, however the correction is an approximation that becomes more inaccurate, the more complex the geology and the more complex the topography gets (Hamacher et al. 2016).

Geological setting area

The study area from the geological point of view is mostly composed by the deposits of the T_3-J_1 (Upper Triassic - Lower Jurassic), representing by limestone with megalodonte (Figure 4.4). These deposits are represented by thick layers up to massifs limestone, stromatous limestone and dolomites. The thickness of these deposits is about 1000 – 1200 m. From the hydrogeologic point of view these deposits are relevant because they carry a considerable amount of groundwater. So, these deposits are important, since they contain karstic waters out of which powerful springs flow.

The N_2 (Pliocene) are represented by Pliocene clays, sandstones-brown coal. These deposits include all continental formations mainly coal – bed. They are represented by conglomerates and soft sandstones which contain rare allevrolites and clay under layers within them. Water bearing is variable and low in general.

The li-ktQh$_2$ (Middle Holocene) represented by lake and marsh (turf) deposits. The lake deposits in general have a limited distribution being represented mainly by clay, subclay, graveling, and sanding layers with a thickness that reaches up to some 10 of meters (as mention in the geological review of the study area).

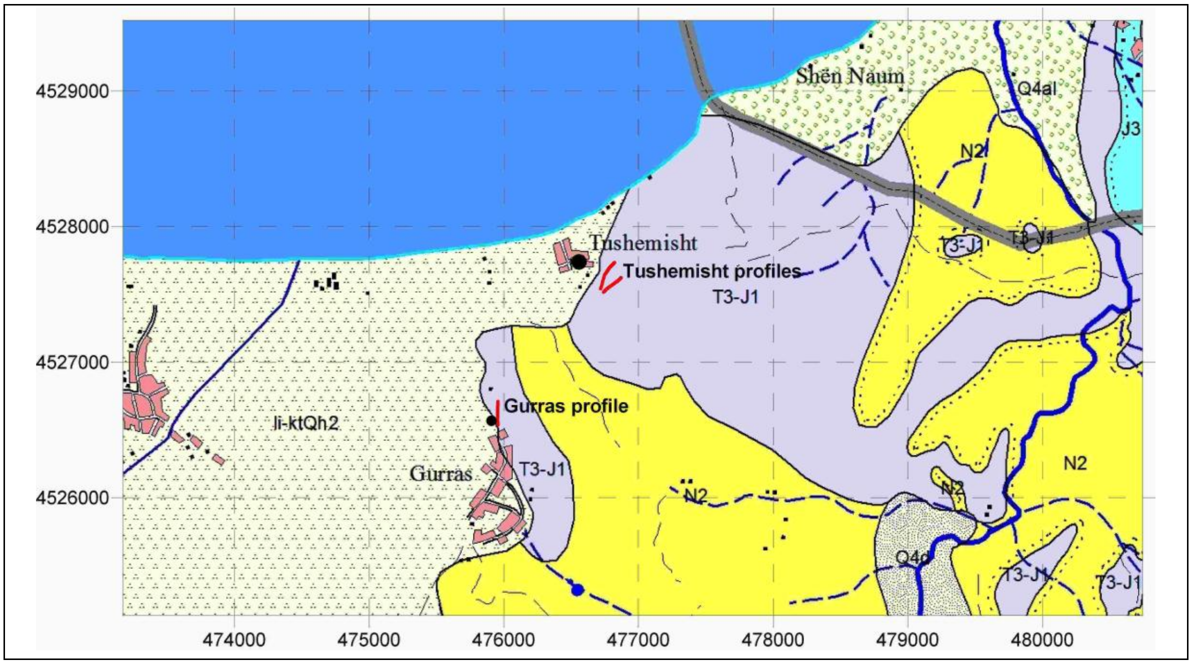


Figure 4.4. Part of geological map when took place the geophysical field work (Tushemisht, Gurras). With red lines are shown the monitored geophysical profiles and with black circles are depicted the positions of karstic springs of Tushemisht and Gurras.

4.4 ELECTRICAL RESISTIVITY TOMOGRAPHY (ERT) PROFILES CARRIED OUT IN THE AREA

In the area presented in Figure 4.4, were carried out 3 ERT profiles, which are located next to the Tushemisht and Gurras springs. The measurements were realized in two periods, in June and October having as scope to monitor the Karst phenomenon in limestone, developed in that area, and the possible connection with ground water movement towards the springs (Figure 4.4). In the study area, the resistivity measurements, revealed high resistive values in the upper part of profiles and some lateral zones inside the limestone. Low resistivity values in the upper part are connected with the cover soils of clay content, whereas low resistive values are shown by lateral changes inside limestone, present the karst which can be filled with soils or mainly connected with water ways toward springs.

Field Procedure

The multi-electrode system used for the field survey in this thesis is the WZG multielectrode Instrument, which handles up to two cables: Two linked cables are connected to the switcher , each possess 30 take-outs for electrodes that are spaced five meters apart. For two profiles (profile 1&3), are used 30 electrodes, whereas in one, the number of electrodes is 45 with 5m separation between them.

The inversion is applied to the measured data, to obtain a model of the subsurface that explains the measured data. For the ERT method the resistivity distribution of the subsurface is sought from the measured apparent resistivities. The topography effect is taken into account, however the correction is an approximation that becomes more inaccurate, the more complex the geology and the more complex the topography gets (Hamacher et al. 2016).

Resistivity results

Below we present the inversion results of resistivity values and probably explain their distribution with the subsurface model.

Profile 1; Tushemisht

The layout of this profile is shown in Figure 4.5; it is realized along an existing unpaved road. The length of profile is 145 m, and 30 electrodes are used with 5 m apart. The true resistivity sections of this profile are shown in figure 4.5, for both periods.

As seen resistivity distribution, there is not any big change in resistivity values for the both periods. However there are some changes between different configurations used, due to errors in measurements and sensitivity related to the changes of subsurface.

The upper part of the area is represented with low resistivity values connected with cover soil deposits, with thickness 3-7 m, and below it, there are high resistivity values which represent the limestone. Lateral changes of resistivity values are seen which can be related with some karst filled with clays or soils in the pickets 80-120 m of the profile, in a depth below 10 m.

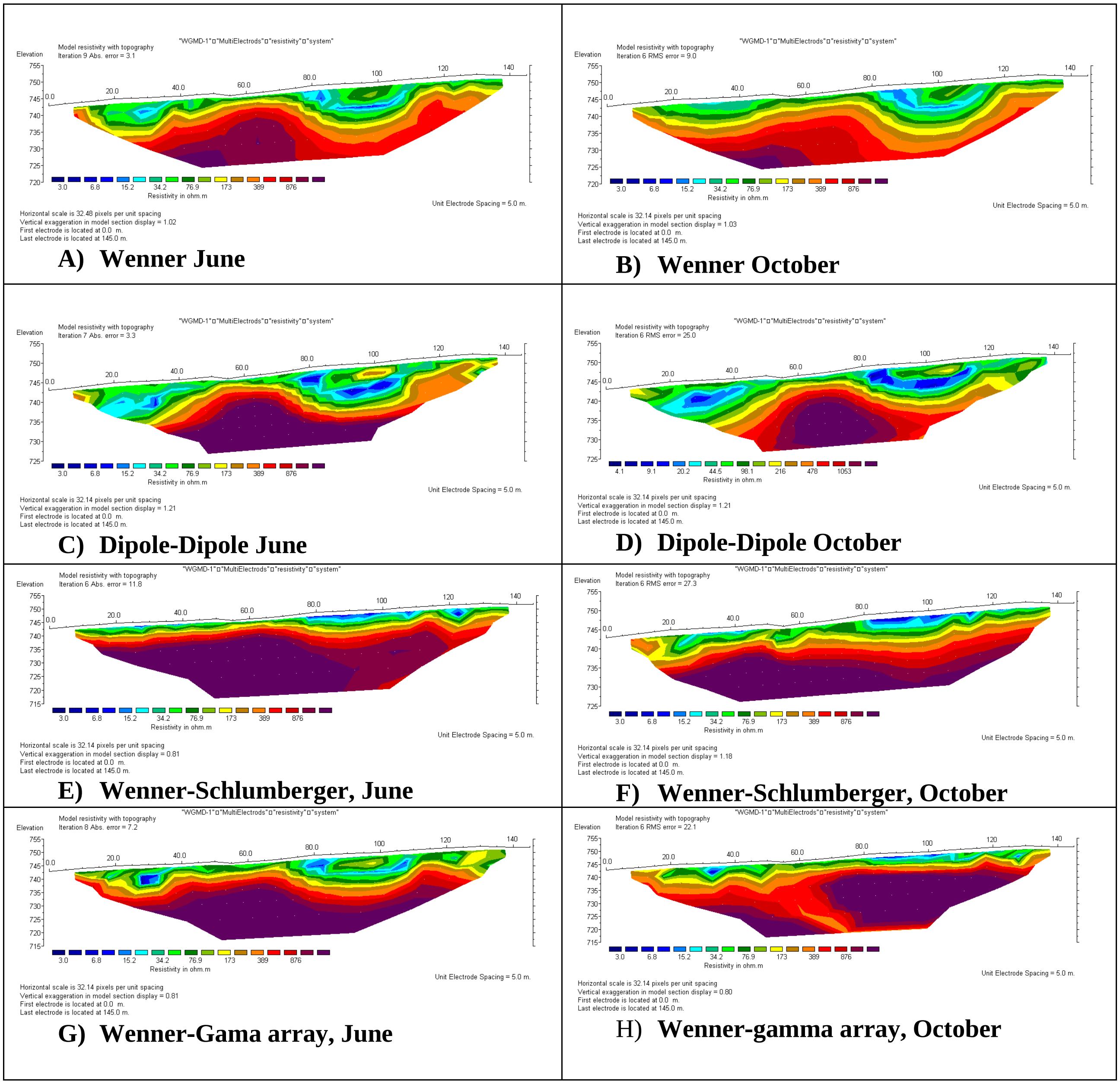
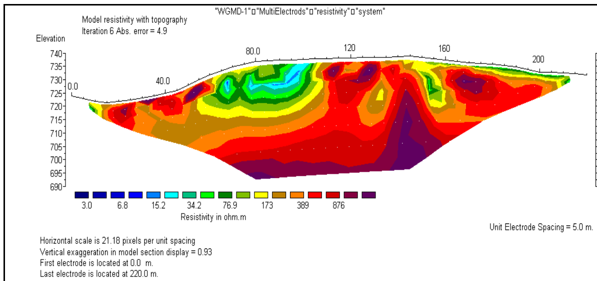


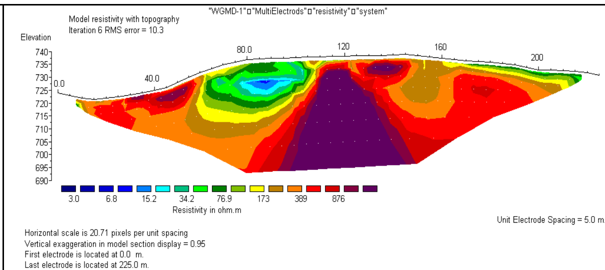
Figure 4.5. True resistivity values of the profile 1, Tushemisht Spring. Different configuration of electrodes was used.

Profile 2; Tushemisht

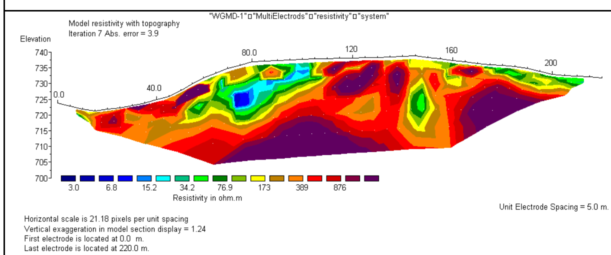
This profile is almost parallel to profile 1, located in the western part of it, about 100 m, in a lower elevation and is closer to the Tushemisht Spring than profile 1 (Figure 4.6). The true resistivity sections of this profile are shown in figure 6, for both periods. As seen from the resistivity values in this profile there is not any cover of soils, but limestone (High resistivity values are present form the surface along all the profile). There are lateral changes of resistivity values especially from 40-120 m (seen in all electrode configurations), which are connected with karst, and probably this is the direction of water movements to the Tushemisht Spring. There is a small change on anomalies between periods mostly observed from dipole-dipole array, where another anomaly with low values exist more clear in the picket 150 m, in June which may be is related with the water movement in June (more precipitation in that period) comparing with October (dry period).



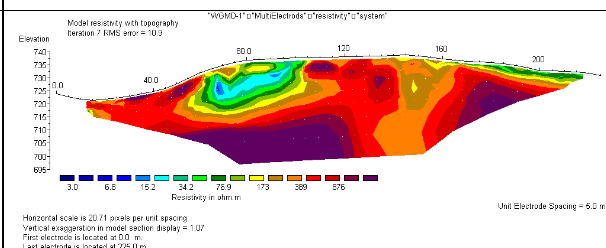
A) Wenner - June



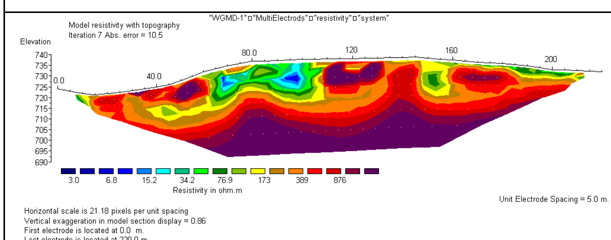
B) Wenner - October



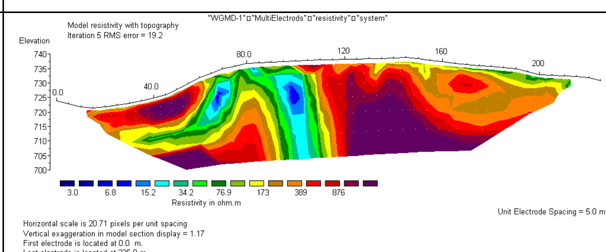
C) Dipole-Dipole, June



D) Dipole-Dipole, October



E) Wenner-Schlumberger, June



F) Wenner-Schlumberger, October

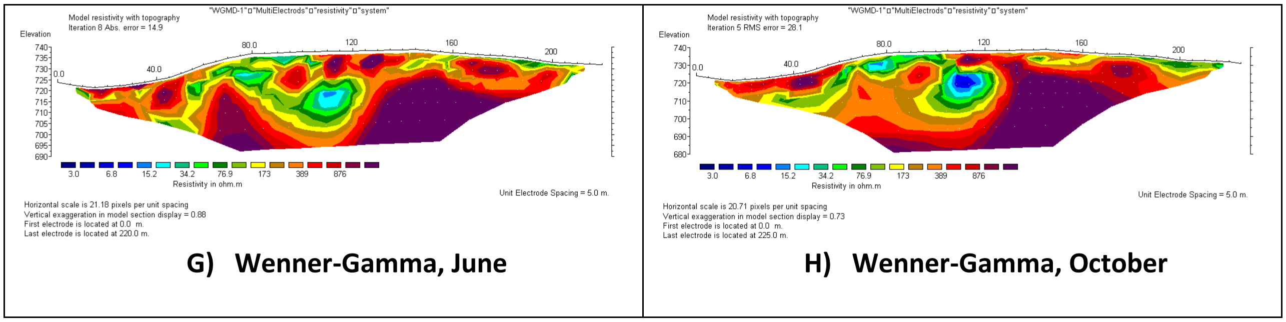


Figure 4.6. True resistivity values of the profile 2, Tushemisht Spring. Different configuration of electrodes was used.

Profile 3; Gurras

This profile is located just above the Gurras Spring (Figure 4.7), on the eastern side of them, at a distance around 10 m, and in an elevation difference of 5 m. The profile is surveyed along an unpaved road, which is parallel to the spring's location. The outcrop formations are limestone (Figure 4.7).

The true resistivity sections of this profile are shown in Figure 4.7, for both periods. As seen from resistivity distribution, high resistivity values are in the upper part connected with limestone, whereas low resistive values (blue color), are in the lower part of profile and are connected with karst filled with water (water ways movements). This is in good agreement with observation in the field where several springs exist in the area, which correspond with low resistive values in the profile. Here was seen that the lower resistive values are more present during June comparing with October, however the places of anomalies are the same. There exist different responses for different configurations, due to errors in measurements especially in October, where ground-coupling of electrodes was more difficult due to dry soils cover.

As a conclusion was seen since the resistivity distribution doesn't change too much at both periods of measurements (June, October), the most of water quantity that moves towards the springs in the area, throughout karst ways, comes from Prespa Lake.

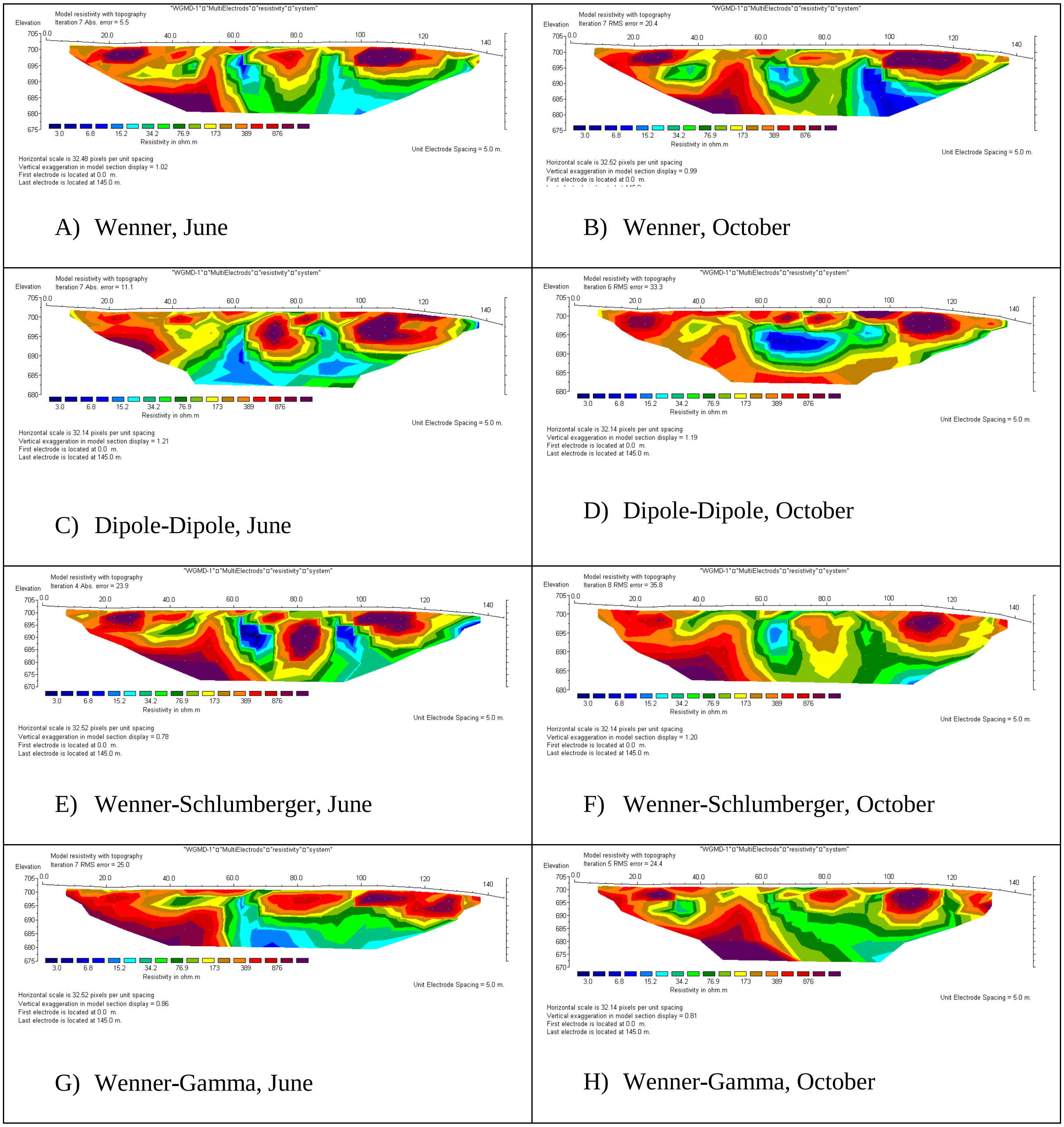


Figure 4.7. True resistivity values of the profile 3, near Gurras Spring. Different configuration of electrodes was used.

4.5 Chapter summary

In this chapter was done an investigation of the karstic development in the south part of the Ohrid Lake. Three profiles, in three different points, for both wet and dry period of year, have been built. In each profile was seen the similarities between the profile for the dry period of year with that of the wet period. In this area was distinguished a very developed karst. Having this kind of similarities between profiles for two mention periods was expected. The groundwater ways in this area are and should be always filled with water for two simple reasons. The first one because during the wet period of year the karstic fractures are filled with the rainfall infiltrations, while during the dry period of the year this fractures are still filled with water, but this time with water that comes from the Prespa Lake. The geographic positions of the lakes help this phenomenon. Ongoing, in the hydrochemistry investigation the water that filled the karstic fractures during the wet period of year, was analyzed and compered with the water of the Prespa Lake, in order to see the similarities between them, if exists. Such similarity shouldn’t normally exist for this period.

CHAPTER 5. HYDROLOGY-HYDROMETEOROLOGY

5.1 CLIMATIC CONDITIONS

The Prespa Region, as well as the Ohrid Region, are characterized by different climates, they are located in the transition region between Mediterranean and Continental zones (Van Der Schriek & Giannakopoulos 2017). The continental climate, created by the mountainous terrain, is associated with the Mediterranean climate that comes as a result of the Adriatic Sea impact. According to the Köppen climate classification, the climate of the study area is ***Csa*** indicating temperate, hot-summer Mediterranean climate; coldest month averaging above 0°C or −3°C, at least one month's average temperature above 22°C, and at least four month average above 10°C.

The precipitation quantity in the wettest month of winter is triple the amount of precipitation in the driest month of summer (the driest month of summer receiving less than 30 mm). In Figure 5.1, the ombrothermic diagram of the Ohrid station is shown; the wet season lasts from late October to April. The following are detailed data on hydrometeorological parameters provided by: Lake Ohrid monitoring program 2002, Popov et al. 2009, https://www.meteoblue.com/en/weather/archive/era5/ohrid_north-macedonia_787487.

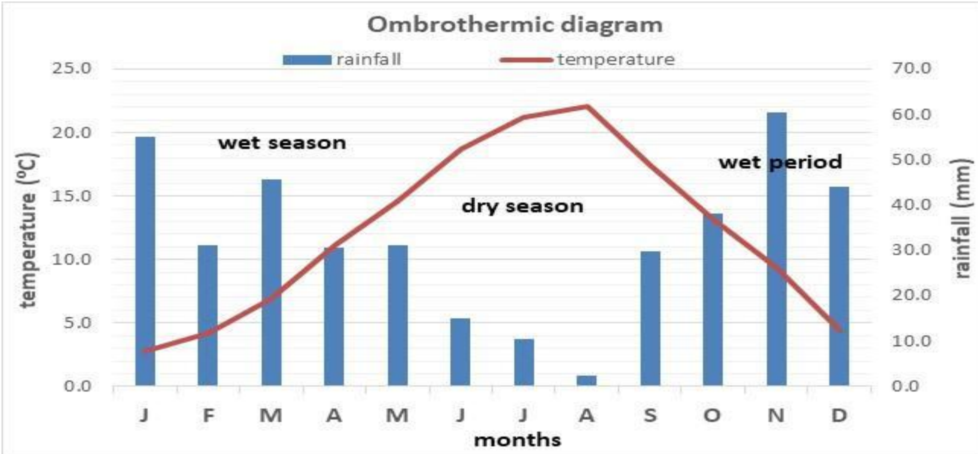


Figure 5.1. Ombrothermic diagram at Ohrid Lake station for the period 2000 to 2019.

5.1.1 Temperature

The temperature regime of the Ohrid Watershed is highly dependent on the influence of the Lake. This influence is more evident during the winter season and close to the shoreline. Based on data at Ohrid station (elevation 703. m a.s.l.), the average annual air temperature is 10.6^{o}C to 11.94^{o}C (for 2000 to 2007) and 11.9 ^{o}C to 12.5^{o}C (for 2008 to 2019). The highest temperatures are reached during the July and August 18^{o}C to 21^{o}C (for 2000-2007) and 22 ^{o}C to 23.6 (for 2008 to 2019), and the lowest in January - 2^{o}C to 3^{o}C (for 2000 to 2007) and -1^{o}C to 3.8^{o}C and 6^{o}C (for 2008 to 2019). These data are shown in Table 5.1, and Figure 5.2.

The average monthly temperature in this area varies from 7^{o}C to 10^{o}C during the cold period of the year (December - January) and from 18^{o}C to 19^{o}C during the warm period (July - August). The mean monthly values of temperature for the period 2008-2019 are shown in Figure 5.3. From the climatic data of the last 10 years in the study area, was noted an increase of the mean annual temperatures over the years (Figure 5.2).

Table 5.1. Average annual temperature at Ohrid Lake station

Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**				
T ^{o}C	11.7	11.7	11.6	11.4	11.1	10.6	10.81	11.94				
Year	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
T °C	12.33	12.2	11.87	12	12.4	12.5	12.2	12.4	11.9	11.7	12.4	12.2

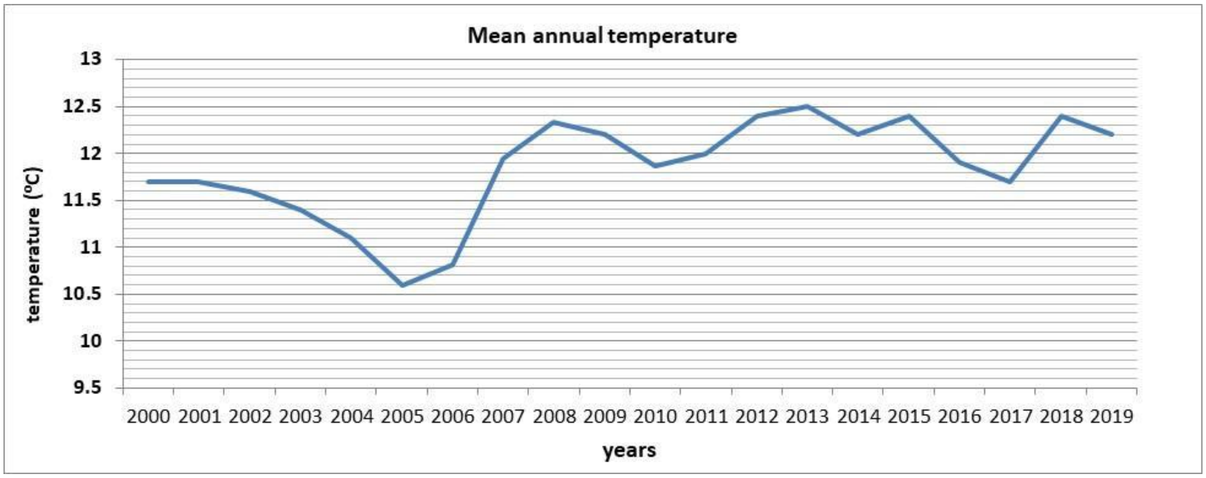


Figure 5.2. Mean annual temperature at Ohrid Lake station for the period 2000 to 2019.

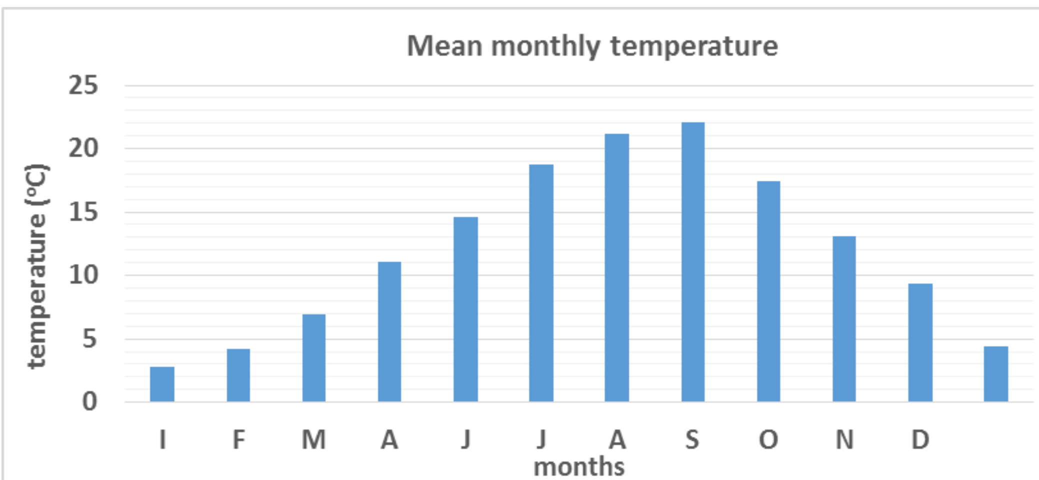


Figure 5.3. Mean monthly temperature at Ohrid Lake station (period 2008 to 2019).

5.1.2 Rainfall

Precipitation (rainfall and snowfall) is a very important element in order to determine the climate regime of a region. Rainfall data at Ohrid Lake station (elevation 703 m a.s.l.) for the period 2000-2019 are provided by: Lake Ohrid monitoring program 2002, Popov et al. 2009,

https://www.meteoblue.com/en/weather/archive/era5/ohrid_north-macedonia_787487.

The location of the Ohrid station is shown in Figure 5.4. Appendix C contains daily climatic data for the last 10 years for Ohrid Lake station. It is pointed out that there is no rainfall data for the mountainous area surrounding the Ohrid Lake.

Table 5.2. Annual rainfall at Ohrid station, (Lake Ohrid monitoring program 2002, Popov et al. 2009)

Years	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
P (mm)	358.8	378.8	575.8	553.2	559.3	528.1	555.5	516.0

Years	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
P (mm)	299.3	611.6	450.9	331.9	437.4	322.4	460.9	381.1	405.9	250.7	382.8	395.0

The annual rainfall of the region mentioned above ranges between 350 mm and 680 mm (Table 5.2, Figure 5.5). From the boxplot of Figure 5.6, it is concluded that the median annual rainfall is 421.6 mm and Q_3 (75^{th} percentile) = 546.9 mm, which means 75% of the annual values is lower than 546.9 mm. The annual course of rainfall shows a downward trend, but not statistically significant (Figure 5.7).

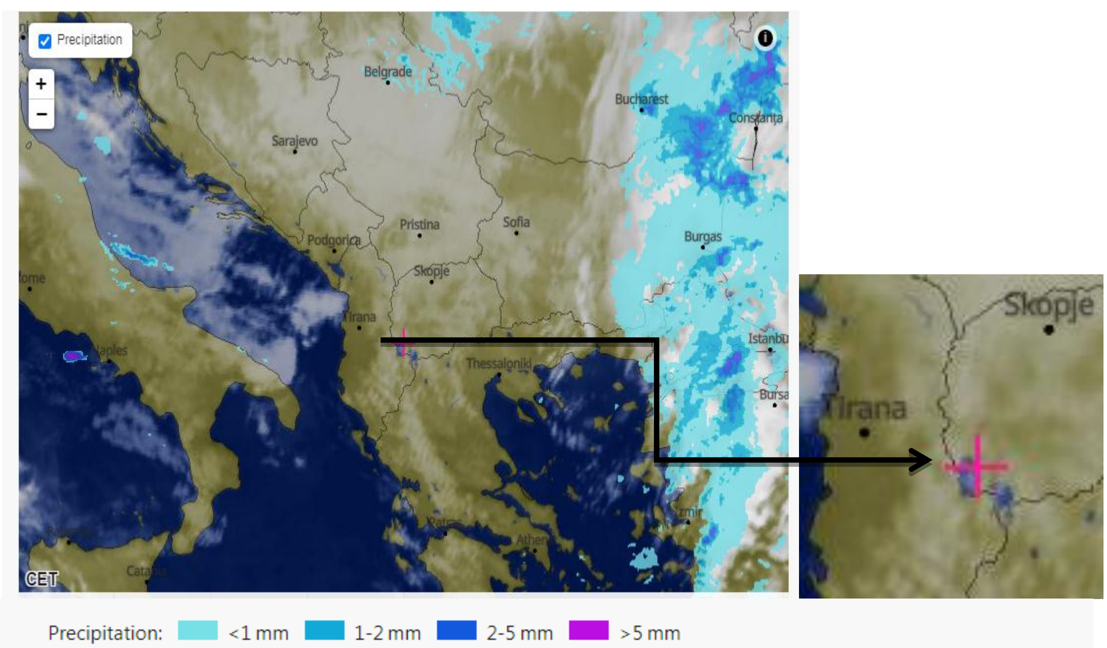


Figure 5.4. The location marker is placed on Ohrid station (meteoblue.com/en/weather/archive). *Copyright 2021 EUMETSAT / meteoblue. Lightning data provided by nowcast.*

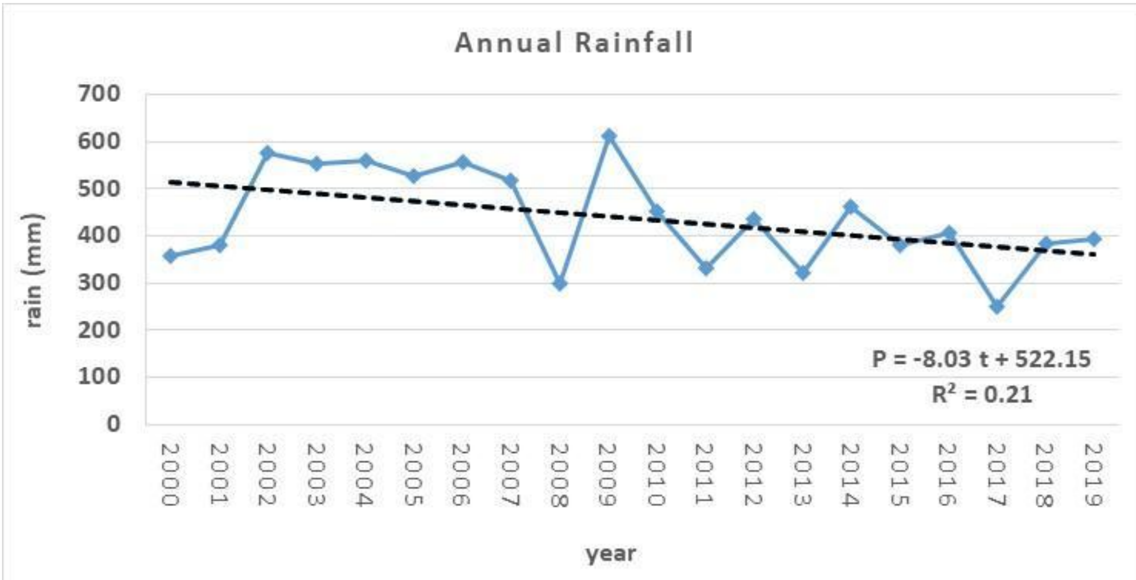


Figure 5.5. Annual rainfall (mm) at Ohrid Lake station (period 2000 to 2019).

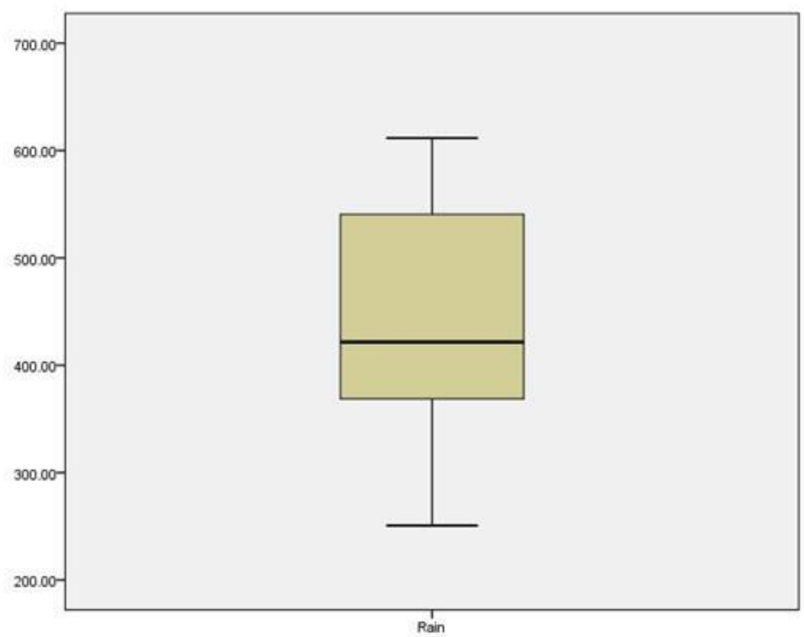


Figure 5.6. Box plot of annual rainfall in mm at Ohrid Lake station (period 2000 to 2019).

The mean monthly rainfall at rain-gauge station of Ohrid Lake (meteoblue.com/en/weather/archive) for period 2008-2019 is shown in Figure 5.7. From this Figure, it is concluded that the Ohrid Region receives the highest mean amount of rainfall in November (60 mm) and the lowest one during August and July <10 mm). The Prespa watershed receives annual precipitation of approximately 750-800 mm (Lake Ohrid monitoring program 2002, Popov et al. 2009).

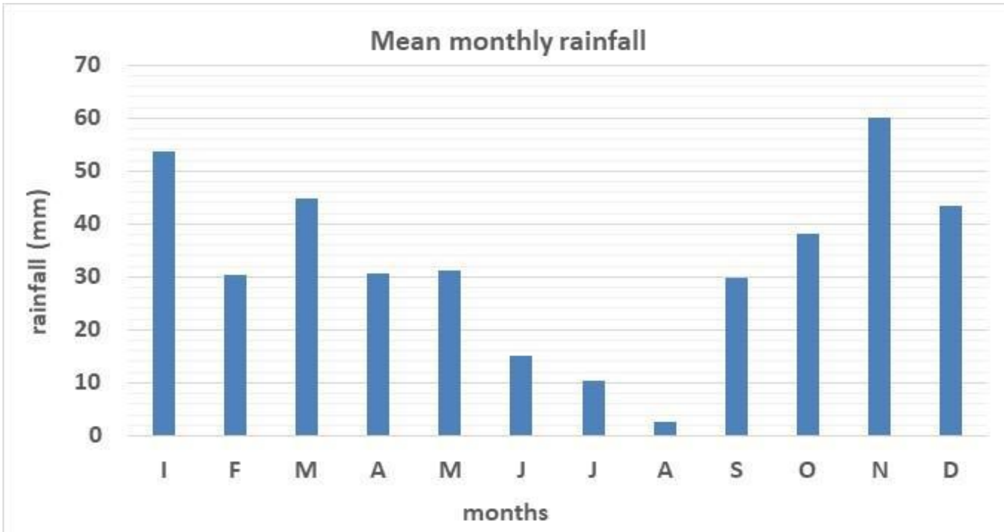


Figure 5.7. Mean monthly rainfall in mm at Ohrid Lake station (period 2008 to 2019).

In the Figure 5.8 the fluctuation of daily rainfall at Ohrid rain gauge station is shown. It is revealed that in five (5) events 24-h duration the rainfall height was greater than 40 mm rainfall.

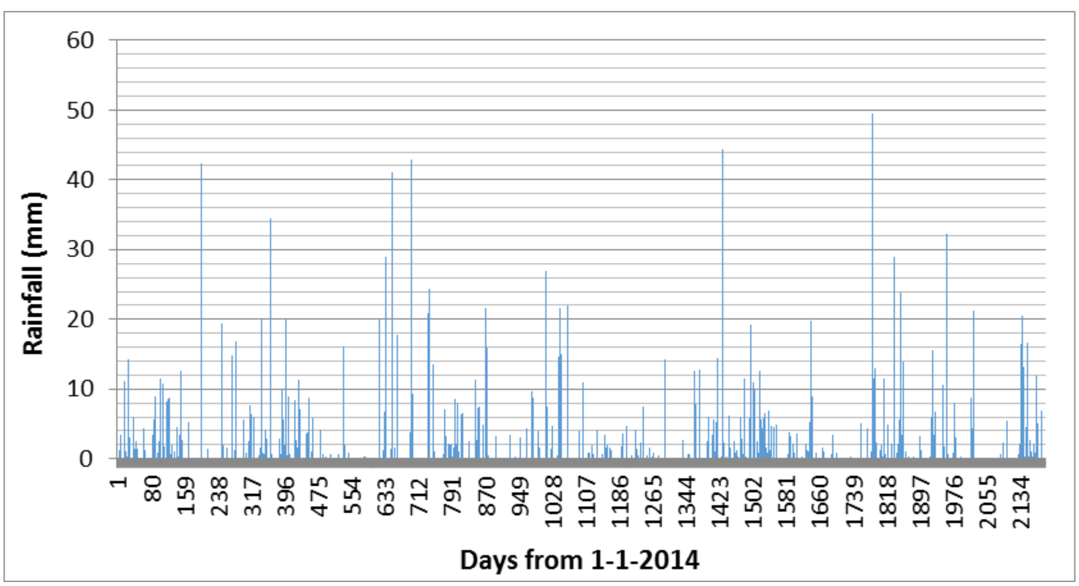


Figure 5.8. Fluctuation of daily rainfall (Ohrid Station) during the period 2014-2019. Number 1 corresponds to the day Jan. 1, 2014 and number 2191 to the day Dec. 31, 2019.

5.1.3 Snow

Annual snowfall data from Ohrid Station (meteoblue.com/en/weather/archive) are shown in Table 5.3 and Figure 5.9. The mean value of annual snowfall is 38.8 mm. The snowfall occurs during the months of January, February, March, and December; with a maximum value in January (Figure 5.10). During the months of April to October the snowfall is zero. Van Der Schriek & Giannakopoulos (2017) report a significant decrease in snowfall after the 1970s. Snowfall is converted to rainfall based on a 10: 1 ratio (Linsley et al. 1975). This conversion was used to calculate the total precipitation (rain- and snowfall).

Table 5.3. Annual snowfall (mm) at Ohrid Lake station for period 2008-2019 (Lake Ohrid monitoring program 2002, Popov et al. 2009).

Years	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Snow (mm)	20.72	98.42	55.6	41.72	64.6	30.2	19.7	15.6	11.9	13.4	30.31	63.1

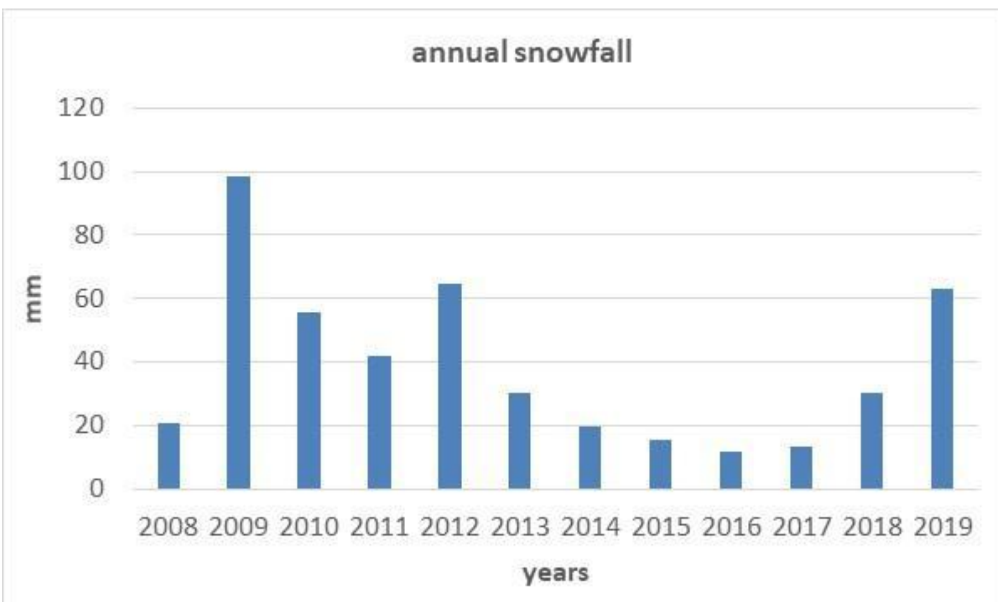


Figure 5.9. Annual snowfall at Ohrid Lake station (period 2008 to 2019).

Snowfall data in mountainous areas are not available, but snowfall events take place even in springtime, as is shown from the satellite image (Figure 5.11). Optical satellite observations can be used to derive spatially comprehensive information on the snow parameters, e.g., snow cover area percentage, snow depth (Voudouri and Kazakis 2021).

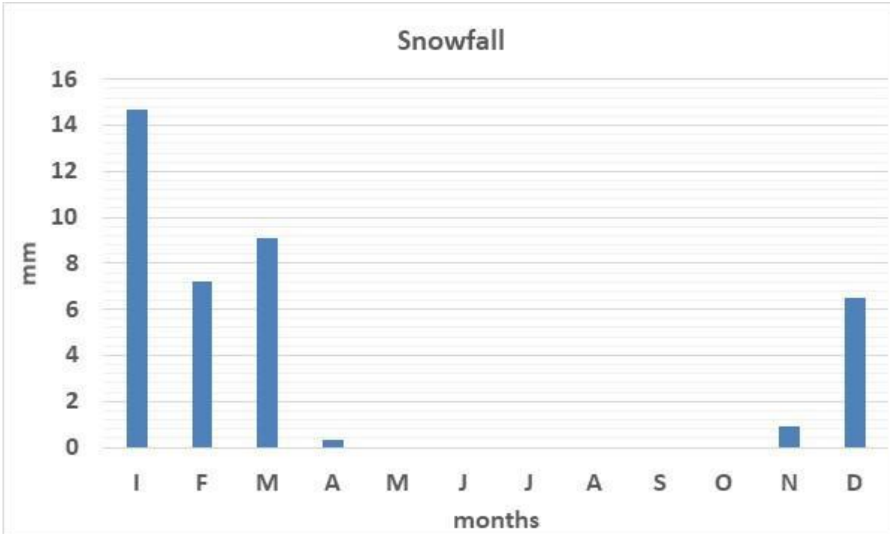


Figure 5.10. Mean monthly snowfall in mm at Ohrid Lake station (period 2008 to 2019).

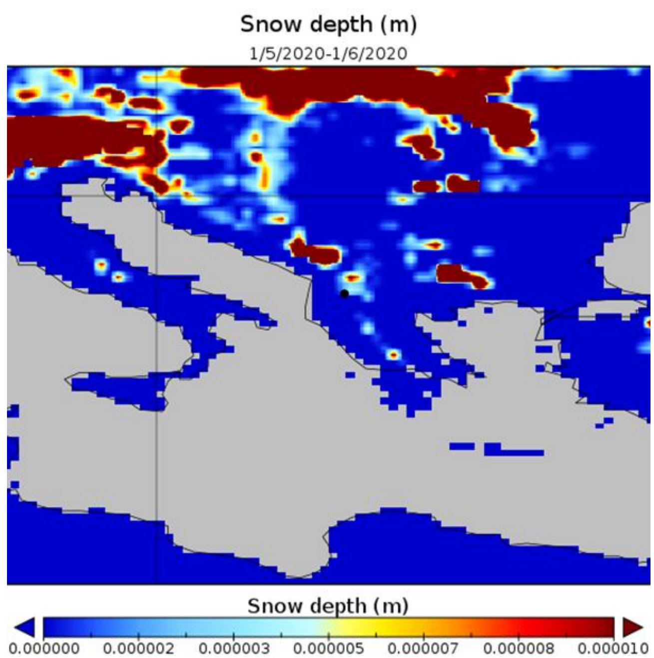


Figure 5.11. Snow depth monthly mean values for the time period 1/5/2020-1/6/2020 form GLDAS Noah Land Surface Model L4 monthly 0.25 x 0.25 degree V2.1 (GLDAS_NOAH025_M) at GES DISC. The study area is marked (https://search.earthdata.nasa.gov/search?q=GLDAS_NOA).

5.1.4 Evapotranspiration

- *Lake evaporation*

Ohrid Lake evaporation was estimated by using data from Ohrid station. The measurement of evaporation comes by meteorological methods (meteoblue.com/en/weather/archive). The annual values for the period 2008-2019 are shown in Table 5.4. It is concluded that the mean annual lake evaporation is 996.1 mm with a standard deviation of 47.1, indicating that all the values are close to the mean value. This value is similar to evaporation from other lakes of North Greece, e.g. Kastoria Lake wit the mean annual evaporation equal to 900 mm (Voudouris 2017). Anovski et al. (2001) estimated the Prespa Lake evaporation, using three different methods, equal to 1100 mm/yr. It is pointed out that lake evaporation depends on the lake surface area, thus the reduction of the surface area of Prespa Lake during the last decades has led to a reduction of evaporation.

Table 5.4. Annual evaporation in mm from Ohrid Lake (period 2008 – 2019),

Years	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
E (mm)	1020.6	949.5	930.8	987.6	1070.2	1000.2	947.1	981.9	981.8	1062.7	965.1	1056.3

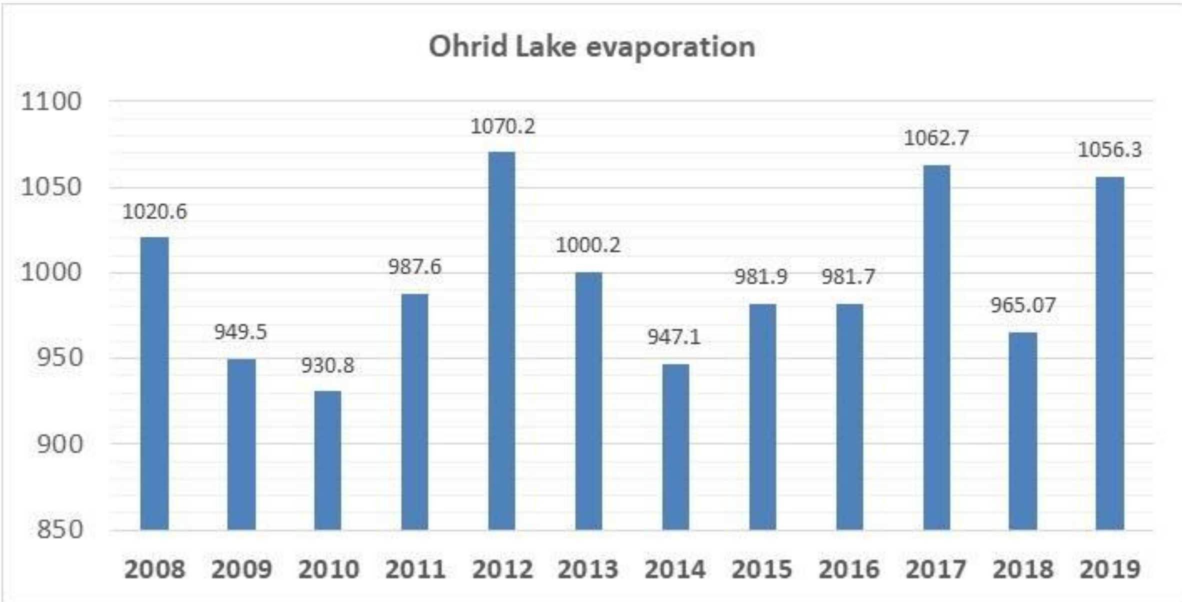


Figure 5.12. Ohrid Lake annual evaporation (2008 to 2019).

The difference between rainfall and lake evaporation in the study area is considerable in recent years. The rainfall has a decrease in distinct values (Figure 5.5 and 5.7), meanwhile for the evaporation and the temperature was noticed an increase in the values during recent years (Figure 5.12 and 5.13). Popovska & Bonacci (2007) reveal a statistically significant increase in temperature over the period 1961-1990. In addition, mean annual precipitation decreased statistically significantly in Ohrid Lake, but non significantly in Prespa Lake (Van Der Schriek & Giannakopoulos (2017).

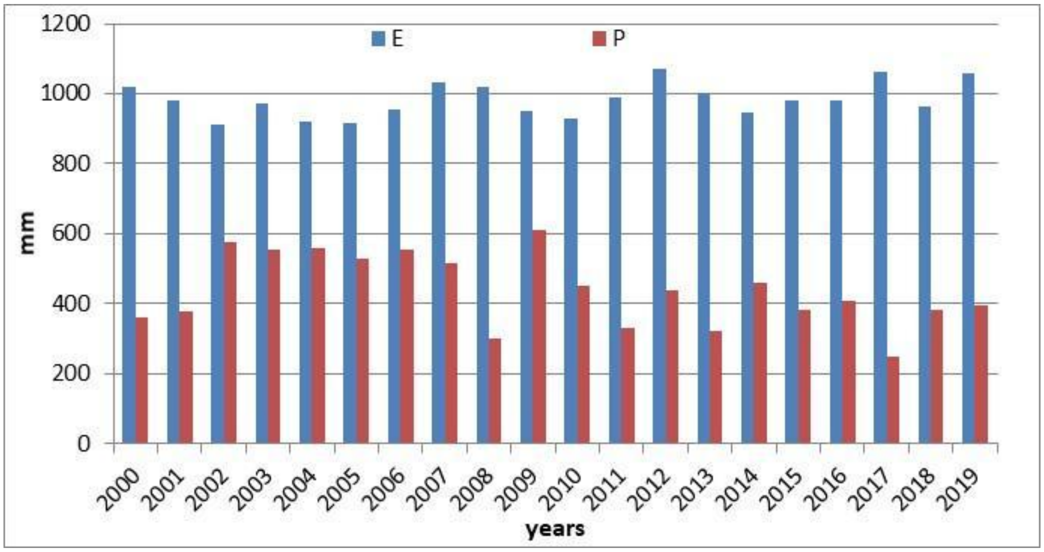


Figure 5. 13. Annual lake evaporation and rainfall at Ohrid Lake station (period 2000 to 2019).

Potential and real evapotranspiration

In order to estimate the evapotranspiration, the Thornthwaite method (Thornthwaite & Mather, 1957) was applied. The potential evapotranspiration (E_p) is calculated by the equation (Voudouris 2006):

$$E_p\ (mm) = 16 * [(10 * T)/I)]^a$$

where , is the monthly temperature (^oC), and I is the annual heat index:

$$I = \sum_{1}^{12} i_j$$

where i_j is the monthly heat index of the month j;

$$i_j = \left(\frac{T}{5}\right)^{1.514}$$

The coefficient a is given by the formula:

$$a = 0.49239 + (1792 * 10^{-5})I - (771 * 10^{-7})I^2 + (675 * 10^{-9})I^3$$

Multiplying the E_p values by one factor N, which depends on latitude, gives the corrected potential evapotranspiration E'_p. The real (active) evapotranspiration (E_r) is calculated, as follows:

1) When $E'_p \leq P \; then \; E_r = E'_p$. Water surplus is given by: $S_t = P - E_r \; and \; W_{S_i} = W_{max}$, where: P is the precipitation (rainfall and snowfall), S_t is the total water surplus (infiltration and surface runoff), W_{S_i} is the water amount in the soil for i-month, W_{max} is the maximum water storage in the soil (constant), assuming a value equal to 60mm for this application (Voudouris 2006). Water surplus exists if the water storage in soil has the maximum value.

2) When $E'_p \geq P \; then \; E_r = P + |\Delta W_S|$, where $\Delta W_S = W_{S_i} - W_{S_{i-1}}$.

The water amount in the soil (W_{S_i}) for i-month, is calculated by the equation:

$W_{S_i} = W_{max} e^{-\left(\frac{|APWL|}{W_{max}}\right)}$ where $AWPL$= accumulated potential water loss $(P - E'_p)$

According to the results of the Thornthwaite method, the average annual real evapotranspiration is 265 mm corresponding to 67.6% of annual rainfall for the period 2008-2019 (Table 5.2). Figure 5.14 shows the mean hydrologic balance (mm) based on rainfall (P), potential (E'_p) and real (E_r) evapotranspiration. From this Figure it is deduced that water deficit (the amount of water by which the E_p and P differ in any month) is recorded during the period April-October. Water surplus and natural groundwater recharge is recorded during the period January-March and November-December when the soil has covered the demand of maximum capacity.

It is well known that the coefficient of real evapotranspiration, depending on temperature, decreases with elevation. In the mountainous area, there is no rainfall data and the calculation of the coefficient is not possible. Based on the international bibliography

(Voudouris 2017), it is deduced that in alpine mountainous areas, the coefficient of real evapotranspiration is 25-38% of the annual atmospheric precipitation. So, it is considered that the real evapotranspiration is 67% of the annual precipitation in lowlands of the study area, where alluvial aquifers are developed, and 35% of the annual precipitation in karst mountainous parts.

Table 5.5. Monthly potential evapotranspiration, precipitation, and real evapotranspiration in mm at Ohrid Lake station for period 2008 to 2019 (Thornthwaite-Mather method).

	J	F	M	A	M	J	J	A	S	O	N	D	annual
Ep	5.8	10.1	24.1	48.9	77.7	108.5	129.3	127.0	81.7	51.4	28.4	10.5	703.4
P	55	31.1	45.7	30.7	31.2	15.1	10.5	2.5	27.8	38.2	60.3	44.0	392.2
Er	5.8	10.1	24.1	44.3	44.1	18.4	10.6	2.5	27.8	38.3	28.4	10.5	265.0

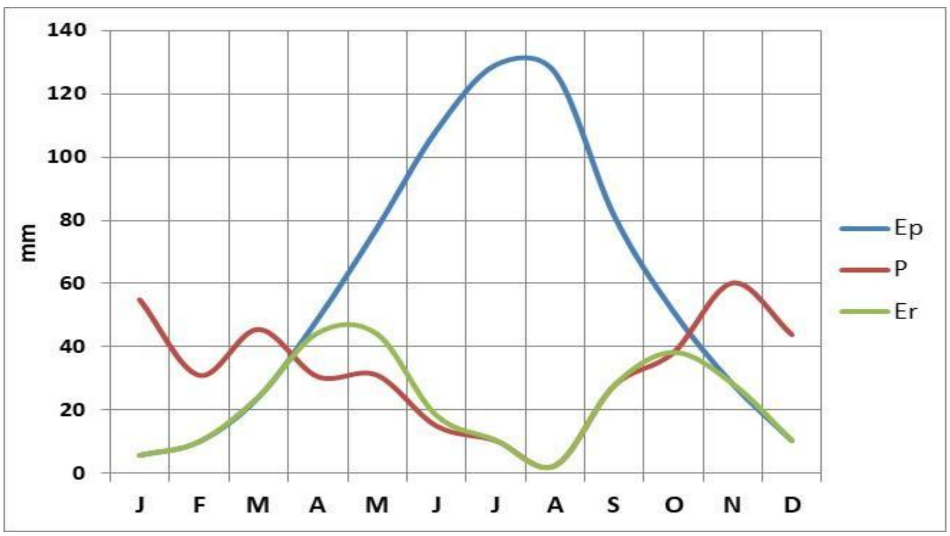


Figure 5.14. Mean annual hydrological balance at Ohrid Lake station (period 2008 to 2019). Ep=potential evapotranspiration, P=precipitation (rain- and snowfall) and Er= real evapotranspiration.

5.2 WATER LEVELS OF LAKES

5.2.1 Lakes water levels fluctuations

As mentioned before (Chapter 2^{o}), Lakes Ohrid and Prespa and the karst aquifer system have hydraulic communication via underground karst conduits. For this reason, the changes in the water level of the two lakes are examined in detail (Figure 5.17). The elevation of Prespa Lake is about 153 m higher than this of Ohrid Lake and they are separated by Mali Thate - Galichica mountain chain with the highest peak of 2288 m a.s.l. Water levels data from both lakes, provided by the Institute of Geosciences, Energies, Water and Environment were used to study the fluctuation of lakes' water level.

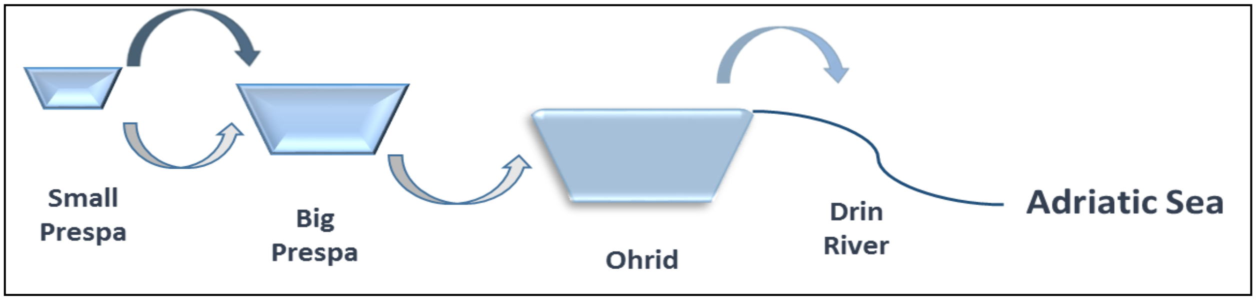


Figure 5.15. Schematic diagram representing the water flow between lakes (Kiri et al. 2017).

Prespa Lake water level

Big Prespa water level during the period 2014-2019 ranged between 844.7 m and 847.47 m above sea level (a.s.l.) with a mean value of 846.07 m and standard deviation 1.011. The mean monthly values are shown in Table 5.6 and the daily values in Appendix D.

The fluctuation of daily water levels is shown in Figure 5.16. The water level trend during the period 2014-2019 is negative (decreasing) but not quite statistically significant (R^2=0.5). According to the Institute of Hydrometeorology of Tirana during the period 1963-2002 the Prespa Lake water level was lowered 8.49 m (Eftimi 2019). The decreasing water trend is 21.7 cm/yr. In addition, according to Popovska and Bonacci (2007), during the period 1951-2000 the Prespa Lake water level was lowered 7.79 m (Figure 5.17). The decreasing water trend is 10.9 cm/yr (Figure 5.16). The highest water levels are recorded in May and the lowest in November-December (Figure 5.18).

Table 5.6. Mean monthly values of Big Prespa Lake water levels.

Y/M	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2014	847.18	847.10	847.04	847.09	847.16	847.15	847.05	845.84	845.64	845.55	845.51	845.60
2015	845.58	846.55	847.11	847.26	847.41	847.32	847.17	847.07	846.99	846.99	846.95	846.44
2016	846.74	847.00	847.33	847.42	847.52	847.54	847.41	847.28	847.21	847.19	846.90	845.78

2017	845.71	845.71	845.69	845.72	845.72	845.63	845.55	845.33	845.16	845.01	844.95	845.05
2018	845.04	845.12	845.38	845.66	845.77	845.77	845.74	845.67	845.52	845.33	845.24	845.26
2019	845.23	845.25	845.21	845.20	845.20	845.16	845.07	844.91	844.80	845.01	845.83	845.83

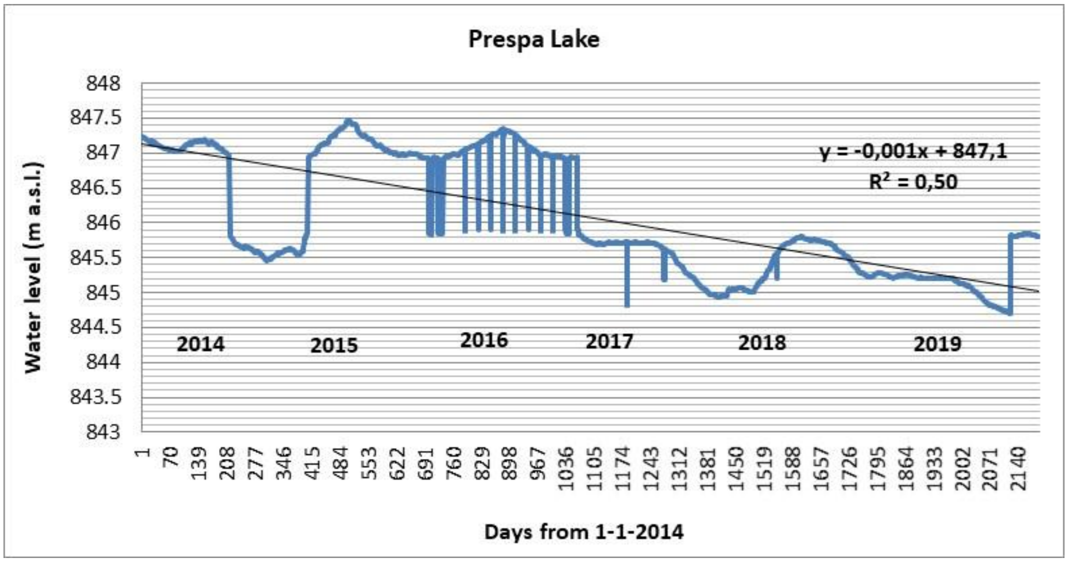


Figure 5.16. Fluctuation of daily water levels of Prespa Lake during the period 2014-2019. Number 1 corresponds to the day Jan 1, 2014 and number 2191 to the day Dec 31, 2019.

According to Eftimi (2019), the maximal historical level was 852.91 m a.s.l. (1963) and the minimal historical level 844.12 m a.s.l. (2002). Besides, Van Der Schriek & Giannakopoulos (2017) suggest that prior to 1995 water levels had never fallen below 847.5 m since historical observations started in 1917. In addition, the same researchers consider that the Prespa lake surface area decreases significantly below the water level of 847 m a.s.l.

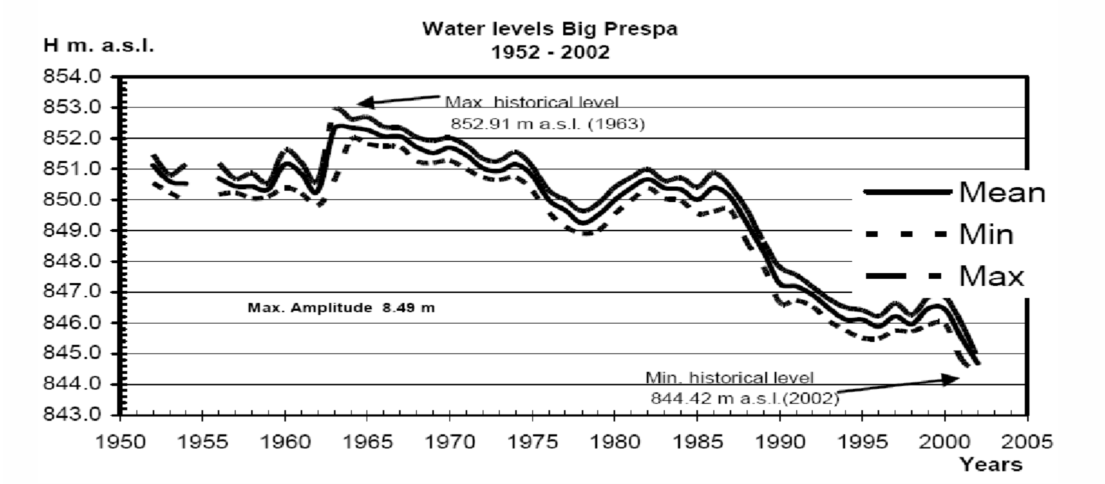


Figure 5.17. Fluctuation of daily water levels of Prespa Lake during the period 1952-2002 (Eftimi, 2019).

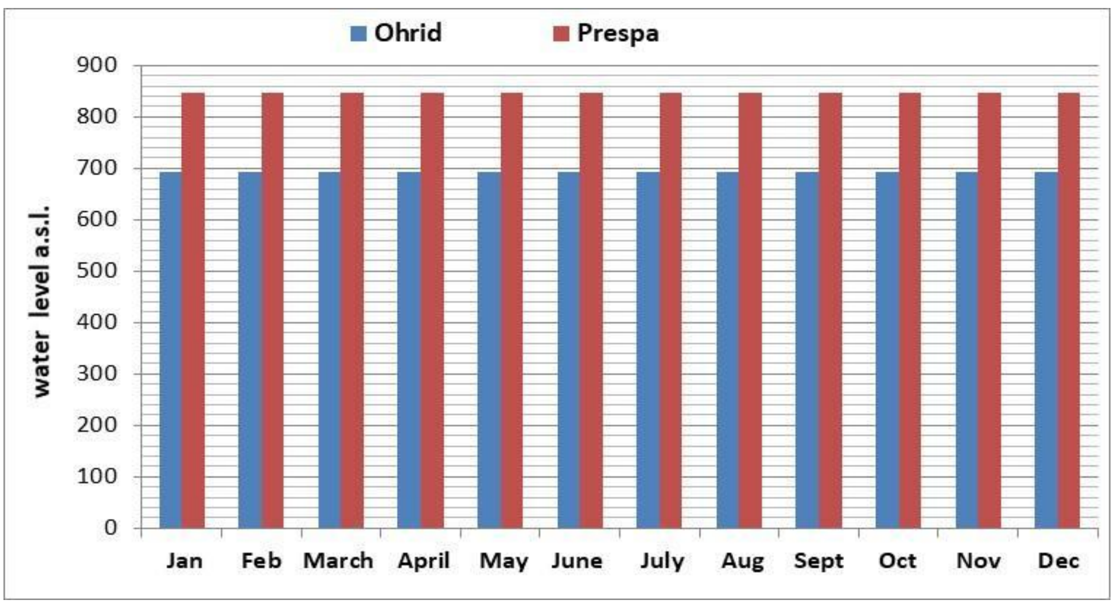


Figure 5.18. Mean monthly water levels of Prespa and Ohrid lakes during the period 2014-2019.

The continuous and prolonged decline of Prespa water level could be associated with climate change which affects the hydrological parameters), anthropogenic activities (increased water use for irrigation purposes, diverting of Devoll River), and/or tectonic and earthquake induced changes, e.g. lowering of lake bottom and widening of underground karstic channels to Ohrid Lake (Eftimi 2019; Hollis & Stevenson 1997; Popov & Anovski 2009; Matzinger et al. 2006; Popovska & Bonacci, 2007).

It is pointed out that Devolli River flow in Albania was diverted to Small Prespa. Van der Schriek & Giannakopoulos (2017) suggest that water abstraction for irrigation use is the main cause of the recent fall of Prespa Lake. Based on previous studies, the annual water abstractions from Prespa Lake were estimated approximately equal to 10-19x10^6 m^3 (Anovski et al. 1992; 2001; Matzinger et al. 2006; Van der Schriek & Giannakopoulos 2017).

Ohrid Lake water level

The mean monthly values of Ohrid Lake are shown in Table 5.7 and the daily values in Appendix D. Based on this Table, Ohrid water level during the period 2014-2019 ranged between 692.08 m and 693.85 m above sea level (a.s.l.). The mean value is 692.8 m and the standard deviation is 0.346, indicating that the water level values fluctuate around the mean value, showing relative stability.

The fluctuation of daily water levels is shown in Figure 5.19. The water level trend during the period 2014-2019 is slightly increasing, but not statistically significant (R^2=0.19). The highest water levels are recorded in May and the lowest in November (Figure 5.18).

Table 5.7. Mean monthly values of Ohrid Lake water levels.

Y/M	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
2014	692.31	692.20	692.19	692.27	692.31	692.38	692.42	692.43	692.42	692.40	692.33	692.33
2015	692.48	692.68	692.75	692.83	692.86	692.78	692.68	692.59	692.50	692.61	692.64	692.82
2016	692.93	693.02	693.19	693.25	693.34	693.30	693.25	693.16	693.09	693.04	692.92	692.84
2017	692.71	692.71	692.72	692.70	692.85	692.89	692.94	692.82	692.85	692.82	692.88	692.98
2018	692.97	693.04	693.40	693.54	693.49	693.44	693.34	693.24	692.83	692.61	692.68	692.66
2019	692.96	692.93	692.73	692.74	692.73	692.70	692.67	692.61	692.63	692.67	692.72	692.82

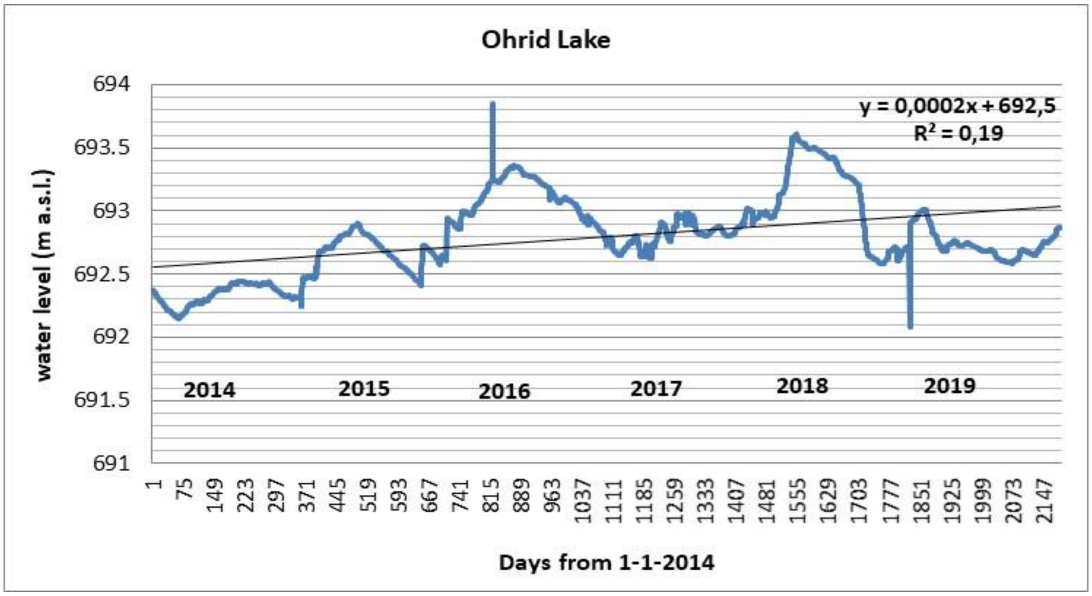


Figure 5.19. Fluctuation of daily water levels of Ohrid Lake during the period 2014-2019. Number 1 corresponds to the day Jan 1 2014 and number 2191 to the day Dec 31, 2019.

Finally, the statistical and linear regression parameters of water levels of both lakes (period 2014-2019) are synoptically presented in Table 5.8. The coefficient of determination (R^2) shows whether observed values are regressed on predictions, R is the coefficient of correlation between the predicted and the observed values.

Table 5.8. Statistical and linear regression parameters of water levels (period 2014-2019).

	Prespa Lake	**Ohrid Lake**
Min value	844.71	692.08
Max value	847.47	693.85
Mean value	846.07	692.80
Standard deviation	0.855	0.320
R^2 (coefficient of determination)	0.506	0.190
R (coefficient of correlation)	0.711	0.430
Slope of trend line of linear regression	-0.001	0.0002

5.2.2 Statistical analysis of water levels

Correlation of water levels of two lakes

Water levels fluctuation of both lakes during the common period 2014-2019 is shown in Figure 5.20 and the scatter plot showing the relationship between the water levels of two lakes in Figure 5.21. From the Figures and regression analysis it is revealed that the two series are not statistically significantly correlated (Figure 5.21). The coefficient of determination is very small (R^2=0.02).

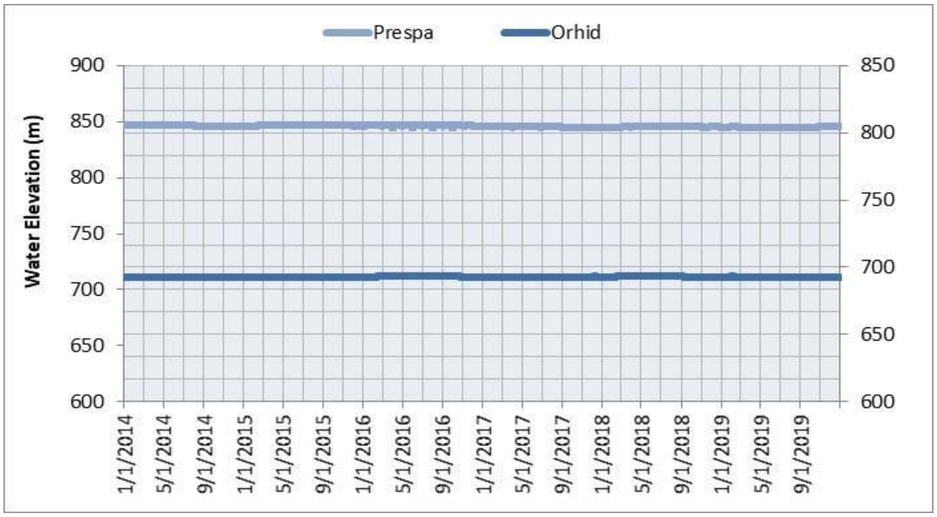


Figure 5.20. Fluctuation of daily water levels of both lakes during the period 2014-2019.

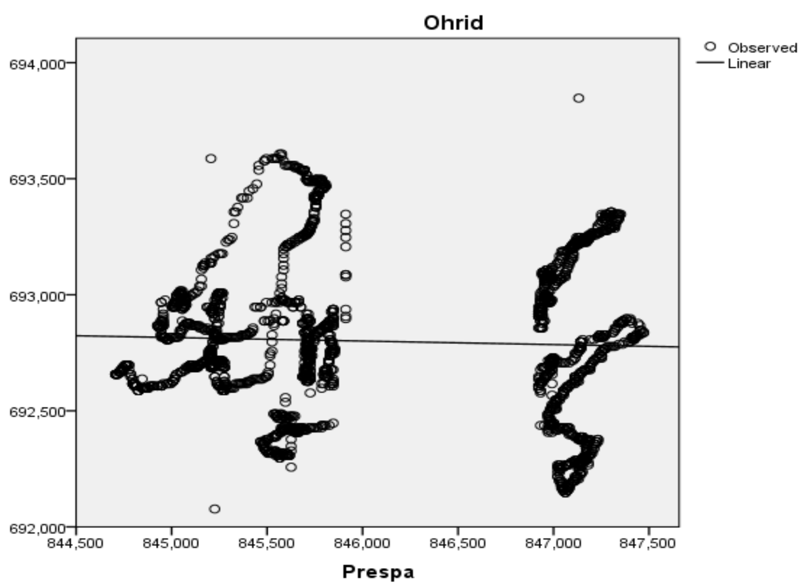


Figure 5.21. Regression of daily water levels (m) of both lakes during the period 2014-2019.

Cross correlation analysis

The cross-correlation examines the correlation between two time-series variables contemporaneously and at various lagged values. It is pointed out that the values of two time-series variables may move together at the same point in time, or it could be that movement in one variable precedes or follows movement in another variable. This method is useful in order to understand whether two variables are related to each other and, if so, whether movement in one variable tends to precede or follow movement in the other. The cross correlation diagram as a function of lag number (days) between water level values of two lakes with a 95% confidence interval in SPSS20, is shown in Figure 5.22 (range of lags from -7 to +7).

From this Figure, it is concluded that the two series are not strongly correlated as the cross-correlation is not statistically significant at most lag numbers. The strongest correlation occurs at lag 0, with a correlation equals to 0.122 (Table 5.9). This shows that the water levels of two lakes are strongly contemporaneously correlated.

The only negative significant correlation occurs at lag 1 and is equal to -0.151. This negative cross-correlation suggests that higher than average water level of Ohrid leads to lower than average water level of Prespa Lake one (1) day later. However, this correlation slightly exceeds the 95% confidence interval.

From the periodicity check it appears that there are no statistically significant periodicities of water level of two lakes (Figure 5.23, 5.24). The results of applied cross-correlation analysis between water level of Ohrid lake and rainfall shows that the two series are not correlated at all lag numbers (Figure 5.25). In general, the lakes' water level follows the peak of precipitation with a lag of about 3-4 months due to the snow-melting (Hollis & Stevenson 1997).

Van der Schriek & Giannakopoulos (2017) suggest that Prespa Lake contributes to the recharging of Ohrid Lake with approximately 25% of its total inflows through underground karst canals.

Finally, the hydraulic residence time of a lake (also called transit time) expresses the average time that water spends in a particular lake. It can be calculated by dividing the lake volume by the outflows of the lake (Ambrosetti et al. 2003). This might be regarded as the first step towards an evaluation of the renewal time of water. Based on the aforementioned term, the residence time of Prespa and Ohrid lakes are approximately 11 and 70 years, respectively (Matzinger et al. 2006).

Table 5.9. Cross correlations and statistical values.

Cross Correlations

Series Pair: Ohrid with Prespa

Lag	Cross Correlation	Std. Error[a]
-7	.004	.021
-6	.014	.021
-5	.003	.021
-4	.003	.021
-3	-.002	.021
-2	.004	.021
-1	.007	.021
0	.122	.021
1	-.151	.021
2	.081	.021
3	.000	.021
4	.009	.021
5	.004	.021
6	-.001	.021
7	.003	.021

a. Based on the assumption that the series are not cross correlated and that one of the series is white noise.

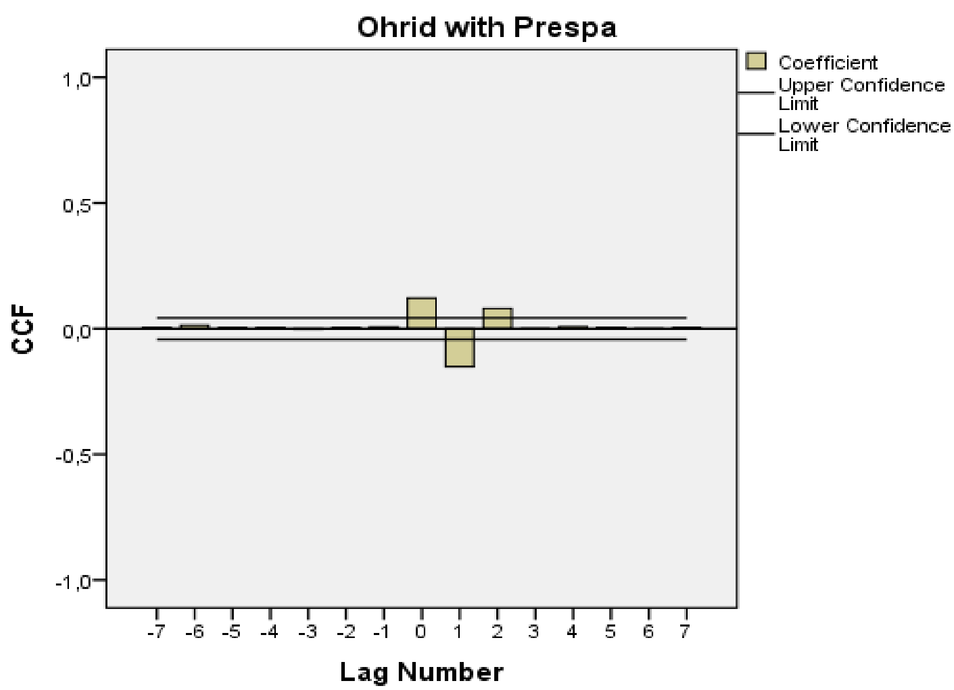


Figure 5.22. Plot of cross-correlation as a function of lag number with a 95% confidence interval.

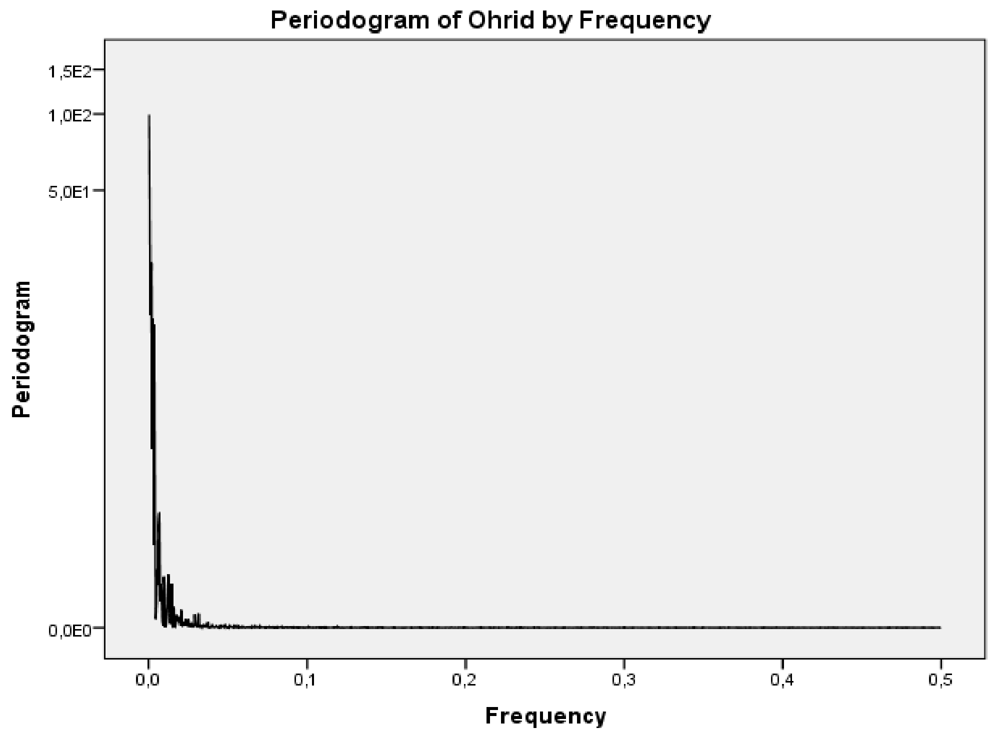


Figure 5.23. Periodogram of water level of Ohrid Lake.

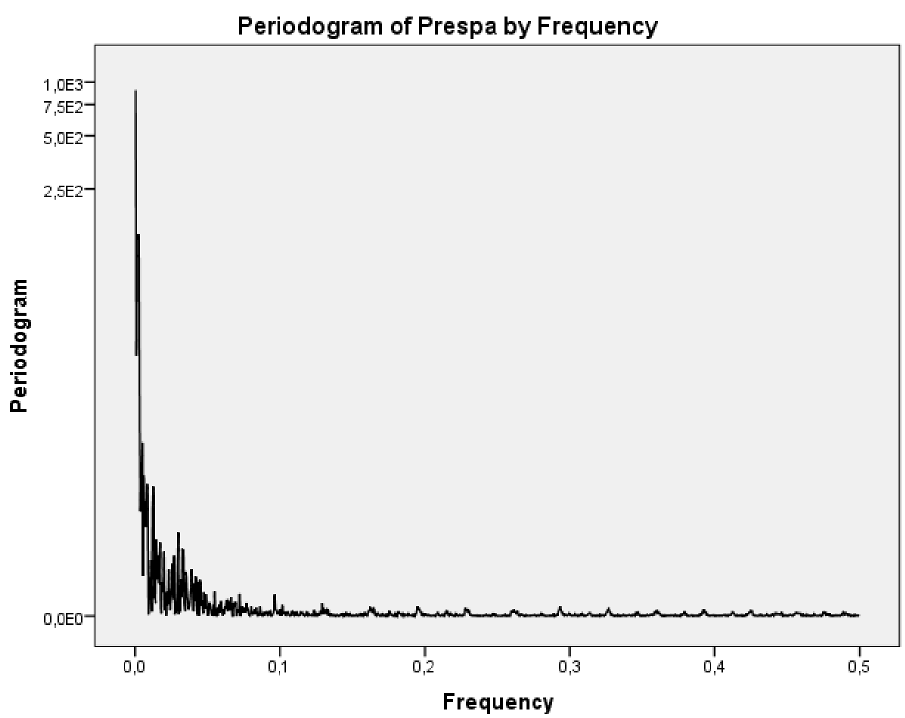


Figure 5.24. Periodogram of water level of Prespa Lake.

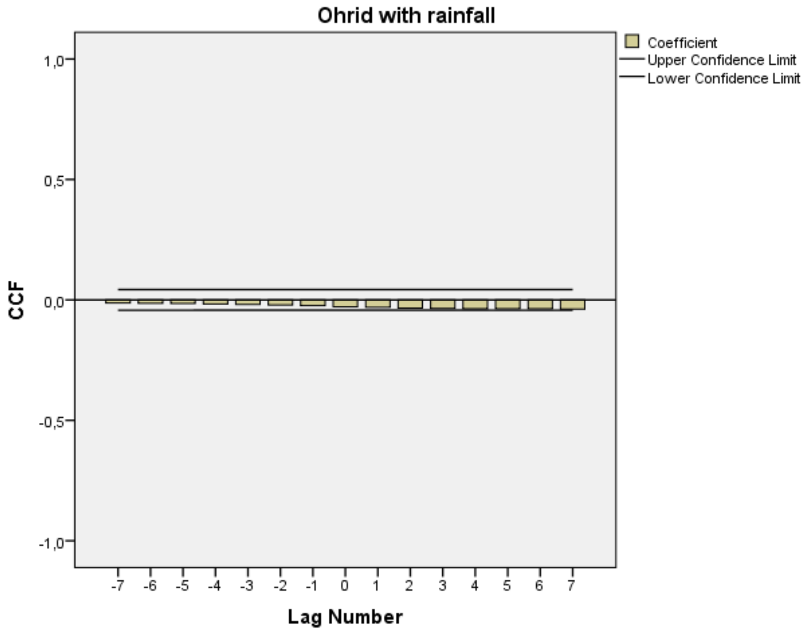


Figure 5.25. Plot of cross-correlation between water level of Ohrid Lake and rainfall is a function of lag number with a 95% confidence interval.

Autocorrelation

In this paragraph autocorrelation analysis is applied in order to understand the temporal dynamics of the water level time series of two lakes. Based on this method two autocorrelation functions are calculated ACF and Partial ACF: 1) ACF measures and plots the average correlation between data points in a time series and previous values of the series measured for different lag lengths.

The PACF is similar to an ACF except that each partial correlation controls for any correlation between values of a shorter lag length. Analytically, the value for an ACF and a PACF at the first lag are the same because both measure the correlation between data points at time t with data points at time t−1. However, at the second lag, the ACF measures the correlation between data points at time t with data points at time t−2, while the PACF measures the same correlation but after controlling for the correlation between data points at time t with those at time t−1 (Norusis, 1993). The plot of the ACF function, produced by SPSS20 statistical package, is shown in Figure 5.26. From this Figure, it is concluded that the calculated correlations in the ACF do not decay to zero, indicating that the time series is non-stationary.

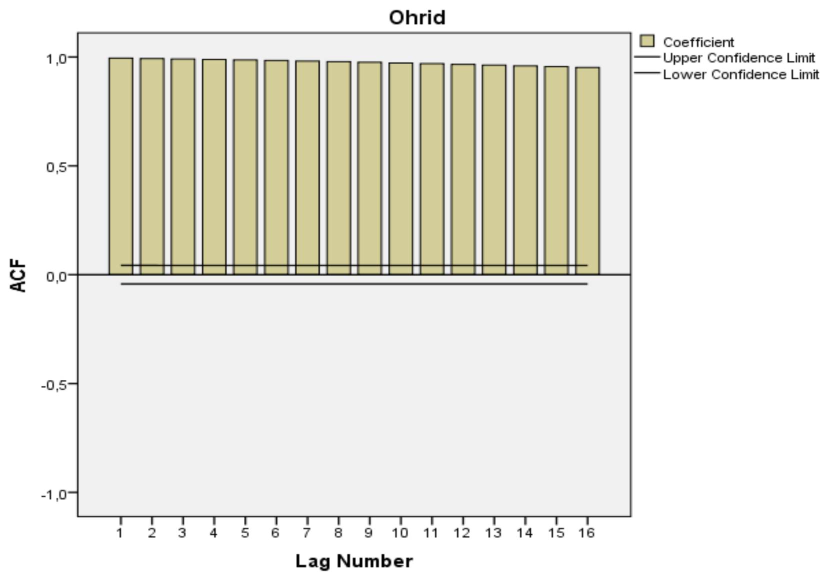


Figure 5.26. ACF for daily water level (in m above sea level) in Ohrid Lake from 2014 to 2019.

For further interpretation the differenced time series is examined. The plots of differenced (difference=1) ACF and PACF functions of daily water level (in m above sea level) time series in Ohrid lake from 2014 to 2019 are shown in Figures 5.26 and 5.27, respectively.

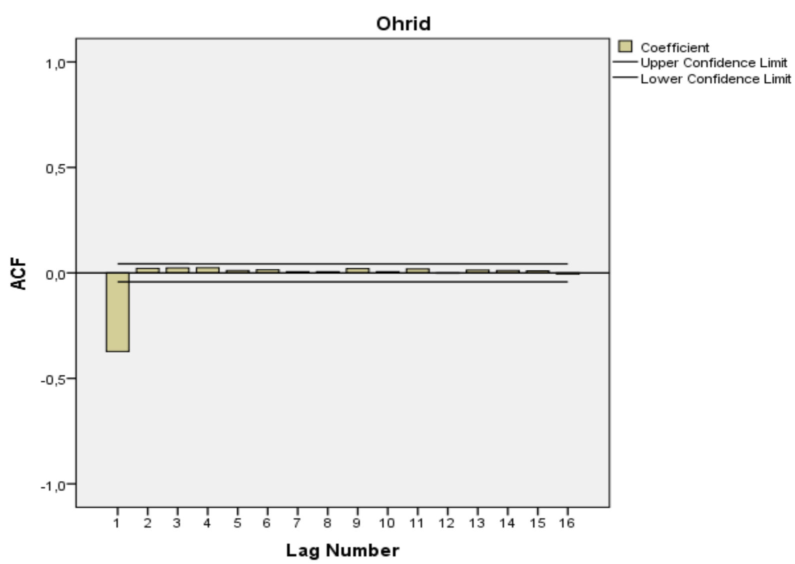


Figure 5.27. ACF for first difference of daily water level (in m a.s.l.) time series in Ohrid Lake from 2014 to 2019.

From Figure 5.26 (ACF), a great negative value at the first lag followed by positive values which are not statistically significant. Similar is the plot of PACF (Figure 5.28), showing a second small negative value at the second lag. A reasonable conclusion is that the first difference of daily water levels of Ohrid Lake is best characterized as following a first-order moving average process.

Completely similar to that of Lake Ohrid is the behavior of the time series of Lake Prespa and that is why the plots of ACF and PACF are not presented.

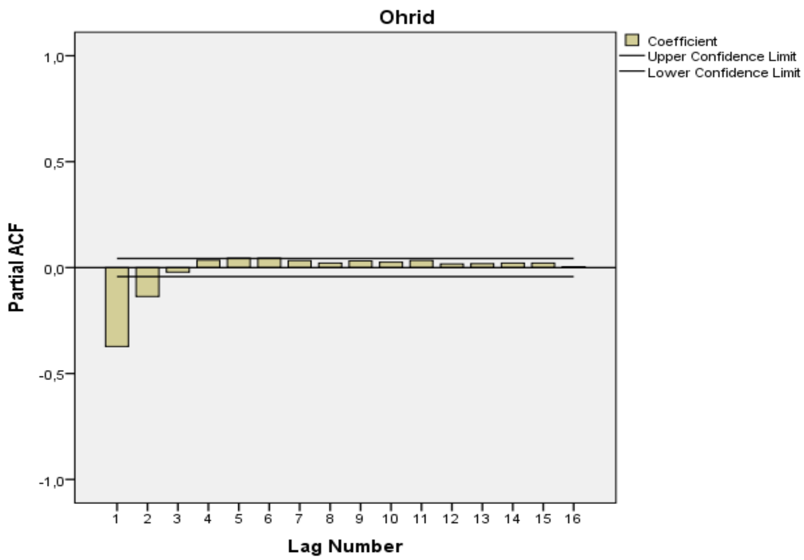


Figure 5.28. Partial ACF for first difference of daily water level (in m a.s.l.) time series in Ohrid Lake from 2014 to 2019.

CHAPTER 6. HYDROGEOLOGY

6.1 AQUIFER SYSTEMS OF THE OHRID – PRESPA REGION

The hydrogeological map of Prespa - Ohrid Region (scale 1:50,000) is compiled, based on the Hydrogeological principle (Appendix A), where is presented the classification of rocks linked with their waterbearing (Appendix B). This classification is based mostly on the knwoledge of the rocks content, fissures, porosity, distribution, reserves and the exploitation of groundwater. The hydrogeological map above mentioned, illustrated in GIS context, by giving a clear overview of the study area from the hydrogeologic aspects, and is presented in Figure 6.3. The polygons represent the aquifers and non-aquifers of the Ohrid – Prespa Region. The maps legend shows the index associated with the respective polygon, representing a specific geological age. The hydrogeological database and the tables joined in this map are showed in the appendix mentioned above. One can find this database in different figures within the text illustrating and addressing different issues in this material as well.

In this dissertation, the Geology constitutes the background, meanwhile the Hydrogeology is indicated detaily through the field's colors of the waterbearing layer's distribution; or non-waterbearing ones, in the uniformity with their classification.

I. *Porous Aquifers*

a. Quaternary Deposits (Qal) (gravels, sands)

Quaternary deposits in Ohrid - Prespa Region include:

Deposits of Upper Pliocene–Ancient Quaternary (N_2-Q_1)

Deposits of New Quaternary (Q_4)

Quaternary in aspect of geological division is included in porous water bearing beds and with a very high penetration which means it's a lot of water there (Figure 6.1). The deposits are called New Quaternary (Q_4).

Depositions of Upper Pliocene–Ancient Quaternary (N_2-Q_1) are of limited distributions and belong to the lakes facial Stream sediments and lakes Alluviums. These deposits are spread on the southwestern part of Small Prespa Lake and in the south of Big Prespa Lake (Kiri et al. 2011).

Q_4al-Alluviums were represented by gravels and coarse sand with very high water penetration. The recharge occurs by direct infiltration of atmospheric precipitation; the coefficient of infiltration is about 15% of the annual precipitation. Except of direct infiltration of rainfall, these aquifers are recharged by stream-beds infiltration and/or lateral inflows from mountainous areas. According to the River Basin Management Plan of the western Macedonia (GR09) of the Greek Ministry of Environment & Energy, the alluvial aquifer which is developed in the extension of these deposits in the Greek territory is characterized by the good status of quality and quantity.

The aquifers are widespread and high productive. These deposits have a good hydraulic connection between surface waters and groundwater. The average transmissivity varies from 2,000–4,000 m/d, but the higher values than 8,000 m/d are also present (Demiraj and Mucaj 1996; Dakoli and Xhemalaj 1997). The groundwaters are in general fresh and low hardness. These reserves of groundwaters are big and can be exploted by means of wells. The well yield varies from 10 to over 100 L/s. The same characteristics are valid also for deposits of Quaternary such as: Q_4al - (stream sediments), Q_4kl - (colluviums), or also intertwining of type alluvium-colluvium that are presented by gravels, grit, and sands.

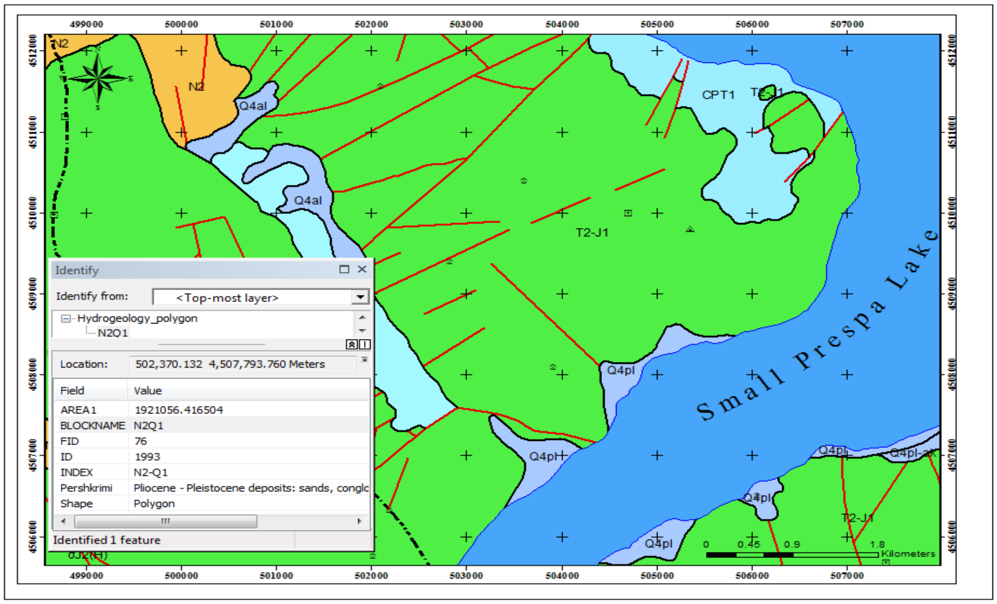


Figure 6.1. Deposits of Upper Pliocene–Ancient Quaternary.

b. The strata with limited or suitable spreading

Quaternary deposits; fluvio – glacial Quaternary Deposits – in general have a limited distribution, in Ohrid Region are located in south-eastern part of the lake, while in the Prespa Region are spread in a considerable way, being represented mainly by clay, sub-clay, graveling, and sanding layers with a thickness that reaches up to some 10's of meters (Dakoli and Xhemalaj 1997). Also here there are other deposits regarding the hydrogeological aspect and their water bearing. There are in the same group with these deposits; such as Q_3ak which is presented by thick material. These deposits have a considerable distribution in Prespa Region, but it can't be said the same thing for Ohrid Region. The hydraulic relation between water of surface and groundwater is limited due to the represented deposits. The water flow is variable and exploiting the reserves of groundwater can be at high risk. The groundwater resources can be managed by springs and only in the fluvial deposits by wells.

II. *Karst Aquifers*

a. The widespread strata with high productivity

They have in general high permeability and are represented by stratified and fissured limestones of Upper Cretaceous (Cr_2), karstified and fissured limestones and dolomites of

Upper Jurassic – Lower Jurassic, of Middle Triassic – Lower Jurassic. The total surface of the karstic area is 941 km^2; within this area several important aquifers are developed, discharging via many springs with variable yield. The average useful infiltration coefficient in the karstic zones is about 45% – 65% of the annual rainfall (Dakoli and Xhemalaj 1997). In the uncovered parts of the karstic rocks the groundwaters are in general fresh. It is difficult to predict the yield of wells because of the high rock heterogeneity. The groundwater can be generally managed mainly by springs.

From hydrogeological point of view, the most significant importance affecting the regime of Prespa Lake water is the karstic hydrogeological system, which as a complex unit functions primarily as a hydrocollector and hydroconductor. This system has been developed in the Triassic massive limestones, which cover the western and southern edge of the valley, and largery lie on the bottom of the Prespa Lake, owing to which this lake represants typical karstic hydrographic structure. One of the main elements of this karstic hydrogeological system is its texture/structure. It is generally connected with the type of rock porosity. Primary porosity of rocks liable to the process of karstification than the secondary porosity which is a result of endogenic and exogenic forces. The karstic outcrops are probably most known for their mixed porosity; the porosity of the rock blocks (matrix porosity), the porosity of small and larger cracks, then porosity of big karstified faults, porosity of karstic caverns and porosity of clastic material which fills all discontinuities mentioned above. Most of unknown in the interpretation of directions and quantity of water transfer from the lake through the karstic system, are indeed the result of undifinied hydrodynamic laws of flow, and predominantly of all these types of porosity in the limestone complex. On the terrain surface all forms of karstic erosion have been developed along the border edges, as well as on the karstic bottom of the lake. The karstification reaches to a depth of 500 m, meanwhile at greater depths the limestones are not karstified (Stamos et al. 2011). Characteristics for the high hill – mountainous areas, mostly between Ohrid and Prespa lakes are numerous crevices, sink – holes, gullies and karstic fields, as surface forms, but there are also underground forms of the types such as: sinkngriver courses, caves, caverns, chanals, etc. Still though most distinctive of surface erosion forms are big gullies and karstic fields spreadover the ridges of the limestones massives (Photo 6.1).

Photo 6.1. Big Prespa Lake (Kolaneci et al. 2007)

Inner karstic processes have cut the limestone massive by numerous caves, underground chanals, etc. Some of them were dry, some under water, and some were submerged in the past. Under the conditions when the karstic mass was not so porous to be able to let the waters pass from Prespa catchment area, larger surface run off the water took place through Grlo Canyon – gorge. Later, when the underground sunk water opened along the lake's bottom and which the drain capacity of the karstic channels and of underground water courses being increased, surface runoff through Grlo Canyon stopped.

Actually the water outflow from Prespa Lake takes place through several underground courses spreadover in the karstic parts of the south – western side of the lake. Such are the underground rivers in the Zaveri's bay (Figure 6.2), and in Micro (Small) Prespa area, whose function during evolution of the basin was very variable. Namely, slidings of larger rock blocks from the steeply limestone sections piled up in the water flow area causing water outflow to be drastically lowered. This is considered as one of the phenomena that had essential effect on the fluctuations of the lake water table, considering the high amounts of water running off into Ohrid Lake in Korca Valley. The reason why so small amount of water of the karstic system flows into Prespa Lake, lies in its position in the area of water impermeable hydro – barier of schists, which is obviously chanalies the main underground water flows towards Ohrid Lake. Due to the great importance of the transboundary karstic aquifer, its properties and hydrodynamic behavior will be presented in detail in paragraph 6.3.

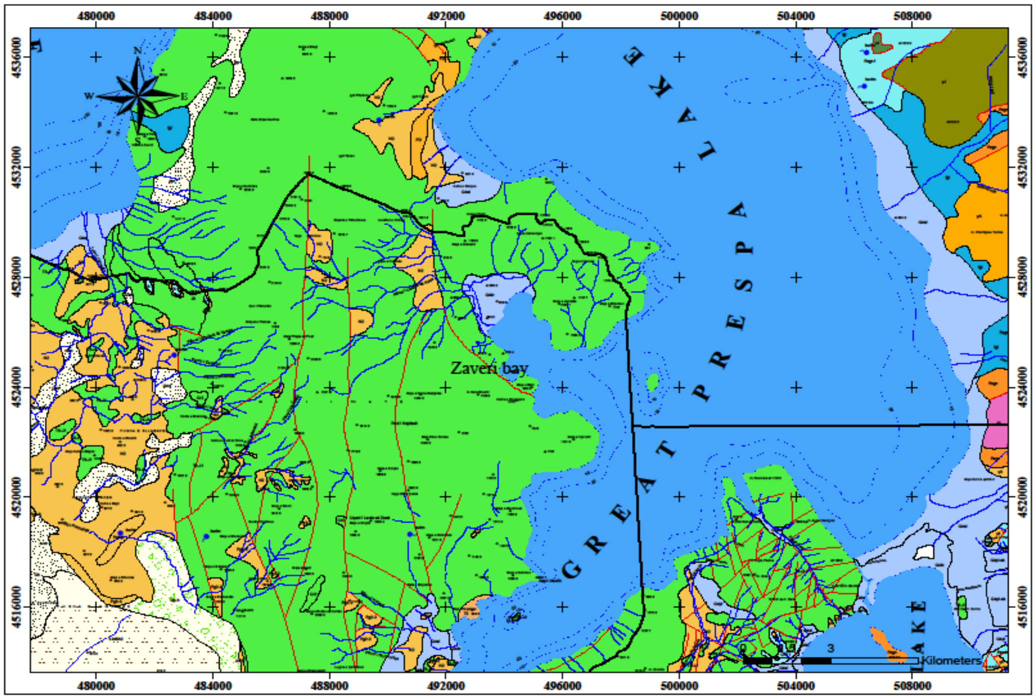


Figure 6.2. Zaveri Bay, Hydrologic Map of Ohrid – Prespa Region.

b. <u>The widespread strata with medium – low productivity</u>

The permeability is medium to low and are represented by: Aquitanian deposits (N_1a) (conglomerates, sandstones, siltstones), Oligocene deposits (Pg_3) (conglomerates, sandstones, siltstones and carboniferous), Permian – Lower Triassic deposits ($C – P – T_1$) slightly metamorphised rocks (conglomerates, limestones, intercalations). The fissured or porous – fissured aquifers with variable groundwater reserves. The medium values of water hydraulic cunductivity for different water – bearing layers varies from 1 up to about 50 m/d (Tafilaj et al. 1977). The aquifers are in pressure and the wells are artesian with yield less than 0.1 to 3 - 4 L/s, whereas the highest yields reaches 10 - 15 L/s. At the depth of 300-400 m the groundwaters are fresh, hard or very hard (Eftimi and Tafilaj 1985). The groundwater can generally managed by wells and less by the springs.

III. <u>Porous or fissured rocks with local and limited groundwater resources or rocks with essentially poor groundwater resources</u>

a. Fissured rocks with local or limited to medium groundwater resources

Their permeability is low to medium, and are represented by all magmatic rocks: Granites (γJ, γ_1, γ_2, γ_0, γa), Gabros (ν), ultrabasic rocks ($\sigma J_{2\text{-}3}$).

The latter rocks are especially common in the Prespa Lake Region. The yields of the wells are highly related to the fissuring of the rocks. The tectonic zones distinguish of highest yield. The medium yield of these zones is about 2 L/s, whereas the highest one reaches to about 10 L/s. The groundwaters are generally fresh and soft and can be managed by springs or wells.

b. Fissured and porous rocks with local groundwater and low permeability

Their permeability is low, and are represented by Eocene – Oligocene deposits (conglomerates, sandstones – marls), Burdigalian deposits (marls, siltstones), and Pliocene deposits (sandstones, conglomerates, marls, sitstones).

The productivity of the rocks is variable being generally low. The median yield of the wells for all aquifer rocks is below 0.5 L/s. The groundwater is generally fresh of low hardness.

c. Very low production aquifers with very low permeability

They are represented by Ophiolitic Mixture (J_3t – Cr_1), Devonian deposits (D) (sandstones, conglomerates) and Paleozoic schists (Pzgn, Pzsch). The productivity of the rocks is very low. The wells practically have no results. The local groundwater can be localized only in the individual sandstones – conglomeratic layers (Eftimi and Tafilaj 1985).

Furthermore, the development of karstic aquifers and the connection between Prespa and Ohrid Lake are shown in Figure 6.4. From this Figure, it is concluded that the limestones and the kast aquifers are extended in the three countries, without creating one unified groundwater level (Stamos et al. 2011). The impermeable stratum (schists, ophiolites, etc.) separates the karstic mass into independent aquifer systems, by different underground water divides.

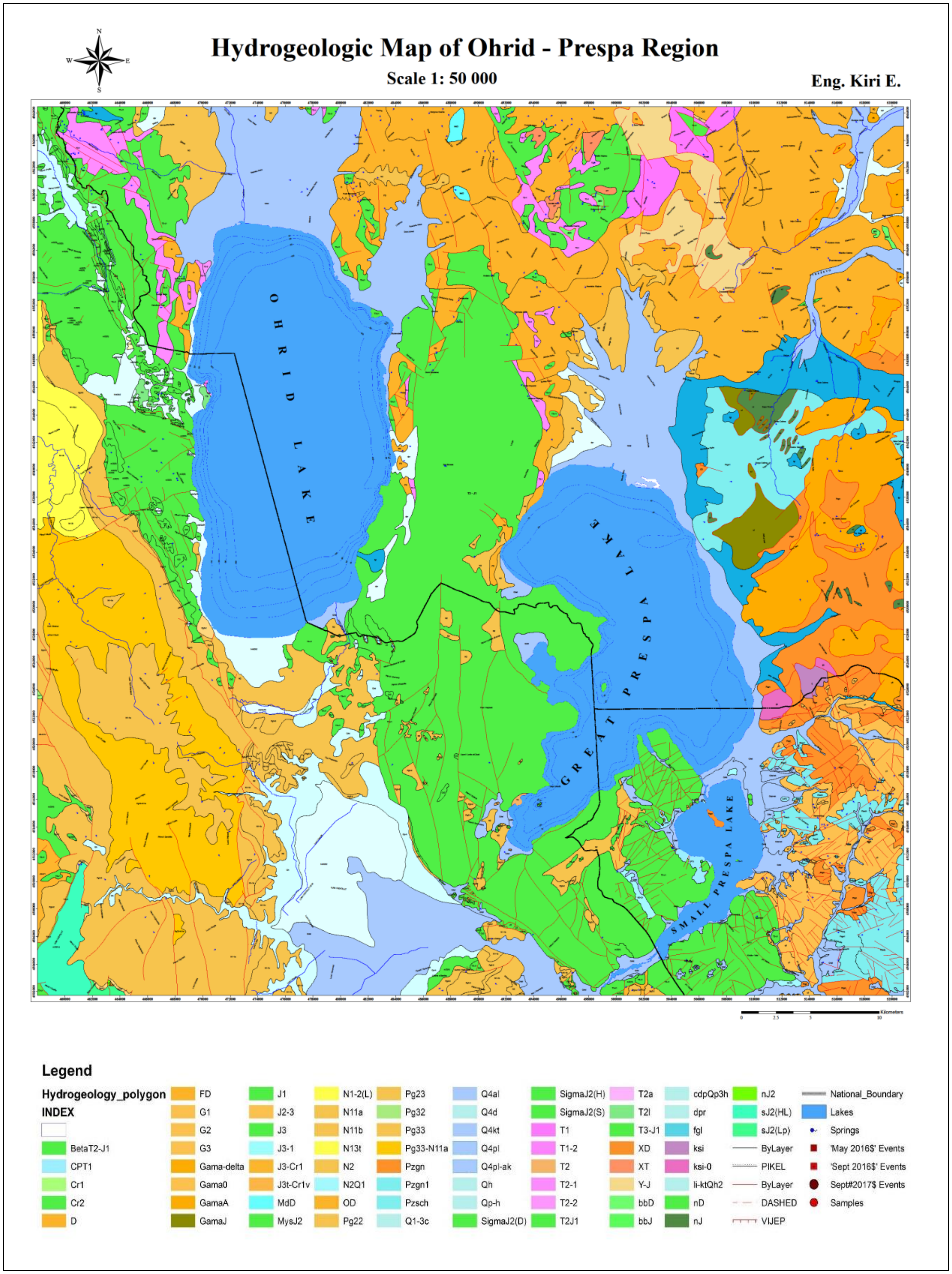


Figure 6.3. Hydrogeologic Map of Ohrid – Prespa Region, Legend, Explanation of symbols.

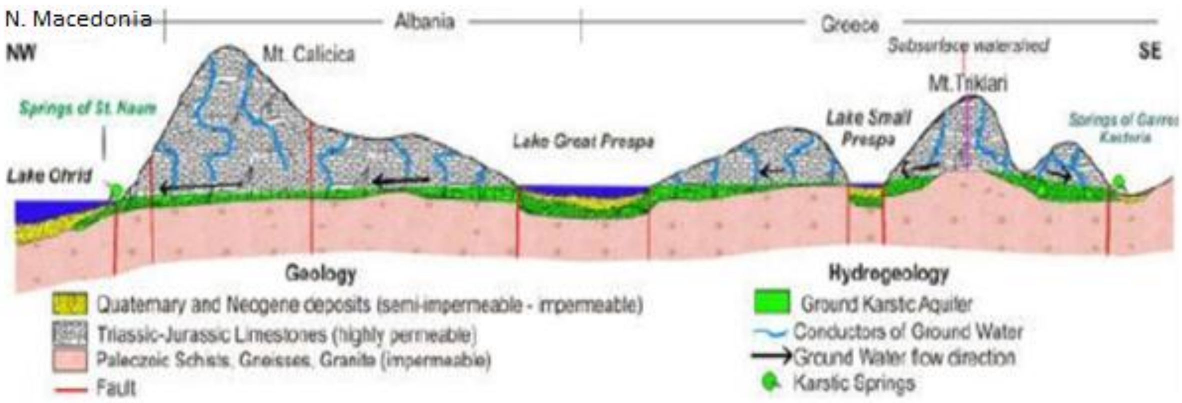


Figure 6.4. Development of karstic aquifers in the wider area and the connection between Prespa and Ohrid Lake (Stamos et al. 2011).

6.2 KARST SPRINGS

Description, discharge, photos:

From the hydrogeological point of view, the karstic zones, are in general, characterized by a high infiltration coefficient. In the study area, the permeability of karstic rocks is not uniform, but high due to geological conditions and tectonic structure. The hydrology in the karstic zone of Ohrid and Prespa Region is distinguished by a poorly surface hydrographic net and by a very good development hydrographic net of groundwater.

The karstic massive of the Dry Mountain represent the southern part of the Mirdita tectonic zone’s structure. The karstic limestone deposits are mostly of the Triassic age and are the main deposits in this massive (Figures 6.4 and 6.5).

The major springs of the study area, like: Tushemisht Spring, Saint Naum Spring that appear in Albania and North Macedonia border flow from this karstic massive. They bring a considerable water quantity and discharge directly into Ohrid Lake. Each of the two aforementioned areas, consist of dozens of springs. There are about a front of 15 springs in North Macedonian territory and 80 springs in Albanian territory. Probably, there are springs at the bottom of Ohrid Lake, but there are no available data. The extension of the karstic mass in Greek territory is discharged throughout the springs of Koromilia, Gabro in the Kastoria area (Figure 6.4). The location of the main springs in the study area is presented in Figure 6.5.

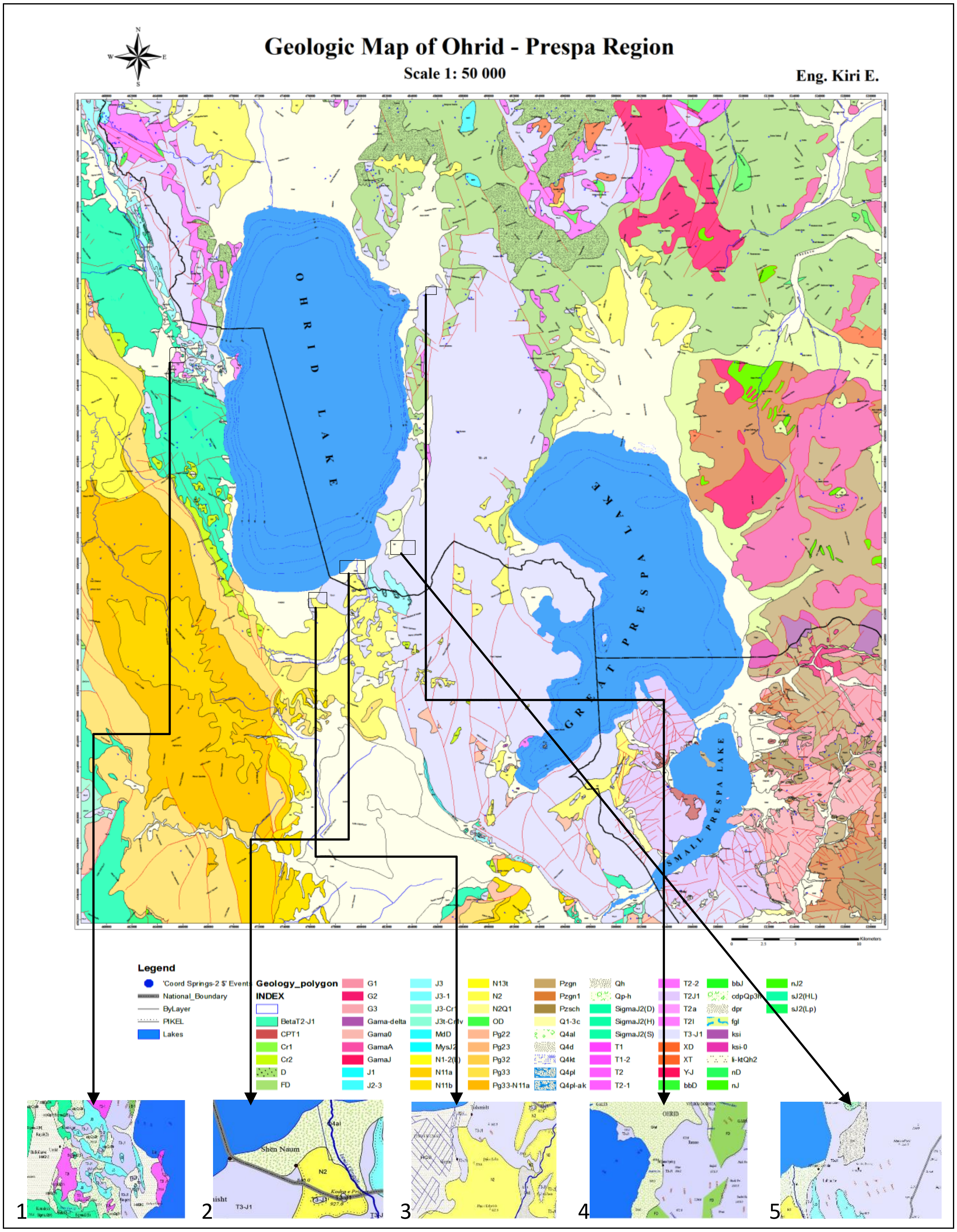


Figure 6.5. Geological map of the Ohrid – Prespa Region (Scale 1:50,000).

Explanation

1- Perrenjas Spring's area, 2 - Saint Naum Spring and Border Spring's area, 3 - Tushemisht and Gurras Spring's area, 4 - Bilijana Spring's area, 5 - Aftokam Lubanisht and Korita spring's area.

- *Saint Naum Spring*

Saint Naum overflow spring is positioned in the south - eastern part of the Ohrid Lake and in southern part of the North Macedonia. This spring emerges by the contact of the Upper Triassic – Lower Jurassic limestone deposits with the terrigenous deposits (Figure 6.6, Photo 6.2). The average discharge of this spring into Ohrid Lake is; 7.63 m^3/sec or 240×10^6 m^3/year (Anovski et al. 2001). The karstic deposits of Dry Mountain in Albanian part and Galicica Mountain in North Macedonian part are the main feeding areas of this spring (55%), the rest comes from Prespa Lake (Pano et al. 2008), same as the majority of springs, positioned in south and south – eastern part of the Ohrid Lake. The temperature, measured during April 2019, of this spring was 11.4 ^oC. The water type, based on the physical – chemical analysis of the water samples, is Ca-Mg-HCO_3.

1. 2.

Photo 6.2. Sent Naum: May (1) and September (2) 2017.

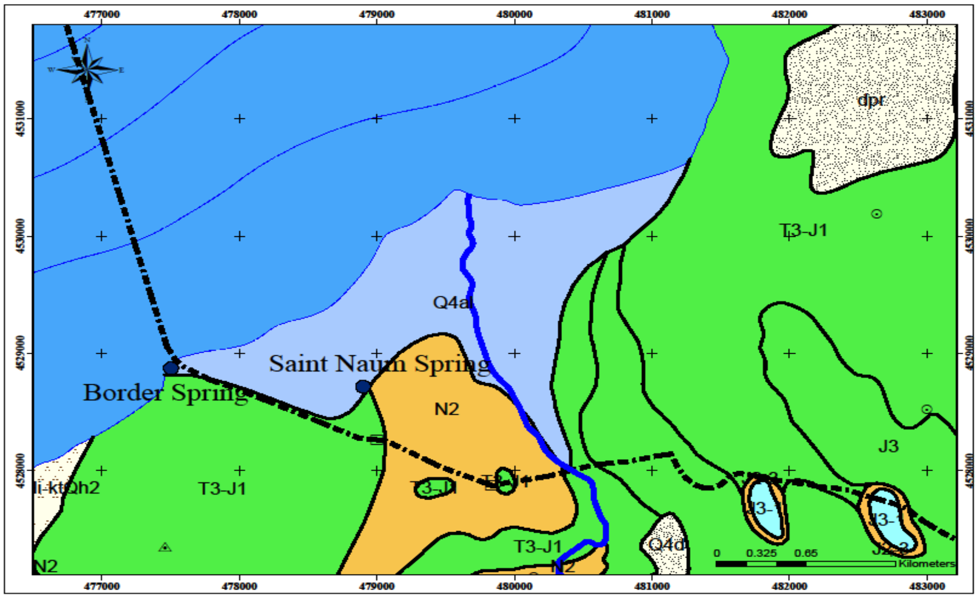


Figure 6.6. Saint Naum Spring and the Border Spring. Hydrogeological Map of Ohrid and Prespa lakes.

1.  2. 

Photo 6.3. Border Spring: May (1) and September (2) 2017.

➢ *Border Spring*

The springs that emerges in the contact of the Upper Triassic – Lower Jurassic limestone deposits with the terrigenous deposits are positioned between Tushemisht Spring and Saint Naum Spring, in the Albanian – North Macedonian border (Figure 6.6, Photo 6.3). There can be notice some springs with small to medium water quantity, but stable during all the year. The feeding area is the same one as the Tushemisht and Saint Naum

Springs. Prespa Lake water feeds these springs mostly during the dry period of year. This phenomenon is favored from the good hydraulic connections that exist between Prespa and Ohrid lakes. The water type of these springs is Ca-HCO_3, and the temperature measured in April 2019 is; 12 ^{o}C. The water quantity of these springs is small but stable during all the hydrologic year.

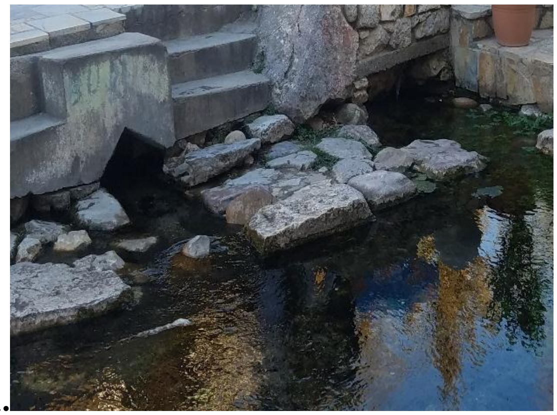
1.  **2.** 

Photo 6.4. Tushemisht Spring, April 2019.

- *Tushemisht Spring*

This spring emerges in the center of the Tushemisht Village (Figure 6.7, Photo 6.4). According to (Anovski et al. 2001, Pano et al. 2008) the spring's quantity is; 2.5 m^3/sec or 18x 106 m^3. This quantity is stable even during the dry period of year. The Tushemisht Spring is emerges in the contact of the Upper Triassic – Lower Jurassic deposits with the Quaternary deposits. It discharges directly in the Ohrid Lake throw a channel (Photo 2. /6.4).

- *Gurras Spring*

This spring is positioned in southern part of the Spring Tushemisht, in Gurras Village. The Gurras Spring emerges in the contact of the Upper Triassic – Lower Jurassic deposits with the Quaternary deposits (Figure 6.7, Photo 6.5).

The temperature during the spring season is 8.1 ^{o}C. The water type is; Ca-Mg-$HCO_{3.}$ The spring's discharge is stable in both; wet and dry period of year. The quantity of the Gurras Spring is 30 L/sec, based on the report of the Municipality of Pogradec (Bashkia Pogradec 2016). The water of the spring is used as drinking water for the villages near it. The amount of water that appears in the Photo 6.5 it's what remains after the water supply of the surrounding villages.

Photo 6.5. Gurras Spring, April 2019.

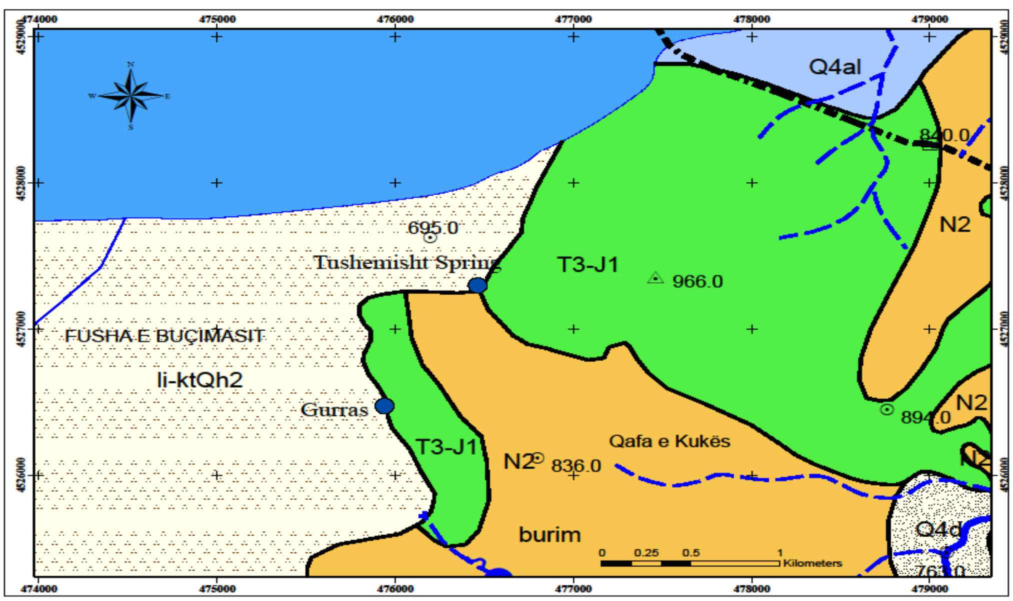
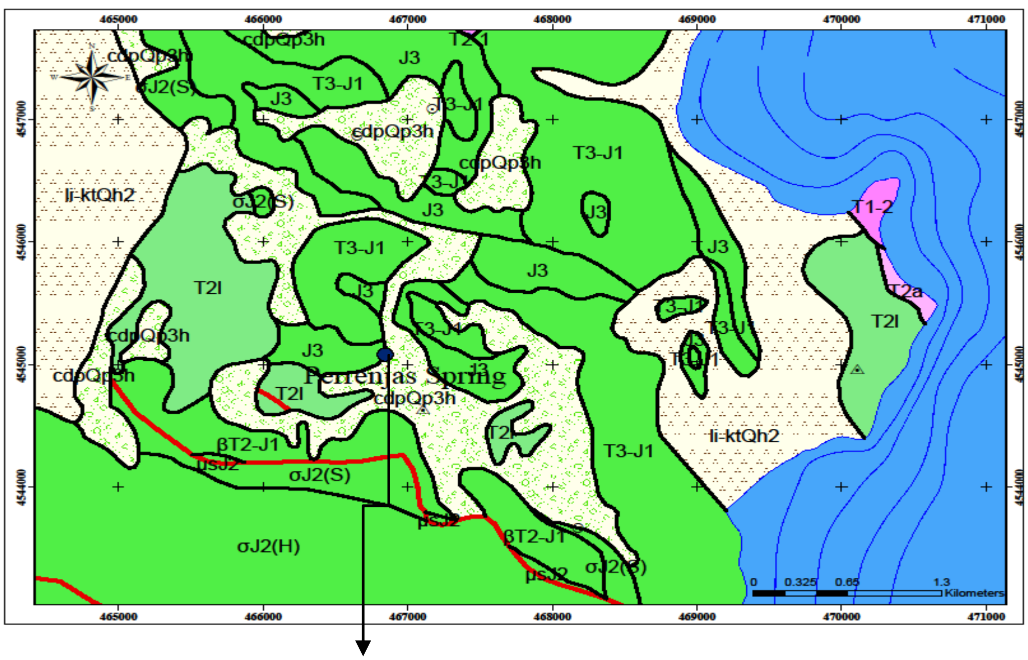


Figure 6.7. Tushemisht and Gurras springs, Hydrogeological Map of Ohrid and Prespa lakes.

- *Perrenjas Spring*

Lin Village is positioned in the western part of the Ohrid Lake. In this area the lake is directly in contact with the karstic rocks, limestone (Figure 6.8). In the other side of the mountain (Qafa Thanes) emerges a group of springs, Perrenjas springs (Photo 6.6). These springs are positioned 603 m above sea level, and 100 m under Ohrid Lake level. The feeding areas of these springs are; the karstic water of the mountain mention above and the Ohrid Lake. The water type of this spring is Ca-Mg-HCO_3 and the temperature measured during April is 11.4 ^oC. The water discharge here is considerable but unknown.

Photo 6.6. Perrenjas Spring, April 2019.



Perrenjas Spring

Figure 6.8. Geological deposits in the west north of the Ohrid Lake, the part were the lakes water comes from Lin Village toward Perrenjas Spring.

- *Bilijana Spring*

This spring is located in the north – western part of the Ohrid Lake (Figure 6.9). Bilijana Spring's feeding area consist not only the karstic waters but even those of Prespa Lake. His discharge is about 1 to 2 m^3/s after (Anovski et al. 2008). In this sector some unknown quantity of karst water are drained directly into Ohrid Lake (Anovski et al. 2001). Based on the recent years observations (2017-2019) this karstic spring during the dry period of year appears to be almost a dry one (Photo1and 2/6.7). Based on the last observation, as mention above, it seems that the feeding area of this spring is only the karst water that comes from Galicica Mountain. According on the water chemistry the water type is; Ca-Mg-HCO_3. It is fresh water, no taste, no color and no smell. The water temperature in April 2019 (the time when the water samples was taken for isotopic analyses) was 10.2 ^oC.

1. 
2. 

Photo 6.7. Biljana Spring, May (1) and September (2) 2017.

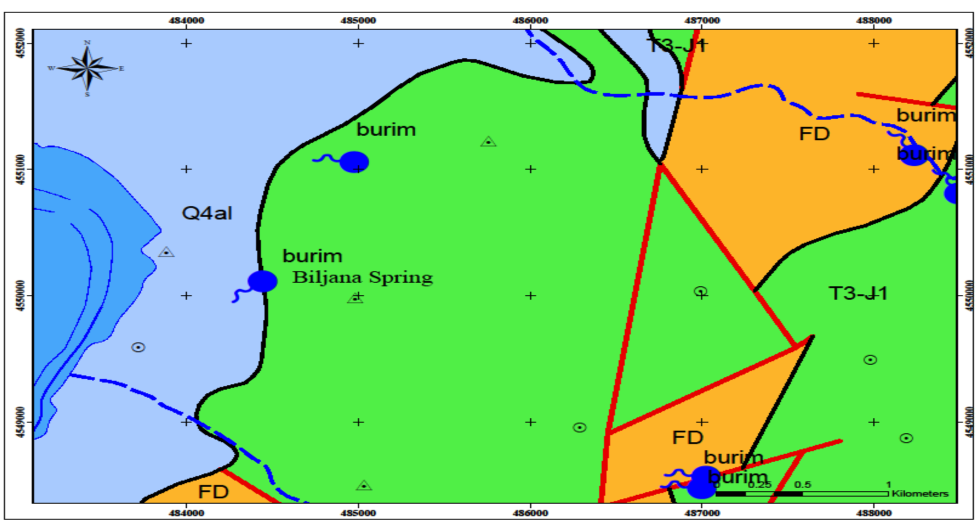


Figure 6.9. Bilijana Spring position in Hydrogeological map of the study area.

➢ *Korita Spring*

Korita Spring is positioned on North - Southern part of the Ohrid Lake, Galicica Mountain, and 1421 m above sea level (Figure 6.10). The feeding area of this spring is only the karstic water of the mountain. His geographic position excludes Prespa Lake as a feeding area. The water quantity of Korita Spring comes totally from the rainfall in the surrounding area. The discharge is stable throughout the year (Photo 6.8). Based on the results of the water chemistry analysis, the water type of this spring is; $Ca\text{-}Mg\text{-}HCO_3$. It is fresh water with a measured temperature 8.1 ^{o}C (April 2019).

Photo 6.8. Korita Spring, September 2017.

➢ *Aftokan Lubanisht Spring*

The Spring Aftokam Lubanisht emerges in the southern part of Ohrid Lake (Figure 6.10, Photo 6.9). This spring during the dry period of hydrologic year appears a dry one. The feeding area here is only the infiltration of the rainfall in karstic deposits of Galicica Mountain. Prespa Lake can’t be considered as a feeding area even though this spring has the same geographic condition as others (springs that discharge a considerable quantity of water coming from this lake). Aftokam Lubanisht Spring has fresh water with a measured temperature 10 ^{o}C. Water type is $Ca\text{-}Mg\text{-}HCO_3$, based on the samples obtained for isotopic analysis during the April 2019.

Photo 6.9. Aftokan Lubanisht Spring, April 2019.

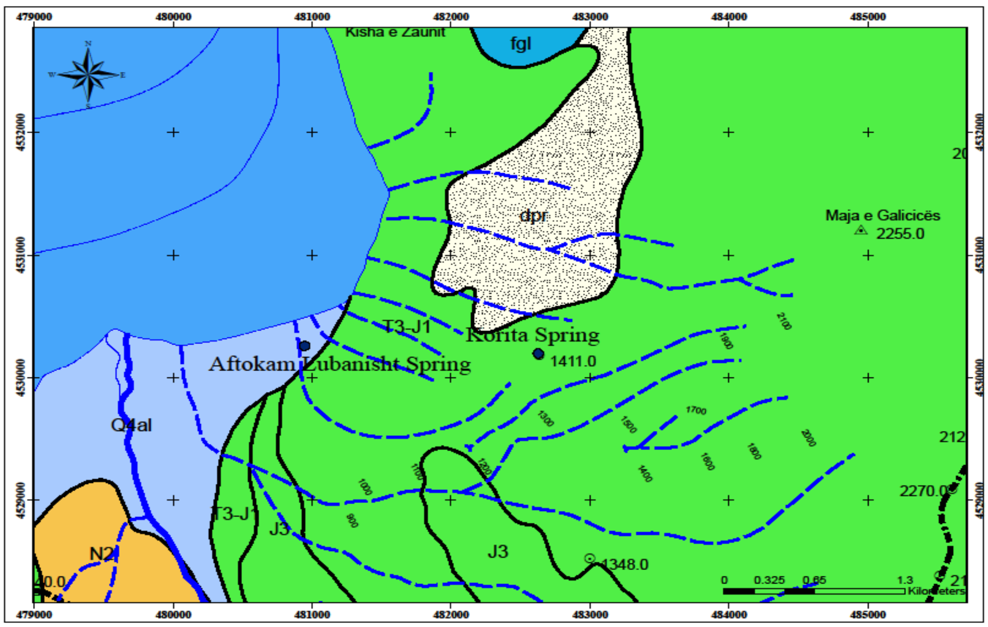


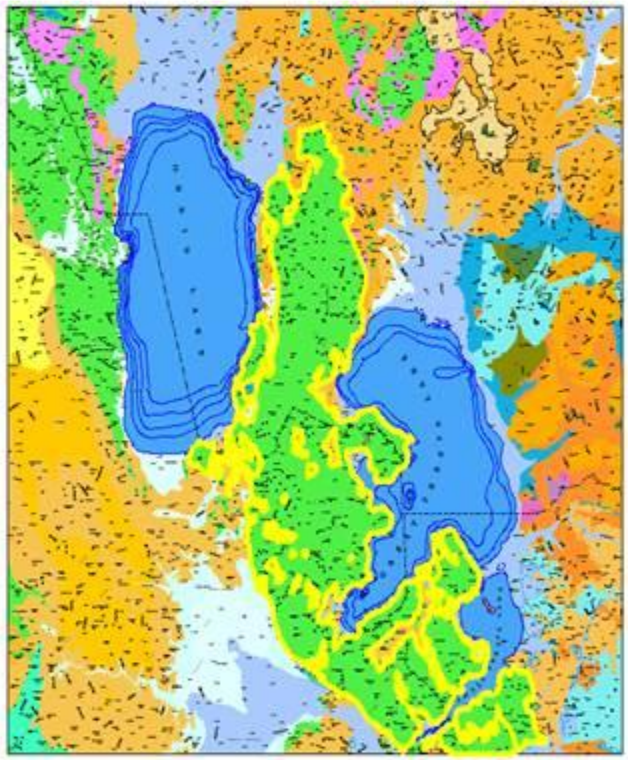
Figure 6.10. Aftokam Lubanisht and Korita springs, Hydrogeological map of Ohrid and Prespa lakes.

6.3 THE TRANSBOUNDARY KARST AQUIFER

- General characteristics

Many aquifers in the world are transboundary (or shared) extending over two or more countries (Voudouris et al. 2019; UNESCO 2016). These aquifers contribute significantly to water supply for domestic, industrial, and irrigation use. Also, many ecosystems depend on these aquifers. So, the modernization of processes to manage demand and distribution of transboundary aquifers is a specific target nowadays (Eckstein & Eckstein, 2003).

As mentioned before, between lakes Prespa and Ohrid, a transboundary aquifer is developed in karstified carbonate rocks (Triassic-Jurassic massive limestone of Galicica-Dry Mountain), covering an area of about 810 km^2. These rocks cover the western and southern edges of the valley, and a large part lie on the bottom of the Prespa Lake. The elevation of Prespa Lake is about 155 m higher than that of Ohrid Lake. These lakes are fed by direct rainfall, overland flows and spring water flows from karst systems. Big Prepsa is also fed by Small Prespa overflows through the canal Koula. In 1962, Sateska River was artificially diverted to Ohrid Lake. The average annual outflow from Ohrid Lake into the Drin River is estimate to be 22 m^3/s (Popovska & Bonacci 2007). Prespa Lake has no surface outflow. The highlighted area in Figure 6.11 represents the transboundary karstic aquifer. The total surface of these polygons covers an area of about 606.828233 km^2 or ≈**606.83 km^2.**



FID	Shape *	AREA	BLOCKNAME	ID	AREA1	PERIMETER
0	Polygon	0	J3-Cr1	191	692526.998535	8026.578333
1	Polygon	0	Qh	191	38513541.978912	147497.342974
2	Polygon	0	Pg22	191	711470.66626	4104.768347
3	Polygon	0	Pg22	192	616749.774902	3066.255569
4	Polygon	0	T2J1	192	30854243.308594	41740.035588
5	Polygon	0	Cr2	192	176931.387022	2064.706991
6	Polygon	0	Cr2	192	101142.980957	1275.17527
7	Polygon	0	Pg22	192	99011.681641	1320.114669
8	Polygon	0	Pg22	192	661358.176736	3876.989374
9	Polygon	0	T2J1	192	227566.235352	2063.654955
10	Polygon	0	T2J1	192	32628.73877	682.933304
11	Polygon	0	Q4kt	192	3794369.619629	19950.420258
12	Polygon	0	Q4pl-ak	192	3204294.76709	9070.167685
13	Polygon	0	Q4al	193	4279192.331299	14644.781609
14	Polygon	0	GamaJ	193	17343106.650879	20739.880317
15	Polygon	0	Cr2	193	365071.938232	3330.266144
16	Polygon	0	Pg22	193	1132636.058719	5677.494566
17	Polygon	0	Pg22	193	289360.885183	2970.443626
18	Polygon	0	Pg22	193	96676.139711	1818.455784
19	Polygon	0	Pg22	193	475371.89753	2807.04835
20	Polygon	0	Pg22	193	248856.254897	2144.134901
21	Polygon	0	Pg22	193	367652.980713	2463.560032
22	Polygon	0	Pg22	193	46510.989502	924.064607
23	Polygon	0	Cr2	194	297866.19786	2559.332784
24	Polygon	0	Pg22	194	544145.529827	4638.046482
25	Polygon	0	CPT1	194	640602.368896	8362.927756
26	Polygon	0	Q4al	194	8326058.206299	84637.826028
27	Polygon	0	T2	194	23579.517822	602.023352
28	Polygon	0	Q4kt	194	2952751.056641	8453.210618
29	Polygon	0	Q4kt	194	1592661.117188	10770.461748
30	Polygon	0	Q4pl-ak	194	1064900.157715	5750.530741
31	Polygon	0	N11b	194	4325332.563147	12796.324541
32	Polygon	0	T2	194	59144.391602	968.307806
33	Polygon	0	T2	195	425806.37793	3788.439306
34	Polygon	0	CPT1	195	2288742.959473	12211.717086
35	Polygon	0	T3-J1	195	200285.373779	1728.961329
36	Polygon	0	Q4al	195	81340830.225086	72340.617021
37	Polygon	0	Q4al	195	128296.799581	3024.169531

Figure 6.11. The transboundary aquifer between Prespa and Ohrid lakes.

The transboundary karstic aquifer is a complex system which functions primarily as a hydrocollector and hydroconductor, affecting the water balance of the lakes. Hydraulic connection that exists between the two lakes has been confirmed by earlier studies (Eftimi & Zoto, 1997; Popov et al., 2009). A conceptual model of the transboundary aquifer and its common hydraulic system of two lakes are shown in Figure 6.12. The hydrogeological behavior of the transboundary karst aquifer is controlled by tectonic deformation, which favors infiltration of meteoric water. Numerous crevices, sinkholes, and karstic fields, as surface forms, and also underground forms of the types such as: caves, canals, conduits, etc. are characteristics of the mountainous area. This aquifer is recorded in the list of transboundary aquifers of SE Europe on the UNESCO/INWEB internet site (www.inweb.gr, Aureli et al. 2008).

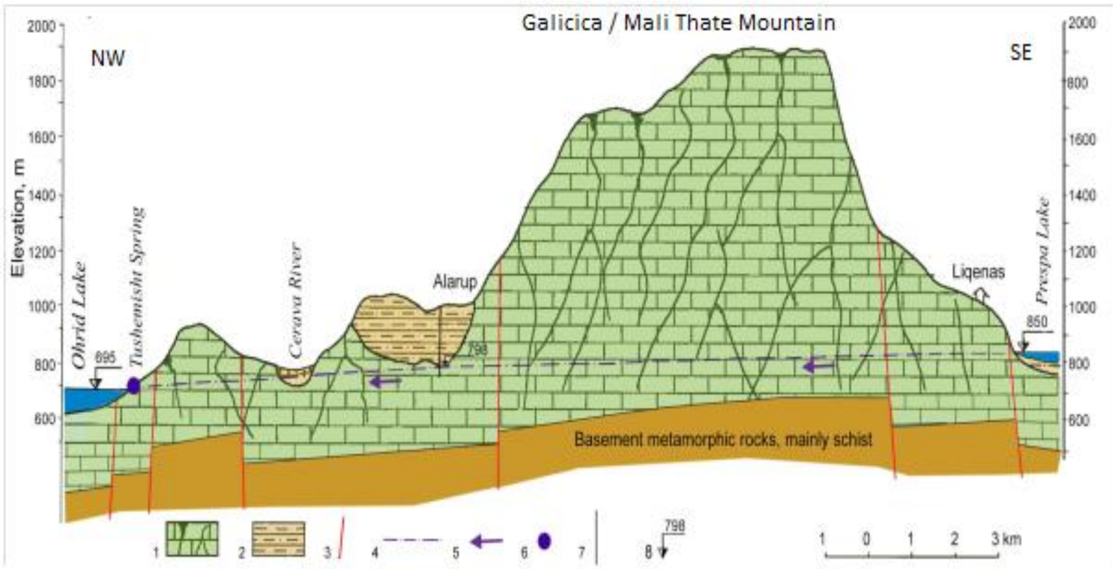


Figure 6.12. The transboundary karst aquifer in hydraulic connection with lakes Prespa and Ohrid (Eftimi & Zoto, 1997 with modifications).

Explanation

1. Carbonate rocks, 2. Recent deposits, 3. Fault, 4. Groundwater level,
5. Direction of groundwater flow, 6. Springs, 7. Elevation, 8. Lakes water level.

- **Aquifer Recharge and Discharge**

Groundwater recharge of karst aquifer occurs via infiltration of rainfall. In order to estimate the volume of precipitation recharging the transboundary karst aquifer, the hypsometric method was applied. Initially, the change in precipitation (P) with altitude (H) was calculated using data from rainfall-gauge stations (Asamati, Brajcino, Carev Dvor, Izbista, Mesista, Nacilec, Ohrid, Pestani, Radolista, Resen, Slivovo, Stenje, Struga, St Naum, Vevcani) of the wider area (Popovska & Bonacci). This relationship with linear regression analysis is as follows (Figure 6.13):

$$P= 0.41\ H + 459.5\ (R^2=0.16)$$

From this equation it is concluded that precipitation showed an insignificant increasing trend of 41 mm per 100 m altitude. The coefficient of determination (R^2) is relatively small (0.16), indicating that only 16% of the observed variance of precipitation can be predicted from this linear model (Oiro et al. 2021). It is underlined that the total absence of hydrometeorological data for the mountain areas makes the detailed estimates of hydrological parameters hazardous with a high degree of uncertainty.

Given that the average altitude of the area is 1326 m a.s.l., the equation shows an average annual precipitation of 1003 mm. Multiplying by the surface of the aquifer surface (606.8 km^2) results in an average annual volume of rainwater equal to 608.6x10^6 m^3.

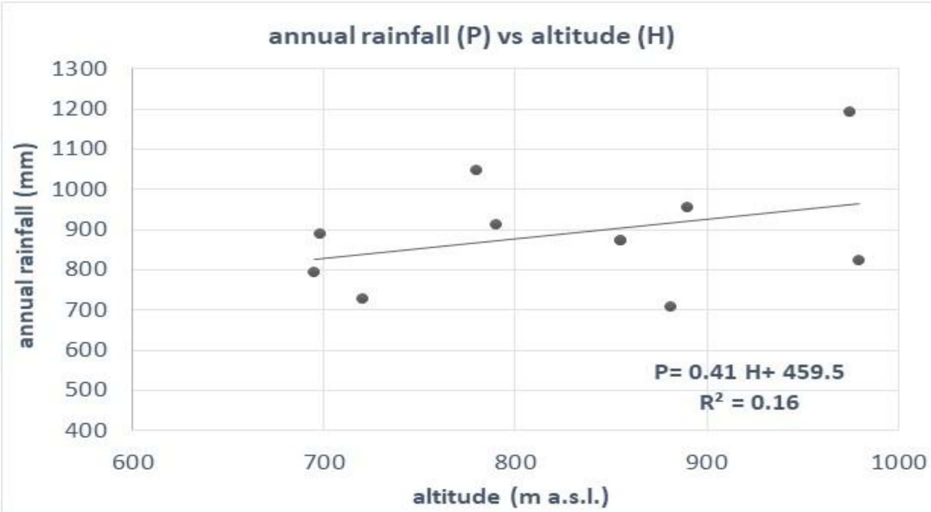


Figure 6.13. Relationship between annual rainfall (mm) and altitude (m a.s.l.) in the wider area of Ohrid Lake.

The average coefficient of infiltration in the karstic zones is about 45%–65% of the annual rainfall (Popovska & Bonacci 2007). In this study, the Kessler coefficients were used in order to estimate the total volume of infiltrated water in karst mass. Kessler (1965) proposed the following monthly coefficient of infiltration in karst areas (Table 6.1). High values of March, April and May are due to the snow melting.

Taking into account the Kessler coefficients and the mean monthly precipitation (Chapter 5), it was estimated that the infiltration coefficient is 49% of the annual precipitation (Table 6.1). This value is being comparable with other similar estimations carried out for karst aquifers of European and Mediterranean countries (Allocca et al. 2014; Soulios 1984). It is pointed out again that the precipitation data come from rain-gauge stations located in low to medium altitudes and there are no available data from high altitudes. The infiltrated water in karst mass is discharged through many springs mainly in the eastern part of the aquifer.

Table 6.1. Kessler coefficients of infiltration.

Jan	43.4	**July**	20.7
Feb	77.5	**Aug**	17.6
Mar	113	**Sept**	14.6
Apr	60	**Oct**	12.8
May	44.6	**Nov**	22.5
June	33.9	**Dec**	49.7

Table 6.2. Approximate hydrological balance of the transboundary karstic aquifer.

	Precipitation	Evapotranspiration	Infiltration	Surface runoff
x10^6 m^3/yr	608.6	279.9	298.2	30.5
Mm	1003	461.4	491.5	50.1
%	100	46	49	5

As mentioned above, the karst aquifer system discharges through many springs; the main are Saint Naum (in North Macedonian territory) and Tushemisht, Gurras (in Albanian territory). The average discharge of St. Naum spring into Ohrid Lake is 7.63 m^3/s and the discharge of Tushemisht is 2.5 m^3/s. The annual discharge of the aforementioned springs ranges between 255-320x10^6 m^3 (Amatij et al. 2006). Additional volumes of water drain into the lakes as sub-lacustrine springs. wss

Taking into account that the average annual outflow from Ohrid lake into the Drim River is 20-22 m^3/s (Popovska & Bonacci 2007) and the main inflows into Ohrid Lake come from karst springs (inflows from permanent surface waters of Ohrid watershed are small and only during the wet period), is estimated that the average annual outflows from Ohrid Lake range between 630-694x10^6 m^3.

From the above estimates, it is considered that there is another supply of Ohrid Lake. The approximate hydrological balance (in round numbers) of the transboundary aquifer (Table 6.2) shows that the supply of the main-springs cannot be only from the infiltration of atmospheric precipitation, confirming the hypothesis that the waters of the Prespa Lake feed the springs via the karst aquifer. Many visible sinkholes (fissures in the karst mass through which the water sinks underground) are recorded in the western part of Prespa Lake.

Cvijić firstly formulated in 1906 the hypothesis that Prespa Lake recharges St. Naum and Tushemisht springs at Ohrid lakeside. An artificial tracer experiment carried out in 2002 physically demonstrated the underground connection between both lakes. This experiment confirmed the supposed underground connection and brought important information about the groundwater velocity, transit time, and karst water conduits development.

Amataj et al. (2007), Leng et al. (2010), Hoffmann et al (2012), Chantzi & Almpanakis 2018, Lacey et al (2015), Chantzi & Almpanakis 2020 confirmed the hydraulic connection between Prespa and Ohrid Lake by using tracer and heavy isotopes methods and by estimated stable isotopes ratio (hydrochemistry). They estimated that St. Naum spring is recharged from Prespa Lake with a percentage equal to 37-42% and Tushemisht spring is recharged to 52-54%. Similar researches showed that the contribution of Prespa Lake to recharge St. Naum spring is 42% (Anovski et al. 1992) and 37% (International Atomic Energy Agency, IAEA 2003). Correspondingly, the contribution of Prespa Lake to recharge Tushemisht is 52% (Eftimi & Zoto 1997) and 54% (IAEA 2003). Manzinger et al. (2006), calculated (from balance) the underground annual outflows of Prespa lake equal to 245x10^6 m^3 and Popov et al. (2009) equal to 282x10^6 m^3. They also reported that the Ohrid lake is fed by inflow from karst aquifers (55%), with smaller percentages from river runoff (<10%) and direct precipitation. Besides, Van der Schriek & Giannakopoulos (2017) suggest that Prespa Lake contributes to the recharging of Ohrid Lake with approximately 25% of its total inflows through underground karst channels. Finally, Stamos et al. (2011) estimated the annual outflows of Prespa Lake to the karstic systems equal to 128x10^6 m^3. From the above, it follows that the calculations of groundwater outflows through the karst aquifer vary widely (Table 6.2), and a value between 7.5 and 10 m^3/s (236x10^6-315x10^{6}m^3/yr) is considered as the total outflow from Prespa Lake to Ohrid Lake via underground karst channels. It is pointed out that the decline of the water level in Prespa Lake increases the hydraulic gradient and consequently the groundwater flow to Ohrid Lake.

Table 6.3. Estimates of groundwater fluxes from different researchers.

	Researchers	Volume of water	Comments
1	Amataj et al. (2007)	220-315x10^6 m^3/yr	Amount of water receiving Ohrid lake from Prespa Lake
2	Matzinger et al. (2006)	245-313x10^6 m^3/yr	Total outflows
3	GFA Consulting (2005)	429x10^6 m^3/yr	Total groundwater outflows
4	Popov et al. (2010)	282x10^6 m^3/yr	Total outflows
5	Stamos et al. (2011)	128x10^6 m^3/yr	Underground inflows of Prespa Lake to springs (St Naum and Tushmisht)
6	Popovska & Bonacci (2007)	694x10^6 m^3/yr	Average outflow from Ohrid Lake to Drim River
7	Anovski et al. (1997)	101x10^6 m^3/yr	42% of St Naum spring comes from Prespa Lake
8	Eftimi & Zoto (1997)	41x10^6 m^3/yr	52% of Tushemisht spring comes from Prespa Lake
9	IAEA (2003)	89x10^6 m^3/yr	37% of St Naum spring comes from Prespa Lake
10	IAEA (2003)	42x10^6 m^3/yr	54% of Tushemisht spring comes from Prespa Lake

Aquifer properties

The karstic rocks appear a mixed porosity; the porosity of the rock blocks (matrix porosity), porosity of small and larger cracks, porosity of big faults and caverns and porosity of clastic material filling all rock discontinuities. The transboundary aquifer shows anisotropy and is not homogeneous.

The groundwater flow direction is from Prespa to Ohrid Lake (Figure 6.14). The water velocities range between 3 and 679 m/h, indicating the complicated developed karst channels, as well as the presence of big and small conduits at small-scale distances (Amataj et al. 2007).

The transboundary karst aquifer shows anisotropy and inhomogeneity. According to pumping-test data from boreholes drilled in the Greek territory, the transmissivity value is approximately 5x10^{-2} m^2/s, hydraulic conductivity 2.5x10^{-3} m/s, and the storativity equal to 2% (Stamos et al. 2011). These values are similar with values reported by Mandilaras et al. (2006) for karst aquifers in North Greece.

Finally, it is pointed out that the transboundary karst aquifer is also vulnerable to external pollution due to the absence of a protective soil cover and the presence of discontinuities at great depths. Besides is vulnerable to climate changes which affect the lakes' ecosystems (see Chapter 8).

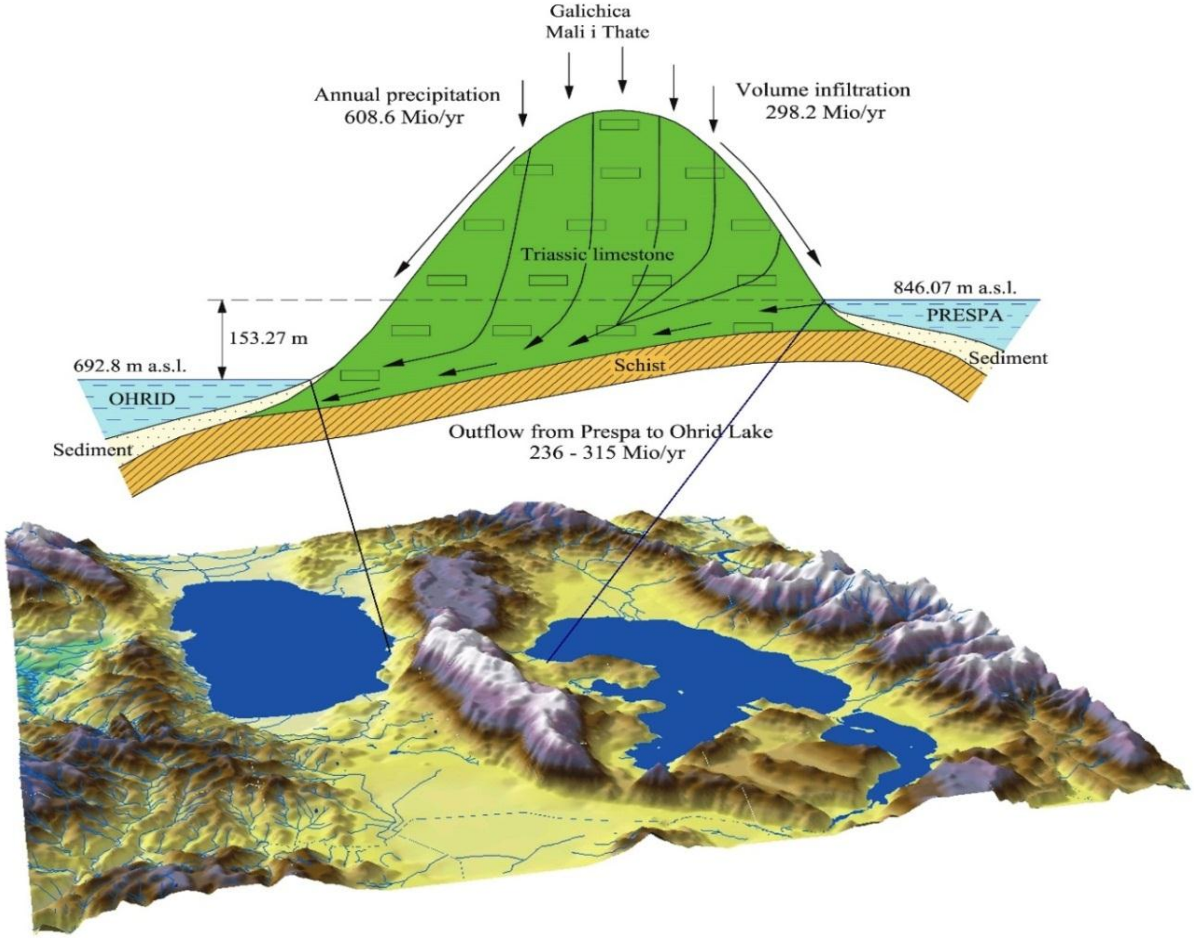


Figure 6.14. Simplified cross section of karstic massif of Galichica and Mali Thate with connection between Big Prespa Lake and Ohrid Lake (Anovski et al. 2001) with modifications, and the ArcScene view of the area.

CHAPTER 7. HYDROCHEMISTRY

Water Quality- Isotope Analysis

7.1 DATA COLLECTION AND ANALYSIS

In order to study the groundwater quality, numerous chemical analyses were used. Moreover to have a clear panorama of possible changes that may have happened in water chemistry previous years' data were also taken in consideration. The water samples were collected from different depths in Ohrid Lake, in the Prespa Lake, and in the springs where the Prespa Lake is considerate as a feeding area. All samples were taken at the end of wet period (May) and dry period (October) during 2016-2017. In the meantime, Stiff diagrams have been constructed based in the water chemistry data of 1978 (at these time, Prespa Lake's water level decreases haven't been notices yet). In progress, was done the same experiment with water chemistry data for 2005 (period of time when this decreases have been well distinguished). The study goes further based on the chemical water samples analysis for 2016 and 2017.

The chemical analyzes were performed at the Laboratory of Engineering Geology & Hydrogeology, Department of Geology, Aristotle University of Thessaloniki, Greece. The following parameters have been determined: Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, NO_3^{-}, SO_4^{2-}, HCO_3^{-}. In situ measurements of pH and Electrical Conductivity (E.C.) and concentration of TDS were also analyzed. The results of chemical analyses were tested by ions balance. The calculated errors were less than 5%, not systematic, and distributed between positive and negative values. Conventional hydrochemical techniques were applied to study groundwater quality and classify the water samples and to product hydrochemical plots.

Application of multivariate analysis on many samples collected from the different aquifers system, helped to delineate the major hydrochemical process that controls hydrochemical evaluation of the region (Voudouris 2000).

7.1.1. Chemical data of Prespa Lake, Ohrid Lake and springs in the study area

It is known that a hydrological link exists between Prespa and Ohrid Lakes. According to the results of water chemical analyses in general some characteristics can be drawn: The fluctuation of pH between 6.8 and 8.3 shows that groundwater is slightly acid to alkaline. Fresh groundwater, not affected by pollution, contains $Ca^{2+}>Mg^{2+}>Na^{+}>K^{+}$ and $HCO_3^{-}> SO_4^{2-}>Cl^{-}>NO_3^{-}$.

High sulphate (SO_4^{2-}) concentrations can be associated with the dissolution of gypsum (Antonakos and Nikas 2005).

The Ca-Mg-HCO_3 water type is the dominant type in Greece, representing freshwater of recent infiltration. The electrical conductivity (E.C.) shows a gradual increase from the mountainous recharge areas towards the lowlands discharge areas (Stamatis and Voudouris 2003). The mineralization of water of Ohrid Lake has a range from 200–250 mg/L (Jordanoski and Lokosk 2002).

The majority of waters in Ohrid Lake contain calcium and magnesium bicarbonates. According to the chemical content, this lake is of the calcium bicarbonate class and the main ions are placed according to this order:

$$HCO_3^{-}> Cl^{-}> SO_4^{-}; \quad Ca^{+2} > Mg^{+2} > Na^{+} > K^{+}.$$

The chemical analysis of samples taken in Ohrid Lake indicates the absence of nitrates, iron and phosphate. Siliceous is present in small quantities (Jordanoski and Lokosk 2002).

The contents of salts in Ohrid Lake are conditioned by the nature of water balance. This lake is supplied via hydraulic connections by Prespa Lake, which is distinguished by low water mineralization. The low sediments of Ohrid Lake do not have a great influence in the enrichment of water units with different salts. Typical feature of chemical water’s composition of Ohrid Lake is the low concentration of salts (Table 7.1 and 7.2).

The water of Prespa Lake has low organic matter. Thus, pH is low in the water of this alkaline lake (Table 7.1, 7.2, 7.3, 7.4). This is due the fact that Prespa Lake is mainly supplied from waters that come from snow-melt (Schetselaar et al. 1995). In Prespa Lake, since the vertical convective mixture includes all its watery volume, the regime of oxygen (O_2) is mainly determined by dispersing of water temperature. In this lake, the chemical content of the surface water and deep water is practically identical. Such phenomenon is not present in the Ohrid Lake.

The Ohrid Lake's water chemistry information was done in purpose to aid a comparison between Prespa and Ohrid lakes. Stiff diagrams were used for this aim.

Generally, groundwater quality depends on the quality of recharged water, atmospheric precipitation, inland surface water and on subsurface geochemical processes (Taheri and Voudouris 2007),

7.2 HYDROCHEMICAL METHODOLOGY

7.2.1. Stiff Diagrams Usage in Water Samples Comparison of Ohrid - Prespa Region

The software package used for the water samples comparison in our study area was AquaChem. This program has been used even before from the author in order to see the visual similarities between different watersheds (Kiri et al. 2011). AquaChem is a software package developed specifically for modeling of water quality data. It contains a customizer database of physical and chemical parameters and offers a detailed selection of analysis tools (Parkhurstet al. 1980, AquaChem v.5.1, 2007).

The diagrams in form of column, the circled graphic, the graphic of Stiff are the main graphic expression approaches of chemical analysis. For this material are used the Stiff diagrams because they appeared more appropriate in comparing the water chemical components. AquaChem program was used to achieve the purpose mentioned above.

Intended use of this program becomes the possibility to see the similarity of the water chemistry in the study region. Data used for this purpose are obtained by researcher during the field work, in two periods of a hydrological year, 2016 and 2017. These data (Tables 7.1, 7.2, 7.3, 7.4) were used for the construction of a database, on the basis of which are built the Stiff diagrams. For this study the AquaChem program aperies to be a very appropriate one.

Prespa Lake water level decrease least decades made that the focus of the most study in the region to be oriented on the water movement from Prespa Lake toward Ohrid Lake. The hydraulic connection that exists between two lakes is very important to be mention in this point. The geographic position helping the hydraulic connections makes Prespa Lake a very good and constant feeding source for Ohrid Lake till in their existence. Ongoing more detailed and graphical explanations will be included by using Stiff diagrams.

The lakes' water comparison was made, as well as the comparison of region's water between them, with the purpose of giving a possible conclusion according to the hydrogeological interpretation of the water chemistry. Stiff diagrams were used for that purpose. To construct these diagrams, it was necessary to have physical – chemical data of water from different point of the study area (lakes and springs). The results expressed in the diagram were compared, so one may have a clear vision of the water chemistry in the whole region, and to see the differences that may or may not exist between samples. These kinds of analyses helped in understanding the water's hydrodynamic in the area too. This method by defining processes and trends indicated by the latter, but not clearly proved for a number of reasons that may include random errors during sampling, analyses, or even resulting from irregularities attributed to localized geological, or hydrodynamic particularities Voudouris (2000).

Firstly, the database of water chemistry was used to construct the Stiff diagrams and after was inputted in the hydrogeological map (map constructed in GIS program). The data was taken mostly in Ohrid Lake for 2016, in the same point but in different depths, and in different points in the Ohrid Region. In the Big Prespa Lake the water samples were taken in the lake. It's important in this point, to mention that Big Prespa Lake is relatively shallow and have the capability to mix the water, so it was not found necessary to analyze many water samples (Popov et al. 2009). The database created and the construction of diagrams makes possible the comparisons above mention for itch season of the year.

Three factors of storage capacity for each hydrogeological unit in every catchment area should be taken into account: the climate regime including precipitation and air temperature, the geological nature of the ground and the surface area of the basin (Voudouris 2011).

7.2.2. Hydrochemical research, work and results

Data used and observed by the author were from different periods: 1979, 2005 and 2016, 2017. What one can aim to achieve by analysing the water chemistry was to find possible similarities between the water in Prespa Lake with that of Ohrid Lake.

AquaChem is a standard program for implementation of the above-mentioned constructions of Stiff diagrams.

The analysis of the water in the region helped in understanding the water flow, as well as, helped with the creation of a valid hypothesis on the reasons that made the water level of Prespa Lake decreasing. Field work, in order to study the geo-chemistry in the area, began shortly before reaching the ascent “Qafe Thana”, at carwash points. This point was important for the study because; was believed that water movement here is from Ohrid Lake toward these springs. In this spring (carwash points) was taken two water samples to be analyzed, in two different seasons (May and October 2016). Based on the geographic position (springs emerged at 633.8 m, a.s.l., measured value) these points appeared below Ohrid Lake’s level separated by karstic limestone deposits.

Ongoing was continued receiving water samples from the Tushemisht Spring (Photo 7.2), and the spring in Gurras’s Village (Photo 7.1). Analysis results of these samples would be compared with those of Prespa Lake. In progress, analyses were taken in different depth of the Ohrid Lake, inside of Albanian border (Photo 7.3).

Water samples were taken initially on the surface of the lake, following at; 10, 20, 30, 40, 50, 75 and 100 m depth (Photo 7.3). Chemical analysis results arising out from these water samples, would be compared with the water sample receive from the Prespa Lake (Photo 7.4).

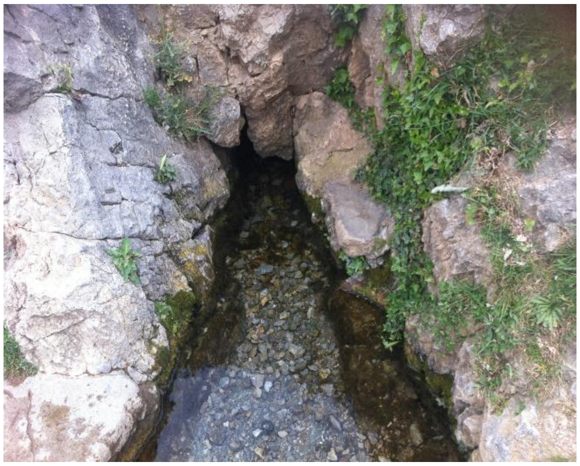


Photo 7.1. Spring Gurras, 2016.

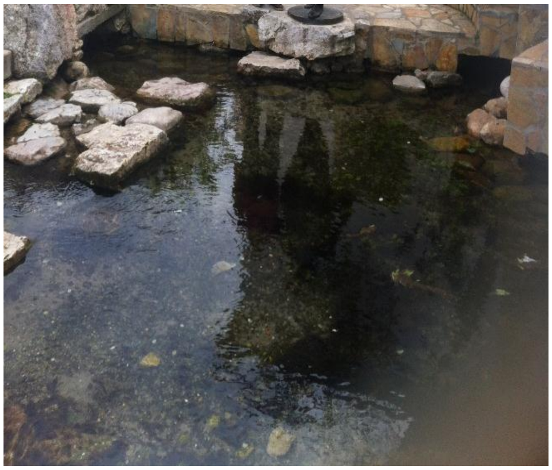


Photo 7.2. Spring Tushemisht, 2016.

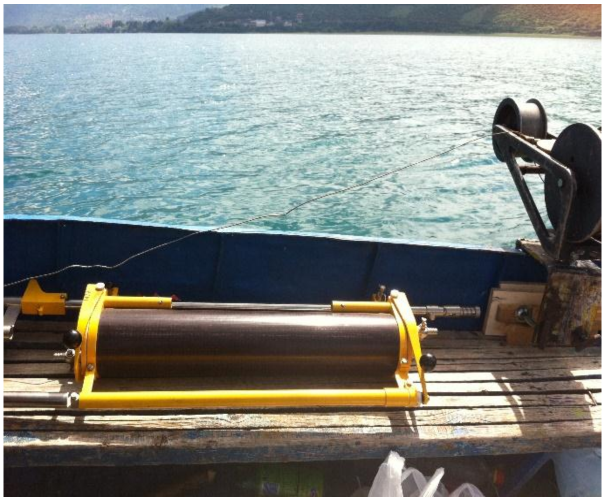


Photo 7.3. Instrument used for obtaining water samples at different depths at Ohrid Lake (2016).

Photo 7.4. Prespa Lake, September 2016.

Table 7.1. Physical-chemical data of the samples taken in Ohrid-Prespa Region, May 2016

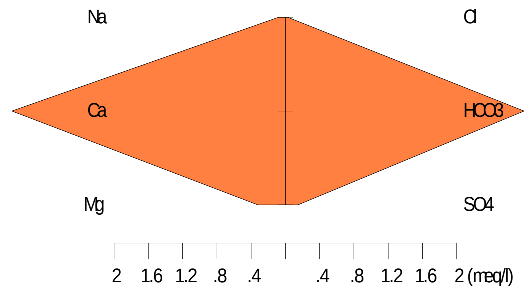
Point	X	Y	a.s.l (m)	NO_3^- (mg/l)	Cl^- (mg/l)	SO_4^- (mg/l)	HCO_3 (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)
S. Per.	465281	4546656	636	10.27	0.90	7	170	64	3.91	1.81	0.90
O. L. s.	475702	4530622	699	5.87	1.53	8	122	34	9.03	3.72	1.30
O.L.-10	"	"	-10	6.60	1.06	8.66	147	35.6	7.51	3.92	1.30
O.L. -20	"	"	-20	2.05	0.83	7	112	34	7	3.72	1.30
O.L. -30	"	"	-30	6.60	1.83	8	115	33	10	3.82	1.30
O.L.-100	"	"	100	6.45	1.13	8	118	34	9.28	3.82	1.30
O.L. -75	"	"	-75	8.21	3.76	8	113	34.8	9.52	3.82	1.30
O.L. -50	"	"	-50	1.32	2.50	8	119	34.4	8.30	3.92	1.30
O.L. -40	"	"	-40	5.28	3.80	8	117	38	7.81	3.82	1.30
S. Tush.	476450	4527773	703	7.33	2.86	5.6	162	58.8	5.62	3.62	1.20
S.Guras	475818	4526562	703	8.51	8.23	6.6	156	56	6.10	3.52	6.72
P. Lake	492309	4515406	853	7.19	4.06	12	113	42.8	3.17	6.03	2.21

Table 7.1. Continues

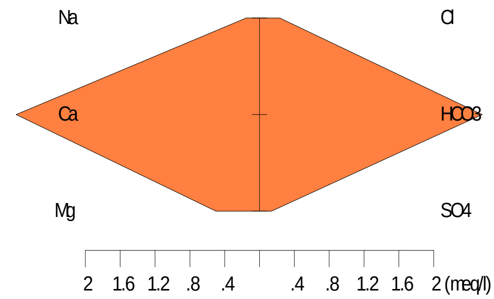
pH	Conductivity	TDS	Water type
8.3	333	213	Ca- HCO3
8.47	238	152.3	Ca-Mg-HCO3
8.49	236	151.6	Ca-Mg-HCO3
8.47	236	151.5	Ca-Mg-HCO3
8.38	236	151.5	Ca-Mg-HCO3
8.3	242	155.3	Ca-Mg-HCO3
8.21	239	153.1	Ca-Mg-HCO3
8.18	237	151.7	Ca-Mg-HCO3
8.16	237	152	Ca-Mg-HCO3
7.48	332	212	Ca-HCO3
7.48	314	201	Ca-HCO3
8.13	249	159.2	Ca-HCO3

Stiff diagrams for May 2016

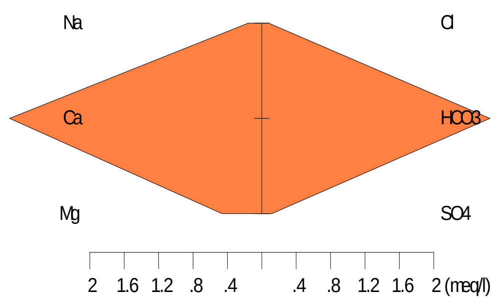
"Samples no. 1; Springs, Perrenjas"



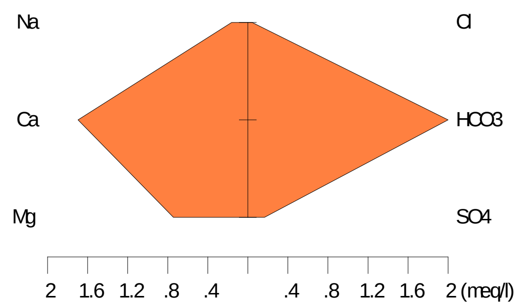
"Samples no. 11;Spring, Guras ",



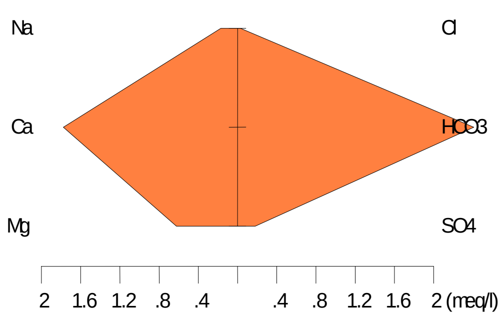
"Samples no. 10; Springs, Tushem



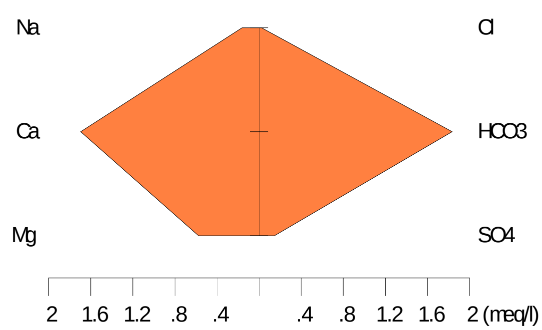
Samples no. 2; O. L. surface, 5/19/

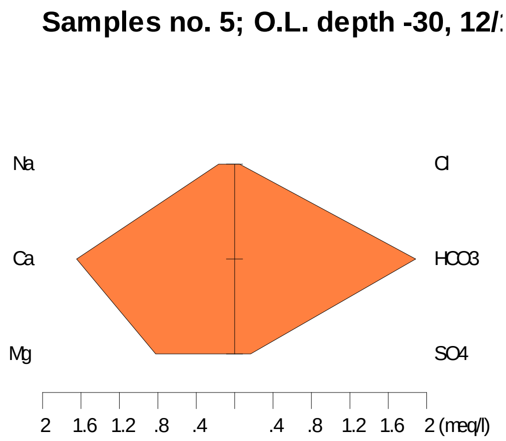


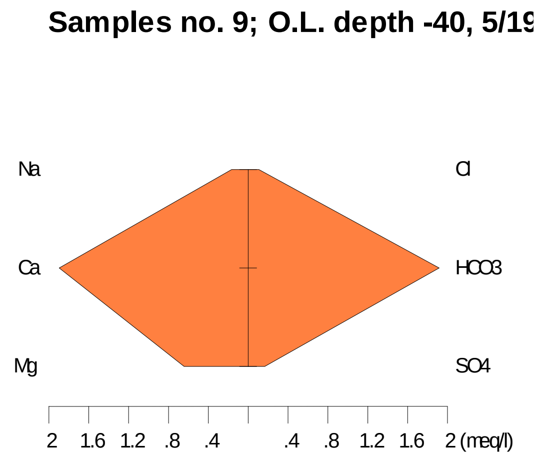
Samples no. 3; O.L. depth -10, 5/19/

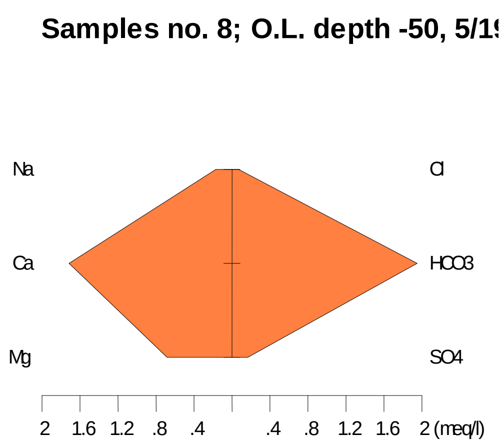


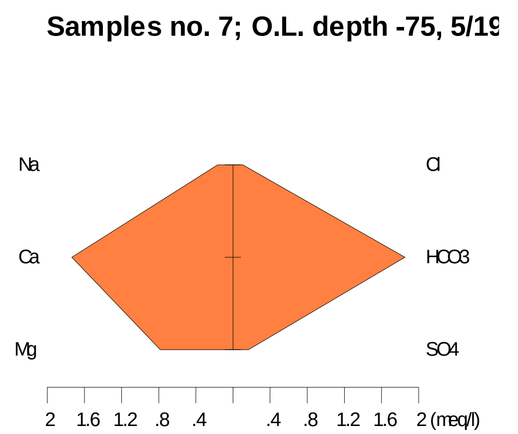
Samples no. 4; O.L. depth -20, 5/19/

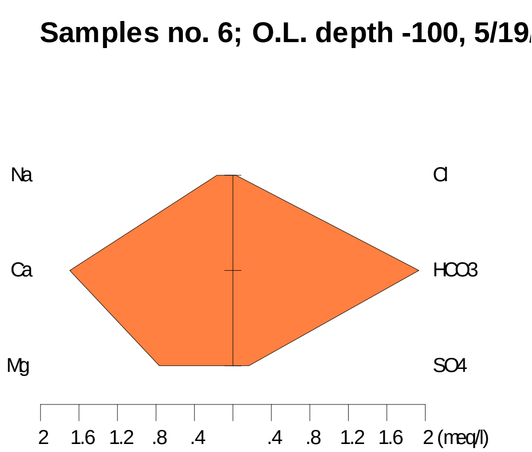



Samples no. 5; O.L. depth -30, 12/
Na
Cl
Ca
HCO3
Mg
SO4
2 1.6 1.2 .8 .4 .4 .8 1.2 1.6 2 (meq/l)


Samples no. 9; O.L. depth -40, 5/19
Na
Cl
Ca
HCO3
Mg
SO4
2 1.6 1.2 .8 .4 .4 .8 1.2 1.6 2 (meq/l)


Samples no. 8; O.L. depth -50, 5/1
Na
Cl
Ca
HCO3
Mg
SO4
2 1.6 1.2 .8 .4 .4 .8 1.2 1.6 2 (meq/l)


Samples no. 7; O.L. depth -75, 5/19
Na
Cl
Ca
HCO3
Mg
SO4
2 1.6 1.2 .8 .4 .4 .8 1.2 1.6 2 (meq/l)


Samples no. 6; O.L. depth -100, 5/19
Na
Cl
Ca
HCO3
Mg
SO4
2 1.6 1.2 .8 .4 .4 .8 1.2 1.6 2 (meq/l)

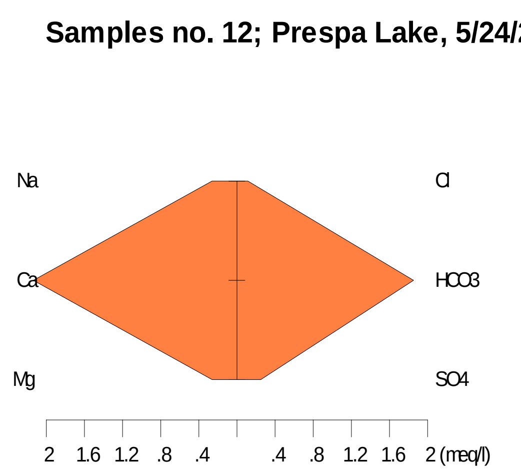

Samples no. 12; Prespa Lake, 5/24/
Na
Cl
Ca
HCO3
Mg
SO4
2 1.6 1.2 .8 .4 .4 .8 1.2 1.6 2 (meq/l)

Table 7.2. Physical-chemical data of the samples taken in Ohrid-Prespa Region, September 2016**.**

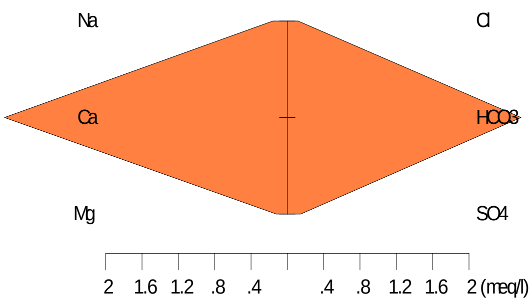
Point	X	Y	a.s.l (m)	NO_3^- (mg/l)	Cl^- (mg/l)	SO_4^- (mg/l)	HCO_3 (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)
S. Per.	465281	4546656	636	1.2	2.17	3	172	49	8	3	1.1
O. L. s.	475702	4530622	699.3	1.1	2.87	8	120	30	10	3.74	1.4
O.L. -10	"	"	-10	1.1	2.83	2	118	32	6	3.74	1.3
O.L. -20	"	"	-20	0.9	2.4	8.33	118	31	8	3.74	1.3
O.L. -30	"	"	-30	1.2	2.83	8.33	128	32	7.56	3.84	1.3
OL.-100	"	"	-100	1.2	3.37	9	120	30	9.5	3.84	1.3
O.L.-75	"	"	-75	1.1	3.47	8	117	31	8.3	3.84	1.3
OL. -50	"	"	-50	1.2	4.4	8	116	33.6	6.8	3.84	1.3
OL. -40	"	"	-40	1.1	2.67	8	118	29	9	3.74	1.2
S.Tush.	476450	4527773	703	1.6	3.6	8	168	58	5	4.43	1
S. Guras	475818	4526562	703	13.4	4.17	7	157	62.4	1.46	3.65	1.2
P. Lake	492309	4515406	853	0.9	7.63	10.67	100	32.4	5.1	6.31	2.1

Table 7.2. Continues

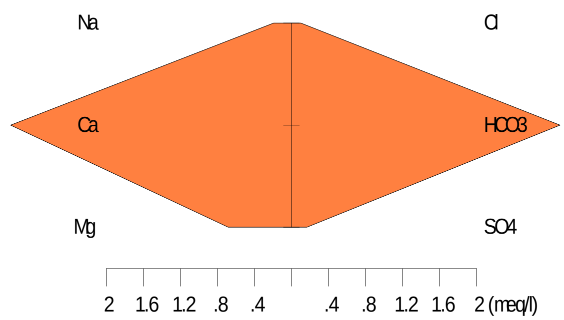
pH	Conductivity	TDS	Water type
7.9	312	199.6	Mg-Ca- HCO_3
8	239	153.3	Ca-Mg-HCO_3
8.01	236	151.7	Ca-Mg-HCO_3
8	236	150.8	Ca-Mg-HCO^3
8.07	236	151	Ca-Mg-HCO_3
8.29	233	149.2	Ca-Mg- HCO_3
8.38	227	145.2	Ca-Mg- HCO_3
8.45	226	144.4	Ca-Mg- HCO_3
8.55	225	144.2	Ca-Mg- HCO_3
7.81	364	233	Ca-Mg- HCO_3
7.84	326	208	Ca- HCO_3
8.76	206	131.9	Ca-HCO3

Stiff diagrams for September 2016

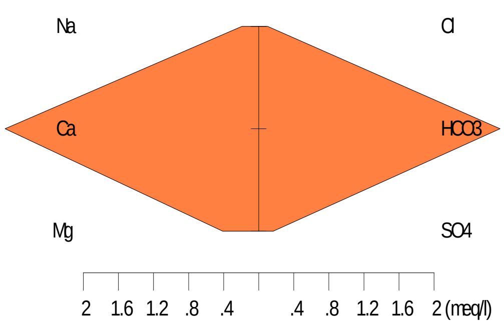
Samples no. 12; Prespa Lake



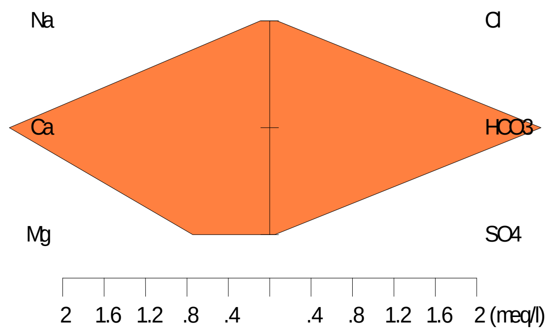
"Samples no. 11;Spring, Guras "



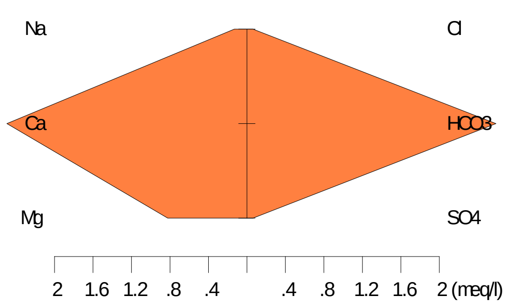
Tushemisht, 9/29/2016



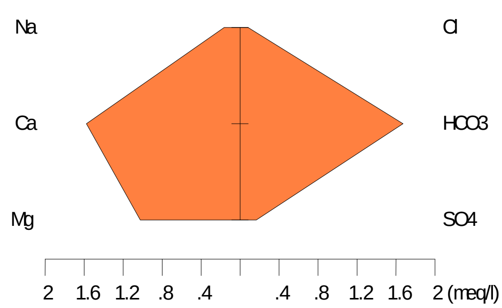
"Samples no. 1; Springs, Perrenja



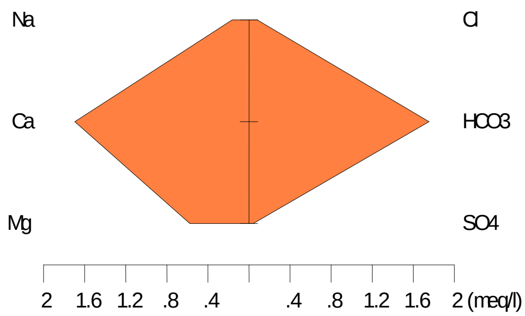
Samples no. 2; O. L. surface, 9/29/



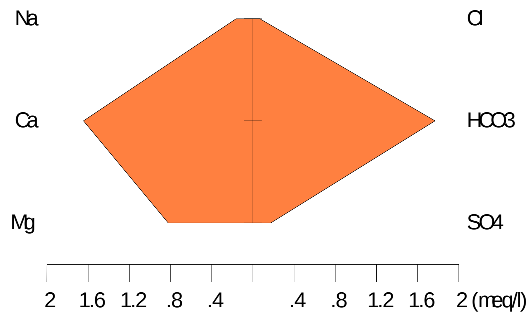
Samples no. 3; O.L. depth -10, 9/29



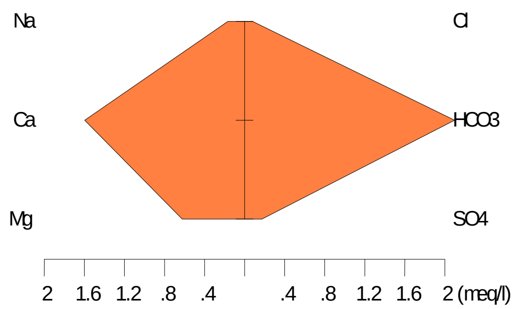
Samples no. 4; O.L. depth -20, 9/29



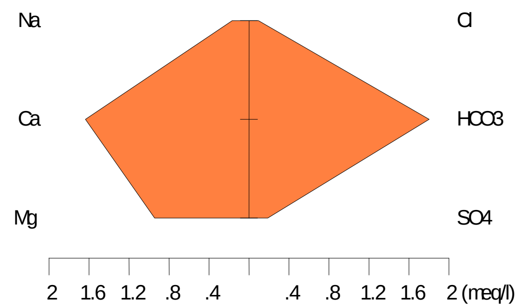
Samples no. 5; O.L. depth -30, 9/29



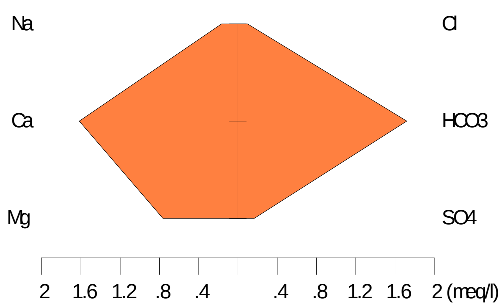
Samples no. 6; O.L. depth -100, 9/29



Samples no. 7; O.L. depth -75, 9/29



Samples no. 8; O.L. depth -50



Samples no. 9; O.L. depth -40

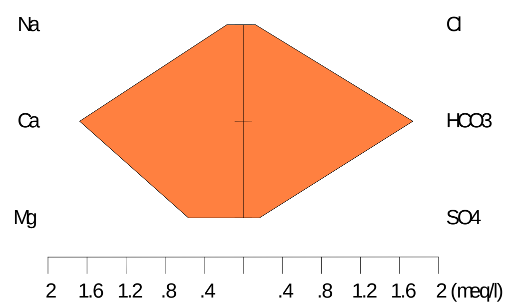


Figure 7.1. Map of the Ohrid – Prespa Region showing the water samples location (2016).

During the dry period of year, was found the maximum reduction of water resources in the karstic mountain. Dry Mountain, a karstic mountain, separates the two lakes in question. Underground water reserves are at their minimum. This is the most likely period where the most amount of water is transferred from Prespa Lake toward Ohrid Lake. During this period the most similarities in water composition are observed (Stiff diagrams).

Table 7.3. Physical-chemical data of the samples taken in Ohrid-Prespa Region, May 2017.

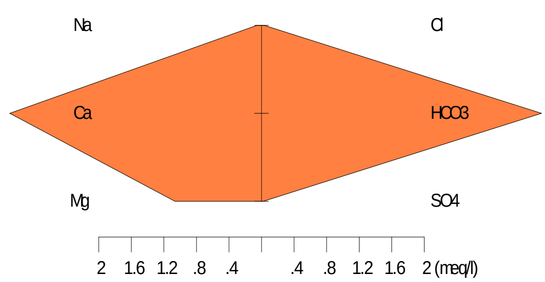
Point	X	Y	asl (m)	NO_3^- (mg/l)	Cl- (mg/l)	SO_4 (mg/l)	HCO_3 (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)
S.Per.	465261	4546645	654	8	4	2	161	50	9	2	1
S.Tush.	476450	4527773	703	23.32	3.2	7	146	60.8	1.22	3.51	1.4
S. S. N.	470311	4529310	716	21.56	2.47	1.33	140	50	5.13	2.62	1.2
S. Biljana	484462	4550135	707	23.76	1	0.33	132	52	0.98	0.9	0.4
S. A.Lub.	480900	4530216	698	21.12	1.17	1	210	62	12.94	1.31	0.4
S. border	477371	4520723	631	18.48	2.8	3	150	55.2	3.17	3.1	1.4
S. Gurras	475818	4526562	703	24.35	2.93	0	150	45	9	3.2	1.5
Lin	469718	4546239	691	18.63	4.2	8	113	30.4	9.03	3.52	1.5
P. Lake	492309	4515406	853	19.21	4.63	10	129	42.4	5.86	9.1	1.4
P. Lake			853	18.92	7.13	11	140	50	4.88	7.43	3.1

Table 7.3. Continues

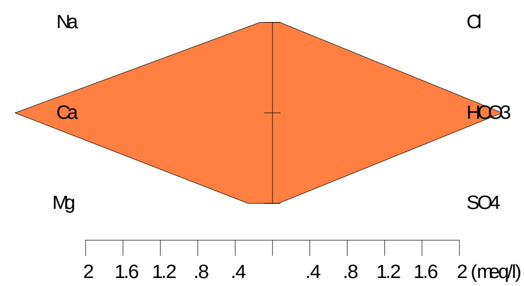
pH	Conductivity	TDS	Water type
7.72	353	226	Ca-Mg-HCO_3
7.68	329	211	Ca-HCO_3
7.69	308	197.2	Ca-HCO_3
7.58	280	178.3	Ca-Mg-HCO_3
7.34	416	260	Ca-Mg-HCO_3
7.42	319	204	Ca-HCO_3
7.47	314	201	Ca-Mg-HCO_3
7.95	219	140.6	Ca-Mg-HCO_3
6.43	274	175.3	Ca-HCO_3
6.29	290	185.6	Ca-HCO_3

Stiff diagrams; May 2017

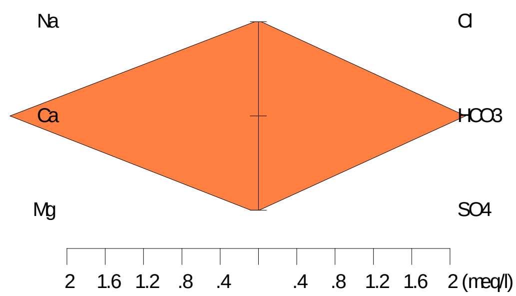
Aftokam Lubanisht S. May 2017, 5/24/2



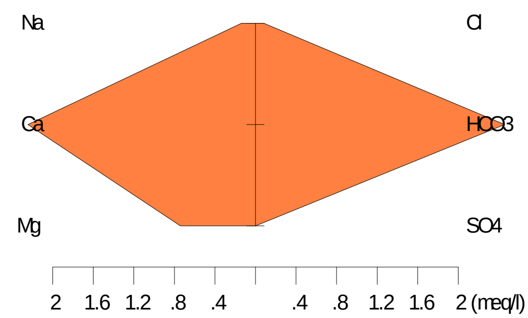
S in the border Al_FYROM, May 20



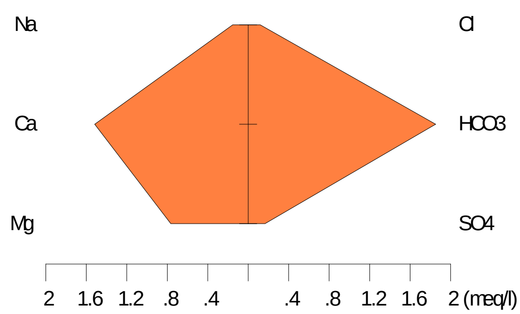
Biliana S. May 2017, 5/24/2017



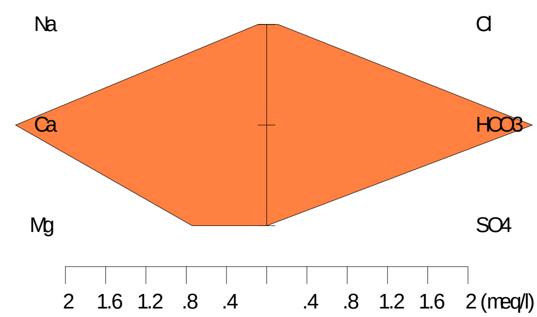
Gurras S. May 2017, 5/24/2017



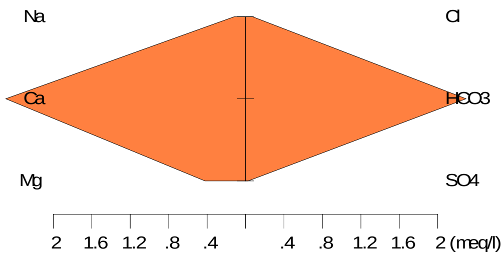
OH-L, Lin. May 2017, 5/24/2017



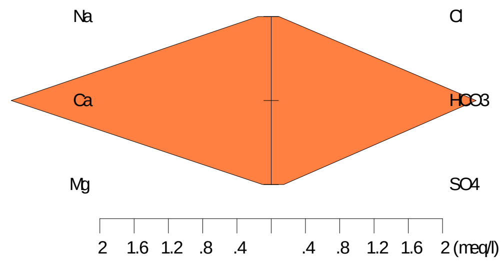
Prrenjas S. May 2017, 5/24/2017



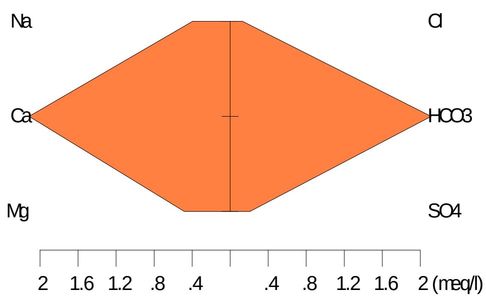
Saint Naum S. May 2017, 5/24/2017



Tushemisht Spring, May 2017, 5/2



Prespa Lake 1. May 2017, 5/24/2017



Prespa Lake 2. May 2017, 5/24/2017

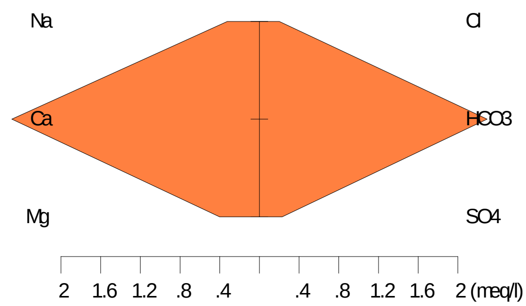


Table 7.4. Physical-chemical data of Ohrid-Prespa Region, September, 2017.

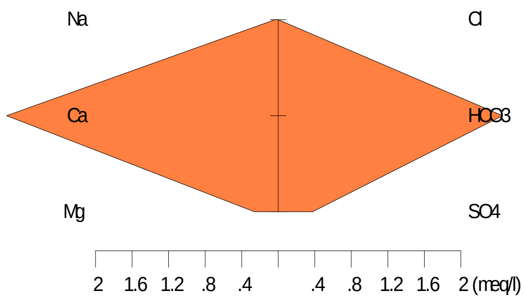
Point	X	Y	asl (m)	NO_3^- (mg/l)	Cl^- (mg/l)	SO_4^- (mg/l)	HCO_3 (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)
S.Per.	465261	4546645	654	29.77	1.37	17.67	169	50	13.18	1.98	0.4
S.Tush.	476450	4527773	703	22.73	1.27	20.67	114	31.6	11.23	3.87	1.3
S. S.N.	470311	4529310	716	26.4	1.37	19	159	56.8	11.47	3.38	1.3
S. Bilja.	484462	4550135	707	26.25	1.57	18	158	52	7.08	2.88	1
S.A.Lub.	480900	4530216	698	28.6	0.03	18	144	49.6	10.01	0.89	0.3
S. bord.	477371	4520723	631	23.32	0	18	150	59.6	3.17	0.79	0.1
S. Gur.	475818	4526562	703	25.22	1.27	18	161	55.2	6.59	3.48	1.2
Lin	469718	4546239	691	25.52	1.33	18.3	198	62.8	4.39	3.67	1.2
P. Lake	492309	4515406	853	22.44	2.37	20.67	105	34.8	3.17	6.45	2.2
P. Lake			853	23.17	3.27	22	100	27	14.16	6.55	2.4

Table 7.4. Continues

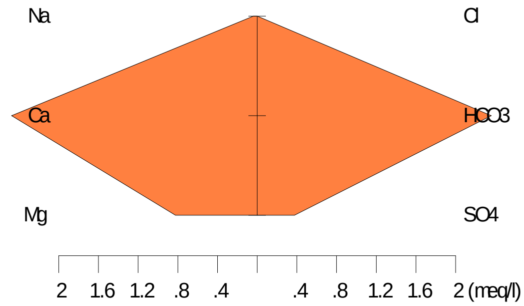
pH	Conductivity	TDS	Watertype
7.7	360	232	Ca-Mg-HCO3
7.6	332	213	Ca-HCO3
7.65	315	200	Ca-HCO3
7.5	280	178.3	Ca-Mg-HCO3
7.3	420	266	Ca-Mg-HCO3
7.38	322	208	Ca-HCO3
7.4	320	207	Ca-Mg-HCO3
7.85	224	145	Ca-Mg-HCO3
6.5	280	180	Ca-HCO3
6.3	295	190	Ca-HCO3

Stiff diagrams; September 2017

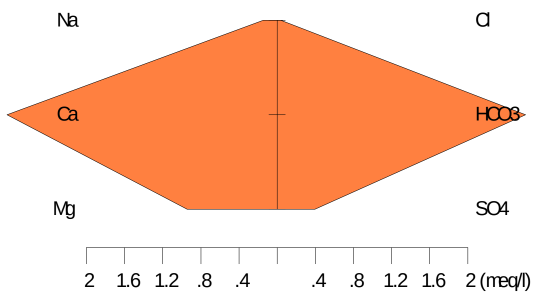
S.6.S.Korita



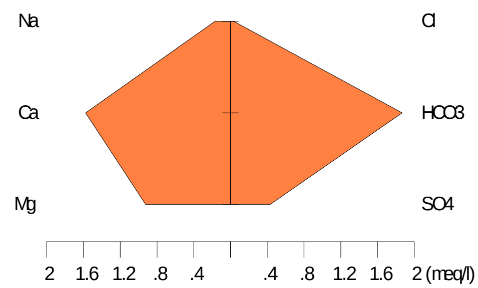
S.5.S. Biljana.Sept.2017



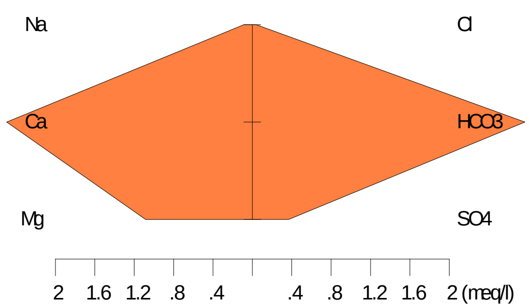
S.3. S. Gurras;Sept.2017



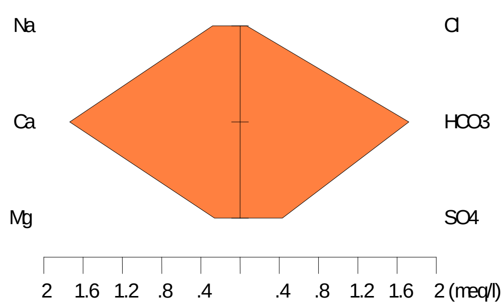
S.2 - OH.Lin; Sept.2017



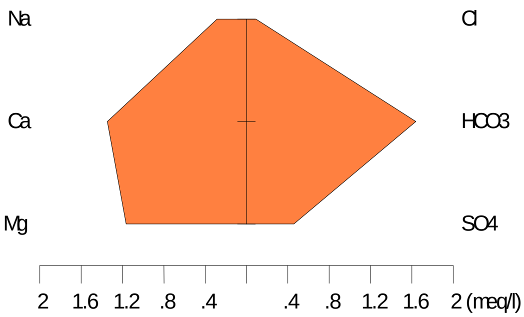
Perrenjas S. Sept. 2017, 9/28/2017



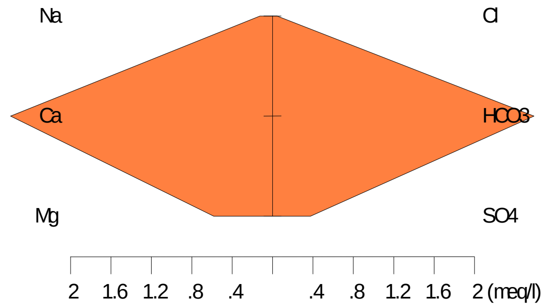
Prespa Lake 1. Sept 2017, 9/28/20



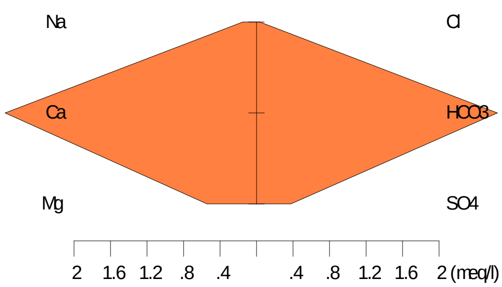
Prespa Lake 2. Sept. 2017, 9/28/20



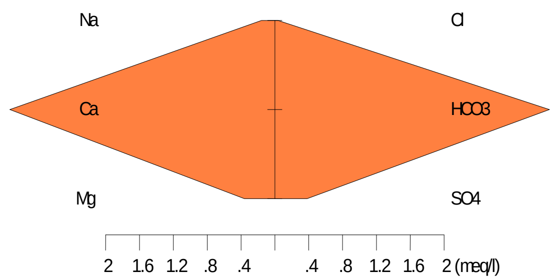
S.4. S.S.Naum.Sept.2017



S,7.S.Border.Sept.2017



S.8.S. Tushemisht. Sept.2017



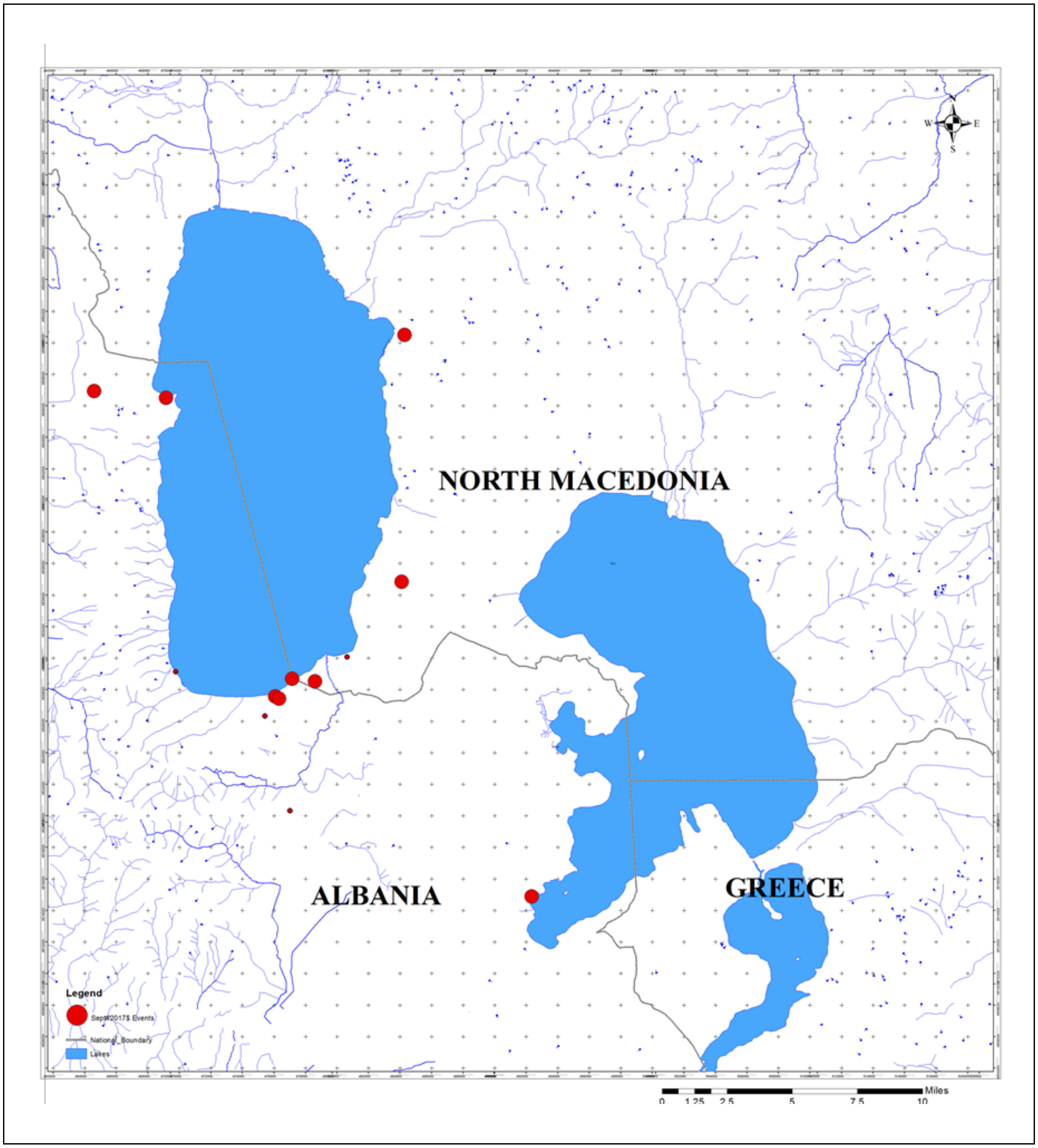


Figure 7.2. Ohrid – Prespa Region and the point where the water samples have been taken, 2017.

During the 2017 other water samples have been taken in the study area. Beside the samples taken in the Prespa Lake, in the Ohrid Lake the samples have been taken in the both states Albania and North Macedonia. The springs around the Ohrid Lake, mostly are supplied by Prespa Lake.

Photo 7.5. St. Naum Spring, May 2017**.**

Photo 7.6. Saint Naum Spring, Sept. 2017.

Photo 7.7. Bilijana Spring, May 2017.

Photo 7.8. Bilijana Spring, September 2017.

Photo 7.9. Spring in the Border, May 2017.

7.2.3. Stiff Diagrams Comparison

The differences and similarities by comparing Prespa and Ohrid lake's water samples for 2017, 2016 and 2005, 1979, one can notice changes happened during different years. Stiff diagrams constructed and analysed based on the 2016 and 2017 data, clearly show changes in the underground water movements between two lakes: Prespa and Ohrid.

The survey of the hydraulic connection between Prespa and Ohrid lakes was made to observe if there was any alteration in the underground waterways that connect these two lakes. For this purpose that chemical analyses were performed for the years mention above.

During 1979 there was no significant decrease of water level in Prespa Lake, so everything was in a natural balance. But, during 2005 was one of many years that had emerged following the water level's fall of the Prespa Lake. 2016 and 2017, years when Prespa Lake water‘s level has an increase (based on measurements of Hydrologic Department, IGJEUM, Albania) compare to the years before.

Based on these data, one can see diagrams belonging to 2016 and 2017 (See Tables 7.8, 7.9, 7.10 and 7.11). Several samples were taken for analysis at Prespa and Ohrid Lake, during spring and autumn seasons, in order to observe major changes from the hydrogeological point of view. In our case water samples were taken in March-May and August – September (Figure 7.1, 7.2). Various symbols were placed throughout the diagrams with the purpose of showing the similarities between samples.

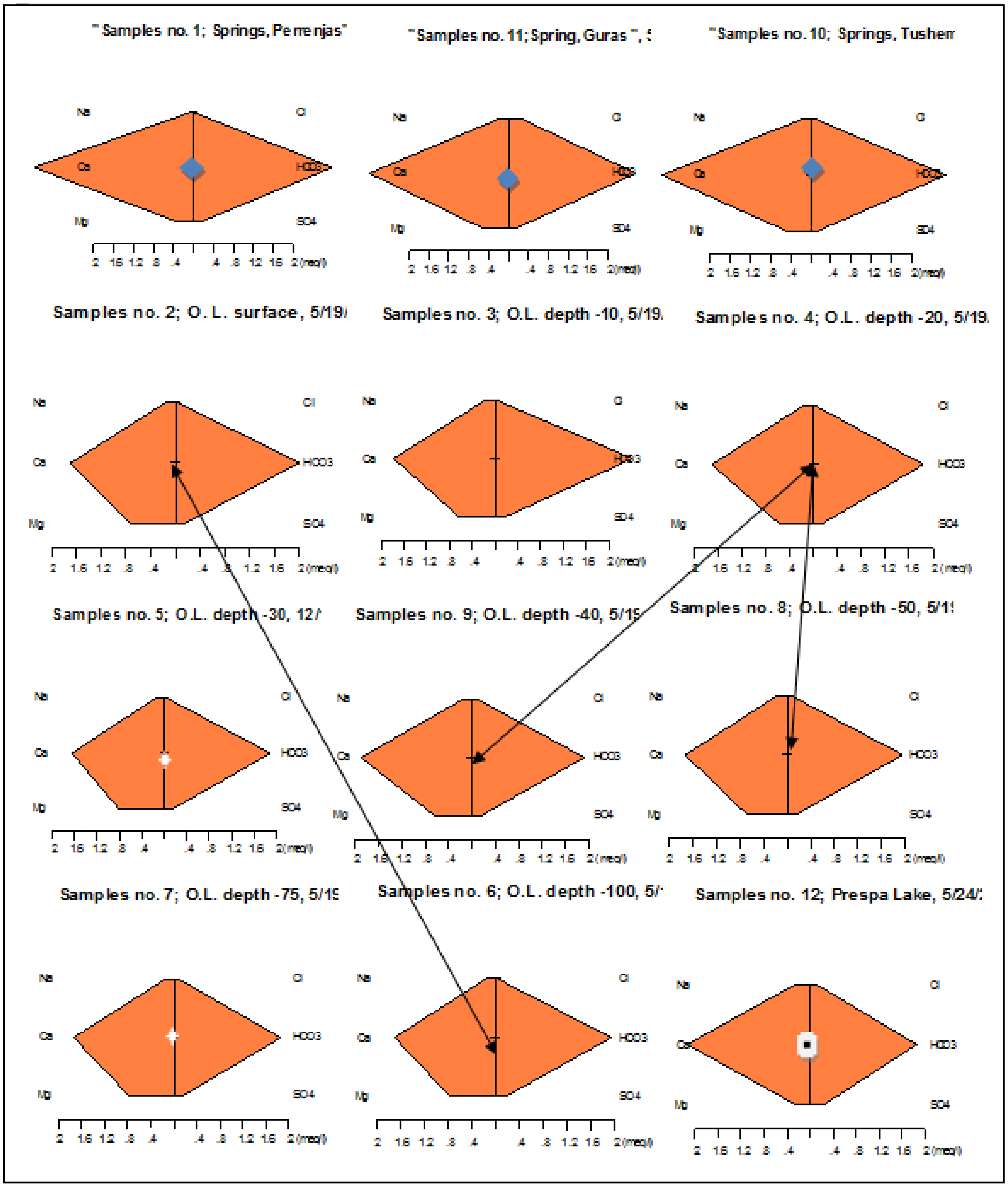


Figure 7.3. Stiff diagrams for May 2016.

Figure 7.3 shows that there are similarities between the spring's samples. During this period of time the spring's main supply of water is the rainfall. Furthermore the samples taken in different depths in the Ohrid Lake have visual similarities. For example, the diagram that represents the samples taken on the surface of the Ohrid

Lake is similar to those taken in the 100 m depth of this lake. On the other hand, the water sample taken in the lakes 10 m depth is not similar to any of the other diagrams. The diagram of the sample taken in the lake's 20 m depth is similar to the other two diagrams which represented 40 and 50 meters deep. The diagram that represents the sample taken in the lake's 30 m depth is also similar to the lake's 75 m depth. What's noticeable for this period of year is that diagram that represents the Prespa Lake samples are not similar to any of the other diagrams. This result was not unpredictable. Prespa Lake is not feeding zone for the springs during the wet period of the year.

A diagram that represent the average data of all the samples taken in different depths of Ohrid Lake was constructed with the purpose of being compared to the previous year's diagrams (Figure 7.11 and 7.12). The same goes for the spring samples, which were placed on the diagram from the average data of the springs (Figure 7.4).

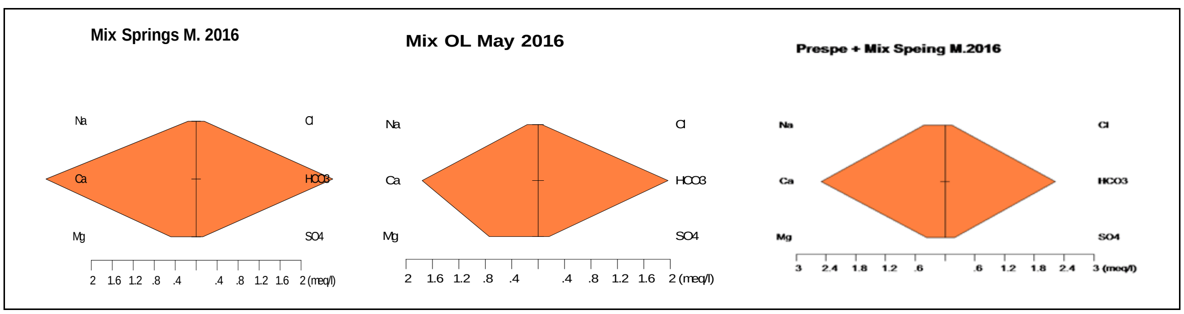


Figure 7.4. Stiff diagrams for May 2016 (avarage data of springs + Ohrid and Prespa Lake's chemical data).

In this case there are not changes or differences between the diagrams built based on the average of the springs Tushemisht and Gurras and other diagrams that represent springs in the Figure 7.3. The same goes for the diagram result of the average samples of Ohrid Lake (Figure 7.4). The reason may have been, as mentioned above in this period of year, the main spring's water supply comes from the rainfall.

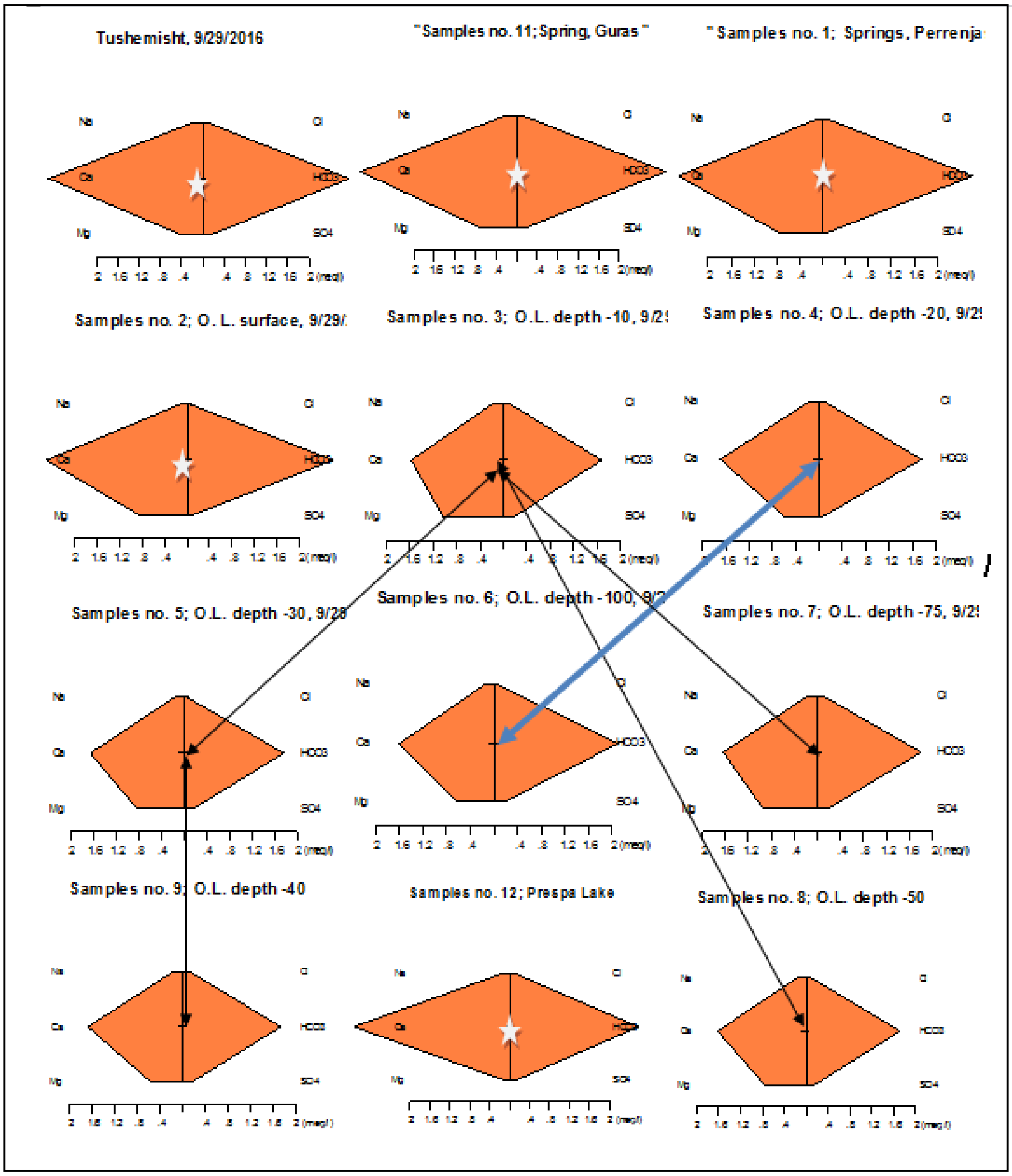


Figure 7.5. Stiff diagrams for September 2016.

To explain the similarities of diagrams build for the dry period of the year (September 2016), let's focus on the interpretation of Figure 7.5. This figure represents all the samples diagrams taken in the study area for the period mentioned above. Observing those diagrams one can see the similarities between diagrams of Prespa Lake with Tushemisht and Gurras springs as well as Ohrid Lake surface sample. On the other hand, similarities exist even between Perrenjas Spring and Ohrid Lake surface water's sample.

The diagram that represents the sample taken in 10 m depth from the surface of Ohrid Lake has visual similarities with diagrams of 30 m, 40 m, 50 m and 75 m depth from the surface of the same lake. From the hydrogeology point of view, the comparison of the diagrams can give a clear concept of the water movement in the study area, for this period of the year.

Beside the comparison done for September 2016, other diagrams were built. In this case have been taken into account the average of the springs (Tushemisht and Gurras), and the average of the Ohrid Lake diagrams (Figure 7.6). Still, even in this period of time, one can’t see similarities between springs diagrams and Ohrid Lake. The results are the same as it appears in the Figure 7.5. As mentioned several times in this material, not all the water quantity of the springs comes from Prespa Lake. Prespa Lake’s water joins the karstic water passing through the underground ways. Even in this time karstic water are in their minimum.

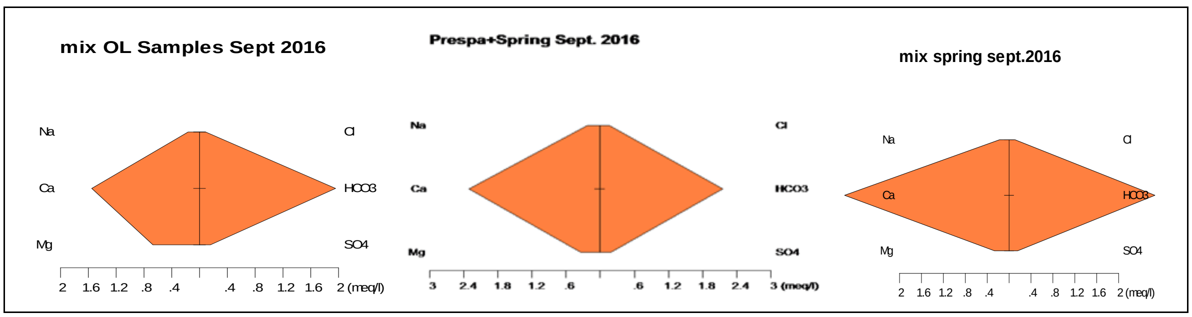


Figure 7.6. Stiff diagrams for September 2016 (avarage chemical data of springs + Ohrid and Prespa lakes).

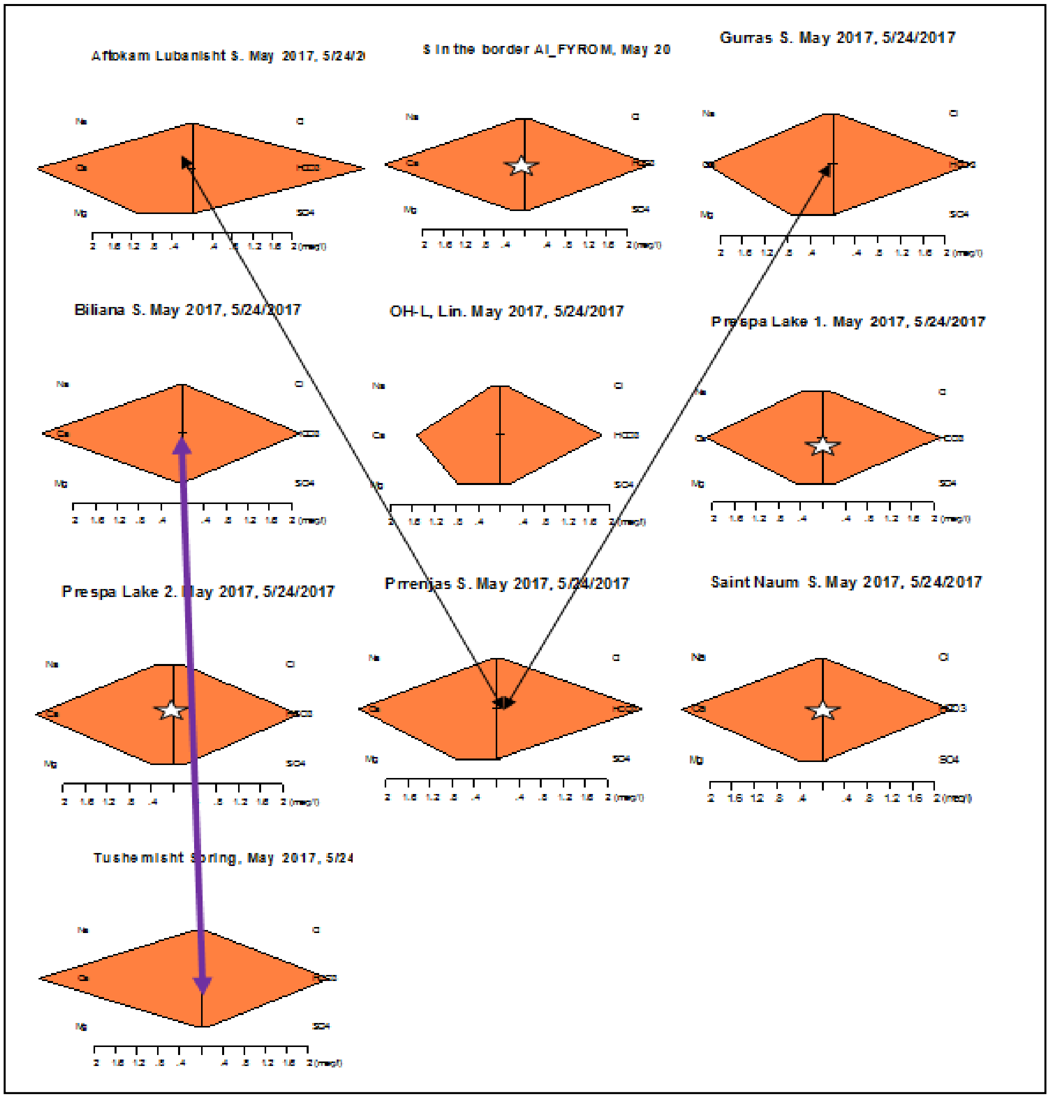


Figure 7.7. Stiff diagrams for May 2017.

In this period of time (May 2017), water sampling has been carried out only in the sources that are supposed to have the Prespa Lake as a supply source. Observing the visual similarity (Figure 7.7) between the diagrams, it is clear that Gurras spring resembles Aftokam Lubanisht and Perrenjas springs. Both diagrams of the samples taken in Prespa Lake have similarities with the spring of Saint Naum.

The diagram that represents the Tushemisht Spring is similar to that of Biliana Spring. The diagram that represents the sample taken in the surface of Ohrid Lake has no similarities with none of others diagrams mentioned above. As in the previous year (2016), a comparison between the averages of the Lubanisht Spring diagram with that of Prespa Lake, was constructed.

The results of this diagram were compared with the spring's diagrams. Meanwhile, Lubanisht diagrams and that of Lin diagrams were also constructed within this material, in order to be compared with the diagram of the Perrenjas Spring (Figure 7.8).

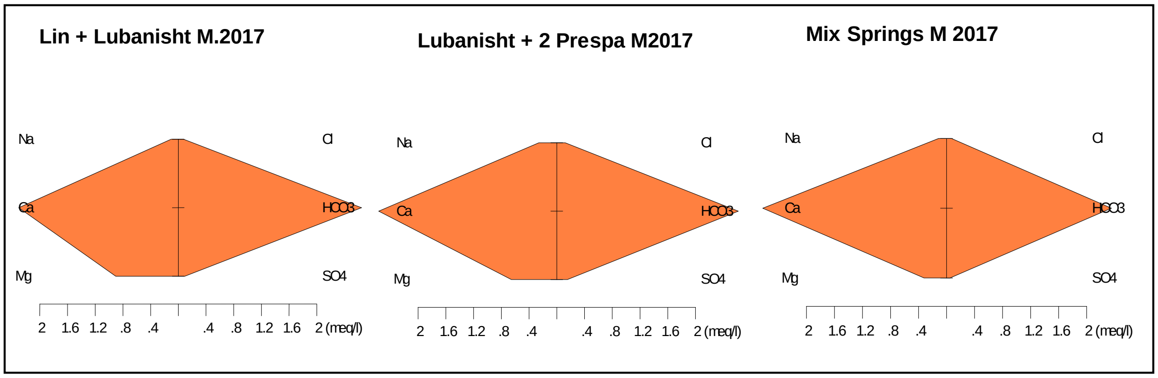


Figure 7.8. Stiff diagrams for May 2017 (avarage data of springs and Prespa Lake's chemical data).

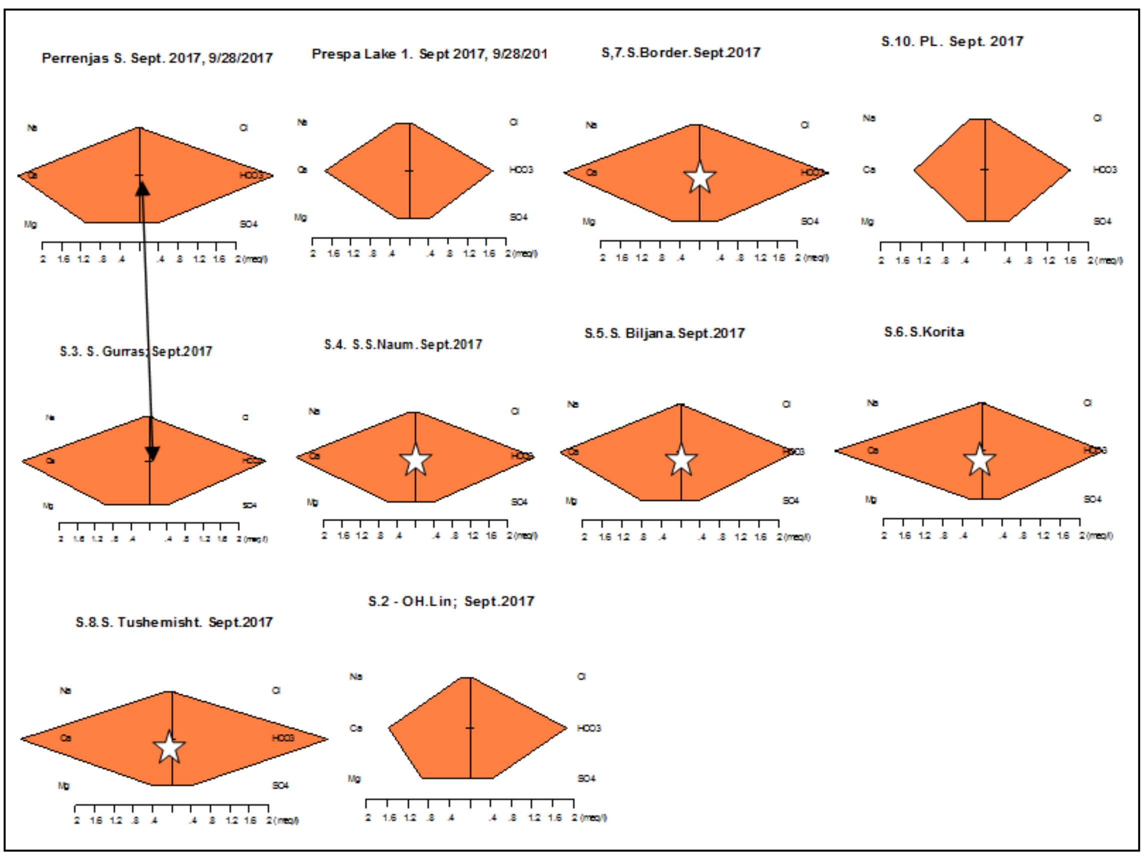


Figure 7.9. Stiff diagrams for September 2017.

Based on the diagrams (Figures 7.9), built for the dry period, September 2017, the following interpretations were made. In this period of time, from the hydrogeologic point of view, it is very important the comparison between diagrams. From the visual similarities of the Stiff diagrams the results are not as they're expected to be. As a result it is hard to find the similarities between spring's diagrams and Prespa Lake diagrams. On the other hand the diagrams representing springs are similar to each other. As an example can be mentioned; the spring in the Albania-North Macedonia border, Saint Naum Spring, Tushemisht Spring and Korita Spring. Gurras Spring and the Perrenjas Spring have similar diagrams. In this figure it is obvious that surface Ohrid Lake diagram is not similar to none of them (Figure 7.9).

It is important to mention that, Korita Spring's feeding area is only the rainfall and their deposits in the karstic mountain, named Galicica. This spring is situated over 1421 m ASL (Photo 7.3), so it has no hydraulic connection with Prespa Lake's water. This sample was taken to compare the karstic water with the spring's water. The feeding area of the springs in the study area is the karstic water as well as the water of Prespa Lake. In this period of time the maximum water amount comes from Prespa Lake toward Ohrid Lake. Ongoing the Korita's diagram was combined with the diagram of Prespa Lake, in order to be compared with the spring's diagrams and with the Ohrid Lake's diagram. Korita's diagram is still combined with the diagram of the Lin (surface of the Ohrid Lake) to compare with Perrenjas Spring (Figure 7.10).

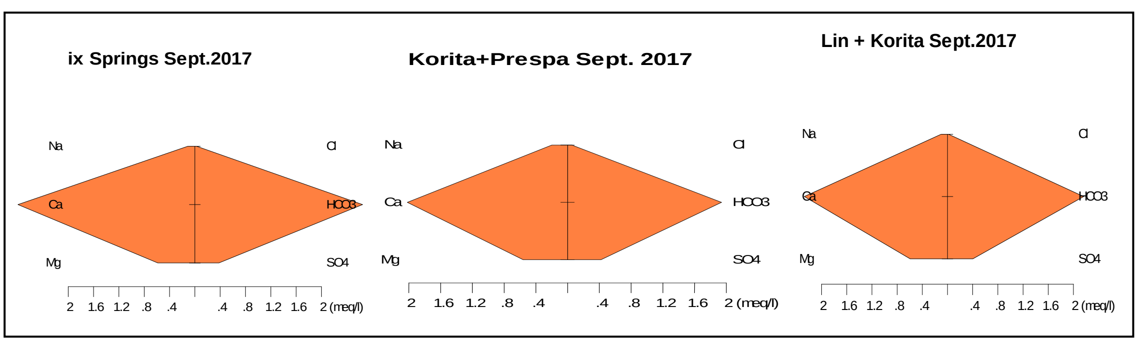


Figure 7.10. Stiff diagrams for September 2017 (avarage chemical data of springs and Prespa Lake).

The interpretation of the diagrams shown in Figure 7.9, Prespa Lake's diagrams has no similarities with none of the spring's diagrams. Meanwhile, in the diagrams build based in average of the data mentioned above (like those of Korita Spring with Prespa Lake, and Lin with Korita Spring), appeared different. One can see similarities between averages of Korita and Prespa Lake with the diagram of spring's average. The diagram; Lin – Korita Spring have much more similarities with the Perrenjas Spring's diagrams than that of Lin diagrams (Figure 7.9).

Photo 7.10. Korita Spring in Galicica Mountain, North Macedonia (September 2017).

The right question, in our case, is: what is happening in this watershed and why? The data interpretation for 2016 (dry period), diagrams that represent the Prespa Lake were similar with those that represent springs in the study area. But, for 2017 is not the same. A logical explanation is the rainfall during the dry season of the year. This hypothesis is supported even by similarities between springs diagrams and the diagram of Korita Spring.

Following, continues with the drawing of diagrams using the available data about the Big Prespa Lake, where the chemical data are taken throughout different years. In the end there is a possibility of making a comparison about the water chemistry and the possible changes that this chemistry may have suffered over time. Later on, a common diagram was drawn, or in other words, the average of the data over the years. This diagram was drawn by using the average of the data throughout the years and the diagrams drawn for every year were compared with the diagrams drawn using the chemical data of samples taken in the aforementioned points.

The chemical data of the Ohrid an Prespa Lakes for year 2005 and 1979 can be found in Table 7.5 and 7.6 (data collected from Albanian Hydrometeorology Station). The samples were taken during two important periods of the year in terms of hydrogeology: dry (August). Prespa Lake is relatively shallow so it was not found necessary to analyse more than one or two water samples**.**

Table 7.5. Water quality data of Prespa and Ohrid Lakes, 1979.

Station ID	Station Name	Location	Eleva m(asl)	Samp ID	Anal. Date	Water Type	Samp. Point
1P	Prespa	PL	849	3WQP	30.08.1979	HCO_3-Ca-SO_4	surface
1O	Ohrid	OL	692	3WQO	23.08.1979	HCO_3-Ca- SO_4	surface

Table 7.5. Continues

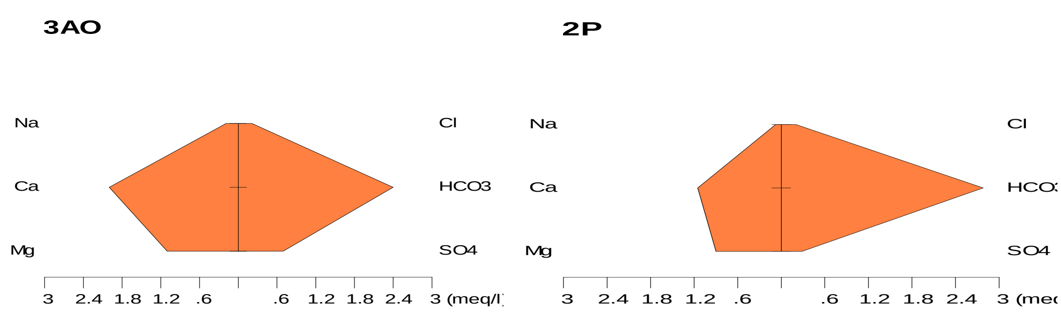
Sample ID	pH	K	Na	Ca	Mg	Cl	SO_4	HCO_3
		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
3WQP	7.9	0.9	3	39.07	7.29	10.63	13.18	167.79
3WQO	7.9	0.6	1.8	23.06	10.94	7.09	13.59	169.69

Table 7.6. Water quality data of Prespa and Ohrid Lakes, 2005.

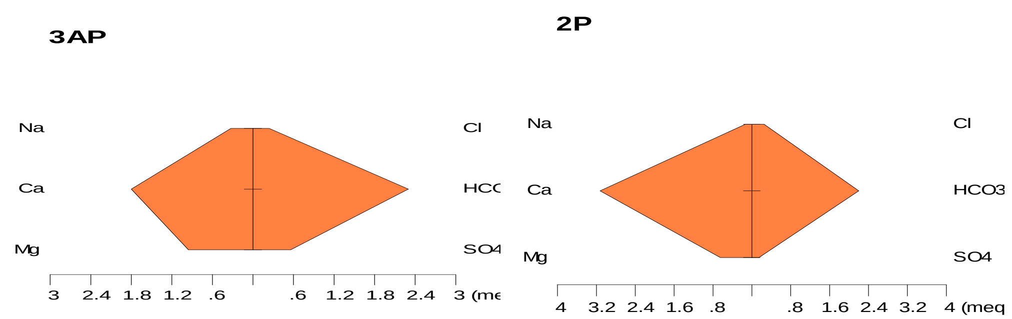
Stat. ID	Stat.Name	Location	Elev m.asl	Sam. ID	Anal. Date	Water Type	Samp. Point(m)
3AP	Prespa	PL	849	3AP	15.10.2005	HCO_3-Ca-SO_4	surface
3AO	Ohrid	OL	692	11AO	13.10.2005	HCO_3-Ca-SO_4	surface

Table 7.6. Continues

Sample ID	pH	K	Na	Ca	Mg	Cl	SO_4	HCO_3
		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
3AP	7.9	2.92	7.50	36.07	11.6	8.51	26.736	140.3
11AO	7.9	1.8	4.24	32.06	10.30	7.09	10.03	134.20



Ohrid Lake for years 2005, 1979 respectively, for the dry period of year



Prespa Lake for years 2005, 1979 respectively, for the dry period of year

Figure 7.11. Stiff diagrams comparison over the years (1978 – 2005) of Ohrid and Prespa Lake (Kiri et al. 2011)

The diagram's comparison for 2016 and 2017 are based on the summery of the chemical data samples. As a conclusion, only two diagrams are presented, one diagram of Ohrid Lake and other one of Prespa Lake, 2016 (dry period). Even for 2017 Stiff diagrams are reduced in 2 samples, in total. These samples are the average of those showed above.

Table 7.7. Summarised water quality data of Prespa and Ohrid Lakes, 2016

Statin ID	Station Name	Loc	Elev. m(asl)	Samp ID	Anal. Date	Water Type	Samp. Point
PLS	Prespa	Al	849	PL	Sept. 2016	Ca-HCO_3-SO_4	surface
OLS	Ohrid	Al	692	OL	Sept. 2016	Ca-HCO_3-Mg	Average of 8 Sem.

Table 7.7. Continues

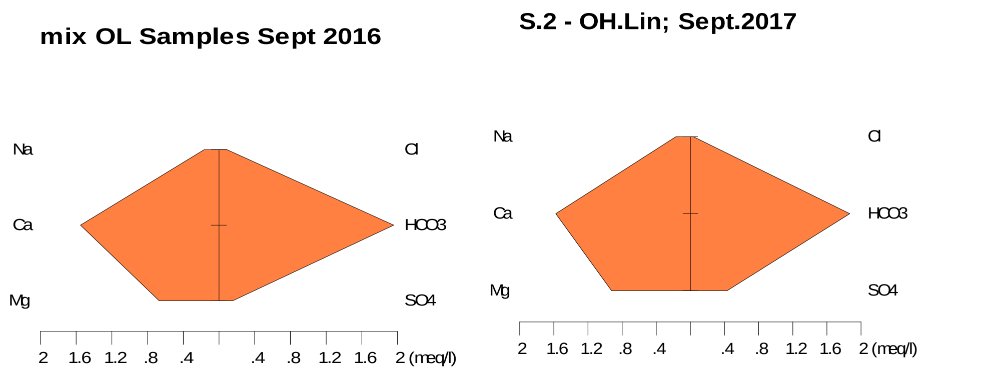
Sample ID	pH	K	Na	Ca	Mg	Cl	SO_4	HCO_3
		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
PL	7.9	2.1	6.3	32.4	5.1	7.63	10.67	100
OL	8.2	1.3	3.79	31.1	8.15	3.1	7.45	119.37

Table 7.8. Summarised water quality data of Prespa and Ohrid Lakes - 2017

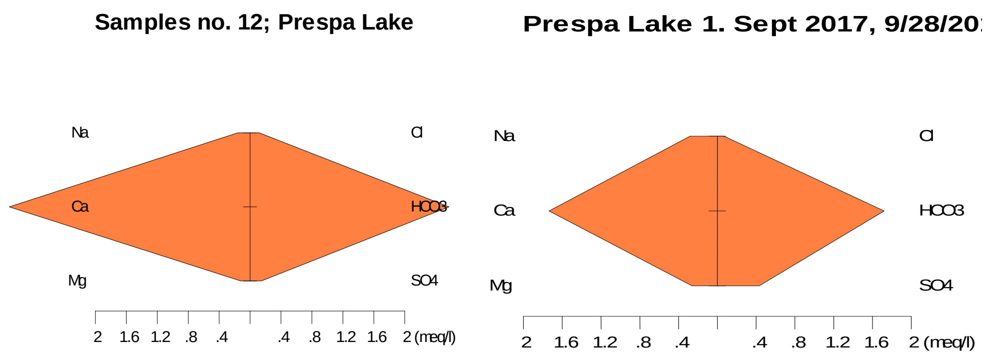
Statin ID	Station Name	Loc	Elev asl	Samp ID	Anal. Date	Water Type	Samp. Point
PLS	Prespa	Al	849	PL	Sept.2017	Ca-HCO_3-SO_4	surface
OLS	Ohrid	Al	692	OL	Sept.2017	Ca-HCO_3-SO_4	surface

Table 7.8. Continues

Sample ID	pH	K	Na	Ca	Mg	Cl	SO_4	HCO_3
		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
PL	7.9	2.2	6.4	34.8	3.2	2.4	20.67	105
OL	8	1.3	3.8	31.6	11.2	1.3	20.67	114



Ohrid Lake for years 2016, 2017 respectively, for the dry period of year



Prespa Lake for years 2016, 2017 respectively, for the dry period of year

Figure 7.12. Stiff diagrams 2016 – 2017 (Ohrid and Prespa Lake)

During the two years (2016 – 2017) that the research was conducted, it can be notice that there are no significant visual similarities between diagrams of Prespa Lake and those of Ohrid Lake. Diagram that represents the water sample chemical data average of Ohrid Lake Region for 2017 is more similar with those of 2005 than it is 2016. The same goes for the Prespa Lake diagrams.

As mentioned above during the 2005 the decreases of Prespa Lake level was notice about, meanwhile in 1979 was not. Temporal changes in the origin and constitution of the recharged water, hydrologic and human factors, may cause periodic changes in groundwater quality (Taheri and Voudouris 2007).

As a result, the study area Prespa - Ohrid Watershed, have a very dynamic aquifer system. Because of the complexities of the region hydrogeological conditions, hydrochemical processes that take place in aquifers are difficult to explain and document, so the application of advance procedures was demanded (Voudouris 1997), as follow.

7.2.4. Ions Ratio

The chemical composition of surface water is controlled manly by the composition of the precipitation. In this study area are analyzed the water that discharge from the springs and the water of the lakes. Meanwhile, the groundwater quality is determined by the interaction of water with soil and rock, as well as the input from the human activities (Voudouris 2006).

To assess water chemistry values under natural conditions 22 water samples in the study area were collected during May and September 2016, and 21 during May and September 2017.

Each sample was collected in 1500 ml plastic bottle, in order to do the physical – chemical analyses. Altogether, for tow study years mention above, were analyzed 43 water samples. Samples were analyzed at the Laboratory of Engineering Geology & Hydrogeology, Department of Geology; Aristotle University of Thessaloniki, Greece.

For the 2019 were collected 17 water samples, unfiltered in 50 ml bottles, in order to evaluate the isotopic ratio, Oxygen isotopes ($\delta^{18}O$) and Deuterium (δD). Samples were analyzed in the Laboratory of Ghent University; Faculty of Bioscience Engineering, Isotope Bioscience Laboratory (ISOFYS); UGENT Stable Isotope Facility (UGENT-SIF).

Major Ion Chemical Analysis: The major ions dissolved in water are Ca, Mg, Na, K, Cl, HCO_3, and SO_4; the major ion ratios are Cl/Br, Ca/Mg, Ca/ (HCO_3 and SO4), and Na/Cl (Sudaryanto and Naily 2017).

If the result of Na/Cl ratio is >1, it means the water is contaminated by anthropogenic source.

The ratio of Ca/Mg and Ca/(HCO_3 and SO_4) can also be used as an indicator, for example if it is >1, it means that sea water intrusion is taking place (El Moujabber et al. 2006, Carole and Crouse 2012, Sudaryanto and Naily 2017).

Sodium in water samples for May - September 2016 varies respectively from 1.8 to 6.03 mg/l, with an average of 3.9 mg/l; and from 3 to 6.3 mg/l, with an average of 4.65 mg/l. Calcium varies in concentration ranging from 33 to 64 mg/l, with average of 48.5 mg/l, and from 29 to 62.4 mg/l with average of 45.7 mg/l. Magnesium concentration ranges from 3.17 to 10 mg/l with an average of 6.58 mg/l and from 1.46 to 10 mg/l with an average 5.7 mg/l. The chloride in water samples ranges from 0.9 to 8.2 mg/l, with average value of 4.5 mg/l, and from 2.1 to 7.6 mg/l with an average of 4.85 mg/l. The bi-carbonate ion ranges from 112 to 170 mg/l with an average value of 141 mg/l and from 100 to 172 mg/l with an average of 136 mg/l. Sulphate ion ranges from 5.6 to 12 mg/l with an average of 8.8 mg/l and from 2 to 10.67 mg/l with an average of 6.33 mg/l. Nitrate ion in the study area ranges from 1.3 to 10.27 mg/l with an average of 5.75 mg/l and from 0.9 to 13.4 mg/l with an average of 6.9 mg/l. The highest NO_3 concentration levels were found in Perrenjas Spring (May) and Gurras Spring (September) (Tables 7.1 and 7.2).

Table 7.9. Na/Cl ratio, May – September 2016

Samples	Na/Cl-May	Na/Cl Sep.
S. no. 1; S.Perrenjas	2:1	1.4:1
S. no. 2; O. L. surface	2.4:1	1.3:1
S. no. 3; O.L. depth -10	3.5:1	1.3:1
S. no. 4; O.L. depth -20	4.6:1	1.5:1
S. no. 5; O.L. depth -30	4.7:1	1.4:1
S. no. 6; O.L. depth -100	3.4:1	1.1:1
S. no. 7; O.L. depth -75	1:1	1.08:1
S. no. 8; O.L. depth -50	1.5:1	0.9:1
S. no. 9; O.L. depth -40	1:1	1.4:1
S. no. 10; S.Tushemisht	1.2:1	1.2:1
S. no. 11;S.Guras	0.04:1	0.9:1
S. no. 12; P. Lake	1.5:1	0.8:1

The Na/Cl molar ratio is approximately one, whereas a ratio greater than one is typically interpreted as Na released from a silicate weathering reaction (El Moujabber et al. 2006). In the study area Na/Cl ratio ranges from 0.04 mg/l to 4.7 (May) and from 0.8 to 1.5 (September).

Majority of the samples have molar ratio greater or equal to 1, except Gurras Spring that has a ratio ranges from 0.04 to 0.9 (respectively May – September). When sodium is plotted against chloride (Figure 7.13), all but one of the water samples lie above the 1:1 trendline. The excess of Na (Table 7.9) can be attributed to anthropogenic activities like waste water. Usually wastewater is enriched in Na relative to Cl. In principle the diversion of waters from one basin to another or the use of river inflows are the basic processes that lead to lake salinization (Shervood et al. 2005). This ratio should also decrease due to the cation exchange of Na as water moves through the aquifer (karstic limestone), which would explain Cl enrichment in most water samples, Gurras Spring in our case.

An appropriate Ca/Mg ratio of the ambient water is essential for the successful culture of fish. Numerous studies have demonstrated that the total hardness (TH) has significant influences on fertilization, hatching, and larval culture (Si Luo et al. 2016). The $Ca^{2+/}Mg^{2+}$ ratio (concentrations in meq/L) in seawater is about 0.20, in brackish water 1.5-3.7, in rainwater 2.26, while in limestone water 1.5-2.0 and in dolomite waters 1.0-1.4. So, the majority of Ca^{2+}/Mg^{2+} ratio (concentrations in meq/L) is greater than 1.0 indicating limestone water (1.5-2.0) or dolomite waters (1.0-1.4).

When calcium is plotted against magnesium (Figure 7.13), all the water samples lay above the 1:1 trendline. The higher Ca:Mg ratio in the study area (May), is 16.4:1 for the Spring Perrenjas and the lower one is 3:1 for the Ohrid Lake (depth 30 m). In September the higher Ca: Mg ratio is 41.6:1 in Spring Gurras and the lower one is 3:1 in surface of the Ohrid Lake (Table 7.10).

Table 7.10. Ca/Mg ratio, May – September 2016

Samples	Ca/Mg-May	Ca/Mg-Sept.
S. no. 1; S.Perrenjas	16.4:1	6.1:1
S. no. 2; O. L. surface	3.8:1	3:1

S. no. 3; O.L. depth -10	4.6:1	5.3:1
S. no. 4; O.L. depth -20	4.1:1	3.9:1
S. no. 5; O.L. depth -30	3:1	4.2:1
S. no. 6; O.L. depth -100	3.6:1	3.2:1
S. no. 7; O.L. depth -75	3.7:1	3.7:1
S. no. 8; O.L. depth -50	4.3:1	4.9:1
S. no. 9; O.L. depth -40	4.9:1	3.2:1
S. no. 10; S. Tushemisht	10.5:1	11.6:1
S. no. 11;S.Guras	9.3:1	41.6:1
S. no. 12; P. Lake	13.4:1	6.3:1

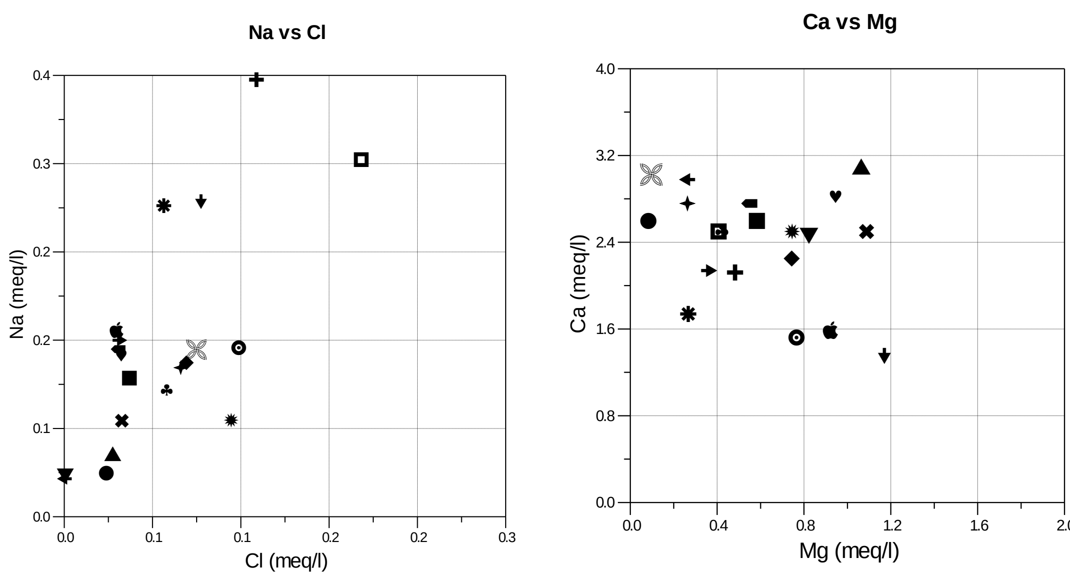


Figure 7.13. Plots that show Na/Cl and Ca/Mg ratio for May – September 2016.

Ca/ HCO_3 ratio for May – September 2016 ranges from r = 0.24 for Ohrid Lake (depth 10 m) to r = 0.38 for Prespa Lake and Spring Perrenjas, and from r = 0.25 for Ohrid Lake (surface, depth 30, 40 and 100 m) to r = 0.4 for Spring Gurras, respectively (Table 7.11). When calcium is plotted against bicarbonate (Figure 7.14), all the water samples lie under the 1:1 trendline.

Ca/SO_4 ratio for May – September ranges from r = 3.6 for Prespa Lake to r = 10.5 for Spring Tushemisht, and from r = 3.03 for Prespa Lake to r = 16.3 for Spring Perrenjas respectively (Table 7.11). When calcium is plotted against sulphate (Figure 7.14), all the water samples lay upper the 1:1 trendline.

The ions ratios that are mention above can be used as an indicator for the anthropogenic pollution and lake salinity (Carole and Kruse 2012, Sudaryanto and Naily 2017).

The abundance of the major cations and anions in the surface water are of the following order: Ca>Mg>Na>K and HCO_3>NO_3>SO_4>Cl respectively for May; Ca>Mg>Na>K and HCO_3>NO_3>SO_4>Cl for September. The hydrochemical water type of the water samples 2016, of the study area is represented in Piper and Schoeller diagrams (Figure 7.13).

Table 7.11. Ca/ HCO_3 and Ca/SO_4 ratio, May – September 2016

Samples	Ca/HCO_3 May	Ca/SO_4 May	Ca/HCO_3 Sept.	Ca/SO_4 Sept.
S. no. 1; S., Perrenjas	0.38:1	9.1:1	0.3:1	16.3:1
S. no. 2; O. L. surface	0.28:1	4.3:1	0.25:1	3.75:1
S. no. 3; O.L. depth -10	0.24:1	4.1:1	0.3:1	16:1
S. no. 4; O.L. depth -20	0.32:1	5:1	0.26:1	3.7:1
S. no. 5; O.L. depth -30	0.32:1	4.5:1	0.25:1	3.8:1
S. no. 6; O.L. depth -100	0.29:1	4.3:1	0.25:1	3.3:1
S. no. 7; O.L. depth -75	0.31:1	4.4:1	0.26:1	3.9:1
S. no. 8; O.L. depth -50	0.29:1	4.3:1	0.29:1	4.2:1
S. no. 9; O.L. depth -40	0.32:1	4.8:1	0.25:1	3.6:1
S. no. 10; S.Tushemisht	0.36:1	10.5:1	0.35:1	7.25:1
S. no. 11;S.Guras	0.36:1	8.5:1	0.4:1	8.9:1
S. no. 12; P. Lake	0.38:1	3.6:1	0.3:1	3.03:1

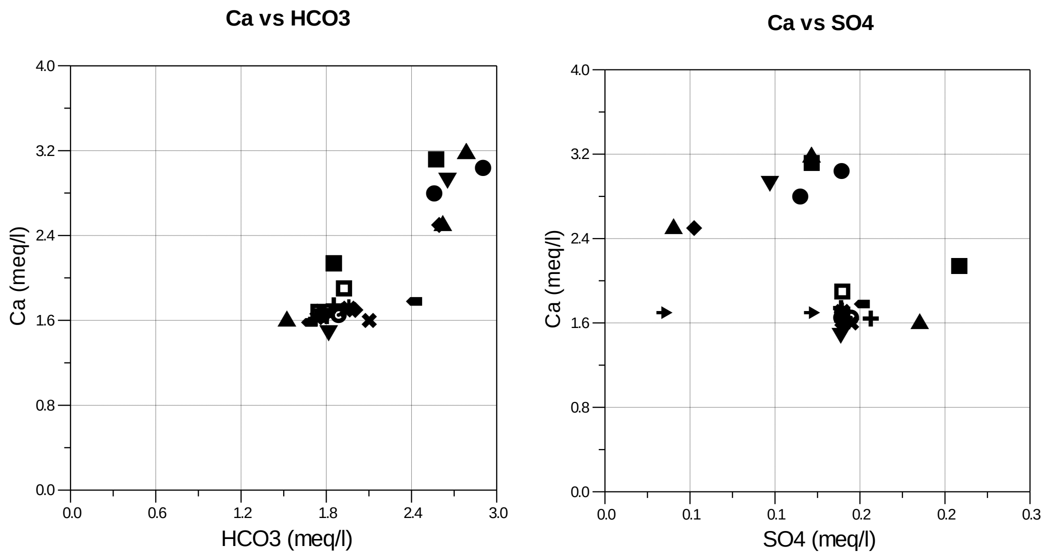


Figure 7.14. Plots that show Ca/HCO_3 and Ca/SO_4 ratio, May – September 2016.

Major Ion Chemical Analysis for May – September 2017.

Sodium in water samples, for May - September 2017 respectively, varies from 0.9 to 9.1 mg/l, with an average of 5 mg/l; and from 0.8 to 6.5 mg/l, with an average of 3.65 mg/l. Calcium varies in concentration ranging from 30.4 to 60.8 mg/l, with average of 44.6 mg/l, and from 27 to 62.8 mg/l with average of 44.9 mg/l. Magnesium concentration ranges from 0.98 to 12.9 mg/l with an average of 6.94 mg/l and from 3.17 to 14.16 mg/l with an average 8.7 mg/l. The chloride in water samples ranges from 1 to 7.1 mg/l, with average value of 4 mg/l, and from 0 to 3.27 mg/l with an average of 1.6 mg/l. The bi-carbonate ion ranges from 113 to 210 mg/l with an average value of 161 mg/l and from 100 to 198 mg/l with an average of 149 mg/l. Sulphate ion ranges from 0 to 11 mg/l with an average of 5.5 mg/l and from 17.67 to 22 mg/l with an average of 19.8 mg/l. Nitrate ion in the study area ranges from 8 to 24.35 mg/l with an average of 16.2 mg/l and from 22.4 to 29.77 mg/l with an average of 26.1 mg/l. The highest NO_3 concentration levels were found in Gurras Spring, 24.35 mg/l (May) and Perrenjas Spring 29.77 mg/l (September) (Tables 7.3 and 7.4). In the study area Na/Cl ratio for May – September 2017 ranges from 0.04 mg/l to 1.97 mg/l and from 1.4 mg/l to 3 mg/l respectively. The Spring Korita has a ratio 30:1 for September (Table 7.12)

The majority of the samples has molar ratio greater or equal to 1; except of Spring Perrenjas, Lin, Spring Biliana and Spring Saint Naum that has a ratio ranges from 0.04 to

2.4 (respectively May – September). For September 2017 the Na/Cl ratio for spring in Border is empty because the chloral values ranges to 0. The excess of Na (Table 7.12) can be attributed to anthropogenic activities like waste water.

When sodium is plotted against chloride (Figure 7.15), all but one of the water samples lie above the 1:1 trendline.

When calcium is plotted against magnesium (Figure 7.15), all the water samples lay above the 1:1 trendline. The higher Ca/Mg ratio in the study is 53:1mg/l for the Spring Biljana and the lower one is 4.3:1 mg/l for the Lin (Ohrid Lake surface in the Lin village) (Table 7.13). In September the higher Ca:Mg ratio is 18.6:1 mg/l for spring in the border and the lower one is 2.8:1 mg/l for the Gurras Spring (Table 7.14).

Table 7.12. Na/ Cl ratio, May – September 2017

Samples	Na/Cl May	Point	Na/Cl Sep.
S. no. 1; S.Perrenjas	0.5:1	S. no. 2;Lin	1.4:1
S. no. 2;S.Tushemisht	1.1:1	S. no. 3; S. Gurras	3:1
S. no. 3; S. Sant Naum	0.04:1	S. no. 4; S. S.Naum	2.4:1
S. no. 4; S. Biljana	0.9:1	S. no. 5; S. Biliana	1.8:1
S. no. 5; S. Aftokam Lub.	1.1:1	S. no. 6; S.Korita	30:1
S. no. 6; S. border	1.1:1	S. no. 7; S. in border	-
S. no. 7; S. Gurras	1.1:1	S. no. 8; S. Tushemisht	2.7:1
S. no. 8; Lin	0.8:1	S. no. 9; lilo	2.8:1
S. no. 9; P. Lake	1.97:1	S. no. 10; P. Lake	2.7:1
S. no. 10; P. Lake	1.02:1	S. no. 11;P. Lake	2:1

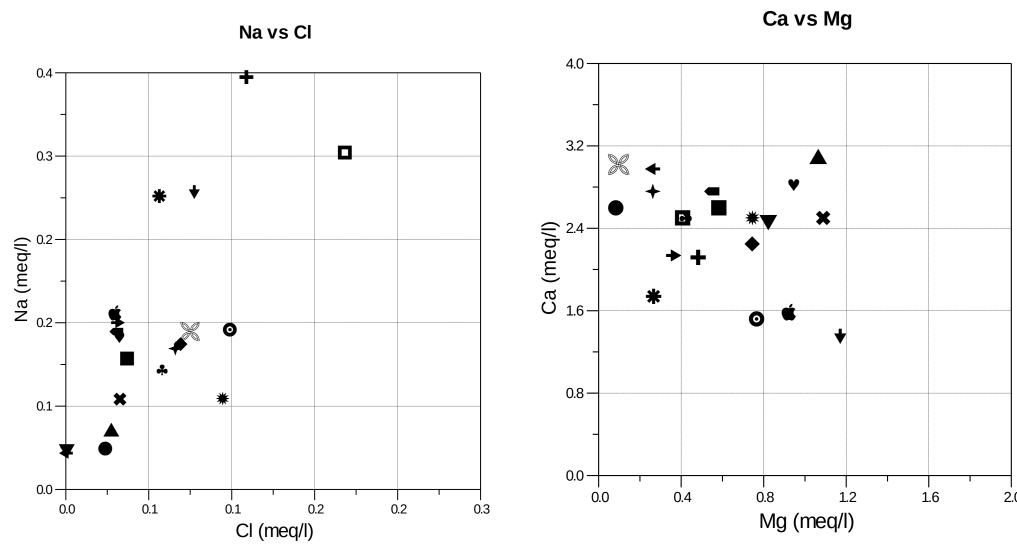


Figure 7.15. Plots that show Na/Cl and Ca/Mg ratio, May – September 2017.

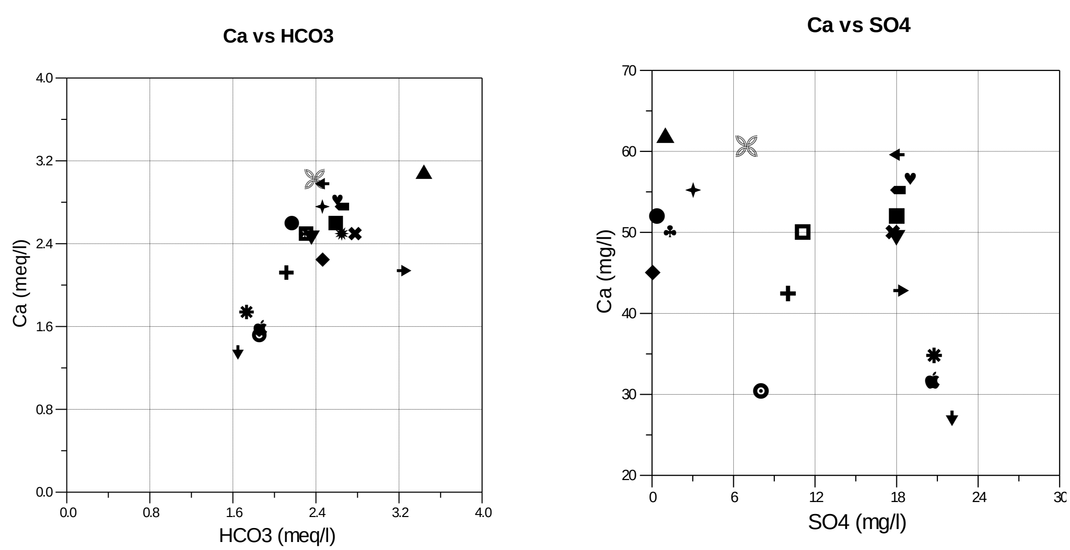


Figure 7.16. Ca versus HCO3 and Ca versus SO4 plotted for May – September 2017.

Ca/ HCO_3 ratio for May – September 2017 ranges from r = 0.27:1 for Lin (Ohrid Lake surface in Lin village) to r = 0.42:1 for Spring Tushemisht, and from r = 0.3:1 for all the points when water samples were taken except Spring in the border and Saint Naum Spring which have a ratio of 0.4:1 respectively (Tables 7.13 and 7.14). When calcium is plotted against bicarbonate (Figure 7.14), all the water samples lie under the 1:1 trendline (Figure 7.16).

Ca/SO_4 ratio for May – September 2017 ranges from r = 3.8:1 for Lin (Ohrid Lake surface in Lin village) to r = 173:1 for Spring Biljana, and from and from r = 1.2:1 for Prespa Lake to r = 3.3:1 for spring in border, respectively (Tables 7.13 and 7.14). When calcium is plotted against sulphate (Figure 7.14), all the water samples lay upper the 1:1 trendline (Figure 7.16).

Table 7.13. Ca/ HCO_3 and Ca/SO_4 ratio, May 2017

Samples	Ca/Mg	Ca/SO_4	Ca/HCO_3
S. no. 1; S.Perrenjas	5.6:1	25:1	0.3:1
S. no. 2;S.Tushemisht	50.7:1	8.6:1	0.42:1
S. no. 3; S. Sant Naum	10:1	38.5:1	0.35:1
S. no. 4; S. Biljana	53:1	173:1	0.39:1
S.s no. 5; S. Aftokam Lub.	4.8:1	62:1	0.3:1
S. no. 6; S. in the border	17.3:1	18.4:1	0.37:1
S. no. 7; S. Gurras	5:1	45:1	0.3:1
S. no. 8; Lin	3.4:1	3.8:1	0.27:1
S. no. 9; P. Lake	7.2:1	4.2:1	0.3:1
S. no. 10; P. Lake	10.2:1	4.5:1	0.36:1

Table 7.14. Ca/ HCO_3 and Ca/SO_4 ratio, September 2017

Point	Ca/Mg	Ca/SO_4	Ca/HCO_3
S. no. 2;Lin	3.8:1	2.8:1	0.3:1
S. no. 3; S. Gurras	2.8:1	1.5:1	0.3:1
S. no. 4; S. S.Naum	4.9:1	3:1	0.4:1
S. no. 5; S. Biliana	7.3:1	2.9:1	0.3:1
S. no. 6; S.Korita	4.9:1	2.8:1	0.3:1
S. no. 7; S. in border	18.6:1	3.3:1	0.4:1
S. no. 8; S. Tushemisht	8.4:1	3.1:1	0.3:1
S. no. 9;Lilo	14.3:1	3.4:1	0.3:1
S. no. 10; Prespa Lake	10.9:1	1.7:1	0.3:1
S. no. 11;Prespa Lake	13.5:1	1.2:1	0.3:1

Calcium is naturally present in water. It may dissolve from rocks such as limestone, marble, calcite, dolomite, gypsum, fluorite and apatite. Calcium is present in various construction materials, such as cement, brick lime and concrete. It is present in batteries, and is applied in plaster as calcium sulphate (https://www.lenntech.com/periodic/water/calcium/calcium-and-water.htm). In Spring Biljana during the May was notice a high value of Ca (Table 7.13).

The abundance of the major cations and anions in the surface water are of the following order: Ca>Mg>Na>K and HCO_3>NO_3>SO_4>Cl respectively for May; Ca>Mg>Na>K and HCO_3>NO_3>SO_4>Cl for September. The hydrochemical water type of the water samples 2017, of the study area is represented in Piper and Schoeller diagrams (Figure 7.14).

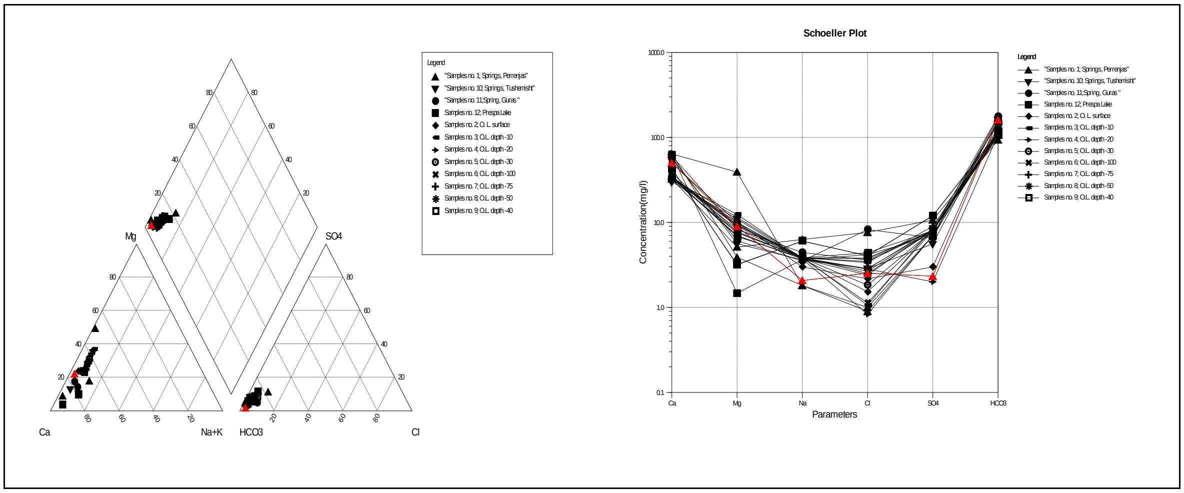


Figure 7.17. Showing the concentration of the major ions in the water samples, 2016 (Piper and Schoeller diagrams).

Majority of water samples represents Ca-HCO_3 and Ca-Mg-HCO_3 types. The Ca-HCO_3 type occurred in Prespa Lake and springs Gurras and Tushemisht and CA-Mg-HCO_3 type occurred for the water samples of the Ohrid Lake taken in deferent depth, for 2016.

For 2017 the water samples of the springs; Tushemisht, Saint Naum, in the border and Prespa Lake have the Ca-HCO_3 water type. Others have the Ca-Mg-HCO_3 water type. Spring Guuras change from Ca-HCO_3 2016 in to Ca-Mg-HCO_3 during 2017.

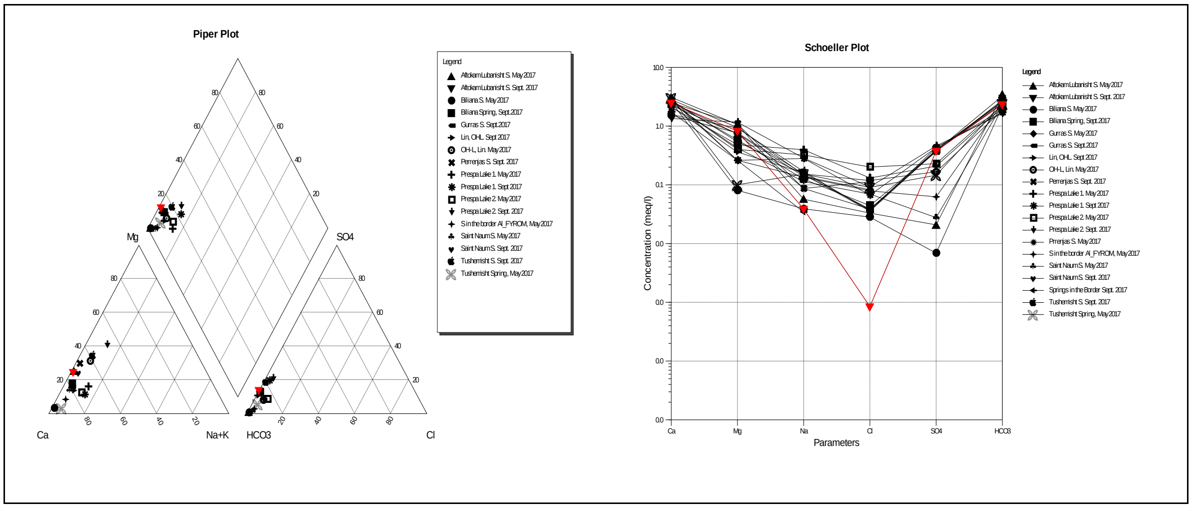


Figure 7.18. Showing the concentration of the major ions in the water samples, 2017 (Piper and Schoeller diagrams).

Concentration of TDS, a measure of quality ranged from 131.9 mg/l (located in Prespa Lake) to 233 mg/l (located in Tushemisht Spring) with an average of 122.45 mg/l, for 2016. Concentration of TDS for 2017, ranged from 145 mg/l (Lin village, Ohrid Lake) to 266 mg/l (Aftokam Lubanisht Spring). According to TDS the classification of the samples, 100 % ranges TDS < 1000 mg/l. The concentration of TDS in the water is mostly less than 1,000 mg/l, belonging to fresh water.

In the water samples pH value ranges from 7.4 to 8.7 with an average of 8, for 2016. The water samples have been taken in different depths in Ohrid Lake (value here ranges 8 to 8.5) the lowest value, 7.4 is the pH of the karstic springs around the study area. The pH value of the water samples for 2017 ranges from 6.2 to 7.9 with an average of 7. The water samples this year have been taken in different points (mostly springs) in the Ohrid – Prespa Region.

Higher pH was noted in depth of the Ohrid Lake (- 40 m) 8.5. The increase in pH is explained by the consumption of dissolved CO_2 gas by organisms and aquatic plants whereas the decrease of this parameter is primarily due to oxidation of organic matter and also due to human induced pollution (Krishnaraj et al. 2011). The electrical conductivity values ranges from 206 µS/cm to 364 µS/cm with an average of 285 µS/cm.

7.2.6. Statistical analysis

- *Factor analysis*

In order to interpret the hydrochemical data, the factor analysis is applied. The aim of factor analysis is to reduce the complexity of the relationships between many hydrochemical parameters to simpler factors. For this reason, the initial data are transformed into factors and each factor contains one or more parameters. In addition, each factor represents a specific hydrogeological process, depending on the participating parameters. Factor method is analytically described by Lawley and Maxwell (1962) and Voudouris et al. (1997).

The significance of each factor is represented by the eigenvalues. Factors with eigenvalue higher than one (>1) are assumed to be significant. The KMO (Kaiser-Meyer-Olkin) criterion should be greater than 0.5 in order the method to be reliable (Davis 2002). Finally, the rotation of the factor axis using the Kaiser's varimax rotation scheme was applied. The contribution of each factor at every sampling point was computed. Positive or near zero values represent areas that are affected by the factor. Negative values represent areas that are not affected by the process that the factor describes (Voudouris et al. 2000).

In this study, the factor analysis is carried out on all the water samples taken from lakes and springs. The following parameters after standardization (mean value equal to zero and standard deviation equal to one) were used: Ca, Mg, Na, K, HCO_3, NO_3, SO_4, Cl, pH, TDS, Electrical Conductivity (EC). According to the following Table 7.15, the KMO criterion is 0.594>0.5 such as the Bartlett's test of sphericity and consequently the method of factor analysis is acceptable and valid.

Table 7.15. Results of KMO criterion and Bartlett's test.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,594
Bartlett's Test of Sphericity	Approx. Chi-Square	545,559
	df	55
	Sig.	,000

Based on results of factor analysis (Table 7.16 and Figure 7.19), three factors showed eigenvalues (>1) higher than one, explaining more than 75% of the total variance of the database. The parameters that participate in each factor are presented in Table 7.17.

Table 7.16 Loading for the varimax roteted 3-facors model.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,310	39,186	39,186	4,310	39,186	39,186	3,912	35,563	35,563
2	2,207	20,062	59,248	2,207	20,062	59,248	2,317	21,060	56,623
3	1,753	15,940	75,189	1,753	15,940	75,189	2,042	18,566	75,189
4	,993	9,023	84,212						
5	,585	5,322	89,533						
6	,402	3,658	93,191						
7	,365	3,320	96,511						
8	,242	2,201	98,713						
9	,093	,842	99,554						
10	,049	,441	99,996						
11	,000	,004	100,000						

Extraction Method: Principal Component Analysis.

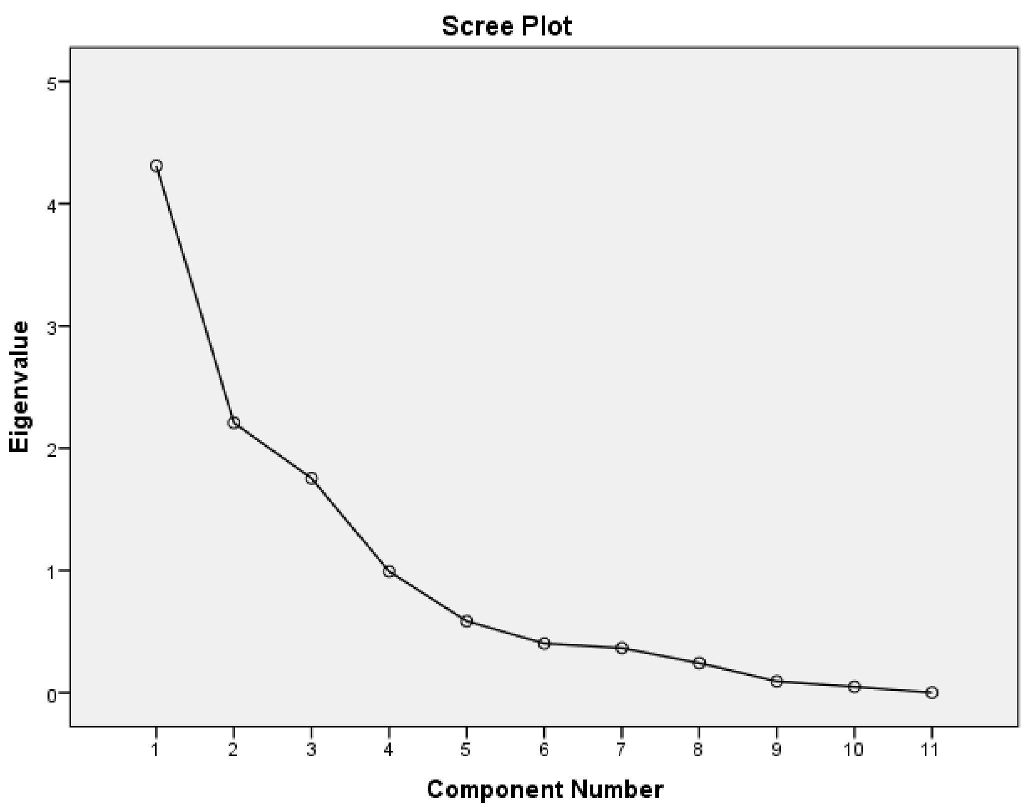


Figure 7.19. Scree plot.

Table 7.17. Loading for the varimax rotated 3-facors model.

Rotated Component Matrix[a]

	Component		
	1	2	3
NO3	,518	-,139	,683
Cl	-,140	,885	-,150
SO4	-,119	-,087	,811
HCO3	,851	-,164	-,093
Ca	,937	,033	-,072
Mg	-,324	-,419	,337
Na	-,452	,681	,327
K	-,087	,820	,023
pH	-,437	-,351	-,716
EC	,866	-,149	,268
TDS	,866	-,146	,277

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 7 iterations.

Factor I, accounting for 35.6% of the total variance, has high loading (>0.70) in the parameters Ca, TDS, EC and HCO_3. The presence of ions Ca and HCO_3 can be associated with the lithology and the karstic dissolution that takes place in the wider area.

Factor II, contributes 21% of the total variance and shows high loading in the elements Cl, K and Na. This factor indicates the strong correlation of ions with the opposite charge and equal valence number (Voudouris et al. 2000). The second factor is attributed by natural processes (dissolution of clay minerals) or impact from agricultural activities.

Finally, factor III accounts for 18.5% of the total variance of the data set with a high positive loading in SO_4 and NO_3 and high negative loading in pH. The factor represents the pollution from fertilizers used in agricultural activities in the wider area. The pH and nitrates negative correlation indicates oxidation or aerobic decomposition of organic matter.

Cluster analysis

A cluster analysis has been employed as a simple approach of classifying samples into smaller coherent groups that can be correlated by location. The aim is that the water samples within a group be similar to one another and different from (or unrelated to) the samples in other groups. Table 7.18 shows the final cluster centers for each variable/property in each water group. As can be observed, the data are classified into two dominant groups.

Table 7.18. Loading for the varimax rotated 3-facors model.

Final Cluster Centers

	Cluster	
	1	2
NO3	16,39	7,65
Cl	2,43	3,02
SO4	9,05	9,78
HCO3	157,72	123,19
Ca	54,11	36,80
Mg	7,01	7,50
Na	2,79	4,38
K	1,31	1,47
pH	7,62	7,91
EC	338,28	244,46
TDS	216,21	156,65

By observing Cluster analysis in the study area, a clear vision of similarities between samples was detected. In cluster 1 are included the samples taken from the springs. The clusters 2 represent the data of the samples taken from different depths of the Ohrid Lake as well as the data of the samples taken from the Prespa Lake. This statistical analysis simplifies and clarify the similarities between two the mentioned lakes (Ohrid and Prespa). Stiff diagrams used in different depths of the Ohrid Lake shows visual similarities with those of Prespa Lake (Cluster analysis support this conclusion).

This method clusters the samples that are similar, giving in this way an important general conclusion for all the samples taken in the study area during two hydrologic years. The water chemical similarities between Ohrid Lake and Prespa Lake are incontestable. The same goes for the springs in the area; they have water chemical similarities between each-other.

The clustering procedure generated two groups of sites. The sites in these groups have similar characteristic features. Cluster 1 includes; Spring in the border, Saint Naum Spring, Tushemisht Spring, Gurras Spring, Perrenjas Spring, Koritas Spring. Cluster 2 includes samples taken in different depths of the Ohrid Lake mention above and samples taken in Prepsa Lake.

7.2.5. Isotope Analysis

Isotopic δD and δ^{18}*O:*

The simplest natural chemical tracing of ground water movement tends to rely on measuring the chloride concentration. Cl^- is a conservative tracer, which is subject, neither to adsorption or desorption during transport. Hence, the relation between chloride concentration and $\delta^{18}O$ or $\delta^{2}H$ values illustrates the effect of various processes such as groundwater mixing (Mebus et al. 2000). During hydrochemical evolution the concentration of individual ionic species either increases, remains constant or decreases.

One of the main application fields of stable isotope abundance is concerned with the origin and mixing of groundwater and of its dissolved natural and anthropogenic constituents. Groundwater is usually a mixture of two or more genetically and chemically distinct groundwater components, often of different age. Isotopic combined with hydrochemical analyses allow to distinguish between different kinds of groundwater and often to set up a mixing balance (Mebus et al. 2000).

For isotopic analysis 17 water samples, with a quantity of 50 ml for each bottle, where taken in the study area (the samples were taken in the point where the springs emerg, in deferent depths of the Ohrid Lake and in Prespa Lake as well). For these analyses these two Lakes (Ohrid and Prespa) and the main springs was the target. In the Ohrid Lake the samples have been taken in the surface and in the different depth and in the Prespa Lake in the surface. The isotopic analysis of the $\delta^{18}O$ and δD, as mentioned above, have been analyze in Ghent University; Stable Isotope Facility (UGENT-SIF) (Table 7.19).

Oxygen isotopes of both rainwater and groundwater samples in different studies were used to obtain information on recharge areas, flow paths, and the origin of wet air masses (Liotta et al. 2013). The Global Meteoric Water Line is an equation defined by the geochemist Harmon Craig (Craig et al. 1961) that states the average relationship between hydrogen and oxygen isotope ratios in natural terrestrial waters, expressed as a worldwide average.

GMWL: $\delta D = 8.0 \cdot \delta^{18}O + 10‰$ (Harmon Craig)

This equation, known as the "Global Meteoric Water Line" (GMWL), is based on precipitation data from locations around the globe. The slope and intercept of any "Local Meteoric Water Line" (LMWL), which is the line derived from precipitation collected from a single site or set of "local" sites, can be significantly different from the GMWL. In general, most of these local lines have slopes of 8 +/- 0.5, but slopes in the range of 5 and 9 are not uncommon; https://wwwrcamnl.wr.usgs.gov/isoig/period/o_iig.html

$$\text{LMWL: } \delta^{2}H = 8 \cdot \delta^{18}O + 14‰ \qquad (1)$$

Eftimi & Zoto 1997[(1)] estimated the following equation $\delta^{2}H = 8 \cdot \delta^{18}O + 14$ ‰, which despite having similar slope the d-excess is distinctively different (14‰), reflecting the image of Eastern Mediterranean Countries.

On a regional scale, the distribution of isotopic compositions is controlled by several factors:

Altitude effect: On the windward side of a mountain, the $\delta^{18}O$ and δD values of precipitation decrease with increasing altitude. Typical gradients are -0.15 to -0.5 ‰ per 100 m for ^{18}O, and -1.5 to -4 ‰ per 100 m for D.

Latitude effect: The $\delta^{18}O$ and δD values decrease with increasing latitude because of the increasing degree of "rain-out".

Continental effect: The ratios decrease inland from the coast.

Amount effect: The greater the amount of rainfall, the lower the $\delta^{18}O$ and δD values of the rainfall; this effect is not seen in snow, https://wwwrcamnl.wr.usgs.gov/isoig/period/o_iig.html.

The $\delta\,^{2}H$ value of the water samples ranges from – 69.67 ‰ to – 19.4 ‰ and $\delta^{18}O$ values range from - 10.53 ‰ to - 1.31 ‰, with an average of - 44.53 ‰ and - 5.92 ‰ respectively.

The conventional δ D versus $\delta^{18}O$ diagram shows that the water samples data plot mostly to the right of the Global Meteoric Water Line (Figure 7.21), defining a single trend with a slope of 5.3 (The slope can be interpreted as the “average rate of change between our data and the GMWL).

All analytical isotope data concerning the Ohrid – Prespa Region are included in table 7.28. The $\delta^{18}O$ values of the Ohrid Lake water, for the sample taken in the surface (sample no. 3) is -3.66 ± 0.07 ‰, and in deferent depth of this lake the values ranges from –3.60 ± 0.07 ‰ to -3.93 ± 0.09 ‰ respectively for depth 20 m to 100 m. Korita Springs $\delta^{18}O$ values is; - 9.93 ± 0.08 ‰ (the rainfall is the only one feeding area of this spring). The Perrenjas Spring values are closed to that of Korita Spring; - 9.96 ± 0.07 ‰. Other springs like: Tushemisht Spring values is; – 6.04 ± 0.07, Saint Naum Spring values is; – 6.83 ± 0.07, Biljana Spring values is: – 10.38 ± 0.07, Aftokam Lubanisht spring values is; – 10.53 ± 0.08, Spring in the boorder values is; – 5.96 ± 0.07, Gurras Spring values is; – 5.67 ± 0.07 ‰. The Prespa Lake values are; Prespa 1; – 1.31 ± 0.07 and Prespa 2; – 1.45 ± 0.08.

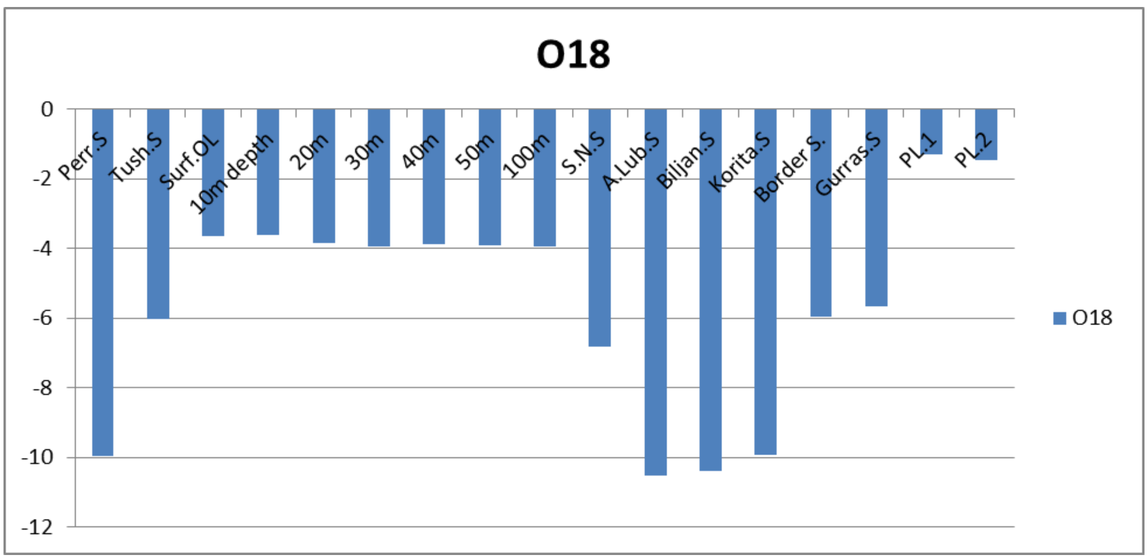


Figure 7.20. Graphic shows the quantity of the heavy isotope $\delta\ ^{18}O$ ‰ for each point in the study area where the water samples have been taken.

The Figure 7.20 represent, in a simple graphic, all the values mention above distributed by the stations of the points where the water sample was taken. Looking at them with attention one can notice that samples taken in the Ohrid Lake have approximate values with each other. The same thing one can say even for those taken in the Prespa Lake. The Perrenjas Spring has almost the same values with that of the Korita

Spring, and approximate values with those of Biljana Spring and Aftokam Llubanisht Spring. The Tushemisht Spring has approximate values with those of the Gurras Spring and Border Spring, and less with that of Saint Naum Spring. Paying attention to the graphic (Figure 7.20), the springs above mention have an approximate values, with the mixed values of the Prespa Lake samples and those of the springs that have a feeding area only the rainfall.

Prespa lake is positioned (850 m a.s.l.) 150 m above Ohrid Lake and the most of the springs mention. Korita Spring only is positioned 1421 m a.s.l. As was mention above; typical gradients are - 0.15 to - 0.5 ‰ per 100 m for ^{18}O, and - 1.5 to - 4 ‰ per 100 m for D. Korita Spring has a values of ^{18}O; - 9.93 ± 0.08 ‰ and the springs that discharge in Ohrid Lake have values that range from - 6.06 ± 0.07 ‰ to - 6.83 ‰; the difference is about - 3 ‰ to - 4 ‰ for 720 m, approximately.

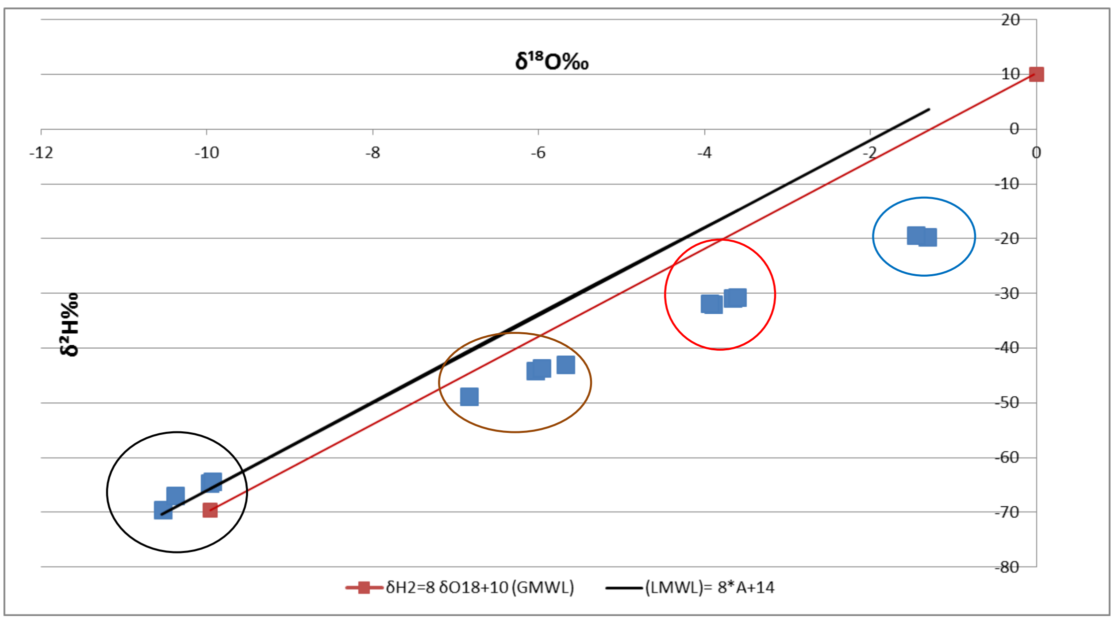


Figure 7.21. The correlation between $\delta^{18}O$ ‰ and $\delta^{2}H$ ‰, GMWL, LMWL.

Explanation:

In the blue circle are included the results of the stable isotopes of Prespa Lake. In the red circle are included the results of Ohrid Lake. In the brown circle are included the results of the springs: Tushemisht, Gurras, Saint Naum and Border Spring. In the black circle are included the results of the springs: Koritas, Perrenjas, Bilijana and Aftokam Lubanisht.

Prespa and Ohrid Lakes present more enriched values of oxygen isotope than those from Karstic springs in the study area as showed in the Figure 7.21 (bleu and red circles).

It is concluded that average values for both origins of atmospheric water overlying the lake, are the modeled lake water isotope values for closed hydrological lake systems in the Eastern Mediterranean area (Chantzi and Almpanakis, 2018).

The brown and black circles include the results of the springs under our investigation. As mentioned above, the spring's fiding zones are the karstic water and Prespa Lake water as well. Therefor, the values of ^{18}O are between Prespa Lake values and those of karstic reserves. The black circle which includes the spring's water that shown by the analysis results, are not interconnected to the lakes. The ^{18}O value of these springs lay on the LMWL, showing that the precipitations are the main feeding resources. Compering the isotope analysis of the karstic water with those of the open water surfice area (lakes in our case) was confermed that the first ones represent themselves less sensitive to evaporation effects.

The treand of the slope 5.3 on the right of the GMWL can be interpreted as the average rate of our data with higher values of the ^{18}O. The temperature is an important factor determining the isotopes composition. Recently was well noted a higher temperature than average in the area. According to (Chantzi & Almpanakis 2020) Ohrid Lake presents $\delta D/\delta^{18}O$ ratio about 5.2, while Prespa lakes system present $\delta D/\delta^{18}O$ ratio about 4.95 reflecting a more intensive evaporation effect.

In general, it is concluded that the open Lake Ohrid is more buffered hydrological as karst systems and less sensitive to evaporation effect, in contrast to the closed lake system of Prespas that present a strong dependence on climate seasonality (Chantzi & Almpanakis 2020).

The isotopic analyses its part of the hydraudinamic investigation of the transboundary aquifer, more specificly to show the conection between the water of the Prespa Lake with those of the karstic springs that emerges on the south-eastern part of the Ohrid Lake.

Table 7.19. Report of the δ^2D and $\delta^{18}O$ in water (27 May 2019)

REPORT Δ^2D AND $\Delta^{18}O$ IN WATER												
						δ^2H (‰)			$\delta^{18}O$ (‰)			n
POINT	X	Y	A.S.L (M)	T (^{0}C)	SAMPLE	AVERAGE	SEM	COMBINED UNC (TO VSMOW)	AVERAGE	SEM	COMBINED UNC (TO VSMOW)	
S. no. 1; S.Perrenjas	465281	4546656	654	11.4	Kiri s. 1	-64.82	0.04	0.34	-9.96	0.02	0.07	10
S. no. 2; S. Tushemisht	476450	4527773	703	11.8	Kiri s. 2	-44.27	0.07	0.36	-6.04	0.02	0.07	10
S. no. 3; Surf. O. Lake S. no.	470311	4529310	716	9.8	Kiri s. 3	-30.90	0.04	0.37	-3.66	0.03	0.07	10
Samples no. 4; -10 m, O. Lake	484462	4550135	707	10.2	Kiri s. 4	-30.78	0.05	0.37	-3.60	0.02	0.07	10
S. no.5; -20 m, O. Lake	480900	4530216	698	10	Kiri s. 5	-31.45	0.03	0.37	-3.86	0.03	0.07	10
S. no.6; -30 m, O. Lake	477371	4520723	631	12	Kiri s. 6	-32.24	0.05	0.37	-3.94	0.03	0.08	10
S. no.7; -40 m, O. Lake	475818	4526562	703	12	Kiri s. 7	-32.13	0.07	0.37	-3.89	0.06	0.09	10
S. no.8; -50 m, O. Lake	484280	4534873	1421	8.1	Kiri s. 8	-31.72	0.08	0.38	-3.91	0.05	0.09	10
S. no.10; -100 m, O. L.	469718	4546239	691	11.2	Kiri s. 10	-31.97	0.05	0.37	-3.93	0.05	0.09	10
S. no 11; S. Saint Naum	469718	4546239	681	10.4	Kiri s. 11	-48.87	0.08	0.35	-6.83	0.02	0.07	10
S. no 12: S. A. Lubanisht	469718	4546239	671	8.8	Kiri s. 12	-69.67	0.05	0.34	-10.53	0.03	0.08	10
S. no 13: S. Biljana	469718	4546239	661	8	Kiri s. 13	-67.02	0.07	0.34	-10.38	0.05	0.09	10
S. no 14: S. Korita	469718	4546239	651	8	Kiri s. 14	-64.41	0.06	0.34	-9.93	0.03	0.08	10
S. no.15; S. in the border	469718	4546239	641	7.8	Kiri s. 15	-43.80	0.08	0.36	-5.96	0.02	0.07	10
S. no 16: S. Gurras	469718	4546239	591	7.2	Kiri s. 16	-43.01	0.06	0.36	-5.67	0.03	0.07	10

S. no. 17; P. Lake 1	492309	4515406	853	12.8	Kiri s. 17	-19.73	0.05	0.39	-1.31	0.02	0.07	10
S. no. 18; P. Lake 2	493020	4516125	853	12.8	Kiri s. 18	-19.44	0.06	0.40	-1.45	0.03	0.08	10

SEM is standard error on mean
Data normalisation was done with two laboratory standards
Lab1 (δ^2H = 7.74 ± 0.4‰, $\delta^{18}O$ = 5.73 ± 0.06‰
and Lab3 (δ^2H = -146.98 ± 0.4‰, $\delta^{18}O$ = -20.01 ± 0.06‰)
One quality assurance sample (δ^2H = -48.68 ± 0.4‰, $\delta^{18}O$ = -7.36 ± 0.06‰) was analysed.
All standards were interlocked between the samples every 10 samples and are all traceable to VSMOW – SLAP.

7.3 Chapter summary

For May 2016 the Stiff diagrams show similarities between each other with those of Ohrid Lake taken in different depths. The same thing was shown even for the samples taken in the investigated springs. Neither Ohrid Lake samples nor those of springs mentioned show any similarities with the diagrams of the Prespa Lake. For September 2016, similarities were noticed between diagrams of Prespa Lake with Tushemisht and Gurras springs as well as Ohrid Lake surface samples. On the other hand, they are similarities even between Perrenjas Spring and Ohrid Lake surface water samples. Observing those diagrams one can see the similarities between diagrams of Prespa Lake with Tushemisht, Gurras and Perrenjas springs as well as Ohrid Lake surface sample. The diagram that represents the sample taken in 10 m depth from the surface of Ohrid Lake has visual similarities with diagrams of 30 m, 40 m, 50 m and 75 m depth from the surface of the same lake. The diagram of the water samples taken in 20 m depth in the Ohrid Lake has similarities with that depth 100 m of the same lake. From the hydrogeology point of view, the comparison of the diagrams can give a clear concept of the water movement in the study area, for this period of the year.

Observing the visual similarity between the diagrams for May 2017, it is clear that Gurras Spring resembles Aftokam Lubanisht and Perrenjas springs. Both diagrams of the samples taken in Prespa Lake have similarities with the Saint Naum Spring.

The diagram that represents the Tushemisht Spring is similar to that of Biliana Spring. The diagram that represents the sample taken in the surface of Ohrid Lake has no similarities with none of the other diagrams mentioned above. A comparison between the averages of the Lubanisht Spring diagram with that of Prespa Lake was constructed. The results of this diagram were compared with the spring’s diagrams. Meanwhile, Lubanisht diagrams and that of Lin diagrams were also constructed within this material, in order to be compared with the diagram of the Perrenjas Spring.

For September 2017; from the visual similarities of the Stiff diagrams the results are not as they’re expected to be. As a result, it is hard to find the similarities between spring’s diagrams and Prespa Lake diagrams. On the other hand, the diagrams representing springs are similar to each other. Based on the diagrams observed it is obvious that the surface diagram of Ohrid Lake is not similar to none of them.

Korita Spring's feeding area is the karstic water only. Ongoing, Korita's diagram was combined with the diagram of Prespa Lake, in order to be compared with the spring's diagrams and with the Ohrid Lake's diagram. Korita's diagram is still combined with the diagram of the Lin (surface of the Ohrid Lake) to compare with Perrenjas Spring.

The feeding area of the springs in the study area is the karstic water as well as the water of Prespa Lake. In this period of time the maximum water amount comes from Prespa Lake toward Ohrid Lake.

Based on these diagrams, were noticed similarities between averages of Korita Spring and Prespa Lake with the diagram of spring's average. The diagram; Lin – Korita Spring have much more similarities with the Perrenjas Spring's diagrams than that of Lin diagrams.

During the two years (2016 – 2017) the hydrochemical research was conducted, one can say that there are no significant visual similarities between diagrams of Prespa Lake and those of Ohrid Lake. Diagram that represents the water sample chemical data average of Ohrid Lake Region for 2017 is more similar to those of 2005 than it is 2016. The same goes for the Prespa Lake diagrams. The results of these diagrams are supported by the Cluster analysis in the best possible way.

Ions ratio:

If the result of Na/Cl ratio is >1, it means the water is contaminated by anthropogenic factors. In the study area during the May 2016 this ratio appeared to be higher than 2, in different depths of the Ohrid lake (30 m r = 4.7 and 20 m r = 4.6); meanwhile Prespa Lake has r = 1.5 and the Ohrid Lake 50 m depth has r = 1.5. This ratio should also decrease due to the cations exchange of Na as water moves through the aquifer (karstic limestone), which would explain Cl enrichment in most water samples, Gurras Spring (r = 0.04) in our case. During September the Gurras Spring and 50 m depth of OL had r = 0.9 and Prespa Lake r = 0.8.

For May and September 2017; during this year appeared the contrary of the previous year. Here, during May the ratio was under 1, and for September appeared the ratio Na/Cl higher than 1. For Prespa Lake and Tushemisht Spring r = 2.8, for Gurras

Spring r = 3, for Saint Naum Spring r = 2.4, and for Korita Spring r = 30 (a serious anthropogenic contamination takes place).

Isotopes $\delta^{18}O$ and $\delta\ ^{2}H$:

Based on the results of the stable isotopes analysis the Saint Naum Spring, Biljana Spring, Lubanisht Spring, Border spring, Gurras Spring and Ohrid Lake surfaces have approximate values of $\delta^{18}O$ and $\delta\ ^{2}H$. The Ohrid Lake samples have approximate values with each other. The same thing goes even for the samples taken in the Prespa Lake. The springs around the study area have approximate values with each other as well.

In the meantime, mixed values of the Prespa Lake samples with those of the spring, that has a feeding area only the karstic water, have approximate values with the other springs taken under investigation. The conventional δ D versus $\delta^{18}O$ diagram shows that the water samples data plot mostly to the right of the Global Meteoric Water Line, defining a single trend with a slope of 5.3

CHAPTER 8. SUSTAINABLE GROUNDWATER MANAGEMENT SWOT APPROACH

8.1. TRANSBOUNDARY AQUIFER MANAGEMENT - INDICATORS

Groundwater resources of the transboundary aquifers are of increasing significance as they represent the most important fresh water in many parts of the world (Aureli et al. 2008). In the case of transboundary aquifers, the need for international cooperation on groundwater is increasingly recognized nowadays (Eckstein & Eckstein, 2003; Vaessen & Brentführer 2015). It is pointed out that in the Mediterranean region, the climate changes have put groundwater under anthropogenic pressures (overexploitation, changes of land uses, construction of dams, pollution from agriculture and wastewaters).

The modernization of processes to manage demand and distribution of groundwater resources of transboundary aquifers is a specific target today. High interdependency and uncertainty, climate change implications, political oppositions and geopolitical setting together with the absence of effective institutional legal machinery for settling riparian disputes form the complex problem of transboundary river basins (Voudouris et al. 2019).

For this reason, different indicators are widely used in order to compare and classify the transboundary aquifers. UNESCO (2015) (GGRETA, Governance of Groundwater REsources in Transboundary Aquifers) defines and proposes the following indicators (Table 8.1):

- Defining or constraining the value of aquifers and their potential functions (annual groundwater recharge, aquifer buffering capacity, natural background groundwater quality, aquifer vulnerability to climate change and pollution).

- Role and importance of groundwater for humans and the environment (human dependency on groundwater for domestic, agricultural and industrial use, ecosystems dependency on groundwater).

- Changes in groundwater state (groundwater depletion and groundwater pollution).

Table 8.1. Proposed indicators for transboundary aquifer management (UNESCO, GGRETA, 2015).

1	***Defining or constraining the value of aquifers and their potential functions***
1.1	Mean annual groundwater recharge depth
1.2	Annual amount of renewable groundwater resources per capita
1.3	Natural background groundwater quality
1.4	Aquifer buffering capacity
1.5	Aquifer vulnerability to climate change
1.6	Aquifer vulnerability to pollution
2	***Role and importance of groundwater for humans and the environment***
2.1	Human dependency on groundwater
2.2	Human dependency on groundwater for domestic water supply
2.3	Human dependency on groundwater for agricultural water supply
2.4	Human dependency on groundwater for industrial water supply
2.5	Ecosystem dependency on groundwater
2.6	Prevalence of springs
3	***Changes in groundwater state***
3.1	Groundwater depletion
3.2	Groundwater pollution
4	***Drivers of change and pressures***
4.1	Population density
4.2	Groundwater development
5	***Enabling environment for transboundary aquifer resources management at bi-/multinational level***
5.1	Transboundary legal framework
5.2	Transboundary institutional framework
6	***Enabling environment for transboundary aquifer resources management at domestic level***
6.1	Policy framework
6.2	Legislative / regulatory framework
6.3	Legal status of groundwater
6.4	Groundwater planning framework
6.5	Regulatory framework of groundwater abstraction and use
6.6	Regulatory framework for the protection of groundwater from point source pollution
6.7	Regulatory framework for the protection of groundwater from diffuse pollution

6.8	Regulatory framework for the protection of groundwater recharge from man-made interferences
6.9	Legislative / regulatory framework implemented
6.10	Legislative / regulatory framework enforced
6.11	Customary water rights
6.12	Formal institutional framework (government)
6.13	Formal institutional framework (users)
6.14	Informal institutional framework

- Drivers of charge and pressures (population density, groundwater development stress).

- Enabling environment for transboundary aquifer resources management at bi-/multinational level (transboundary legal and institutional framework).

- Enabling environment for transboundary aquifer management at domestic level (policy framework, legal status of groundwater, regulatory framework of groundwater abstraction and use, regulatory framework for the protection of groundwater from pollution, customary water rights, formal institutional framework/government or users, informal institutional framework, etc.).

8.2. GENERAL CHARACTERISTICS OF THE COMPLEX SYSTEM KARST AQUIFER-LAKES

Between the Ohrid and Prespa Lake (Figure 8.1), a transboundary karstic aquifer is developed in karstified carbonate rocks (Chapter 6). This aquifer is discharged via numerous springs and is controlled by tectonic deformation, which favors infiltration of meteoric water. The water demand (domestic use and irrigation) in the wider area are mainly covered by the exploitation of these springs.

The aquifer is recharged by the infiltration of meteoric precipitation. As mentioned in the paragraph 6.3, the transboundary karst aquifer is vulnerable to external pollution due to the absence of a protective soil cover and the presence of discontinuities at great depths. Besides is vulnerable to climate changes which affect the lakes' ecosystems. The general characteristics of the aquifer are presented in Table 8.2.

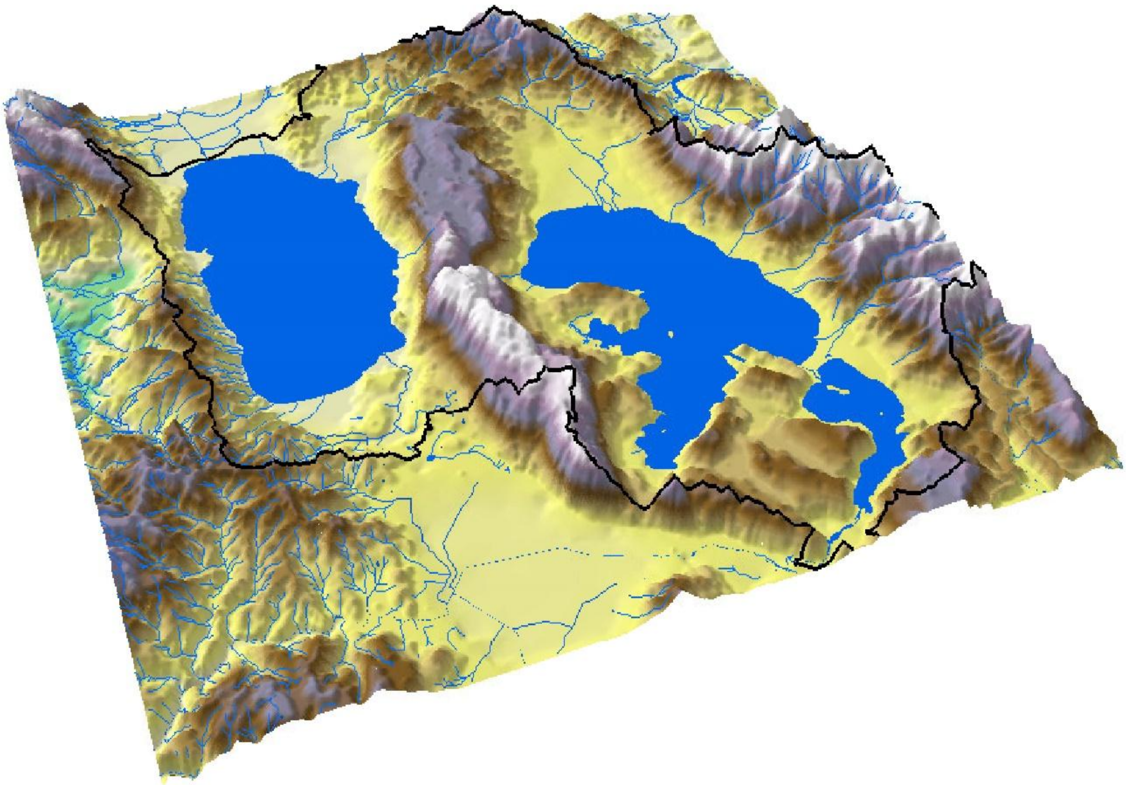


Figure 8.1. Location of Prespa-Ohrid watershed

Table 8.2. General characteristics of the transboundary karst aquifer

	Transboundary karst aquifer
Surface area (km^2)	606.8
Mean value of elevation (m a.s.l.)	1326
Mean annual precipitation (mm)	1003
Recharge volume by infiltration of precipitation ($x10^6$ m^3 or Mio m^3)	298.2
Volume of total outflows from Prespa Lake to Ohrid Lake via underground karst channels ($x10^6$ m^3)	236-315
Annual discharge of main springs St. Naum and Tushemisht ($x10^6$ m^3)	255-320

The general characteristics of Ohrid and Prespa lakes are shown in Table 8.3. Ohrid Lake has 87.5 km of shoreline and covers an area of 362.6 km^2. The watershed of Ohrid Lake includes steep mountains, as well as both Macro (Big) and Micro (Small) Prespa Lakes. The total area of the watershed is about 3,921 km^2 (UNESCO 2004). Big Prespa Lake has a surface area of 253.6 km^2 and a catchment area of 1058 km^2. Small Prespa Lake with a surface area of 47.4 km^2 (essentially in Greek territory) has a catchment area of 189 km^2. The total catchment area is 1360 km^2. Big Prespa Lake is divided between tree states; Albania, Greece and North Macedonia. Small Prespa Lake is divided between Albania and Greece. Ohrid Lake is divided between Albania and North Macedonia. The water level trend of Prespa Lake during the period 2014-2019 is negative or decreasing (see Chapter 5). A decreasing trend of the water level of Prespa Lake during the period 2014-2019 is recorded.

Table 8.3. General characteristics of lakes Prespa and Ohrid (data for period 2014-2019)

	Prespa Lake	**Ohrid Lake**
Min elevation in m a.s.l.	844.71	692.08
Max value of elevation (m a.s.l.)	847.47	693.85
Mean value of elevation (m a.s.l.)	846.07	692.80
Total catchment area (km^2)	1058	3921
Surface area (km^2)	254	362.6
Mean Depth (m)	14	155
Maximum Depth (m)	54	288
Water volume (km^3)	≈3	≈55
Residence time* (yr)	11	70

* Matzinger et al. (2006).

The hydraulic connection between Prespa and Ohrid Lake via underground karst channels is confirmed by different methods (stable isotopes, hydrochemistry). Besides, the St. Naum Spring and Tushemisht Spring are recharged from Prespa Lake via underground channels.

A schematic drawing of the hydraulic system of aquifer and lakes is shown in Figure 8.2.

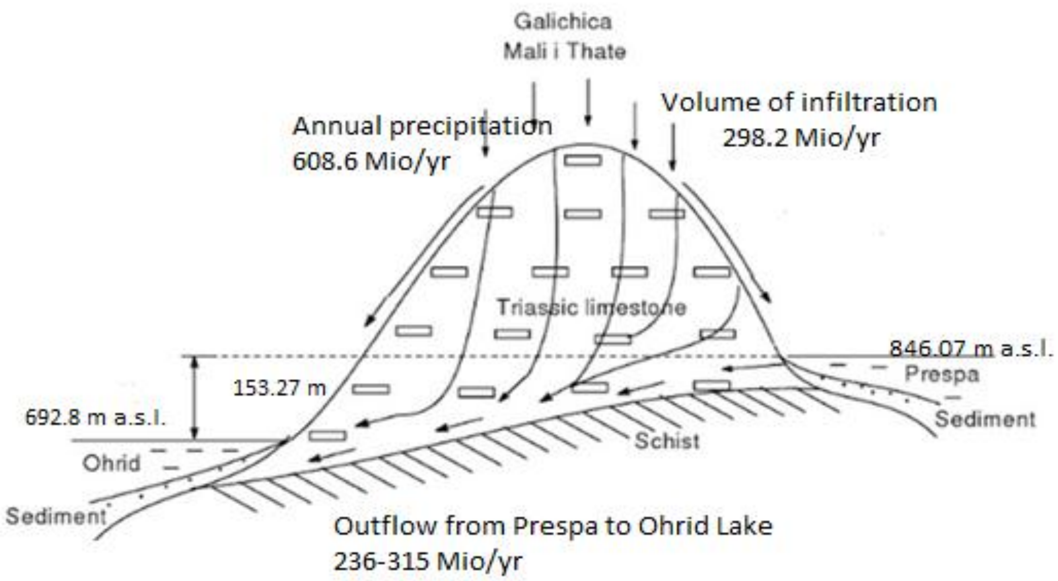


Figure 8.2. Simplified cross section of karstic massif of Galichica and Mali i Thate with connection between Big Prespa Lake and Ohrid Lake (Anovski et al. 2001 with modifications).

8.3. EVALUATION OF INDICATORS

The evaluation of the indicators is examined and presented in Table 8.4. The indicators are a useful tool in the diagnostic analysis of the transboundary aquifer system. The outcome of this evaluation, in combination with SWOT analysis (see next paragraph 8.4), may be used from local authorities and water policy makers for the sustainable and rational management of transboundary aquifer. In addition, the results should be disseminated among stakeholders. This will create awareness and motivation to cooperate in order to adopt common management strategies and actions.

Table 8.4. Evaluation of indicators for transboundary karst aquifer (UNESCO 2016, with modifications).

	Indicators	**Definition**	**Classification**	**Comments**
1	**Defining or constraining the value of aquifers and their potential functions**			
1.1	Mean annual groundwater recharge depth	Long-term mean groundwater recharge divided by area	Very High: >300 mm/yr	Infiltration of atmospheric precipitation
1.2	Annual amount of renewable groundwater	Long-term mean groundwater recharge divide by the number of	High: >5000 m^3 per capita per year	Population of the area is around 167,000

	resources per capita	inhabitants of the area		inhabitants
1.3	Natural background groundwater quality	Percentage of the area where groundwater satisfies drinking water standards	Very high: > 80%	Suitability for drinking use
1.4	Aquifer buffering capacity	Ratio between volume stored and long-term mean groundwater recharge (mean residence time)	Low <10 yr	
1.5	Aquifer vulnerability to climate change	Extent of expected groundwater budget regime change in response to change in climatic conditions	High: aquifer actively interacting with atmosphere and lakes and streams	Karst aquifer under unconfined conditions
1.6	Aquifer vulnerability to pollution	Percentage of area where the aquifer is considered vulnerable to pollution	Very high: >80%	Karst aquifer without protective soil cover
2	**Role and importance of groundwater for humans and the environment**			
2.1	Human dependency on groundwater	Percentage of groundwater in total water abstraction for all human water uses	Very High: >80%	Spring-water is considered as groundwater
2.2	Human dependency on groundwater for domestic water supply	Percentage of groundwater in water abstraction for domestic water use	Very High: >80%	
2.3	Human dependency on groundwater for agricultural water supply	Percentage of groundwater in water abstraction for agricultural water use	Very High: >80%	Estimated values because no reliable data are available
2.4	Human dependency on groundwater for industrial water supply	Percentage of groundwater in total water abstraction for domestic water use	Very High: >80%	Estimated values because no reliable data are available
2.5	Ecosystem dependency on groundwater	Percentage of the aquifer's area where the aquifer has a phreatic water level shallower than 5 m below ground	Low to medium: <25%	Alluvial aquifers exist close to lakes

		surface		
2.6	Prevalence of springs	Total annual water discharge by springs divided by mean annual groundwater recharge	Very High: >50%	There are many karst springs in lakeshore
3	**Changes in groundwater state**			
3.1	Groundwater depletion	Observed current rate of long-term progressive decrease of groundwater storage, accompanied by steadily declining groundwater levels	Very Low: < 2 mm/yr	Precipitation decreases affect groundwater reserve
3.2	Groundwater pollution	Observed polluted zones as a percentage of total aquifer area	Very Low: <5%	
4	**Drivers of change and pressures**			
4.1	Population density	Number of people per unit of area on top of the aquifer	Low to medium: <10 p/km^2	
4.2	Groundwater development stress	Total annual groundwater abstraction divided by long-term mean annual groundwater recharge	Low: 2-20%	
5	**Enabling environment for transboundary aquifer resources management**			
5.1	Transboundary groundwater management legal framework	Existence, status and compre-hensiveness of a binding agreement on the transboundary aquifer under consideration	No agreement in existence	
5.2	Transboundary groundwater management institutional framework	Existence, mandate and capabilities of institutions or institutional arrangements for managing the transboundary aquifer under consideration	No institutions in existence	There is no harmonization with the Directive 2000/60/EC (water policy)

Concluding remarks of the evaluation using indicators

From the evaluation of the indicators, concerning the transboundary karst aquifer, some synoptic conclusions can be drawn:

- Very high recharge by infiltration of atmospheric precipitation.

- Vulnerable to climate changes, as well as to external pollution due to human activities.
- Existence of many karst springs discharging the aquifer.
- The transboundary karstic aquifer operates as a hydro-collector and hydro-conductor; it affects and is affected by the lakes' water balance.
- Groundwater as spring-water is very important for domestic and agricultural uses.
- No significant pollution has been reported.
- Agriculture, livestock and tourism development are the main driving forces of the area.
- Groundwater development stress is relatively low.
- Transboundary legal framework and institutional framework do not exist.

8.4. SWOT ANALYSIS IN THE TRANSBOUNDARY AQUIFER OHRID – PRESPA WATERSHED

– SWOT analysis represents the Strengths, Weaknesses, Opportunities, and Threats in a study area.

SWOT analysis shows a clear vision of the environment and socio – economic in a basin divided between three different countries. By using this method is expected a rational conclusion connected with integrated management of the entire surface and groundwater resources of the transboundary aquifer Ohrid- Prespa watershed.

In the present study, SWOT analysis is applied for the environmental planning development and optimization of groundwater management. The method is analytically described in many previous studies (Diamantopoulou & Voudouris 2007; Kallioras et al. 2010). It aims to minimize the threats and weaknesses and convert these into opportunities (Voudouris 2007). This approach is used to analyze the information from an organizational analysis and classify it into internal (strengths and weaknesses) and external environment (opportunities and threats). Defining the strengths, weaknesses, opportunities and threats in the study area it's important mostly for the groundwater management in the region.

Figure 8.3 shows the results of this approach, which were produced after the evaluation of the response of questionnaires sent to experts and water administrators (only in the Albanian part), as well as the results of this study (Kiri et al. 2021).

Strengths

Natural resources

The strong points of the region taken into investigation, transboundary aquifer Ohrid – Prespa watershed, are natural resources. The Prespa and Ohrid Lakes positioned among mountains, offers quiet beaches. Prespa Lake is the hosts of the white pelicans (Dalmatian pelicans) the largest colony in the world. Prespa Region, an area rich in natural assets, lakes, rivers, forests, flora and fauna, now is a national park protected by the low. Being a cross-border area the Ohrid - Prespa region protection requires the harmonious cooperation by all three countries that share it, Greece, Albania and North Macedonia. Ohrid Lake has the same advantages and disadvantages as Prespa Lake. Availability of spring-waters; the springs here are distributed in the south eastern part of the lake making this parte more attractive for tourists. Most of these springs have a stable water quantity during a hydrologic year.

-Existence of many hydrogeological and environmental studies

Many research projects, concerning hydrogeology, isotope analysis, environmental studies, etc. have been carried out in the wider area.

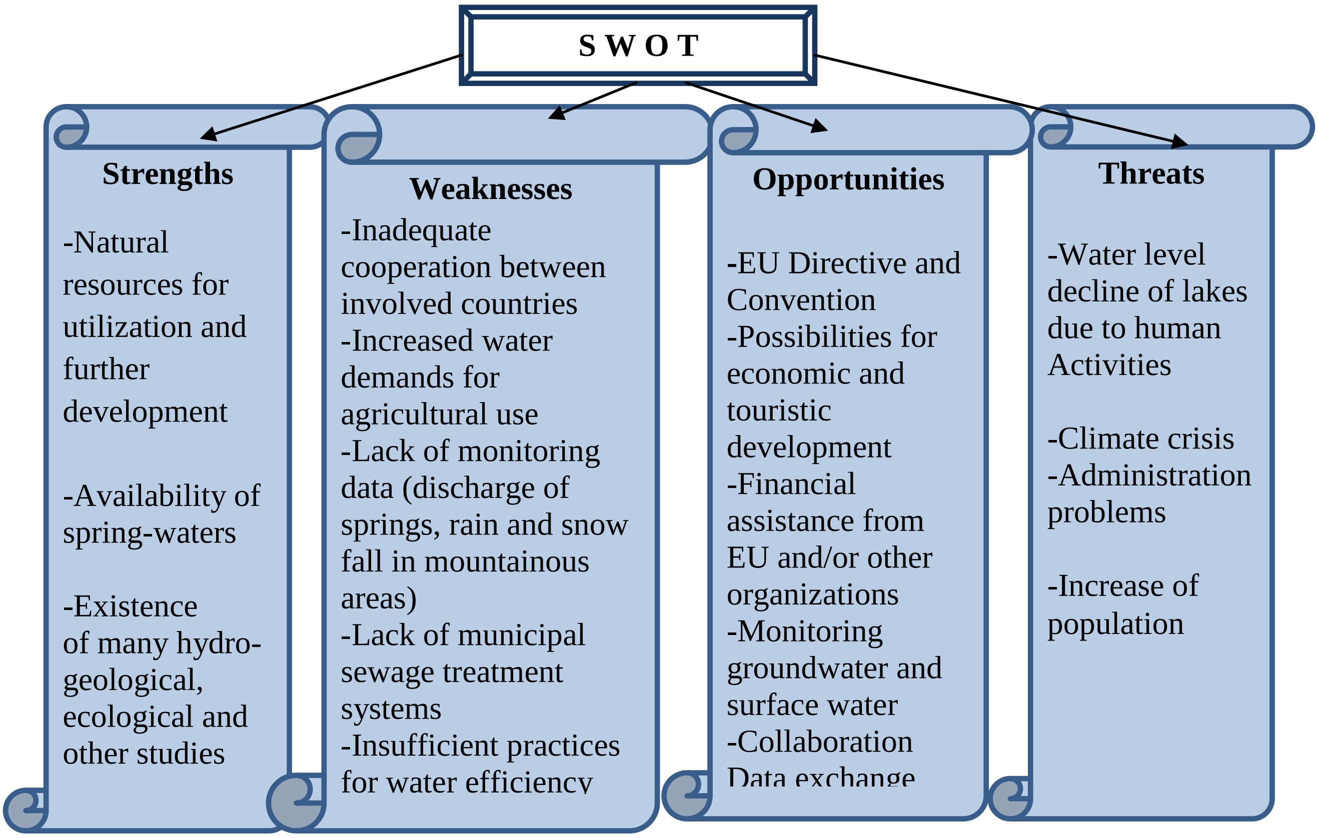


Figure 8.3. This diagram provides an overview of the SWOT analysis in transboundary aquifer Ohrid – Prespa watershed.

Weaknesses

Inadequate cooperation between involved countries

The fact that this natural resource is shared between the three countries as mentioned above is a weak point of the SWOT analysis. Method of storage and management of all natural resources that are included in this region, are different in different countries. A part of this region is a national park and is of special importance for the three countries. It’s an understatement that groundwater as well as surface water knows no boundaries.

Increased water demands for agricultural use

The expansion of irrigated areas in combination with the reduction of rainfall is expected to increase the required volume of water for irrigation purposes

-Lack of monitoring data (high density and quality data, discharge of springs, rain-gauges stations at higher altitudes, snow-fall measurements, etc.), and lack of common databases among the different water research institutions and Universities.

-Lack of municipal sewage treatment systems

Wastewater distribution has been and will continue to be a problem for the study region although many investments and improvements have been made by all three countries. The continuous increase of the population, as well as the attraction of as many tourists as possible, in addition to the positive effect for the economy, also has a negative side in the pollution of the environment. This problem will constantly require investment. At this point cooperation between countries would facilitate and improve the management of all urban waste.

-Insufficient practices for water efficiency

Good agricultural practices do not apply to irrigation water savings.

Opportunities

-EU Directive and Convention

Albania and North Macedonia are not members of the European Union and have not harmonized with the Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 in the field of water policy.

-Possibilities for economic and touristic development

The beauty of the lakes and the mountains surrounding these lakes are unique and very attractive. This makes the tourism grow year after year. In both Albania and North Macedonia, tourism is important for boosting the economy in this region. The biggest profit in the area comes by tourism. This is also a strong point for SWOT analysis. Economic development and growth is the goal of every state and individual. Development in this aspect brings at the same time opportunity and threats, as following. The development of the study region is inevitable due to the fact that this region is of interest in many aspects, such as: scientific, natural beauty (tourism), special flora and fauna, etc. Many investments are made by all three respected countries so far, regardless of whether they are related to a region that needs a coordinated development. Over time, the ever-increasing demands for investment and the creation of a more developed infrastructure and in particular the awareness that the Ohrid-Prespa border region cannot be addressed separately will inevitably lead to cross-border cooperation between countries.

-Financial assistance from EU and/or other organizations

The opportunities include financial assistance from the EU and/or other organizations, as well as the implementation of the European legislation for environmental protection and management. The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention-Helsinki 1992), and the Convention on the Law of the Non-Navigational Uses of International Watercourses (Watercourses Convention 1997) are the two legal documents which support and reinforce transboundary cooperation.

Monitoring groundwater and surface water

Groundwater and surface water monitoring is an opportunity for cooperation between neighboring countries. Given that this cross-border region, in addition to its beauty and peculiarities, also presents relatively difficult problems to solve. The continuous decline of the water level in Prespa Lake can be mentioned. Numerous studies and projects have been conducted on this problem and the negative effects that follow this continuous drop in water level. As long as this decline doesn’t stop then joint studies and projects will continue to be realized.

Collaboration (Data exchange):

The study area in terms of hydrogeology and hydrology is complicated. In hydrogeological terms, the dynamics of groundwater is very developed. Prespa Lake, which continuously feeds Ohrid Lake, has been facing the problem of falling water levels for several years. Continuous measurements of the lake water level confirm this fact (Appendix D). Also the hydraulic connection that exists between the two lakes has been confirmed by many studies. Moreover, the research done in this study further reinforces these facts.

At this point we can say that cooperation between the three countries is necessary in many aspects. By exchanging data related to what was said above, possibly in real time helps in important scientific definitions for the problems presented in the region.

Threats

-Water level decline of lakes due to human activities (anthropogenic factor)

The decrease of water level in Prespa Lake is a serious threat in this transboundary aquifer. Based on the daily data level of this lake (for 10 years - Appendix D), the decrease continues year after year. The geographic position disfavors Prespa Lake, but in the other hand favors Ohrid Lake. The geological deposits help this phenomenon in unquestionable way, presented by a developed karstic limestone (Dry Mountain and Galicica Mountain). The water flows from Prespa Lake toward Ohrid Lake during the whole hydrological year, by filling in this way all the necessities needed in order to retain a stable water level in Ohrid Lake.

It is noted that in the Mediterranean region, the climate changes have put groundwater under anthropogenic pressures (overexploitation, changes of land uses, construction of dams, pollution from agriculture and wastewaters) (Van der Schriek & Giannakopoulos 2017; Aureli et al. 2008). The documented decline of lake levels could be associated with a decrease in precipitation over the last decades of the 20th century and not only by water abstraction (Kolokytha 2010; Van der Schriek & Giannakopoulos 2017). In the study area, besides the others factors one can mention a few as below:

- Pollution

Industry, agriculture, irrigation, sewages, livestock, etc. have their negative impact in the pollution of the study area. Water in Big Prespa Lake is polluted by the continued use of the herbicide and pesticides by agricultural interests which continue to grow every year. This is responsible for directly or indirectly spreading nutrients in the lake. They are a threat to the environment as they are mainly developed near the lake shores.

However, it is believed, in both countries (Albania and North Macedonia) the industrial sources do not have a significant influence in the water quality of Prespa Lake.

- Population grow

Population growth as mentioned has its negative effect on environmental pollution. Along with the development of the economy which in this case is associated with population growth, especially during the summer, brings the negative effect that is environmental pollution. In Albania and North Macedonia, urban pollution in the zones near the Big Prespa Lake is relatively under control. Yet, more needs to be done to further reduce the negative impact on groundwater and lakes water as well.

- Eutrophication

The study area includes three lakes, so the most serious threats for these lakes comes from nutrient loading. Ohrid Lake historically was classified as an Oligotrophic or clean water lake. Prespa Lake water is going from mesotrophic to eutrophic type. During the summer months the rivers that feed the lake run below normal flows because of agriculture irrigation. In the future, the summer flows could be a trickle because of the overuse. Low water levels in the river during the summer also impacts the oxygen level; the lowest levels have been recorded in the Golema River basin (Kiri et al. 2011; Matzinger et al. 2006). Agriculture land is mostly located near the river adding nutrients to the river, eventually ending up in Prespa Lake.

One third of the water that supplies Ohrid Lake comes from Prespa Lake. This inflow negatively affects the eutrophication of Ohrid Lake. The amount of phosphorus (P) concentration has been increased over time in Ohrid Lake. Considering the large volume of water in Ohrid Lake, the concentration of 3 or 4 times the concentration measured before World War II, is a significant change. Whether this trend will continue in the next few decades Ohrid Lake can be expected to change dramatically (UNESCO 2004).

- Climate crisis

Global climate change is having a negative impact on this region. After analyzing the temperature, evaporation and daily precipitation data for the last 10 years, the changes noticed will inevitably affect the study area. There is an increase in temperature and evaporation values, and a decrease in precipitation. Normality, on a global scale the precipitation is projected to increase, but not everywhere, some areas are likely to experience an increase and others a decrease in annual precipitation (Training Manual 2015; Kolokytha 2010). In our case a decrease quantity of the rainfall was distinguished. Administration problems and population growth are a constant and interrelated threat to this area.

SWOT analysis was applied in order to optimize the sustainable groundwater and surface water resources- Recommendations

Transboundary aquifers have been a priority in many projects in the recent decades. Groundwater has always been considered a national asset, but in the case of transboundary aquifers this issue needs to be addressed from a broader perspective. Groundwater does not recognize the dividing borders between countries. Their finding area could be in one country while they merge in another one. The groundwater's dynamic does not depend on the anthropogenic factor, but exploitation, land-used, management of the groundwater do. This being said, different countries follow different rules. The need of the international cooperation is essential in this point, if one of the countries doesn't pay attention to quality and quantity of the groundwater, it affects all other counties involved in transboundary aquifer. Strengths, weaknesses, opportunities and threats analysis is a useful tool for the planning development and decision-making in transboundary aquifer (Voudouris et al. 2019).

In transboundary aquifer Ohrid – Prespa watershed were carried out the hydrogeological, geophysical, hydrochemical studies, stable isotopes, statistical analyzes, as well as additional works for this scientific research. Being divided between the three different countries, the region under study has without question its weaknesses and strengths and in particular has the threats that may come as a result of a lack of interaction between these countries.

Hydrogeological studies provide in tabular form general hydrogeological data for the whole region (Appendix D). A hydrogeological map was also constructed by the author at a scale of 1: 50,000 in the GIS program which contains a hydrogeological database. Hydrochemical water analyzes by using Stiff diagrams, or those of stable isotopes were done in order to study the hydrodynamics of groundwater in the cross-border region of Ohrid and Prespa Lake. Statistical analyzes reinforce the conclusions drawn from the above mentioned studies.

The Tushemisht spring inflow calculation, as well as the measurements of the water levels of Ohrid Lake and the Big Prespa Lake shows the fluctuation that these levels have undergone in the last 10 years.

The fact that North Macedonia, Greece and Albania, share this transboundary aquifer system, makes it harder to do a hydrologic analysis. The canal water connections between Big and Small Prespa lake is located in the Greek territory, a part of outflow of Big Prespa Lake flows through the Zaveri abyss (in Albanian territory) toward Saint Naum Spring (North Macedonian) and Tushemishti Spring (Albania). Pumping water for irrigation from Prespa Lake (Big and Small) in all three countries is another factor that must be added to the artificial outflow.

This fact is another weakness point of this analysis. Collaboration between the three countries is essential in order to exchange scientific information, groundwater and surface water monitoring, as well as their sustainable management. Observing the SWOT analysis in the transboundary aquifer Ohrid – Prespa watershed, the threats are presently more than the strengths. Being a region divided by three countries for such a delicate area is a weakness in the SWOT analysis. The opportunities of collaboration between these countries are imposed by several reasons like; monitoring groundwater and surface water, data exchange and development factors. The political linkages in transboundary aquifer management are important, such as “water for cooperation” (Aureli et al. 2008). The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention-Helsinki 1992), and the Convention on the Law of the Non-Navigational Uses of International Watercourses (Watercourses Convention 1997) are the two legal documents which support and reinforce transboundary cooperation. Among the major concerns and principles are the following (Voudouris et al. 2019):

- Cooperation on the basis of territorial or national sovereign, which is now more or less translated into 'good neighborliness' rather than absolute sovereignty.

- The concept of 'equitable and reasonable use' refers to the obligation the riparians have to use and develop watercourses in a sustainable way and to promote the protection of shared waters. It should be mentioned through that there is no ratification of these principles on groundwater aquifers and the problem gets more intense when it comes to implementation due to high vulnerability and aquifer recharge rates.

- Obligation to cooperate in the sense of exchanging of data and information so that informed decision making is facilitated. Also of forming joint mechanisms and promote planned measures.

- The precautionary principle has been incorporated into international agreements and has the aim to proactively prevent environmental harm rather than in retrospect act to alleviate it.

- Cause no harm assuring adequate protection and recharge rates.

- Provide dispute resolution tools

The networking should be improved as well as the information exchange and cooperation activities. In addition, common databases should be created among the different water institutions and Universities of the three countries (Greece, Albania, and North Macedonia). The previous actions would support the direct exploitation and dissemination of scientific results, as well as the promotion of feedback mechanisms. As mentioned before (Chapter 6), the total absence of hydrometeorological data for the mountain areas makes the detailed estimates of hydrological parameters hazardous with a high degree of uncertainty. So, establishing and operating adequate and dense monitoring networks is the first priority.

Furthermore, the construction of sanitary landfills and waste-water treatment plants, as well as the delineation of protection zones around the springs, will contribute to water quality protection. The applications of water saving techniques in irrigation (spray and drip irrigation) will reduce water needs.

Finally, integrated risk analysis and multi-criteria decision analysis should be applied as an additional managerial tool (Ganoulis et al. 2010).

CHAPTER 9. CONCLUSIONS AND DISCUSSION

9.1 GENERAL CONCLUSIONS

The study area, including the transboundary aquifer of Ohrid-Prespa Lakes' watershed, is situated in south-western Europe (40°40'- 41°2'N latitude; 20°23'-21°16'E longitude). It is shared between three countries; Albania, Greece and North Macedonia. It was treated as a single catchment basin based on the similarities, from the hydrogeological point of view, existed between Prespa Lake Basin and Ohrid Lake Basin. Here can be mentioned the good hydraulic connection, common hydrogeological complexes, similar climatic conditions, geographical position, the economic development in the region, etc.

The aim of this research is the hydrodynamic study of the transboundary aquifer system in Prespa–Ohrid watershed, based on hydrogeological, geophysical and hydrochemical investigation. The following are the main conclusions revealed from this investigation.

Geomorphology

Ohrid Lake, covering an area of 362.6 km^2, is positioned on the north of the Big Prespa Lake. Galicica rises as a horst between Prespa Valley in the east and Ohrid Valley in the west with peaks greater than 2000 m. The Prespa Lakes (Big and Small) surface is 254 km^2 (in 1984 the surface has been 329 km^2). Both these lakes are separated by Mali i Thate (Dry) Mountain with highly developed karst.

Water level in Prespa and Ohrid Lake is approximately 846 m and 693 m above sea level, respectively. The highest water levels are recorded in May and the lowest in November-December. In general, the lakes' water level follows the peak of precipitation with a lag of about 3-4 months due to the snow-melting. The residence time of Prespa and Ohrid lakes are approximately 11 and 70 years, respectively. The general characteristics of both lakes are shown in Table 9.1.

Outflows from Ohrid Lake feed the Drin River which discharges into the Adriatic Sea. The lakes are very important wetlands, supported by Ramsar Convention, with significant biodiversity, included in the European Network of Protected Areas NATURA 2000. The water level trend of Prespa Lake during the period 2014-2019 is negative (decreasing) but not quite statistically significant (R^2=0.5). According to Institute of Hydrometeorology of Tirana during the period 1963-2002 the Prespa Lake water level is lowered 8.49 m.

Along the western side of the Galicica Mountain, numerous karst springs arise, recharging directly Lake Ohrid. The karstic features are the dominant genetic type of relief forms on Galicica Mountain, which is a typical karstic area. Relief karstic forms, such as numerous karst sinkholes and karstic dry flows, as well as karstic fields, are frequent. Land use includes arable land, pasture, forest and water lakes. The area used for cultivation lies mainly on the shoreline of the lakes.

Table 9.1. General characteristics of lakes Prespa and Ohrid.

	Parameters	**Prespa Lake**	**Ohrid Lake**
1	Surface area (km^2)	254	362.6
2	Mean Depth (m)	14	155
3	Maximum Depth (m)	54	288
4	Elevation (m a.s.l.)	846	693
5	Catchment area (km^2)	1300	2610
6	Water volume (km^3)	≈3	≈55
7	Slope of trendline of water levels’ time series	-0.001	+0.0002

Geology-Tectonics

Ohrid - Prespa Region is characterized by fairly complex geological - tectonic structures with rocks from the oldest Paleozoic formation to the youngest Quaternary’s sedimentary rock (Figure 3.1).

The Transboundary aquifer, in this study, from the geological point of view is represented mostly by karstic deposits of Upper Triassic–Lower Jurassic (T_3-J_1). This deposits continue normally above those of T_2 and are represented by pelagic deposits. Pelagic deposits are represented by carbonate–siliceous deposits and are considerably dispersed on the region.

Neritic deposits of Upper Triassic, which continue in the Lower Jurassic, are situated on the east side of Dry Mountain. These deposits are represented by thick layers up to massifs limestone, stromatous limestone and dolomites. The thickness of deposits of neritic facial is about 1,000–1,200 m (Vranai et al. 1997, Xhomo et al. 2002). Along neritic depositions described above are met pelagic deposits represented by intertwining of limestone with pelagic bivalve siliceous radiolarian, whose thickness ranges 50–100 m. These are met as in T_3-J_1 in bases of placement on deposits of T_2 and under deposits of Titonian–Lower Cretaceous (J_3t-Cr_1). These deposits are dispersed mostly on the eastern part of Ohrid Lake's shore and on the western part of the Big and Small Prespa lakes. On the western part of the Ohrid Lake these deposits are dispersed, but in smaller polygons

Ohrid Lake Basin, a graben structure, is located in the contact between Mirdita Ophiolitic Zone and Korabi Zone.

Prespa Lake Basin it is extended westward to Galichitsa and Dry Mountain and south – eastward to Rakicka highland and to peak Vejsovari (Greek border).

The study area is part of inner Alpine-folding area affected by extensional tectonics since Pliocene era. Some fault systems were delineated by some previous geological investigations (Meçe and Aliaj 2000, Melo et al. 2001, Temovski et al. 2016). The most important conclusion of this investigation concerning the tectonics is that, in the area of Prespa – Ohrid Region, the tectonic faulting is intensively developed and it seems that some tectonic faults nowadays continue to be very active (Figure 3.6). Significant tectonic occurrences are also the regional faults along the eastern and western edges of Galicica - Dry Mountain mountainious horst, generally extending in North-South direction. The most important regional fault of the western edge of Galicica- Dry Mountain is developed from Ohrid City in the north following to Saint Naum and Bilishti at the south. In the study area from Saint Naum Springs in the north to Tushemisht - Zagorchan in the south, some other very active faults create a relatively low elevation limestone zone (Melo et al. 2001).

This fault zone facilitates the groundwater flow movement to the springs of Saint Naum and Tushemisht. The intensive faulting is developed also in the eastern side of Galicica – Dry Mountain, along the western coast of Prespa Lake. A fault near Zaveri swallow hole is very clearly expressed where a natural limestone rocky wall falling vertically for more than 30 meters contacts the Prespa Lake.

Geophysics

Geophysical investigation was conducted by Electrical Resistivity Methods. In order to see the distribution of karstic zones in the region and the direction of water movement, 3 profiles were built in the south and southeastern part of Ohrid Lake. The scope to monitor and investigate the karst phenomenon developed in limestone, in this area was achieved. Furthermore, the possible connection with groundwater movement towards the springs emerged in the south and east southern part of the Ohrid Lake (the measurements were realized in two periods, in June and October 2016).

The resistivity measurements revealed high resistive values in the upper part of profiles and some lateral zones inside the limestone. Low resistivity values in the upper part are connected with the cover soils of clay content, whereas low resistive values are shown by lateral changes inside limestone, present the karst which can be filled with soils or mainly connected with water ways toward springs (Figures 4.5, 4.6 and 4.7).

As a conclusion; since the resistivity distribution doesn't change too much during both periods of measurements (June, October), most of the water quantity moving towards the springs in the area, throughout karst ways, is coming from Prespa Lake and from karstic water as well. What's important in this point; the underground waterways that emerge in the above mentioned springs were all year full of water. For this to happen a support is required, so, in this case the Prespa Lake helps as much as needed.

Hydrometeorology-Climate conditions

The study area is characterized by different climates, as is located in the transition region between Mediterranean and Continental zones. According to the Köppen climate classification, the climate is Csa indicating temperate, hot-summer Mediterranean climate. Based on data at Ohrid station, the average annual air temperature is 11.85^{o}C. From the climatic data of the last 10 years in the study area, was noted an increase of the mean annual temperatures over the years.

The annual rainfall of the region mentioned above ranges between 350 mm and 680 mm. The annual course of rainfall shows a downward trend, but not statistically significant. It is revealed that in five events 24-h duration, the rainfall height was greater than 40 mm rainfall. The snowfall occurs during the months of January, February March, and December; with a maximum value in January. According to the results of the Thornthwaite method, the average annual real evapotranspiration is equal to 67.6% of annual rainfall for the period 2008-2019. The mean annual value of Ohrid lake evaporation is 99.6 cm. The rainfall has a decrease in distinct values, meanwhile for the evaporation and the temperature was noticed an increase in the values during recent years. Water surplus and natural groundwater recharge is recorded during the period January-March and November-December.

Hydrogeology

The main aquifer systems are developed within alluvial deposits close to lakeshore and carbonate karstified rocks.

Alluvial aquifers:

The recharge of alluvial aquifers occurs by direct infiltration of atmospheric precipitation; the coefficient of infiltration is about 15% of the annual precipitation. Except of direct infiltration of rainfall, these aquifers are recharged by stream-beds infiltration and/or lateral inflows from mountainous areas. The average hydraulic conductivity varies 2.5×10^{-3} m/s. The groundwaters are in general fresh and low hardness. The groundwater reserves are big and can be exploted by wells. The yield of wells varies from 10 to over 100 L/s.

Karst aquifers:

They have in general high permeability and are represented by stratified and fissured limestones of Upper Cretaceous (Cr_2), karstified and fissured limestones and dolomites of Upper Jurassic – Lower Jurassic, of Middle Triassic – Lower Jurassic. The total surface of the karstic area is 941 km^2; within this area several important aquifers are developed, discharging via many springs with variable yield.

The karstification reaches to a depth of 500 m, and at greater depths the limestones are not karstified. The karst aquifers show high anisotropy and heterogeneity. The hydrogeological behavior of the transboundary karst aquifer is controlled by tectonic deformation, which favors infiltration of meteoric water. The karstic rocks appear a mixed porosity; the porosity of the rock blocks (matrix porosity), porosity of small and larger cracks, porosity of big faults and caverns and porosity of clastic material filling all rock discontinuities. The impermeable strata (schists, ophiolites, etc.) separate the karstic mass into independent aquifer systems, by different underground water divides. The average useful infiltration coefficient in the karstic zones is about 45% – 65% of the annual precipitation. According to pumping-test data from boreholes drilled in the Greek territory, the transmissivity value is approximately $5x10^{-2}$ m^2/s, hydraulic conductivity $2.5x10^{-3}$ m/s, and the storativity equal to 2%.

The most important is the transboundary aquifer which is developed in karstified carbonate rocks (Triassic massive limestone) between Prepsa and Ohrid Lake. The transboundary aquifer is a complex karst system which functions primarily as a hydrocollector and hydroconductor, affecting the water balance of the lakes. The general characteristics of this aquifer are shown in Table 9.2.

Table 9.2. General characteristics of the transboundary karst aquifer.

	Transboundary karst aquifer
Surface area (km^2)	606.8
Mean value of elevation (m a.s.l.)	1326
Mean annual precipitation (mm)	1003
Recharge volume by infiltration of precipitation ($x10^6$ m^3 or Mio m^3)	298.2
Volume of total outflows from Prespa Lake to Ohrid Lake via underground karst channels ($x10^6$ m^3)	236-315
Annual discharge of main springs St. Naum and Tushemisht ($x10^6$ m^3)	255-320

Hydrochemistry

According to the results of water (lake- and spring-water) chemical analyses the following can be drawn: The pH values range between 6.8 and 8.3 showing a slightly alkaline type. Fresh groundwater, not affected by pollution, contains $Ca^{2+}>Mg^{2+}>Na^{+}>K^{+}$ and $HCO_3^{-}> SO_4^{2-}>Cl^{-}>NO_3^{-}$. The mineralization of water of Ohrid Lake has a range from 200–250 mg/L.

According to Piper and Schoeller diagrams, the Ca-Mg-HCO_3 water type is the dominant type in karstic springs, representing freshwater of recent infiltration meteoric water. According to the chemical content, Ohrid Lake is of the calcium bicarbonate class and the main ions are placed according to this order: anions: $HCO_3^{-}> Cl^{-}> SO_4^{2}$, cations: $Ca^{+2} > Mg^{+2} > Na^{+} > K^{+}$

Nitrate ion in the study area ranges from 0.9 to 13.4 mg/l with an average of 6.9 mg/l; the highest NO_3 concentration levels were found in Perrenjas Spring (May) and Gurras Spring (September).

The application of statistical factor analysis showed that three factors explain than 75% of the total variance of the database. The most important Factor I, accounting for 35.6% of the total variance, has high loading (>0.70) in the parameters Ca, TDS, EC and HCO_3. The presence of ions Ca and HCO_3 can be associated with the lithology and the karstic dissolution that takes place in the wider area. Cluster analysis simplifies and clarify the similarities between two the mentioned lakes Ohrid and Prespa.

The δ^2H value of the water samples ranges from – 69.67 ‰ to – 19.4 ‰ and δ^{18}O values range from - 10.53 ‰ to - 1.31 ‰, with an average of - 44.53 ‰ and - 5.92 ‰ respectively. The conventional δ^2D versus δ^{18}O diagram shows that the water samples data plot mostly to the right of the Global Meteoric Water Line, defining a single trend with a slope of 5.3. Based on the results of the stable isotopes analysis the Saint Naum Spring, Biljana Spring, Lubanisht Spring, Border spring, Gurras Spring and Ohrid Lake surfaces have approximate values of δ^{18}O and δ^2H.

Groundwater management

Evaluation of indicators, proposed by UNESCO (2016), concerning the transboundary karst aquifer, has shown the following:

- Very high recharge by infiltration of atmospheric precipitation.
- Vulnerable to climate changes, as well as to external pollution due to human activities.
- Existence of many karst springs discharging the aquifer.
- The transboundary karstic aquifer operates as a hydro-collector and hydro-conductor; it affects and is affected by the lakes' water balance.
- Groundwater as spring-water is very important for domestic and agricultural uses.
- No significant pollution has been reported.
- Agriculture, livestock and tourism development are the main driving forces of the area.
- Groundwater development stress is relatively low.
- Transboundary legal framework and institutional framework do not exist.

SWOT approach is used to analyze the information from an organizational analysis and classify it into internal (strengths and weaknesses) and external environment (opportunities and threats). Table 9.3 shows the results of this approach.

The main strength is the availability of spring-waters, especially during the wet period. The weaknesses are the inadequate cooperation between involved countries (Greece, Albania, North Macedonia), the increased water demands for agricultural use, Lack of monitoring data (quality data, discharge of springs, rain-gauges stations at higher altitudes, snow-fall measurements, etc.), and the lack of municipal sewage treatment systems.

The rational and sustainable management of the transboundary aquifer requires the necessity of mutual cooperation between all involved countries. For this purpose, data (hydrogeological, climatic and water quality data, land uses, water demands for different uses, groundwater abstractions, pollution sources, etc.) of the transboundary aquifer system should be collected and evaluated. Also a monitoring program of water quality and quantity should be established in order to avoid pollution and depletion phenomena. The construction of sanitary landfills and waste-water treatment plants, as well as the delineation of protection zones around the springs, will contribute to water quality protection. The application of water saving techniques (sprays and drip irrigation) will reduce water needs. The networking should be improved as well as the information exchange and cooperation activities. Furthermore, common databases should be created among the different water institutions and Universities of the three countries (Greece, Albania, North Macedonia).

Table 9.3. SWOT analysis for groundwater in transboundary aquifer.

Strengths - Availability of spring-waters - Good water quality status - Existence of many hydrogeological and ecological preliminary studies - Natural resources for utilization and further development of the area	**Weaknesses** - Inadequate cooperation between involved countries - Increased water demands for agricultural use - Lack of monitoring data (quality data, discharge of springs, rain-gauges stations at higher altitudes, snow-fall measurements, etc.) - Lack of municipal sewage treatment systems - Insufficient practices for water efficiency
Opportunities - EU Directive and Convention - Possibilities for touristic development - Financial assistance from EU and/or other Organizations (e.g. UNESCO)	**Threats** - Climate crisis - Water level decline of lakes due to human activities and water quality degradation - Administration problems - Increase of population and water needs

9.2 DISCUSSION

Hydraulic connection between Prespa and Ohrid Lake via karstic channels

Cvijić firstly formulated in 1906 the hypothesis that Prespa Lake recharges St. Naum and Tushemisht springs at Ohrid lakeside. Hydraulic connection that exists between the two lakes has been confirmed by earlier studies (Eftimi and Zoto 1997, Melo et al. 2001, Anovski et al. 1992, Popov et al. 2009). The amount of water flowing from Prespa Lake toward Ohrid Lake is unknown and very difficult to be calculated.

Based on hydrological balance and isotope analyses, the calculations of groundwater outflows through the karst aquifer vary widely and a value between $236x10^6$-$315x10^6$ m^3/yr (results from all previous studies) is considered as the total outflow from Prespa Lake to Ohrid Lake via underground karst channels.

In addition, beside well-known springs that emerge on the surface, there are also underground waterways passing through the highly developed karstic mountain (Dry Mountain for the Albanian part and Galicica Mountain for the North Macedonian part). What led to the necessity of detailed hydrogeological studies, along with other science studies, it was the significant decrease of water level in the Prespa Lake. This decrease had its maximum in 2008, about 8 m, based on the data of Albanian Hydrometeorological Institute, Prof. Dr. Molnar Kolaneci (Popov et al. 2009). A previous hydrogeological study suggests that this decline is due to climate change and/or abstraction for irrigation use (Kiri et al. 2011).

In order to have a clear overview of the different zones with different permeability was described the geological construction of the transboundary aquifer system Ohrid - Prespa watershed, proceeding with detailed hydrogeological interpretation. The description of the hydrogeological complexes shows a complicated region. The geology, hydrogeology, hydrographic network, tectonics, etc., of the region are presented clearly in the hydrogeological map built at scale 1: 50,000 in the GIS program (Appendix A plus general hydrogeological database in Appendix B). The polygon itself represents a certain geological age with the relevant deposits. Also, chemical data of water samples taken at different points all over the region have been attached to the above mentioned map. The geophysical profiles constructed for this study are attached to the map as well.

On other scope of this research was to investigate the groundwater movement from Prespa Lake toward Ohrid Lake based on hydrochemistry study. By using Stiff diagrams were compared the water samples chemistry taken throughout the study area. Data used for this purpose are obtained in two periods (dry and wet period) of a hydrological year, for two years, 2016 and 2017 (Table 7.8, 7.9, 7.10 and 7.11).

The lakes' water comparison as well as the comparison of region's water was made with the purpose to give a possible conclusion according to the hydrogeological interpretation of the water movement and the feeding areas of the springs under investigation. The results expressed on the diagrams were compared between them, so one may have a clear vision of the water chemistry in the whole region, and to observe the similarities and differences that may or may not exist.

Data used in purpose comes from different periods: 1979, 2005 (from previous study) and 2016, 2017 observed by the author. What one can aim to achieve by analyzing the water chemistry is to find a possible similarity between the water of the Prespa Lake to that of Ohrid Lake.

It is important to highlight whether this hydraulic link has changed, and if so, how much has it changed. Have these changes in the hydraulic link had an effect in the decrease of the water level in the Prespa Lake?

The analysis of the waters in the region helped in understanding the flow of these waters, as well as, with the creation of a valid hypothesis on the reason why the water level of Prespa Lake has been decreasing. After Kiri (2011), referring to the results of the analysis, for 1979 and 2005, during the dry seasons, there is a logic explanation in regard to these changes. The decrease of the water level of Prespa Lake may suggest changes in underground inflow from Prespa to Ohrid: there maybe exist more flows now than in the previous years. More similarities in the water chemistry of both lakes support this hypothesis.

The Prespa Lake is situated 153 m above the Ohrid Lake and, due to a good hydraulic connection it is a great supplier to the Ohrid Lake. In addition, the water level of the Prespa Lake is decreasing while that of Ohrid Lake remains constant. By observing this phenomenon, one can conclude that the real loss of water might be happening in the Ohrid Lake Region as well as in Prespa Lake Region.

For wet period of 2016, all the springs' diagrams appear similar with each other thanks to the rainfall that is the main water supply for them during this period. On the other hand, the other diagrams that represent the samples of the lakes (Ohrid and Prespa) have no similarities between them. For September 2016, similarities were noticed between diagrams of Prespa Lake with springs under investigation. In addition, they are similarities even between Perrenjas Spring and Ohrid Lake surface water samples.

For 2017, water samples have been carried out in the springs that are supposed to have the Prespa Lake as a water supply during the dry period of the year. By observing the visual similarities (Figure 7.7) between the diagrams for 2017 (wet period), the Gurras Spring's diagram appears similar with that of Lubanisht Spring's, all this thanks to karstic water supply for both of them. Perrenjas Spring's diagram shows more similarity with the diagram that represent the mixed of Ohrid Lake and Lubanisht Spring's water samples. The explanation based on the possibility is that the main water supply of this spring is the karstic water but still a quantity of water comes from Ohrid Lake. Both diagrams of the samples taken in Prespa Lake have similarities with that of Saint Naum spring's (this shows the lack of water supply from karstic water and the needed support from Prespa Lake). Meanwhile the diagram that represents the Tushemisht Spring, not so far from the Saint Naum Spring (same conditions), is similar to that of Biljana Spring's (this spring during the dry period of year has a quantity of water less than 10% of the quantity in the wet period of year, so the main water supply here appears to be the meteoric precipitation).

Still, changes can be noticed in the hydrodynamic phenomenon in this area. For more, the diagrams of the Saint Naum Spring's and the Border Springs have more similarities with the diagram that represents the mixture between Prespa Lake and Aftokam Lubanisht Spring. So, even the springs on the border have as a water supply the karstic plus Prespa Lake's water during the wet period. As a result, depending on the rainfall, Prespa Lake's water plays a significant role for these springs even during the wet period of the year. By observing the diagrams, the presence of the Prespa Lake water in some of the springs was distinguished but not evenly. In this case one can say that the water supply coming from karstic water during the wet period of the year was not sufficient.

During the dry period for 2017, the diagrams that represent; Border Spring, Saint Naum Spring, Tushemisht Spring, Gurras Spring and Bilijana Spring have similarities with the diagram that represent water mixed of the Prespa Lake with that of the Korita Spring's (Korita Spring is positioned in Galicica Mountain at level 1421 m a.s.l. in this way excluding Prespa Lake as a feeding area). In this period of time the maximum water amount comes from Prespa Lake toward Ohrid Lake. This means that the water supply for the springs mentioned above comes not only from the Prespa Lake but from the rainfall as well. *During this period of year appeared to have karstic water reserves. These reserves were mixed with the water that comes from Prespa Lake toward Ohrid Lake feeding the springs mentioned above.*

As a conclusion, from the Stiff diagrams comparisons through the years one can conclude that from one year to the other, for all years taken into account in this material, the results are not the same. So, there are different presentations of diagrams for different years, and of course there are different points in the study area for different years were similarities took place. These types of analyses helped in understanding the water movement (hydrodynamics) in the area which appears to be very developed and unpredicted.

By observing cluster analysis in the study area, a clear vision of similarities between samples was detected based on the water quality. These statistical analyses simplify and clarify the similarities between Ohrid and Prespa lakes water. Using Stiff diagrams different points in different depths of the Ohrid Lake shows visual similarities with those of Prespa Lake (cluster analysis support this conclusion).
Stiff diagram method draws a general conclusion regarding all the samples collected in the study area during two hydrologic years. The water chemical similarities between Ohrid Lake and Prespa Lake are incontestable. The same can be told for the springs in the area, they have water chemical similarities between each-other.

In order to support the idea of the water supply's origin in this region, the stable isotopes study (δD and $\delta^{18}O$) were added. Isotopic δD and $\delta^{18}O$: One of the main application fields of stable isotope abundance is concerned with the origin and mixing of groundwater and of its dissolved natural and anthropogenic constituents (Mebus et al. 2000). Groundwater is usually a mixture of two or more genetically and chemically distinct groundwater components, often of different ages. Isotopic combined with hydrochemical analyses allow to distinguish between different kinds of groundwater and often to set up a mixing balance (Mebus et al. 2000).

The Ohrid Lake samples have approximate values with each other. The same thing one can say even for the samples taken in the Prespa Lake. Even the springs around the study area have approximate values with each other. But, mixed values of the Prespa Lake samples with those of the spring, that has a feeding area only the karstic water, have approximate values with the other springs taking under investigation. The conventional δ D versus $\delta^{18}O$ diagram shows that the water samples data plot mostly to the right of the Global Meteoric Water Line, defining a single trend with a slope of 5.3. According to (Chantzi & Almpanakis 2020) Ohrid Lake presents $\delta D/\delta^{18}O$ ratio about 5.2, while Prespa lakes system present $\delta D/\delta^{18}O$ ratio about 4.95 reflecting a more intensive evaporation effect.

The Figure 7.20 represents, in a simple graphic, all the values mentioned above distributed by the stations where the water sample was taken. Looking at them was noticed that springs have an approximate value with the mixed values of the Prespa Lake samples and those of the springs that have a feeding area only from rainfall.

The same conclusion comes even from the study of the Stiff diagrams. The feeding zone of the springs in the study area is a mixture of two genetically and chemically distinct water components; Prespa Lake and reserves of karstic water that comes from Dry Mountain (Albanian part) and Galicica Mountain (North Macedonian part).

There are changes in water chemical structure between the surface and depth of Ohrid Lake, meanwhile the Prespa Lake has a mixture of waters (Loffler et al. 1998), and it has a constant structure of water in its entirety. The previous study (Kiri et al. 2011) shows that in certain pockets in the depths of Ohrid Lake there are similarities in water chemistry, during the dry period of the year, to that of Prespa Lake for 2005. For 2016, the comparison between Stiff diagrams built based on water's chemistry (in the same pockets as in 2005 mention above) for both Ohrid and Prespa lakes show less similarities between water samples during the dry period of the year. In conclusion: during different years, different hydraulic exchanges are possible during dry and wet period of a hydrologic year. Referring to Stiff diagrams it is possible that there is bigger inflow coming from Prespa Lake towards Ohrid Lake not only during the dry period but, during the whole hydrologic year. Knowledge of geochemical processes often leads to an understanding of the groundwater quality and can occasionally result in making useful predictions (Tizro and Voudouris 2007).

Climate change can be viewed as a dynamic system of atmospheric processes (Kolokytha 2010). Weather getting warmer has definitely its negative impact in this study area. Logically there is more evaporation because of higher temperatures, especially in an open water surface (the lakes in this study). So, the input for both lakes is decreased and on the other hand the output is increased. As mentioned, Prespa Lake is situated at 153 m above the Ohrid Lake and due to a good hydraulic communication it is a great water supplier for Ohrid Region. Prespa Lake will supply with enough water quantity this lake beside all mentioned even the increased output of Ohrid Lake that comes from the higher values of evaporation. Furthermore, the reduction of atmospheric precipitation (rain, snow) and the increase of evapotranspiration will result in the reduction of the natural recharge (mainly infiltration) of the aquifer and the discharge of karstic springs. The hydro-dynamism of the study area is depending on the climatic conditions' changes.

Based on geophysical and hydrochemical investigation of the transboundary aquifer system Prespa – Ohrid watershed, the hydrodynamic study appears very complicated. Taking into account that the internal structure of a karst aquifer may only be partially known, the main hydraulic aspects are usually deduced from springs. Systematic records of spring discharges allow for a definition of the spring regime.

9.3 FUTURE WORK SUGGESTED

It is important to calculate the water balance of the Prespa – Ohrid watershed, by collecting data from three countries. So, collaboration between; Albania – Greece – North Macedonia is essential. Other studies must take place in this area in order to have a clear idea how to protect this huge and beautiful park, from the negative impact of anthropogenic factors. The climate change has its own negative impact in this zone. Taking into account the higher water quantity evaporation on the open surface water, Ohrid and Prespa Lakes, it is important to calculate the water reserves of the area.

Besides, what was mentioned above is important to take in consideration the water chemistry analyses (rain, lakes and groundwater) in order to have a clear panorama of water hydrodynamics' in this karstic region, which appears to be always in movement.

In addition, the results of future research would be benefited by simulation of the water cycle in the study area using more detailed data, e.g. hydrological and meteorological (snow- and rainfall in mountainous area, water demands in different uses, discharge of numerous springs, etc.). Finally, the coupling of climate with precipitation-infiltration models could ameliorate the accuracy of the simulation of springs' discharge under climate changes.

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In order to complete the Ohrid-Prespa Watershed, Topographic maps, scale 1:50 00, for North Macedonia part are taken:
http://www.lib.utexas.edu/maps/topo/former_yugoslavia/ and
http://maps.vlasenko.net/soviet-military-topographic-map/map50k.html

https://www.meteoblue.com/en/weather/archive/era5/ohrid_north-macedonia_787487

(https://search.earthdata.nasa.gov/search?q=GLDAS_NOA).

UNESCO/INWEB internet site (www.inweb.gr,

(https://www.lenntech.com/periodic/water/calcium/calcium-and-water.htm).

https://wwwrcamnl.wr.usgs.gov/isoig/period/o_iig.html

APPENDIX – A

(Preparation of the Map - AutoCAD and GIS Program)

The Geographic Information System (GIS) Program

This program is useful in different disciplines, in our case it represent the hydrogeology of the area. Various forms of spatial-temporal data can be stored in GIS databases, and a plethora of software tools allows scientists to effectively study those patterns and their relationships. The inherent digital and quantitative nature of modern-day analysis should be carefully examined with respect to GIS-based empiricism and the ability to produce repeatable results (Texas A&M University, USA 2013).

About hydrogeology this program has been used even before from the author of this work. The representation of the hydrogeology of the region Prespa Lake in GIS program appears to be very practice for this science.

GIS can be used to analyze, make decisions, and emerge geographic information. In essence, GIS are computerized information systems composed of hardware and software (Sheppard et al. 2004). One can see an increasing use of GIS program in the management of geographic regions and gained acceptance from engineers and scientists in Albania (Keenan et al. 2001). Maps have been a useful tool. Geographically referenced data are a crucial and they represent exactly the right thing in the right place. The spatial information from maps may help communicating results of analysis (Benedikt et al. 2002). According to Ranger (2002), one can discusses how to use GIS in order to plot changes over time and make appropriate conclusions based on the gathered data. Developments in hardware and software have made it possible to link maps and database information making in this way to look at this information in a different light. Arc View is a software package that can store information about points, lines, polygons and the spatial relations between them (Barraud et al. 2005).

The GIS stores two kinds of information: geographic coordinate data, or spatial data, and attribute data (Cox and Gifford 1997). The importance of a GIS lies in its ability to create new data by manipulating the existing ones and therefore bringing to light information that was not previously evident. Recently revisited GIS packages are improved and can be found on mainstream platforms, such as Windows (Traybor et al. 2001). According to Schetselaar (1995), Geographic Information Systems (GIS) and Computer-Aided Design systems (CAD) may be used to store, manage and visually represent geologic data. A GIS allows the researcher to associate each grain with various attributes, such as: phase name, position, size, aspect ratio, orientation and convexity (Barraud et al. 2005).

GIS offers powerful techniques to visualize, manipulate, and analyze spatial data (Schetselaar et al. 1995, Clapp et al. 1997, Parkhurst et al. 1980). GIS is a powerful and useful program and its usage will increase over time (Kiri et al. 2011).

By Cox and Gifford 1997, the presentation of points, lines and areas is how spatial data is presented on maps and how the data is usually stored in the computer environment of a GIS program.

This program can standardize and store data, analyzing this data and the relationship between them in order to create information and to display all these data in the map. All the features that represent spatial data have known locations on the earth. There are three deferent tips of spatial data that can be defined as one in a map; points (no dimension), lines (one dimension), and areas (two dimensions) (Cox and Gifford 1997).

The GIS program has been used even before from the author to construct a hydrogeologic map (Figure A.1), Prespa Region Map (Kiri et al. 2011). The hydrogeologic map (Prespa Lake Region) in scale 1:50,000 were taken from the archive of Albanian Geological Survey. It was processed in GIS program, where data is added according to map's profile. The work will be explained that was completed on setting and adapting this map to the requested. According to Kiri (2011), the database of this map has been explained in two parts, since the first one was for the hydrogeologic aspect, in which all the existing data has been included. In the second part, the map was enriched with chemical data of the region. The existing hydrogeologic map (Prespa region) is extended with the other part of study area (Ohrid Region). All the topographic maps of the study area are collected (Figure A.2, A.3, A.4, A.5, A.6, A.7, A.8), and after are digitized.

The digitalization of the curriculum mapping (hydrogeologic map scale 1:50,000) was done in AutoCAD 2015 (Figure A.9), and later relocated to the GIS program.

In addition have been completed the attribute table of polygons such as hydrogeology (hydrogeologic classification), which defines the ranges of hydrogeological data (Appendix A) in ArcMap.

By observing the attribute table of the ranges one can obtain a clear picture of all hydrogeological data in the Ohrid – Prespa's Region. In this map each polygon explain the water deposits, which itself represents a particular geological age and that age is represented by the respective deposits.

A complete hydrogeologic map of Ohrid - Prespa's area is now available.

By means of this program one can input all the data about the region. Also, one can add and change data according to the presented needs or upon bases of further studies of the region in question.

Building the map involved substantial amount of work, however, it will not be needed to construct another map of this kind. As it was mentioned earlier the possibility exists that new data can be added, corrected, or replaced without removing the existing ones.

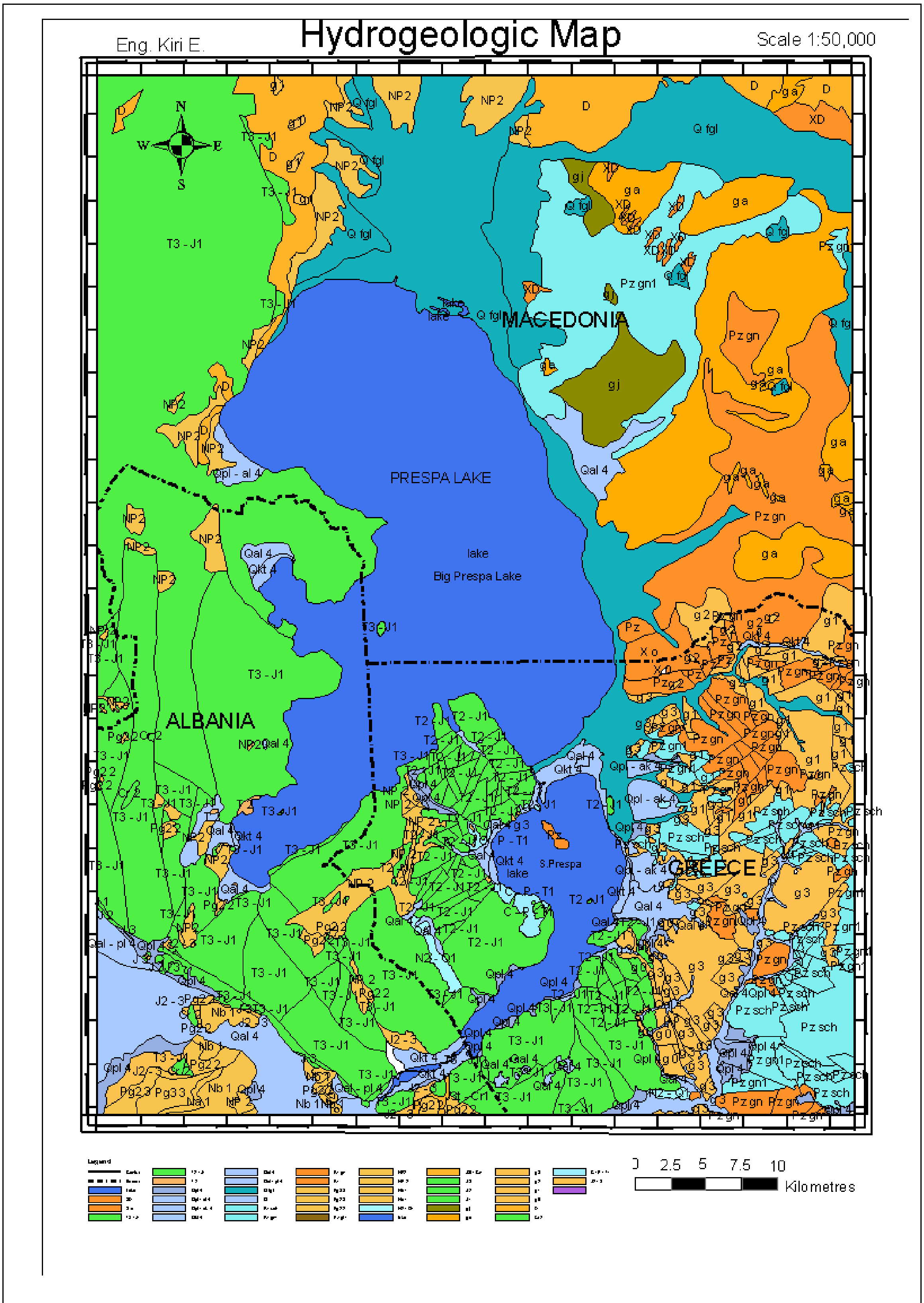


Figure A.1. Hydrogeologic Map in GIS program; Prespa Lake Region (Kiri et al. 2011).

Survey and the other part of the Ohrid-Prespa region are taken:
http://www.lib.utexas.edu/maps/topo/former_yugoslavia/&http://maps.vlasenko.net/soviet-military-topographic-map/map50k.html.

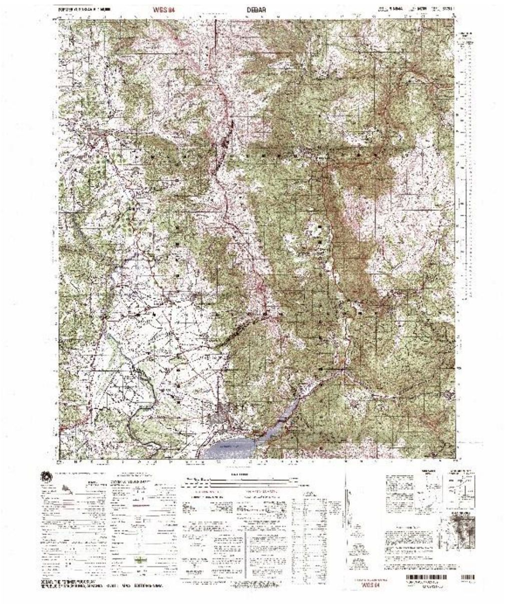
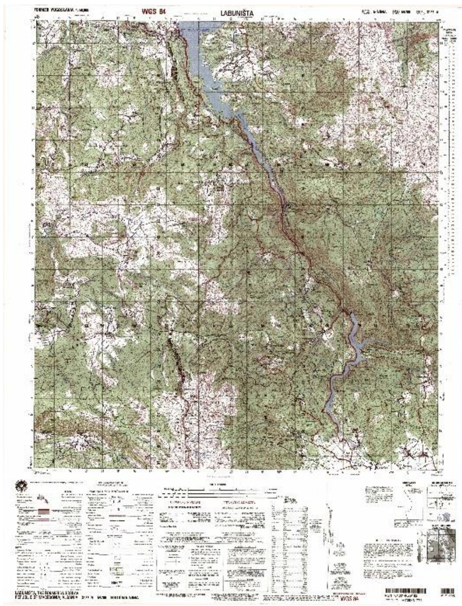



Figure A.2. & A. 3. Topographic maps of Ohrid Region in N.M. side (scale 1:50.000, 1998)
http://maps.vlasenko.net/soviet-military-topographic-map/map50k.html.

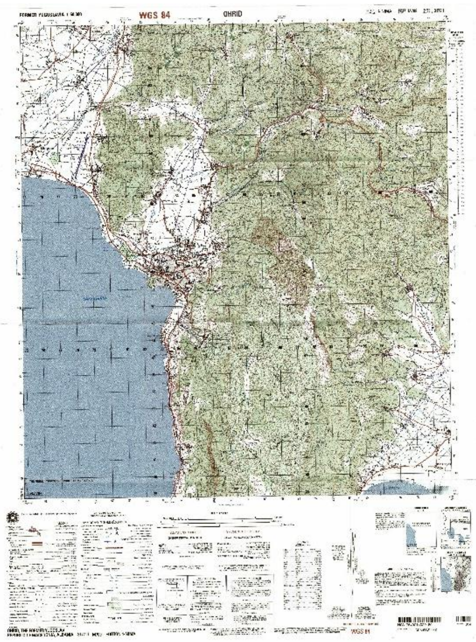


Figure A.4. Part of the Ohrid – Prespa Region in N.M. (scale 1:50.000, 1994)

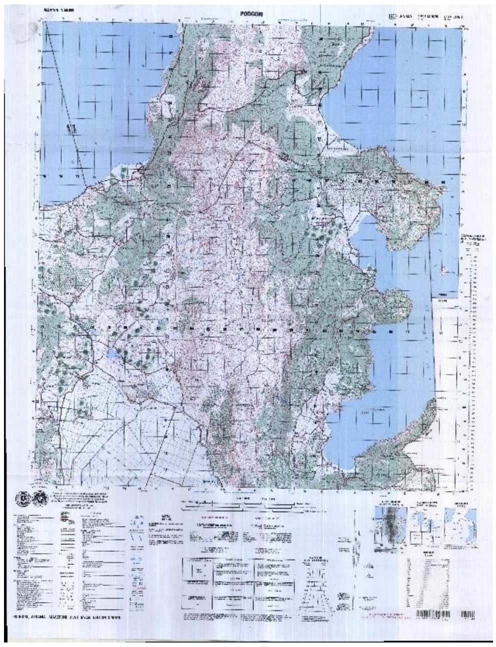


Figure A.5. Part of the Ohrid Prespa Region in Albania (scale 1:50.000, 1999)
http://maps.vlasenko.net/soviet-military-topographic-map/map50k.html.

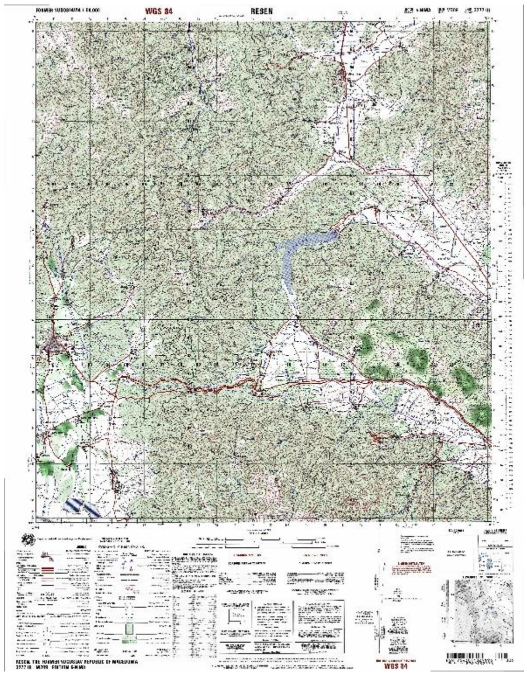
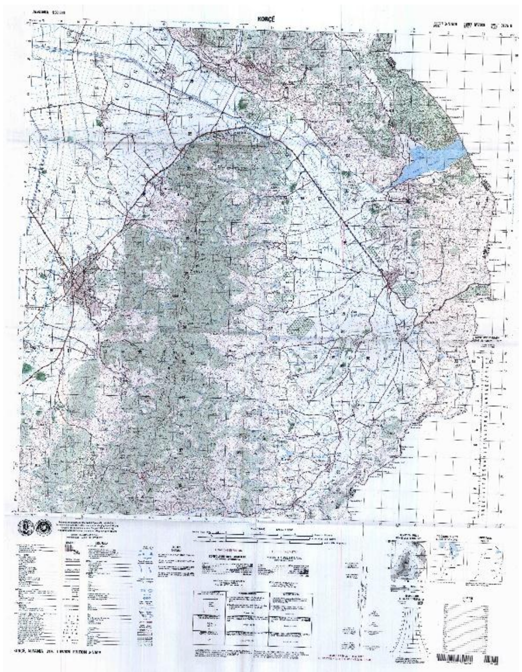


Figure A.6. Part of the Ohrid – Prespa Region in Albanian part (scale 1:50.000, 1994)

Figure A.7. Part of the Ohrid – Prespa Region in N.M. part (scale 1:50.000, 1994)



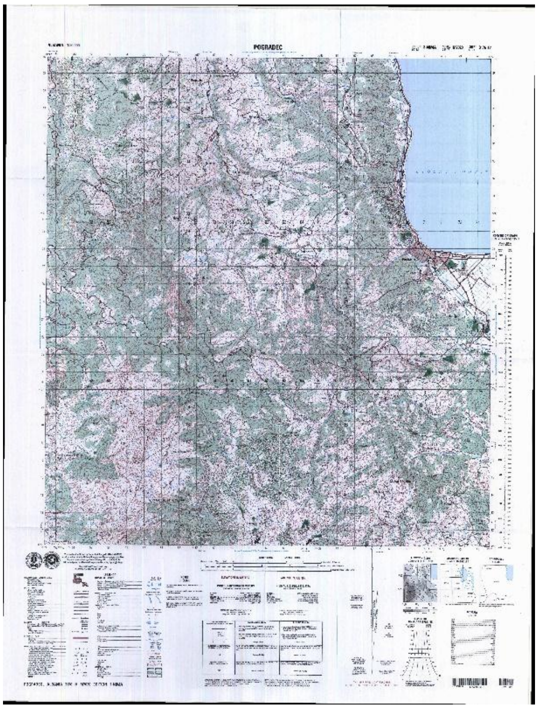


Figure A.8. Part of the Ohrid – Prespa Region in Albania side (scale 1:50.000, 1999)

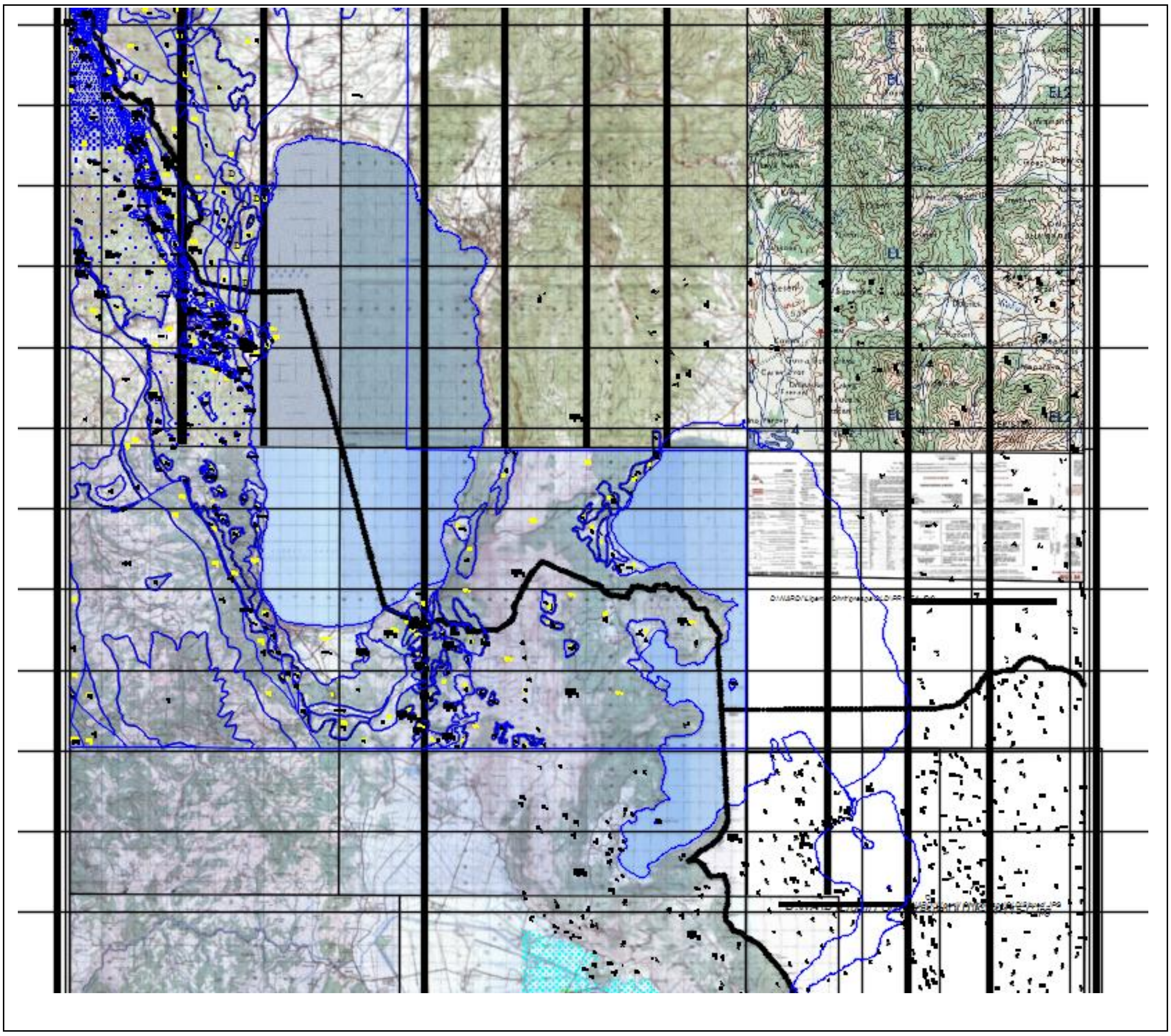


Figure A.9. Ohrid – Prespa Region (images linked in AutoCAD program)

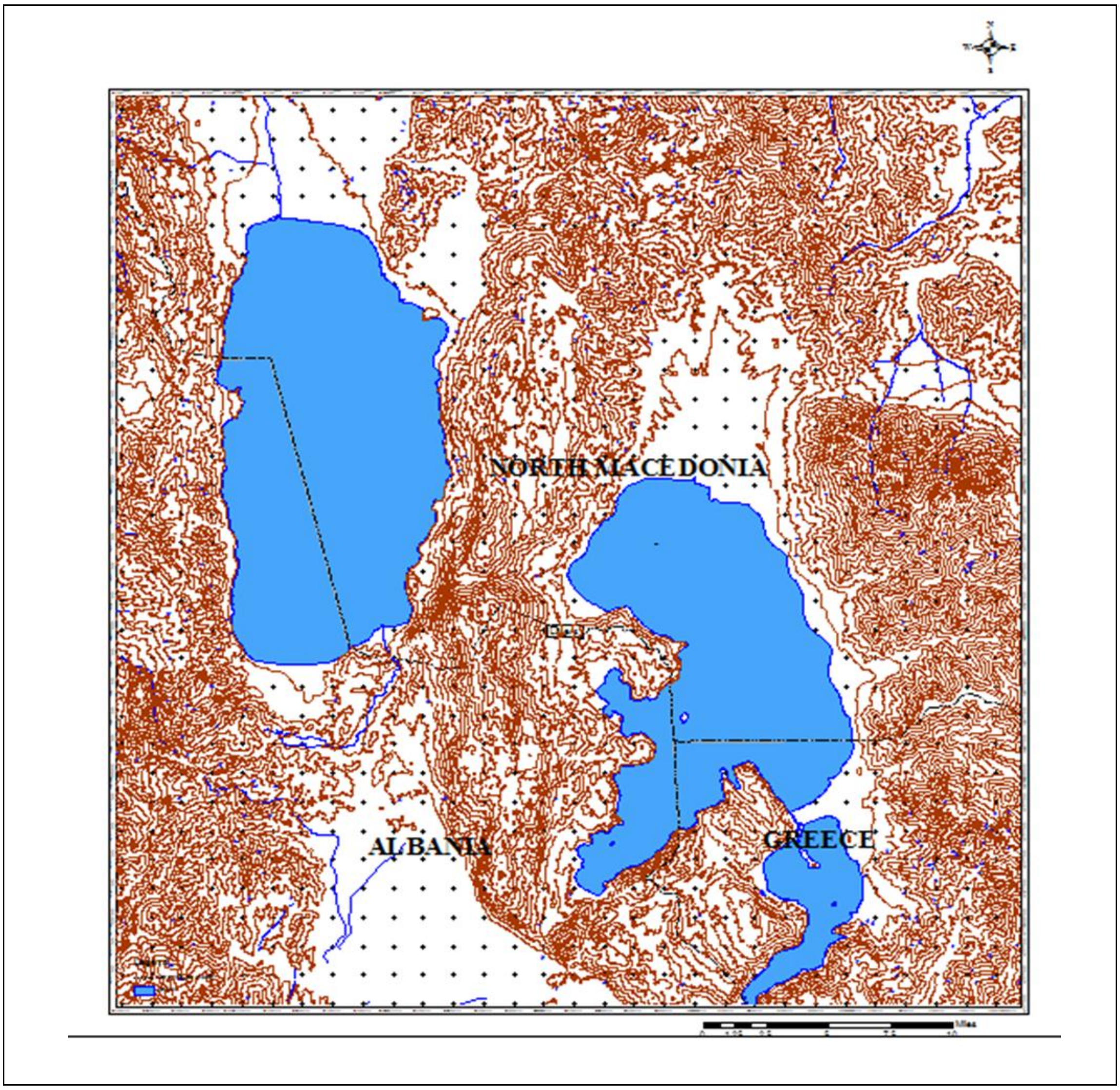


Figure A.10. Topographic Map of Ohrid – Prespa Region (scale 1:50 000).

The database included in the map has been explained in three parts, the first one is for the hydrogeology, in which the general hydrogeological data existing in the whole region has been included. The second part is the database of the geophysics field work. In the third part, the map is enriched with chemical data of the region Ohrid-Prespa.

The Geographic Information System (GIS) technology is a critical methodology to represent, manage, and to better understand the earth as a system.

A GIS program is used for the management, analysis, and display series of information data.

In this program all the collections of geographic objects are organized into a series of data themes, or layers, that cover a given map, for example: roads, rivers, place names, buildings, parcels, political boundaries, surface elevation, and satellite imagery (Benedikt et al. 2002).

ArcMap is the main application in the ArcGIS program and is used for map-based studies and analysis (Figure 7.16, 7.17, 7.18, 7.19). It can be used for all mapping and editing as well chemical database and geophysics (Figure 7.19, 7.20, 7.21 and 7.22).

By this application are represented the layers and other elements on the map. The most common map elements for a given area (Figure 7.1, 7.10, 7.11, 7.12, 7.13, 7.15, 7.23) are the map layers, scale bar, north arrow, title, and of course a legend symbol (Ranger et al. 2002).

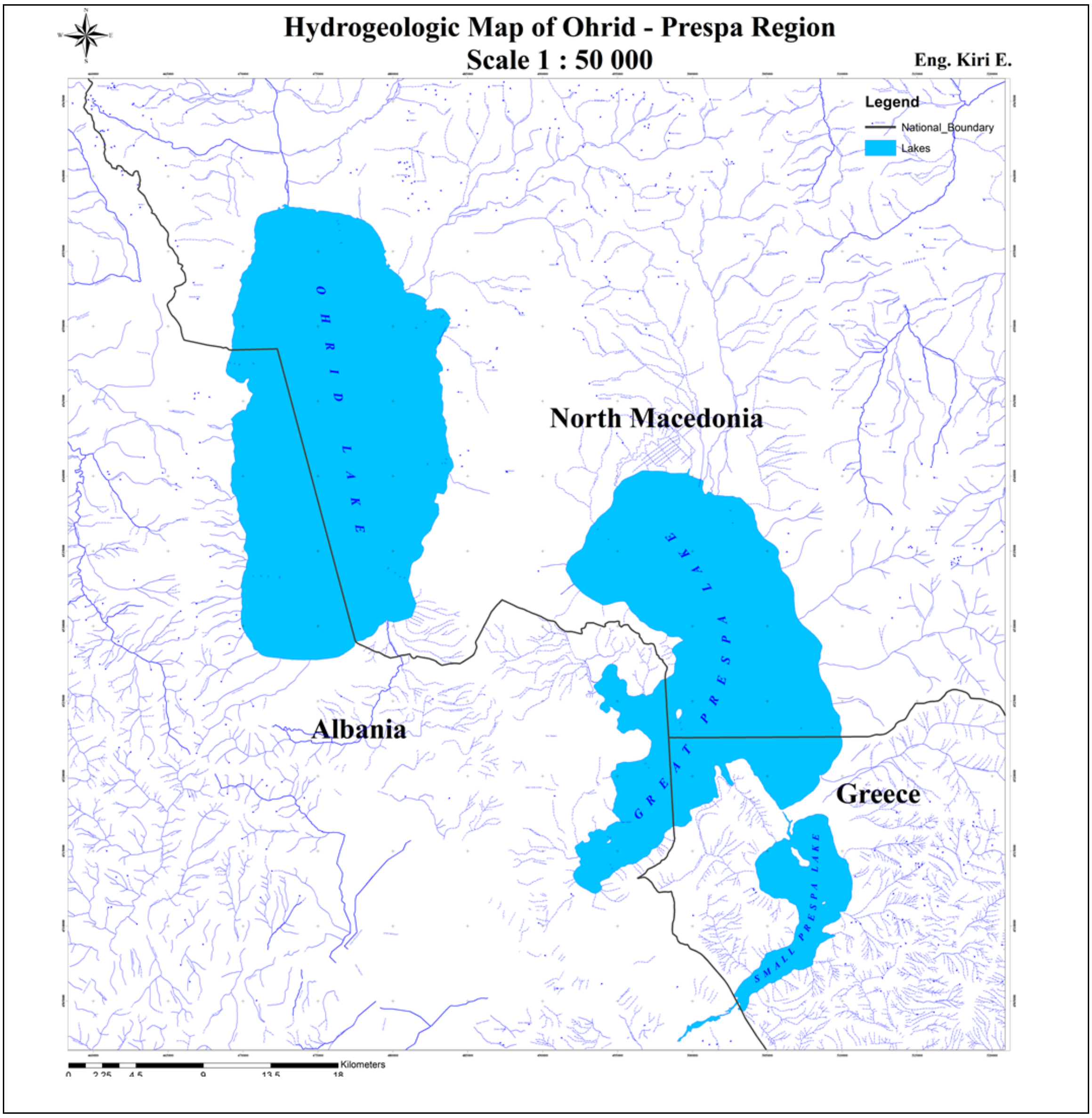


Figure A.11. Hydrographic net of Ohrid – Prespa Region (scale 1:50, 000).

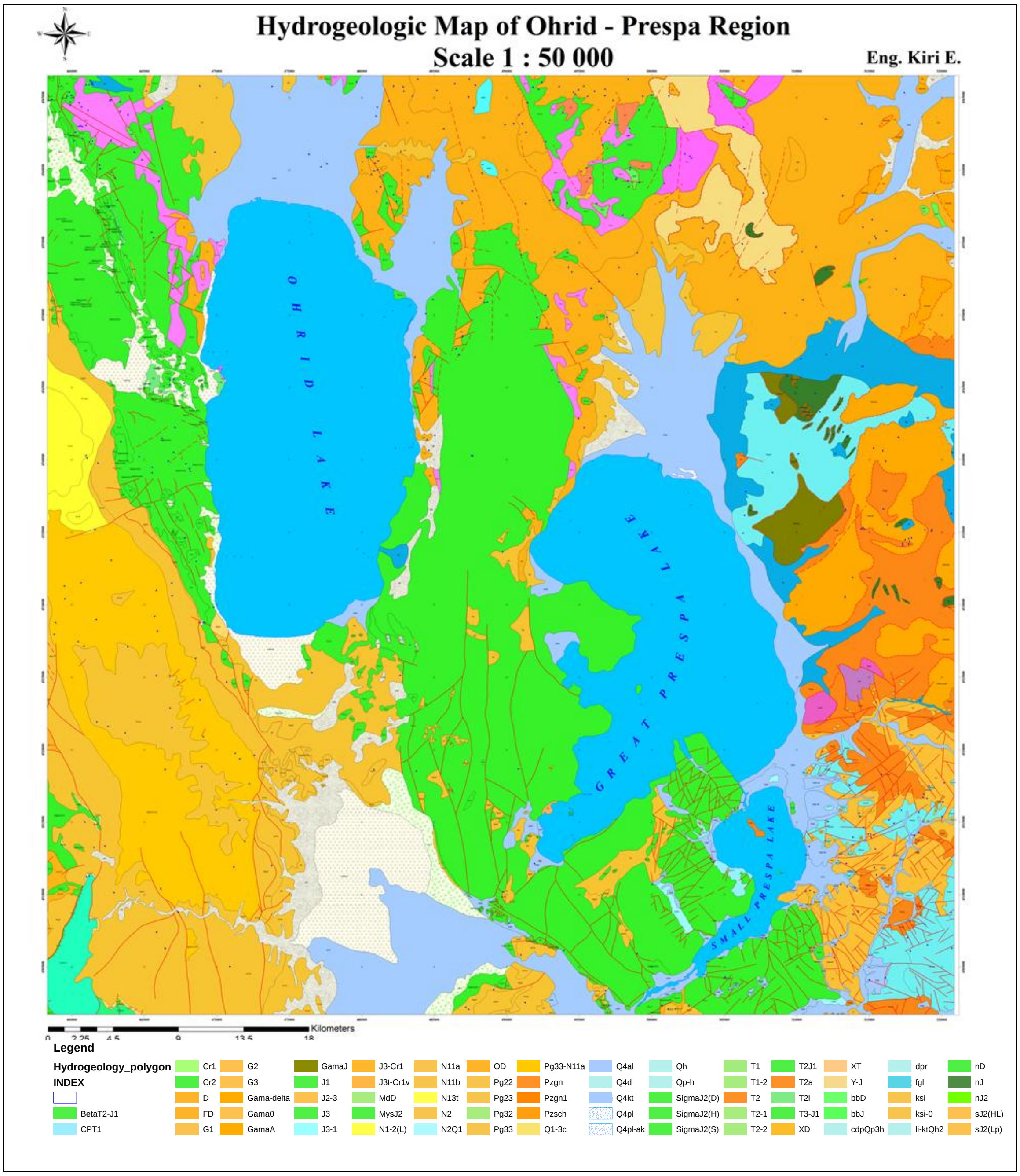


Figure A.12. Hydrogeologic Map of Ohrid – Prespa Region (scale 1:50, 000).

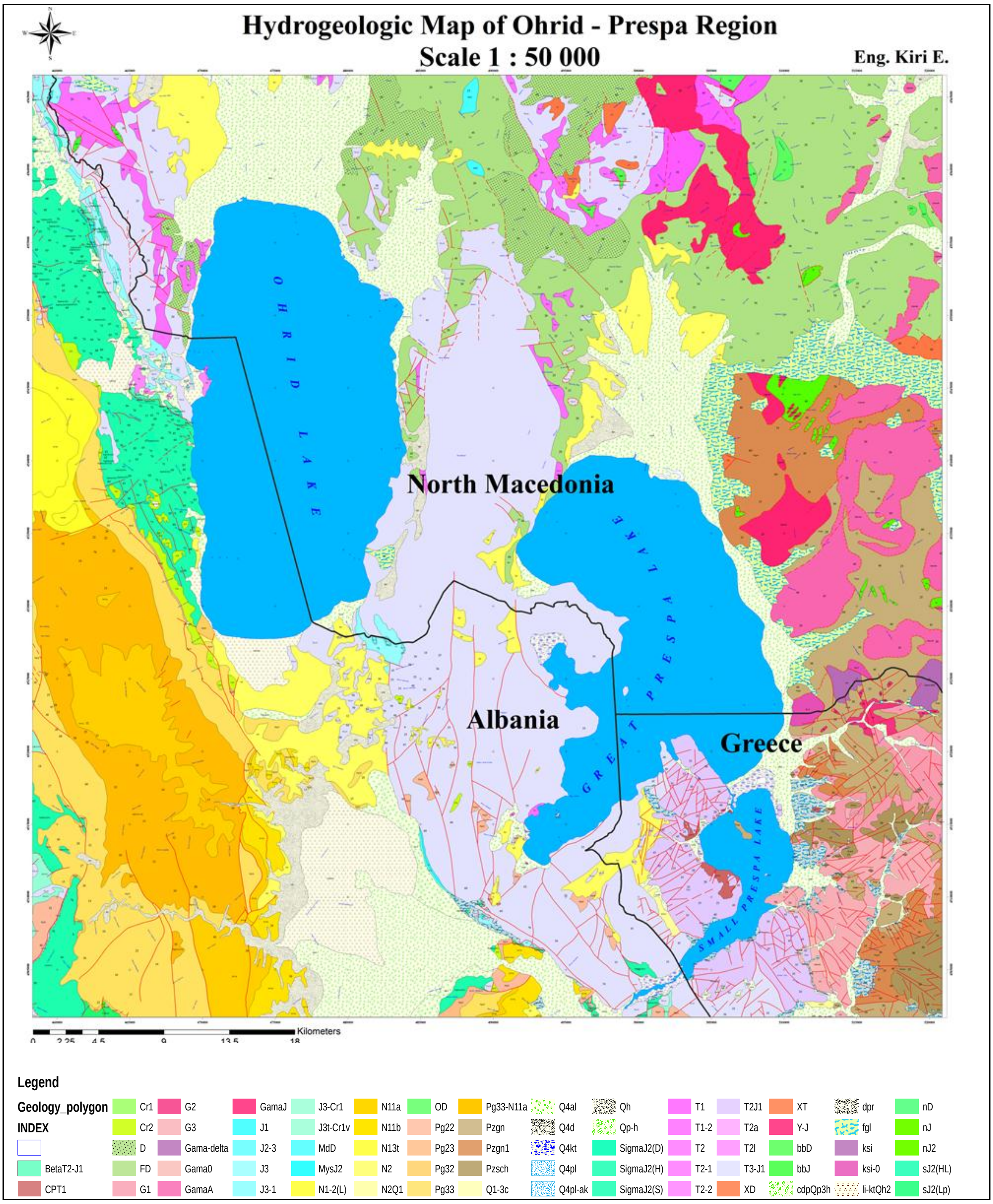
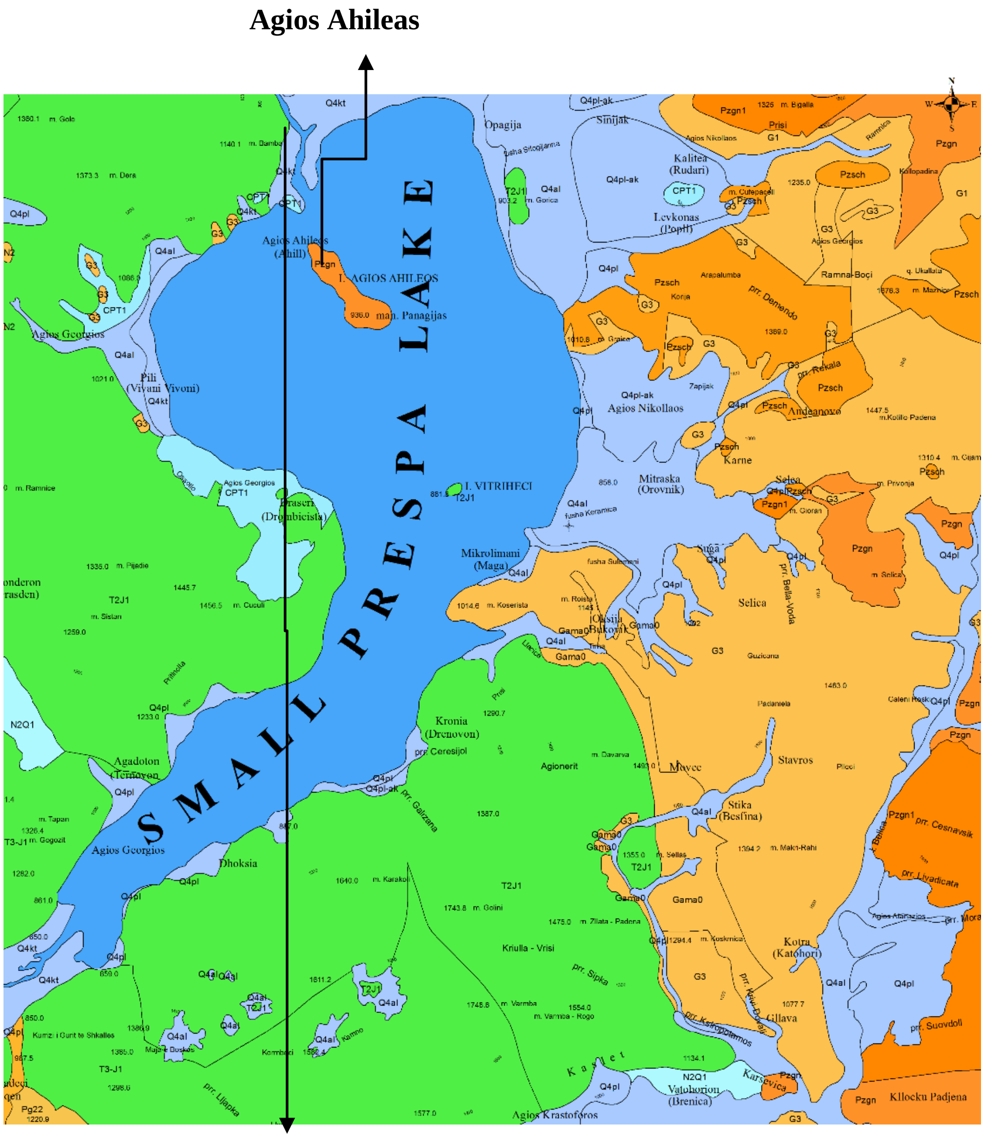


Figure A.13. Geologic Map of Ohrid – Prespa Region (scale 1:50, 000).



The channel that link two lakes, Small and Big Prespa lakes

Figure A.14. Hydrogeologic Map of Small Prespa Lake.

In this part of the study area, one has to do with a very karstic zone, especially in southeast and west part of the lake. The channel that link two lakes is controlled by the Greek part, by building a gate in order to save the water level of the Small Prespa Lake. So, the water quantities that move from this lake to the big one cannot be account like an input of the Big Prespa Lake.

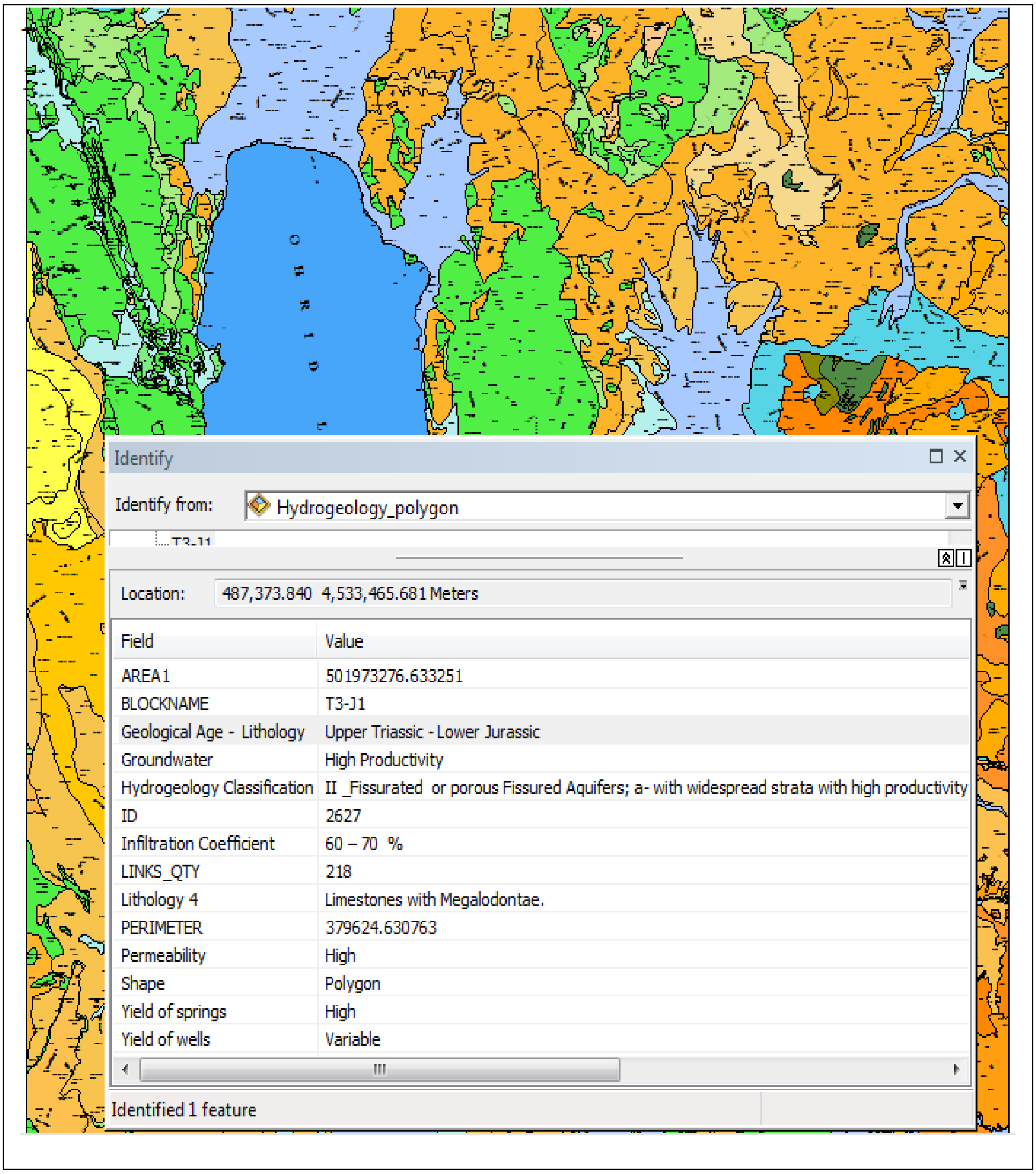


Figure A.15. The hydrogeologic data of the polygon, geological age (T_3-J_1).

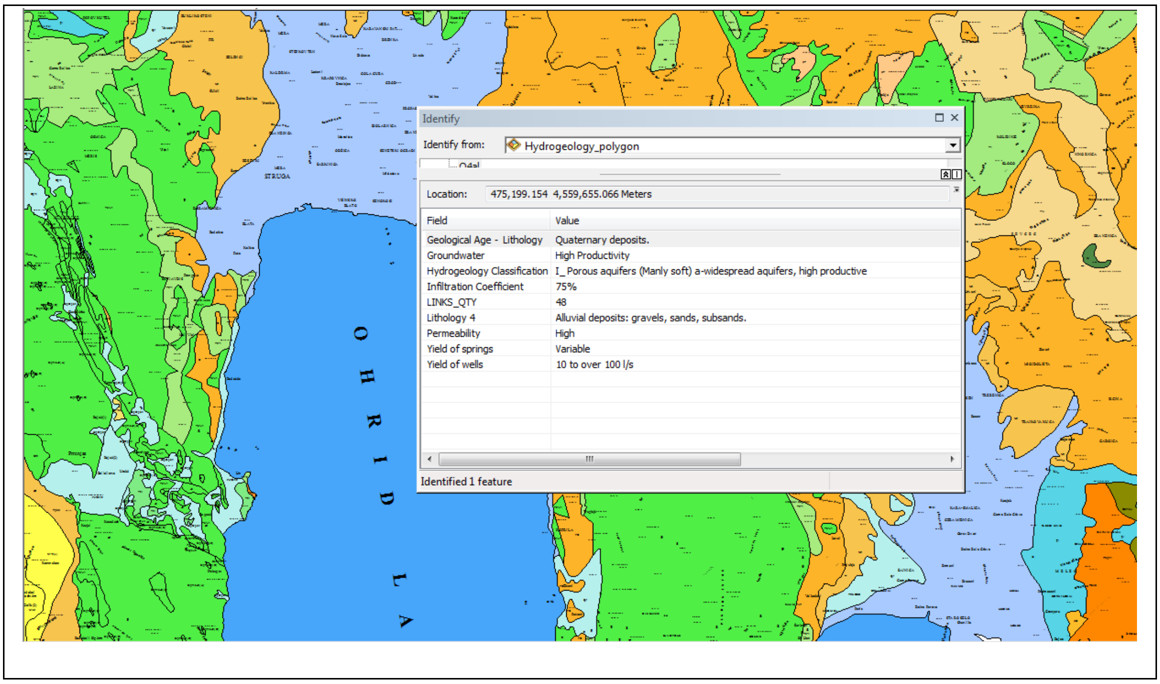


Figure A.16. The hydrogeologic data (Quaternary deposits), in north part of the Ohrid Lake.

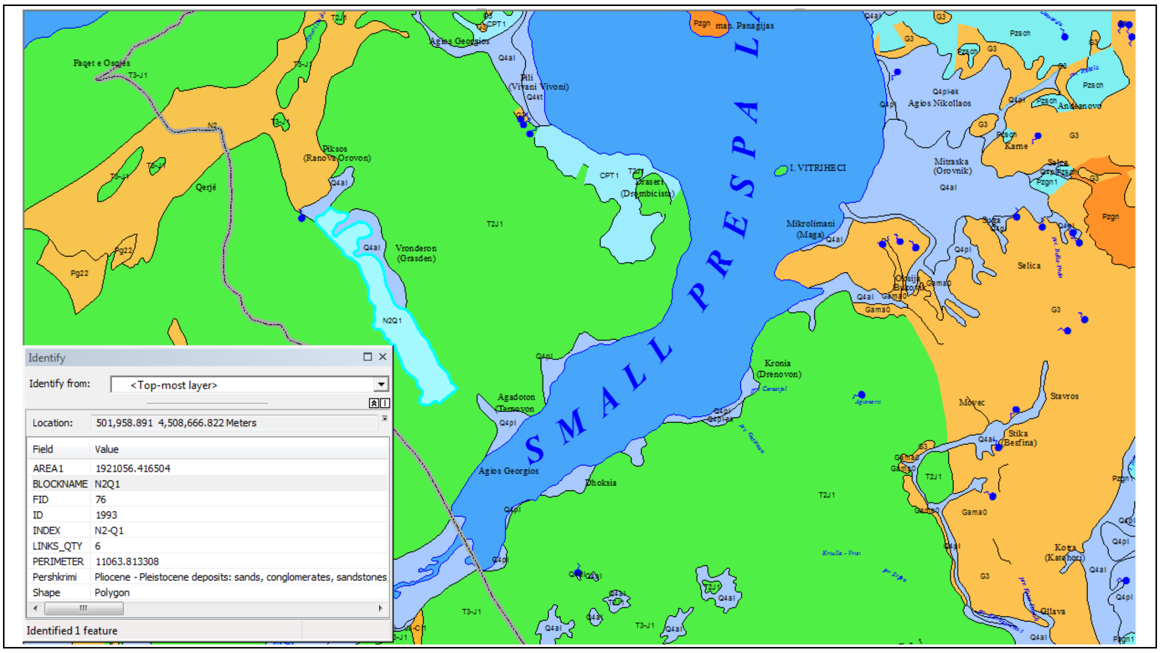


Figure A.17. The hydrogeologic data (Quaternary deposits), in Small Prespa Lake.

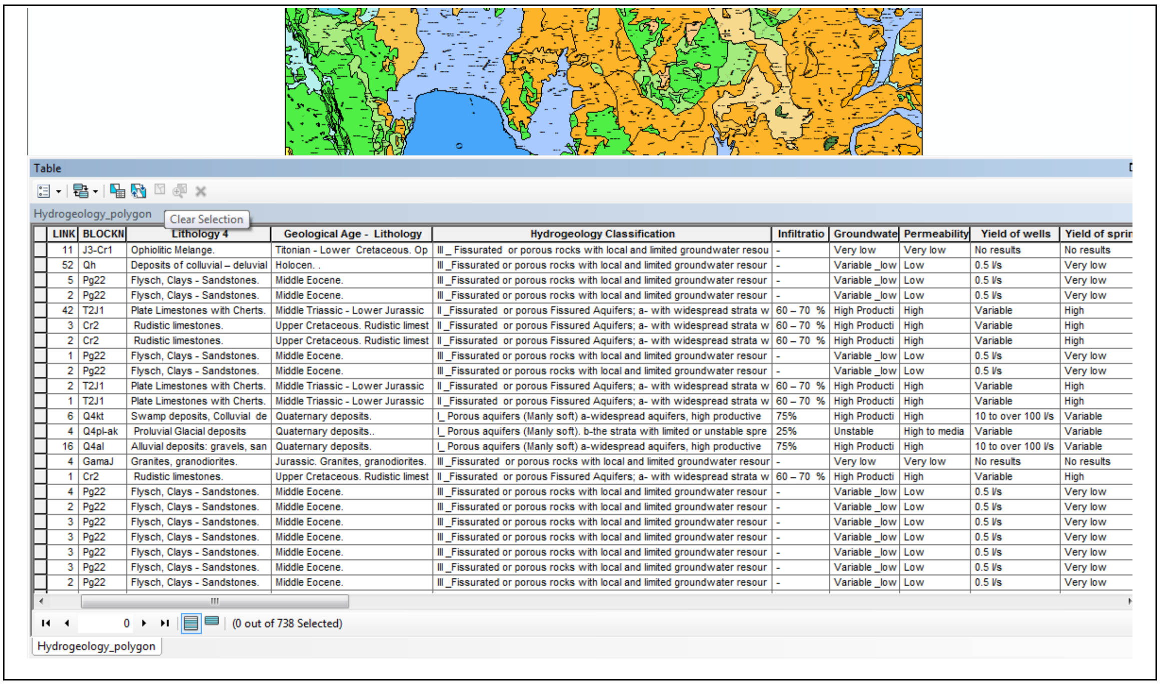


Figure A.18. The database that shows the hydrogeologic general characteristics, in the Ohrid – Prespa Region (included in the HG Map).

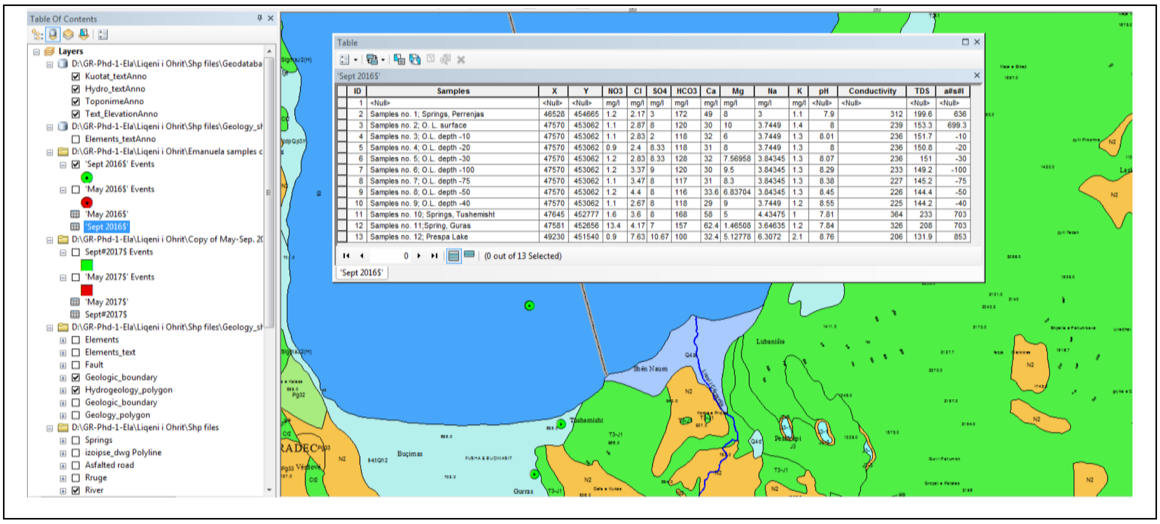


Figure A.19. The database that shows the samples chemical analyses, in the Ohrid – Prespa Region (included in the HG Map, September 2016).

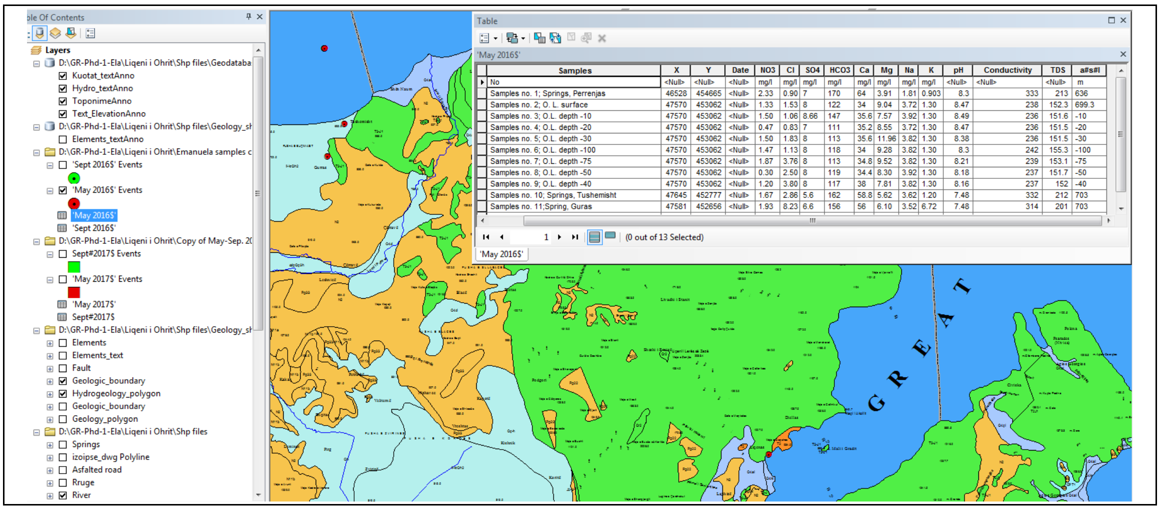


Figure A.20. The database that shows the samples chemical analyses, in the Ohrid – Prespa Region (included in the HG Map, May 2016).

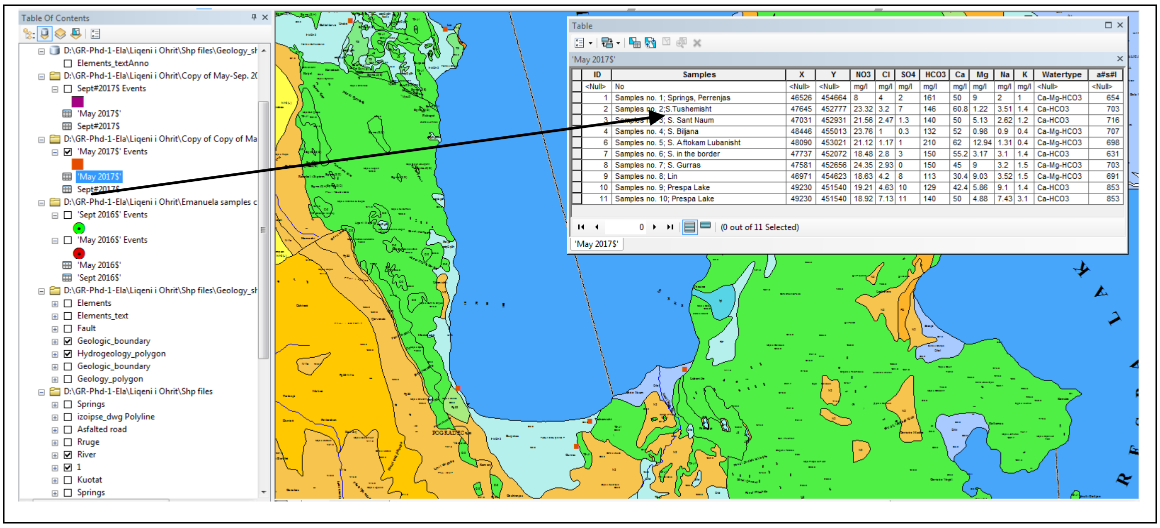


Figure A.21. The database that show the sample chemical analyses , in the Ohrid – Prespa Region's (Albanian part) included in the HG Map (May 2017).

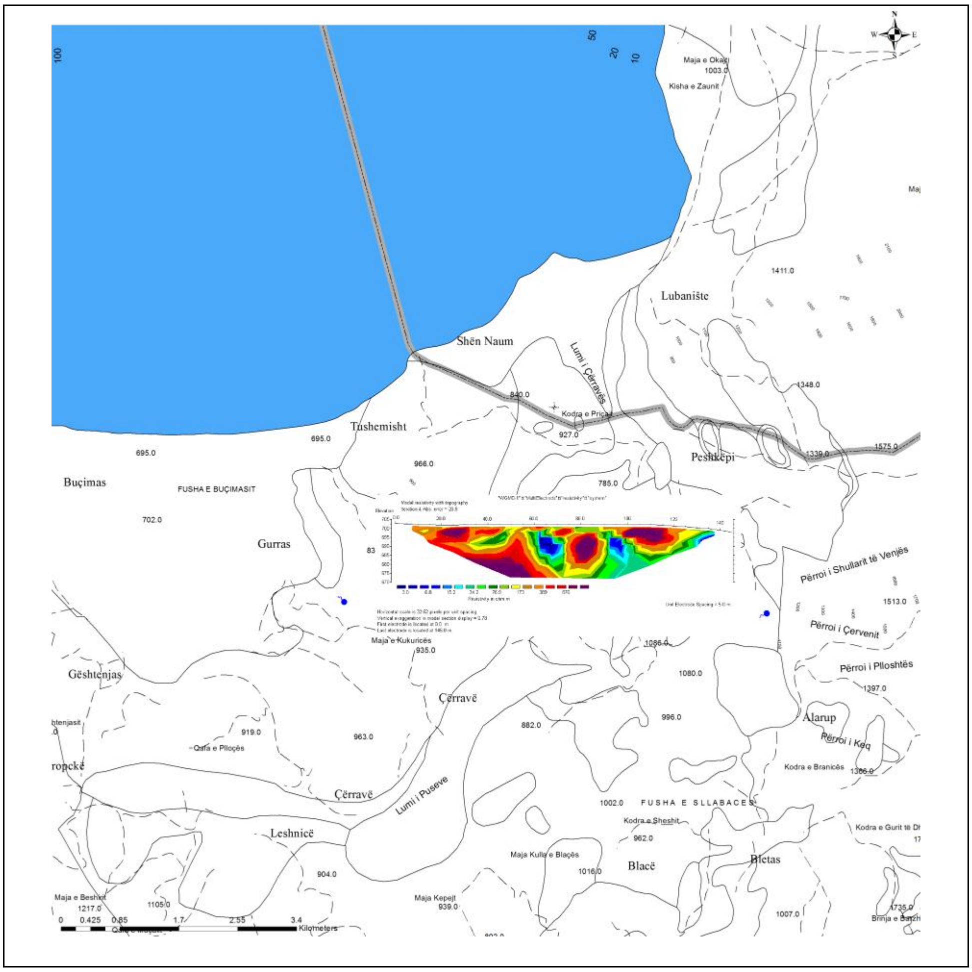


Figure A.22. The geophysics profile in Gurras Village, Ohrid – Prespa Region (Albanian part).

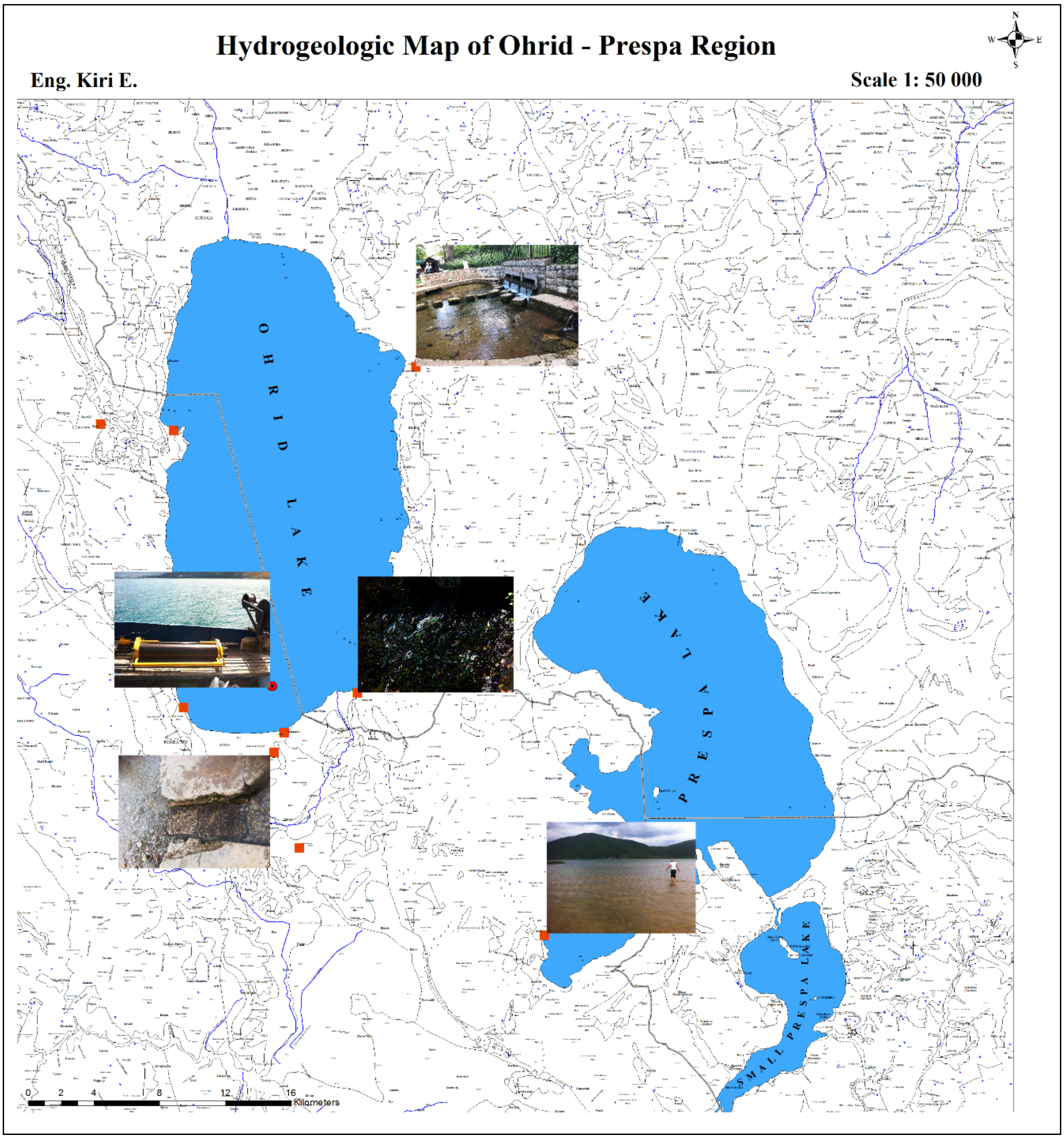


Figure A.23. Photo in Ohrid – Prespa Region (Albanian and North Macedonia part).

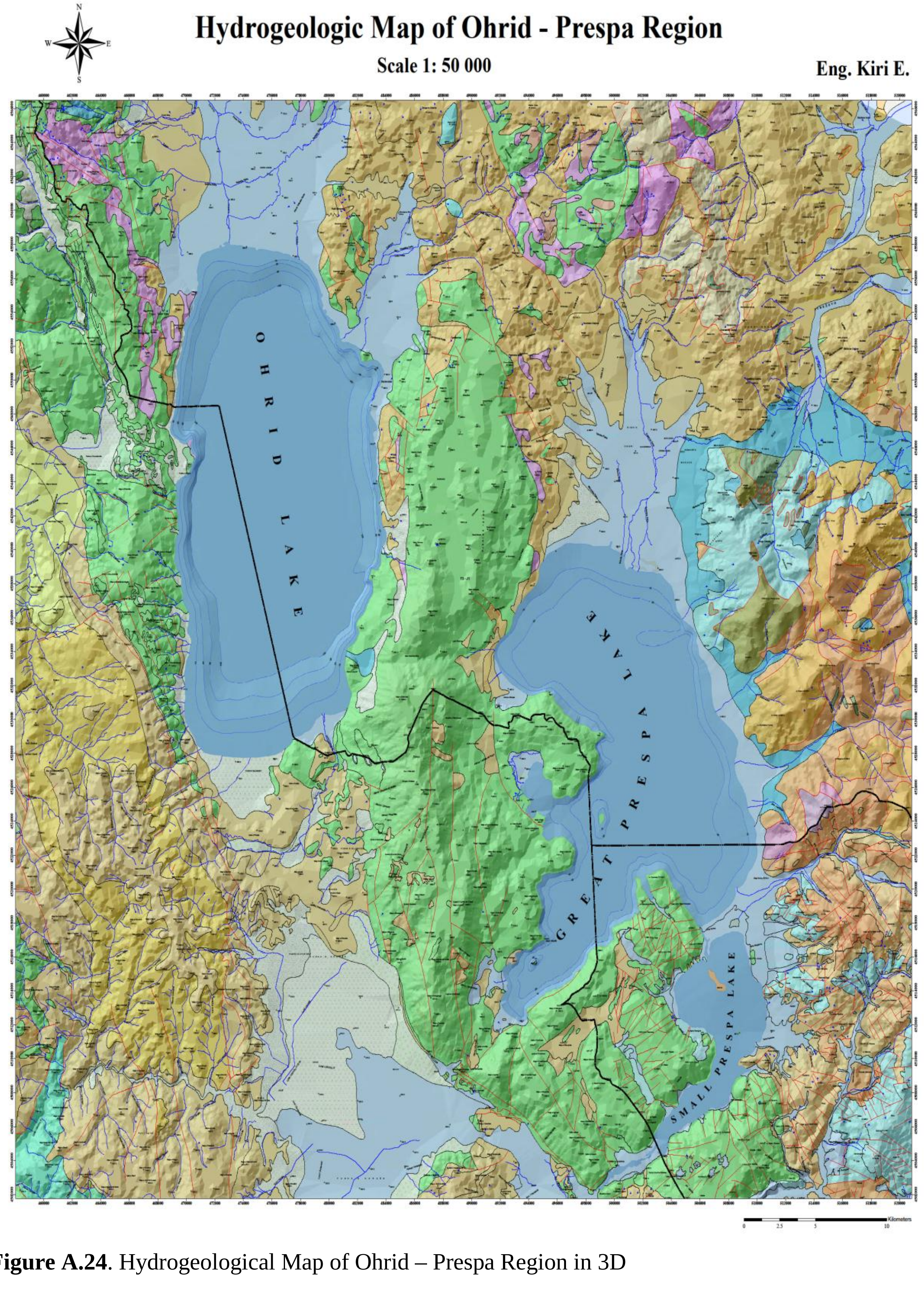


Figure A.24. Hydrogeological Map of Ohrid – Prespa Region in 3D

APPENDIX B

(Database of the General Characteristics of Hydrogeology)

After Kiri et al. 2011

BLOCK NAME	INDEX	Geological Age	Lithology	Hydrogeology Classification	Infiltration Coefficient	Groundwater	Permeability	Yield of wells	Yield of springs
BetaT_2-J_1	T_2-J_1	Middle Triassic – Lower Jurassic	Plate lime stone with chert	II _ Fissured or porous Fissured Aquifers; a-with widespread strata with high productivity	60 – 70 %	High Productivity	High	Variable	High
CPT1	CPT_1	Carbonian - Permian - Triassic	Rock with Weak Metamorphism. Alternations of Conglomerates, Limestone's.	II _ Fissured or porous Fissured Aquifers; b-widespread strata with median low permeability	-	Variable	Medium to low	0.1-4-10-15 l/s	Variable
Cr1	Cr_1	Lower Cretaceous	Limestone with flints massive limestone, dolomites.	II _ Fissured or porous Fissured Aquifers; a- with widespread strata with high productivity	60 – 70 %	High Productivity	High	Variable	High
Cr2	Cr_2	Upper Cretaceous.	Rudistic limestone.	II _ Fissured or porous Fissured Aquifers; a- with widespread strata with high productivity	60 – 70 %	High Productivity	High	Variable	High
D	D	Devonian	Meta-sandstone, conglomerate.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
FD	FD	Devonian	Metasandstones, Philites, conglomerates.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
G1	γ1	Jurassic	Amphibolite and/or biotite granite - granodiorite, monzogranite, diorite.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; a-local or limited to median groundwater resources	-	Median	Low _ Median	2-10-70-100 l/s	Median
G2	γ2	Jurassic	Syenites, granosyenites.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; a-local or limited to median groundwater resources	-	Median	Low _ Median	2-10-70-100 l/s	Median
G3	γ3	Jurassic	Metagranite - cristallin until porphoroid. Cataclastic structure.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; a-local or limited to median groundwater resources	-	Median	Low _ Median	2-10-70-100 l/s	Median
Gama-delta	γδ	Jurassic.	Granodiorite Amphibolites, granodiorit biotitic.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results

Gama0	γ0	Jurassic.	Aplitic Granites.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
GamaA	γA	Jurassic.	Adamelites (Alcaline granites).	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
GamaJ	γJ	Jurassic.	Granites, granodiorites.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
J_1	J_1	Lower Jurassic Limestones.	Dolomites.	II _ Fissured or porous Fissured Aquifers; a- with widespread strata with high productivity	60 – 70 %	High Productivity	High	Variable	High
J_{2-3}	J_{2-3}	Upper - Middle Jurassic.	Biomicritic limestones.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; a-local or limited to median groundwater resources	-	Median	Low _ Median	2-10-70-100 l/s	Median
J_3	J_3	Upper Jurassic	Limestones Cherts. Argileous Schists.	II _ Fissured or porous Fissured Aquifers; a- with widespread strata with high productivity	60 – 70 %	High Productivity	High	Variable	High
J3-1	J3-1	Upper - Lower Jurassic	Silicore radiolaritik.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable	Medium to low	0.1-4-10-15 l/s	Variable
J_3-Cr_1	J_3-Cr_1	Titonian - Lower Cretaceous.	Ophiolitic Melange.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
J_3t-Cr_1v	J_3t-Cr_1v	Upper Titonian - Valanzhinian	Ofiolitic conglomerate, sand – conglomerate combination.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
MdD	MdD	Devonian	Metamorphic limestone and marbles	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
MysJ_2	μsJ_2	Middle Jurassic	Amphibolite.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; a-local or limited	-	Median	Low _ Median	2-10-70-100 l/s	Median

				to median groundwater resources					
N_{1-2}(L)	N_{1-2}(L)	Middle Miocen	Alternations of conglomerates with sand	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
N_1^1a	N_1^1a	Aquitanian.	Molasses deposits, Clays, Siltstones, Sandstones, Conglomerate.	II _ Fissured or porous Fissured Aquifers; b-widespread strata with median low permeability	-	Variable	Medium to low	0.1-4-10-15 l/s	Variable
N11b	N1-1b	Burdigalian.	Marls, Limestone.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
N13t	N1-3t	Tortonian.	Sand, clay, conglomerate, limestone with litotamnie.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
N2	N2	Pliocene	Clay, Sandstones-brown coal.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
N2Q1	N2-Q1	Pliocene - Quaternary deposits	Sands, conglomerates, sandstones, clays.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
OD	D	Devonian	Quartz	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
Pg22	Pg2-2	Middle Eocene.	Flysch, Clays - Sandstones.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
Pg23	Pg2-3	Upper Eocene.	Clays, sandstones, conglomerates and brown coal.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low

Pg32	Pg3-2	Middle Oligocene;	Clays, siltstones, sandstones, coral limestone, marls and brown coals.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
Pg33	Pg3-3	Upper Oligocene:	Marls, siltstones.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
Pg33-N11a	Pg33-N11a	Upper Eocene - Aquitanian.	Alternations of allevrolit, clay and sand with brown coal layer.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
Pzgn	Pzgn	Paleozoic. Lower horizon	Gneisses schists intercalations.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
Pzgn1	Pzgn1	Paleozoic.	Granites-gneiss of western Macedonia (Lower part of metamorphic system)	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
Pzsch	Pzsch	Paleozoic. Upper Horizon.	Schist amphibolites,amphibolit - epidot, mica, graphite, calcite.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
Q1-3c	Q1-3c	Quaternary	Deposits of coluvial, rock slope.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
Q4al	Q4al	Quaternary deposits.	Alluvial deposits: gravels, sands, subsands.	I _ Porous aquifers (Manly soft); a-widespread aquifers, high productive	75%	High Productivity	High	10 to over 100 l/s	Variable
Q4d	Q4d	Quaternary	Delluvial deposits.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
Q4kt	Q4kt	Quaternary deposits.	Swamp deposits, Colluvial deposits. Proluvial deposits. Alluvial deposits.	I _ Porous aquifers (Manly soft); a-widespread aquifers, high productive	75%	High Productivity	High	10 to over 100 l/s	Variable
Q4pl	Q4pl	Quaternary deposits.	Proluvial deposits.	I _ Porous aquifers (Manly soft); b-the strata with limited or unstable spreading in strike, with median or variable aquifers	25%	Unstable	High to median	Variable	Variable

Q4pl-ak	Q4pl-ak	Quaternary deposits	Proluvial Glacial deposits	I _ Porous aquifers (Manly soft); b-the strata with limited or unstable spreading in strike, with median or variable aquifers	25%	Unstable	High to median	Variable	Variable
Qh	Qh	Holocene	Deposits of colluvial – deluvial	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources. b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
Qp-h	Qp-h	Pleistocene-Holocene.	Alternated deposits; alluvial – proluvial – sand – gravel and alevrite.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
SigmaJ2(D)	σJ2(D)	Middle Jurassic	Dunites	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
SigmaJ2(H)	σJ2(H)	Middle Jurassic	Harcburgites.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
SigmaJ2(S)	σJ2(S)	Middle Jurassic	Serpentinite.	III _Fissurated or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; a-local or limited to median groundwater resources	-	Median	Low _ Median	2-10-70-100 l/s	Median
T1	T1	Lower Triassic	Sand and clay	II _ Fissured or porous Fissured Aquifers; b-widespread strata with median low permeability	-	Variable	Medium to low	0.1-4-10-15 l/s	Variable
T1-2	T1-2	Verfeniane-Aniziane	Lime radiolaritice limestone’s.	II _ Fissured or porous Fissured Aquifers; b-widespread strata with median low permeability		Variable	Medium to low	0.1-4-10-15 l/s	Variable
T2	T2	Middle Triassic	Massive Limestones with Cherts.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
T2-1	T2-1	Upper - Lower Triassic	Sand, clay and conglomerate	II _ Fissured or porous Fissured Aquifers; b-widespread strata with median low permeability		Variable	Medium to low	0.1-4-10-15 l/s	Variable
T2-2	T2-2	Middle Triassic	Massive limestone, dolomite.	II _ Fissured or porous Fissured Aquifers; b-widespread strata with median low permeability		Variable	Medium to low	0.1-4-10-15 l/s	Variable
T2a	T2a	Middle Triassic. Anizian.	Sand, clay, conglomerate, massive silica limestone.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low

T2J1	T2-J1	Middle Triassic - Lower Jurassic	Plate Limestones with Cherts.	II _ Fissured or porous Fissured Aquifers; a- with widespread strata with high productivity	60 – 70 %	High Productivity	High	Variable	High
T2l	T2l	Middle Triassic. Ladinian.	Plate limestone with silics, rare dolomites.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
T3-J1	T3-J1	Upper Triassic - Lower Jurassic	Limestone with Megalodonte.	II _ Fissured or porous Fissured Aquifers; a- with widespread strata with high productivity	60 – 70 %	High Productivity	High	Variable	High
XD	XD	Jurassic	Metamorphic rhyolites.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
XT	XT	Jurassic	Rhyolites.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
Y-J	Y-J	Jurassic	Granites (Peristeri), granodiorites.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
bbD	ββD	Devonian	Metamorphic diabaze.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
bbJ	ββJ	Jurassic	Diabaze, spilite.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
cdpQp3h	cdpQp3h	Middle Pleistocene-Holocene.	Alternated deposits colluvium – deluvial – proluvial.	I _ Porous aquifers (Manly soft); b-the strata with limited or unstable spreading in strike, with median or variable aquifers	25%	Unstable	High to median	Variable	Variable
dpr	Qdpr	Quaternary deposits.	Deluvion, proluvion.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results

fgl	Qfgl	Quaternary deposits.	Fluvial - glacial deposits.	I _ Porous aquifers (Manly soft); a-widespread aquifers, high productive	75%	High Productivity	High	10 to over 100 l/s	Variable
ksi	ξ	Jurassic	Syenites, granosyenites.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources. a-local or limited to median groundwater resources	-	Median	Low _ Median	2-10-70-100 l/s	Median
ksi-0	ξ0	Jurassic	Granosyenites	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; a-local or limited to median groundwater resources	-	Median	Low _ Median	2-10-70-100 l/s	Median
li-ktQh2	li-ktQh2	Middle Holocene.	Lake and marsh deposits.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources. b-local groundwater and low permeability	-	Variable _low	Low	0.5 l/s	Very low
nD	νD	Devonian	Metamorphic Gabbro	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; c-very low productive aquifers	-	Very low	Very low	No results	No results
nJ	νJ	Jurassic	Gabbro.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; a-local or limited to median groundwater resources	-	Median	Low _ Median	2-10-70-100 l/s	Median
nJ2	νJ2	Jurassic	Gabbro.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; a-local or limited to median groundwater resources	-	Median	Low _ Median	2-10-70-100 l/s	Median
sJ2(HL)	σJ2(HL)	Middle Jurassic	Harcburgite lercolitike.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; a-local or limited to median groundwater resources	-	Median	Low _ Median	2-10-70-100 l/s	Median
sJ2(LP)	σJ2(LP)	Middle Jurassic	Lercolite plagioclazik.	III _ Fissured or porous rocks with local and limited groundwater resources or rocks essentially poor with groundwater resources; a-local or limited to median groundwater resources	-	Median	Low _ Median	2-10-70-100 l/s	Median

APPENDIX C

Ohrid Lake daily climatic data 2008 - 2019

Ohrid Lake - 2008 daily climatic data

D	January	January	January	January	January	D	February	February	February	February	February
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1						1	5.76309	0	0	0.34128	3.510113
2	-2.756076	0	0	0.7632	5.878872	2	5.200591	0	0	0.54	5.214472
3	-1.967743	0	0	0.65519994	5.0002193	3	5.983507	0	0	0.43344	2.808238
4	0.42232653	0	0	0.5371199	5.318962	4	6.938506	0	0	0.68112	6.585125
5	2.3614237	0.6	0.42	0.19151999	4.23486	5	6.431006	6.9	0	0.43632	5.389002
6	3.9239237	9.2	0	0.08928	12.733523	6	6.411007	0	0	0.9072	7.837332
7	6.2105904	4.8	0	0.07776	6.9984956	7	4.997674	4.2	0	0.35136	5.999336
8	6.69059	0	0	0.75887996	5.3590736	8	4.40059	0	0	1.4976	21.09558
9	4.116423	0	0	0.5543999	3.4558742	9	1.21184	0	0	1.19376	17.72073
10	4.7539234	0	0	0.39311993	3.3476973	10	-0.30899	0	0	1.02384	12.34706
11	3.4914234	0	0	0.468	2.4583976	11	0.765174	0	0	0.94176	8.850165
12	3.8526735	0	0	0.47376	2.0418174	12	1.04184	0	0	0.9504	7.232561
13	5.4372563	1.2	0	0.6019199	3.1167238	13	1.618507	0	0	0.8568	5.071344
14	4.89934	0.8	0	0.48384005	4.895	14	3.13934	0	0	0.95328	2.590304
15	3.4810069	0	0	0.55727994	3.647156	15	3.835174	0.4	0.28	0.9792	3.891209
16	5.036841	0	0	0.18575999	8.828912	16	-3.43983	0	0	1.72224	30.43102
17	6.8576736	0.4	0	0.5543999	5.1118	17	-6.43024	0	0	1.22976	26.21921
18	6.3168406	0	0	0.51552	2.9221888	18	-4.26566	0	0	0.95328	7.20024
19	5.9889235	0	0	0.41183996	2.5094879	19	1.48309	0	0	0.85104	5.142547
20	6.396007	0	0	0.44208002	2.3597107	20	4.425591	0	0	1.06416	5.107464
21	7.976007	0	0	0.48096	3.2476642	21	5.164757	0.8	0	0.7776	3.762483
22	5.279757	0	0	0.70848	8.777751	22	7.839757	0.5	0	0.90576	2.517959
23	2.2272568	2.5	0	1.22256	20.695162	23	7.682674	0	0	0.81504	2.498141
24	0.4722568	0	0	0.51264	10.0296545	24	9.631007	0	0	1.12752	5.709789
25	2.3864238	0	0	0.6163201	6.0513554	25	9.811841	0	0	0.97632	2.592623
26	3.9880898	0	0	0.94607997	8.922883	26	10.92726	0	0	0.9864	2.178642
27	5.3243403	0	0	1.08144	9.258881	27	9.153091	0	0	0.97488	5.441051
28	1.6851734	0	0	0.52272004	21.224651	28	8.14309	0	0	0.82224	5.367085
29	-0.5806596	0	0	0.3312	6.6662884	29	8.413923	0	0	0.88848	4.447932
30	1.9768404	0	0	0.65519994	3.6492774	30					
31	3.6889238	0	0	0.48095998	3.6304674	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	7.36684	0	0	0.92592	17.4365	1	9.271424	0	0	1.85328	3.545011
2	8.166423	0	0	1.24272	14.07429	2	8.965591	0	0	1.5408	4.824465
3	9.676423	0	0	1.22976	8.309283	3	7.311842	2.2	0	1.08864	3.989257
4	10.18059	0	0	1.22688	7.248375	4	7.448508	6.6	0	1.48176	4.071009
5	9.732675	0	0	1.11888	10.41111	5	7.920174	9.900001	0	1.07424	2.804013
6	11.37767	0.4	0	1.27152	12.48863	6	6.393091	0.1	0	1.8216	12.59411
7	8.006007	5.4	0	0.93744	12.52519	7	8.00434	0	0	1.90512	10.6173
8	5.100591	0	0	1.03104	12.04246	8	11.97059	0.2	0	2.23344	5.787201
9	5.24059	2.6	0	1.08144	5.138929	9	10.92684	0.2	0	2.20032	11.86148
10	5.337257	0	0	1.08864	8.672289	10	12.35267	0	0	2.304	8.563087
11	5.805173	3.8	0	0.88992	11.43226	11	15.79392	0	0	2.71584	7.76784
12	7.412256	0	0	1.39536	9.143184	12	17.26392	0	0	2.5776	9.305869
13	6.714341	0	0	1.09872	6.722187	13	13.78351	0.3	0	2.13408	9.005763
14	6.912674	0	0	1.40832	5.093289	14	10.29184	3.2	0	0.7632	4.957661
15	8.863924	0	0	1.50624	6.087894	15	6.400591	0.1	0	1.67184	14.78451
16	9.61684	0	0	1.21248	5.769099	16	6.31434	0	0	1.78272	17.48151
17	8.473924	0	0	1.17936	9.211537	17	8.256007	0	0	2.0016	6.571268
18	7.046007	0	0	1.12032	12.92815	18	10.46184	0	0	2.53152	7.224953
19	4.648924	12.9	0	0.99072	11.7752	19	13.58601	0	0	2.89152	8.991239
20	6.681007	0	0	1.41264	7.265181	20	16.14351	0	0	3.11472	4.66154
21	4.722257	0.1	0	0.83952	16.20837	21	18.67809	0	0	3.29328	8.236888
22	5.921007	0	0	1.30464	20.45228	22	11.79309	0	0	2.12976	15.87138
23	9.376422	0	0	2.10384	11.92608	23	9.220174	0	0	1.92672	16.38006
24	5.095591	24.6	13.02	0.56448	21.72653	24	10.38934	0	0	2.26944	5.017176
25	2.168924	7.000001	4.900001	0.8928	19.43195	25	9.437256	0.1	0	0.78048	7.778111
26	4.147673	0	0	1.23984	9.721784	26	10.03142	2	0	1.69632	10.50699
27	6.351424	0.8	0	0.91872	5.811505	27	9.906424	0	0	2.95488	16.26756
28	8.152674	0	0	2.19888	16.35864	28	9.052257	0	0	2.47248	5.897404
29	8.852674	0	0	1.90656	6.901245	29	9.401423	0.1	0	2.45664	8.376788
30	9.19934	0	0	2.26368	11.01236	30	10.30684	0	0	2.66976	6.470438
31	8.569757	0	0	1.90944	6.883699	31					

D	May	May	May	May	May	D	June	June	June	June	June
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	12.2364235	0	0	3.01104	6.014087	1	18.56975	0	0	4.25376	3.647561
2	14.316424	0	0	3.4128	3.713112	2	20.58892	0	0	4.12704	5.702957
3	13.873506	0	0	3.79008	14.254092	3	16.97351	4.4	0	2.92176	3.972448
4	12.125587	0	0	3.4127998	13.008441	4	15.96142	0.2	0	2.71008	2.95919
5	11.952672	0	0	2.8209603	4.6987395	5	15.48767	0.2	0	3.08736	5.784037
6	10.571839	1	0	2.00016	6.0476604	6	14.11476	0.1	0	3.62448	6.070309
7	9.530589	0.2	0	1.48896	7.1168485	7	13.24476	1.2	0	2.5488	3.148437
8	11.523923	0	0	2.6193597	5.1701756	8	13.78184	2	0	2.0664	2.672553
9	12.433922	0	0	3.2817602	4.031797	9	14.40601	0.8	0	2.8872	4.554699
10	13.206006	0	0	2.9505599	7.3209567	10	17.26892	0	0	3.408481	4.121707
11	12.62684	0	0	3.06	4.40718	11	18.30059	0	0	4.67856	4.799031
12	12.805173	0	0	3.0528002	3.0909498	12	17.75726	0	0	3.47184	3.039478
13	14.921841	0.3	0	3.4228802	5.892187	13	15.65392	0.1	0	3.09024	8.041991
14	12.9047575	1.9	0	2.0664	4.057862	14	14.94226	0.1	0	2.89728	5.138878
15	13.096008	0	0	3.7079997	4.1277323	15	14.28351	0	0	3.6	7.831001
16	14.42059	0	0	3.9441602	4.9908957	16	15.59726	0	0	4.3704	6.077941
17	17.211422	0	0	4.11408	2.9186218	17	20.14892	0	0	5.19264	4.112917
18	19.168505	0	0	4.0608	5.956041	18	22.67267	0	0	5.64768	7.296565
19	19.264338	1.9	0	3.5611203	8.449796	19	20.77184	0	0	5.29632	5.293494
20	16.164341	0.1	0	4.08672	10.336119	20	21.04059	0	0	5.3496	10.93313
21	14.221841	0	0	3.5366402	7.5466	21	21.53475	0	0	5.1624	8.497893
22	12.728923	0	0	3.168	10.391425	22	22.19267	0	0	4.1688	6.358971
23	13.3126745	0.2	0	2.3817604	4.406874	23	22.84267	0	0	4.2984	3.639101
24	14.410172	0	0	3.02256	4.328287	24	23.41309	0	0	4.973761	3.392584
25	16.603922	0	0	3.6216	2.85267	25	25.22392	0	0	5.34672	5.546682
26	19.482252	0	0	4.5014405	3.7720032	26	24.01309	0	0	3.996	4.238355
27	22.444756	0	0	4.2264	3.021944	27	23.01059	1.2	0	3.09024	3.494004
28	22.468924	0	0	5.19552	3.2518728	28	22.85309	0	0	4.9752	4.269746
29	24.098091	0	0	5.2531204	3.0992126	29	22.85184	0	0	3.42576	6.64983
30	20.686838	0	0	4.4496	4.73819	30	22.88684	0	0	4.835519	3.481616
31	17.907673	0	0	4.176	6.1542516	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	23.23643	0.2	0	2.8944	3.949627	1	23.04559	0	0	3.77856	4.116897
2	22.78142	0	0	4.69296	4.772513	2	22.72934	0	0	2.71728	3.964479
3	22.55934	0	0	4.73904	4.36245	3	22.58267	0	0	3.85344	6.146004
4	22.386	0	0	4.70016	3.55761	4	23.20392	0	0	2.99232	5.264819
5	22.90476	0	0	3.80448	6.123334	5	23.94476	0	0	3.84336	3.548277
6	21.36893	0	0	4.37328	5.535756	6	25.451	0	0	3.89664	5.188428
7	22.74309	0	0	4.57776	5.411551	7	24.20934	0	0	2.5848	4.97076
8	23.70226	0	0	4.8168	9.564165	8	23.40309	0	0	3.44016	3.330508
9	21.87059	0	0	4.3992	6.938433	9	23.68517	0	0	3.58416	7.926008
10	20.551	0	0	4.3272	6.495459	10	20.13767	0	0	2.55024	8.299093
11	21.65892	0	0	4.35024	5.717779	11	19.67267	0	0	3.27312	5.383236
12	23.51892	0	0	3.46032	2.86363	12	22.02851	0	0	3.37248	3.843101
13	23.41976	0	0	4.44096	3.631913	13	24.45267	0	0	3.46176	3.262788
14	24.67767	0	0	4.59648	6.455317	14	25.82101	0	0	3.50784	3.754526
15	21.09351	0	0	3.62448	10.31205	15	25.96976	0	0	3.49344	3.644656
16	17.40517	0	0	3.7368	16.33593	16	23.35434	0	0	3.14352	9.29828
17	18.94517	0	0	3.57264	5.056362	17	19.99642	0	0	3.04272	6.500979
18	21.46684	0	0	4.00032	6.7111	18	20.46892	0	0	2.90592	6.971422
19	22.41392	0	0	4.0464	4.055136	19	22.19809	0	0	3.29616	8.586694
20	24.01476	0	0	2.58768	5.275916	20	23.82392	0	0	3.00384	4.237041
21	23.10434	0	0	4.09968	3.600068	21	25.80267	0	0	3.07728	8.362085
22	21.99309	1.4	0	2.78496	7.260422	22	24.3085	0	0	2.99376	5.142492
23	13.98642	0	0	1.88784	7.602706	23	24.18017	0	0	3.05856	5.499525
24	13.46809	0	0	2.12976	12.46081	24	22.42434	0	0	1.9944	8.435777
25	15.26059	0.2	0	2.52144	10.26986	25	20.23017	0	0	2.57328	5.002244
26	17.27851	0	0	2.8368	8.220762	26	22.63517	0	0	1.64016	5.375185
27	18.78767	0.3	0	1.8648	3.611236	27	22.73559	0.1	0	2.32704	5.253347
28	20.24351	0	0	3.7872	7.406448	28	21.75642	0.7	0	2.02608	3.576532
29	20.53142	0	0	3.09024	4.722286	29	20.02767	0	0	2.48112	5.088398
30	22.27767	0	0	4.043521	6.643187	30	20.46018	0	0	2.86416	11.52096
31	22.51267	0	0	3.75696	4.711538	31	18.77309	0	0	2.52864	7.707216

D	Sept.	Sept.	Sept.	Sept.	Sept.	D	October	October	October	October	October
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	19.909756	0	0	1.3320001	2.5071514	1	12.42309	0	0	1.71936	3.762391
2	20.352255	0	0	2.1499202	3.903696	2	13.57434	6.1	0	0.94032	4.633795
3	20.48559	0	0	2.53584	3.6483924	3	13.02684	14.6	0	0.89856	6.059526
4	21.031006	0	0	2.63232	3.565405	4	13.04476	10.9	0	1.37232	10.91621
5	21.793505	0	0	2.6496	3.804102	5	8.730173	4.2	0	1.7856	15.77317
6	23.238508	0	0	1.78416	2.9583547	6	8.336007	0	0	1.38384	12.70442
7	24.163088	0	0	2.74608	3.2126312	7	12.25142	0	0	1.512	2.189526
8	25.228508	0	0	2.77488	3.7292757	8	13.95017	0	0	1.69344	2.633694
9	23.354342	0	0	1.4299202	5.5370293	9	15.59059	0	0	1.76112	2.800464
10	21.906008	0	0	2.4983997	5.214708	10	14.90893	0	0	1.55808	5.352121
11	22.213507	0	0	2.39616	4.173702	11	13.39434	0	0	1.57536	6.933712
12	22.975174	0	0	2.46528	3.9315922	12	13.90059	0	0	1.61568	6.793188
13	21.670172	0.6	0	2.26656	6.655539	13	14.23809	0	0	1.48464	4.604317
14	18.955172	7.500001	0	1.5177602	6.247221	14	15.47101	0	0	1.31904	2.818048
15	16.609755	12.1	0	2.13552	11.44975	15	14.64809	0	0	1.42848	2.875133
16	13.590591	4.3	0	1.39968	7.0644164	16	14.36768	0	0	1.46304	4.588274
17	12.19059	0.3	0	1.7539201	7.2382565	17	14.40059	0	0	1.29168	5.238265
18	10.8422575	0	0	1.8936001	5.2913356	18	15.05059	0	0	1.36224	5.067953
19	11.419341	0	0	1.4616001	5.4122834	19	14.73142	0.6	0	1.42992	3.527313
20	11.428506	0	0	1.83312	10.794164	20	14.50351	0	0	1.19088	2.480225
21	9.603925	0	0	1.6646401	7.9809594	21	14.99767	0	0	1.2384	2.598028
22	11.049758	0	0	0.58464	4.6951923	22	14.17892	0	0	1.08576	3.007374
23	11.745589	0	0	1.5220801	3.8253405	23	13.06517	0	0	0.96624	3.90261
24	12.675174	3.3	0	1.4328	4.4993176	24	12.75434	0	0	1.19232	5.08825
25	11.09309	17.6	0	1.26	7.7403483	25	12.21976	0	0	0.82944	5.665312
26	11.892257	0	0	1.36656	2.7883193	26	10.26517	0	0	0.92304	4.627548
27	11.715172	3.9	0	1.29888	6.6733513	27	9.841424	0	0	0.84816	5.556055
28	10.823506	1.1	0	1.4688001	5.884071	28	11.42101	0	0	0.74592	4.885296
29	10.441008	0.5	0	1.61424	4.5440354	29	13.78351	4	0	1.13184	6.608632
30	10.513507	0	0	1.6646401	6.9288154	30	16.32809	0	0	1.23984	13.35358
31						31	15.39392	0.8	0	1.23696	8.783784

D	November	November	November	November	November	D	December	December	December	December	December
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	17.52309	0	0	1.34208	9.312104	1	8.901423	0	0	0.78336	12.33121
2	13.93517	0	0	0.62352	5.655128	2	11.59726	0	0	0.80064	11.34766
3	15.04267	0	0	0.98928	3.194977	3	11.35892	2.5	0	0.6768	7.52528
4	15.53892	0	0	0.95184	4.094547	4	11.57809	0.3	0	1.17072	18.77648
5	16.27101	0	0	0.77328	4.60179	5	6.91684	0	0	0.95472	15.9856
6	14.86267	2.6	0	1.02096	4.61389	6	7.892256	0	0	0.58608	16.77928
7	13.43601	0.4	0	0.95184	6.687863	7	4.638507	0.9	0	0.58608	12.2531
8	11.74143	0.2	0	1.09872	3.676175	8	1.93684	0	0	0.44496	4.250545
9	10.99101	0	0	0.5976	2.982666	9	1.510174	0	0	0.396	4.035965
10	9.836007	0	0	0.6048	4.06458	10	2.21809	0	0	0.52992	4.128334
11	8.168507	0	0	0.55872	2.947161	11	5.394758	0.3	0	0.74736	12.02767
12	7.847257	0	0	0.54144	2.673526	12	5.987257	7.2	0	1.0152	13.49034
13	9.287674	0	0	0.56304	3.498395	13	5.683924	1.1	0	0.59904	10.99592
14	9.507674	1	0	0.5256	5.56464	14	6.949341	4.5	0	0.55584	7.627362
15	10.58809	0	0	0.7992	8.0122	15	7.747675	0	0	0.6552	7.734457
16	9.850174	4.599999	0	0.89856	6.650252	16	8.428507	0	0	0.65088	9.586104
17	9.038507	0	0	0.55872	6.198986	17	8.538091	4.1	0	0.25488	7.627701
18	3.500173	4.3	2.03	0.75312	10.99907	18	7.608924	9.700001	0	1.08432	12.29626
19	5.40934	1.3	0	0.81072	6.258799	19	6.082674	1.5	0	0.828	9.571263
20	4.613507	0	0	0.46224	9.602528	20	4.459757	0	0	0.7056	6.51907
21	8.133506	0	0	0.65952	22.41164	21	2.60309	0	0	0.47664	11.85093
22	6.285174	3.9	0.07	1.10736	27.17399	22	1.21559	0	0	0.83088	15.75862
23	0.753507	0	0	0.71856	6.933437	23	2.268091	0	0	0.61056	6.343566
24	3.003507	0	0	0.504	8.662119	24	-0.39566	0	0	0.37152	10.28724
25	11.12976	0.2	0	1.08576	21.60341	25	0.557257	0	0	0.69696	3.249868
26	8.478091	0.4	0	0.63072	13.03368	26	-0.66191	4.4	0	0.42336	9.377259
27	4.231007	0	0	0.62496	3.513171	27	-0.28149	0	0	0.52704	10.40118
28	5.738091	5.3	0	0.63504	4.756585	28	-0.74608	0	0	0.5904	9.732245
29	6.93184	10.4	0	0.98208	7.889377	29	-1.14399	0	0	0.5616	6.505322
30	8.245173	0	0	0.67104	7.463917	30	-1.40149	0	0	0.72144	6.295778
31						31	0.511424	0	0	0.4824	1.794152

Ohrid Lake - 2009 daily climatic data

D	January	January	January	January	January	D	February	February	February	February	February
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	1.98309	1.9	0	0.60768	5.061309	1	3.84309	0	0	0.71136	9.291537
2	3.960174	11.7	0	0.67392	6.180894	2	6.011424	0	0	0.84816	9.655079
3	0.947257	11.1	7.14	0.50112	9.877746	3	7.988506	0	0	0.77328	7.61661
4	-1.05816	10	7	0.26784	6.486907	4	8.199758	0.1	0	0.78912	15.04633
5	-2.15066	0	0	0.24048	5.596493	5	6.471423	0	0	0.792	11.86905
6	-1.08941	0	0	0.45648	8.191245	6	6.734339	0.4	0	0.76032	3.724207
7	1.401424	0	0	0.22032	1.929345	7	9.035176	0	0	1.01088	9.279885
8	2.25684	3.7	0	0.108	4.504211	8	6.561007	1.7	0	1.36224	20.25263
9	0.599757	6	4.2	0.42048	7.874468	9	4.471424	5.3	0.35	0.5184	9.094594
10	2.27934	6.4	4.48	0.20304	3.885557	10	3.30934	0	0	0.76608	11.53554
11	1.11434	0	0	1.19088	9.755067	11	5.31184	2.4	1.4	0.77472	20.16522
12	1.426424	0	0	0.51552	7.577948	12	2.085174	6.8	4.76	0.83376	11.51581
13	2.01184	5.8	0.35	0.49392	8.540336	13	0.427257	0.2	0.14	0.82224	5.182639
14	6.050589	2.2	0	0.62352	9.427674	14	-1.39858	0	0	1.0224	11.92418
15	7.63684	0	0	0.68976	6.945251	15	-1.53441	0	0	1.4256	20.39059
16	6.796841	0	0	0.66528	5.045826	16	-0.79649	0	0	0.61488	4.823904
17	2.330174	0	0	0.76176	5.115444	17	-0.60316	0	0	0.8208	12.12649
18	3.949757	0	0	0.8496	7.241473	18	2.245174	2.1	1.47	0.64512	16.66522
19	4.887674	0	0	0.65232	12.94335	19	-0.61024	1.4	0.98	1.06848	12.9083
20	6.92309	0.7	0	0.7416	8.346757	20	-1.47899	0	0	1.20816	15.63941
21	9.16434	5.2	0	0.84528	11.35361	21	-1.02649	0	0	0.99792	9.710236
22	10.78601	2.6	0	1.01664	11.97225	22	-0.78649	0.1	0	0.7272	8.213243
23	6.931007	11.8	0	0.67824	13.61587	23	-1.30524	0	0	0.98064	4.393775
24	7.19809	0.1	0	0.8856	16.20039	24	1.01559	0	0	1.02528	5.720102
25	6.798508	2.3	0	1.02816	14.57777	25	1.153924	0	0	1.46016	14.03177
26	6.032674	0	0	0.4248	5.991598	26	0.78809	0	0	1.36512	8.342524
27	4.928507	16.9	0	0.23616	8.566497	27	2.046007	0	0	1.09728	3.715189
28	3.956007	0	0	0.63072	3.548178	28	4.09684	0	0	1.04832	7.215129
29	4.529757	0	0	0.7128	3.805516	29					
30	2.76309	2.7	1.89	0.55296	9.580959	30					
31	2.751007	2.4	1.68	0.79776	7.221235	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	5.774341	0	0	1.37808	7.442301	1	16.00226	0.2	0	2.36736	3.047994
2	6.89059	0	0	1.06992	5.788371	2	15.06434	0	0	2.31696	6.508442
3	7.403925	0	0	1.22688	9.745597	3	12.81809	1.4	0	1.74096	4.5076
4	8.291425	0	0	1.17504	5.319455	4	12.00392	0	0	1.98	3.385365
5	8.964758	5	0	2.19024	21.59284	5	12.79934	0	0	2.53872	5.097384
6	4.581423	19.2	0	0.9	14.63751	6	12.05309	0	0	1.99584	9.841194
7	5.673507	4.8	0	1.29024	10.13346	7	11.21851	0	0	2.08368	4.198987
8	5.218924	0.8	0	1.53792	6.89904	8	12.38726	0	0	2.2824	3.049613
9	4.561841	0	0	1.24704	14.15712	9	12.75934	0	0	2.28384	3.57646
10	4.186424	0.6	0	1.88208	16.65609	10	13.12809	0	0	2.10096	7.502832
11	3.84684	0	0	1.23552	5.904732	11	12.13809	0	0	2.35728	6.12498
12	4.73684	0.5	0	1.43856	15.23169	12	11.03726	0	0	1.81728	11.01989
13	2.635174	0	0	1.31472	10.41084	13	8.886425	1.5	0	1.65888	9.281022
14	3.251423	0	0	0.90576	9.319761	14	9.237674	6.7	0	1.74816	5.637274
15	4.816007	0	0	1.30464	2.992534	15	10.19184	0	0	2.088	4.617294
16	7.636007	0	0	1.35072	5.176005	16	12.26601	0	0	2.06784	3.629284
17	5.917674	0	0	1.56816	11.86572	17	11.89517	0	0	2.620801	6.047081
18	3.43184	2.5	0	1.04112	12.52717	18	13.14184	0	0	1.97568	4.244961
19	1.92559	0	0	0.8064	13.68074	19	13.60851	0.6	0	1.63872	6.162249
20	-0.29024	36.8	25.76	0.2664	13.18198	20	13.79726	3	0	2.4984	6.908186
21	0.40059	22.5	15.75	0.57888	15.19523	21	12.77476	0.5	0	1.99728	10.45237
22	-0.01233	0.9	0.63	1.512	22.24354	22	11.72642	1	0	2.44656	13.27993
23	1.09559	0	0	0.82368	5.773699	23	10.13601	0.7	0	1.44432	6.756538
24	3.55559	0	0	1.52496	17.27919	24	10.72934	0.6	0	2.772	3.454659
25	2.827673	23.3	7.28	0.83952	18.64775	25	11.21767	0	0	2.4984	3.559478
26	1.867257	0	0	1.29312	5.884268	26	12.30476	0	0	2.00592	3.842418
27	5.17184	0	0	1.66176	4.567388	27	11.44309	0	0	2.76624	6.911289
28	7.297257	0	0	1.76256	3.582821	28	8.987674	11.6	0	1.99152	10.19983
29	10.48059	0	0	1.78128	13.79913	29	8.875173	0.2	0	2.4048	7.151655
30	12.78642	1.7	0	1.5768	10.94482	30	9.573924	0.3	0	1.61424	8.795391
31	14.71143	0	0	2.15136	2.938898	31					

D A Y	May Temp. °C daily	May Precip T. mm daily	May Snowfall cm daily	May Evapot. mm daily	May Wind S. km/h daily	D A Y	June Temp. °C daily	June Precip T. mm daily	June Snowfall cm daily	June Evapot. mm daily	June Wind S. km/h daily
1	8.420173	9	0	1.56384	5.067504	1	17.74225	0	0	3.84192	4.61541
2	12.13476	0	0	3.46176	4.908591	2	16.61726	1.2	0	2.29104	9.089561
3	10.69309	3.1	0	1.6776	5.722219	3	13.50226	0.2	0	2.68128	4.97925
4	11.51393	0.3	0	2.10816	5.402878	4	14.94518	0	0	4.14432	5.856987
5	12.20726	0.4	0	2.51856	6.855134	5	16.34226	0	0	4.45968	7.290234
6	11.57851	0	0	3.14208	5.555998	6	20.05309	0	0	4.45104	5.491558
7	12.41767	0.2	0	1.64448	5.224705	7	20.23101	0	0	5.47056	5.119746
8	14.09767	0	0	3.36384	3.774171	8	20.86767	0.1	0	5.28048	3.105629
9	15.55309	0	0	3.79008	2.834571	9	22.55267	0	0	5.22432	2.811919
10	16.98226	0	0	4.15728	2.746086	10	23.62309	0	0	5.191199	3.019534
11	16.86059	0.6	0	2.5056	2.72691	11	21.61142	0	0	5.330881	7.325754
12	15.68767	0	0	4.134241	5.642248	12	19.17976	0	0	5.044321	10.60911
13	17.56351	0	0	3.79872	2.730819	13	17.58976	0	0	4.70304	6.384244
14	19.00101	0	0	4.19616	3.147917	14	18.62642	0	0	4.72176	6.427122
15	18.34476	0	0	4.13136	3.85056	15	19.85392	0	0	4.53456	4.14582
16	18.69642	0	0	4.458241	3.373677	16	22.72392	0	0	5.05296	2.44779
17	20.24142	0	0	3.81024	9.953101	17	24.15726	0	0	5.3496	3.961528
18	19.33184	0.5	0	3.3984	4.762569	18	21.00184	0	0	3.51648	7.143349
19	19.21017	0	0	3.60288	4.109374	19	20.19809	0	0	4.24944	3.657153
20	20.54642	0	0	4.6944	6.386201	20	19.79767	0.9	0	2.82384	3.991065
21	19.64059	0	0	4.53456	7.949853	21	17.04934	1.8	0	2.53584	2.967468
22	19.06559	0	0	4.27968	4.197822	22	15.20226	2.9	0	2.6568	8.939683
23	20.11225	0	0	4.53168	2.949731	23	13.16726	5.2	0	2.29824	8.553376
24	21.55059	0	0	4.88304	4.61445	24	13.69726	5.4	0	2.60496	4.869714
25	20.48809	3	0	3.19248	4.675232	25	13.95101	0	0	3.276	7.750408
26	19.37809	0	0	4.54176	4.266852	26	14.40309	0	0	3.6648	8.169923
27	19.82309	1	0	4.160161	5.234779	27	15.80059	0	0	3.92832	5.769027
28	17.24809	0	0	2.43648	3.418609	28	16.18892	0.7	0	3.29184	4.164534
29	15.14101	0.2	0	2.33424	3.459274	29	17.39601	0	0	2.7648	3.463687
30	12.60601	0.5	0	2.38752	7.387543	30	18.45059	0.1	0	3.42	2.6433
31	14.87934	0	0	4.0248	3.993522	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	17.83559	2.6	0	2.41776	3.414538	1	22.96559	0	0	3.95424	5.671824
2	17.34601	1.5	0	2.93328	2.407568	2	23.84643	0	0	3.03264	4.147065
3	18.14601	0	0	4.456801	3.232947	3	23.17643	0	0	3.36096	3.896429
4	19.03643	0	0	4.34592	3.9336	4	22.50143	0.7	0	2.96784	5.903019
5	19.71892	0	0	4.54608	3.534946	5	20.75226	0.8	0	3.00384	7.112003
6	19.10642	1.6	0	3.48336	2.434178	6	20.13934	1.1	0	3.00672	8.471409
7	19.15601	0	0	4.785121	4.188263	7	19.48559	0	0	2.6424	5.311814
8	20.53017	0	0	4.986719	6.051548	8	19.52684	0	0	2.23056	3.99469
9	21.39059	0	0	4.73616	6.318874	9	19.73684	0	0	2.77488	4.250996
10	20.05392	0	0	4.74336	3.741056	10	19.97184	0.2	0	2.76048	3.588381
11	17.34684	0.5	0	3.07008	3.857599	11	19.68059	1	0	2.7936	4.079568
12	15.95309	0	0	4.12992	5.321523	12	18.88934	0	0	2.81664	5.939677
13	18.60142	0	0	3.8232	6.299882	13	19.46142	0	0	3.3984	4.077497
14	20.40892	0	0	4.86576	5.157599	14	20.74309	0	0	3.37104	3.088369
15	23.78226	0	0	4.6656	5.166043	15	20.88934	0	0	2.93616	7.186716
16	24.42017	0	0	5.48496	7.841192	16	21.29434	0	0	3.63312	4.597374
17	24.07017	0	0	4.89312	4.709924	17	21.82934	0	0	3.25296	4.983042
18	23.91601	0	0	4.49424	6.183248	18	22.6835	0	0	2.95344	5.875692
19	19.93267	0	0	4.30128	6.733651	19	22.83517	0	0	3.9384	9.485641
20	19.26809	0	0	4.832641	10.56429	20	23.09892	0	0	3.69792	5.025603
21	20.29101	0	0	4.632481	5.549387	21	22.83684	0	0	3.3552	4.178416
22	22.29809	0	0	4.56336	4.739048	22	23.28101	0	0	3.44592	5.292186
23	24.70059	0	0	4.13712	3.911275	23	22.79476	0	0	3.51648	6.082459
24	26.87309	0	0	5.0688	2.866483	24	20.96642	0	0	2.60496	4.924631
25	26.31767	0	0	5.14656	6.590833	25	19.45476	0	0	2.4768	4.40779
26	20.39517	0	0	4.68432	16.81644	26	20.88017	0	0	3.09888	4.008967
27	19.46559	0	0	4.285441	6.931029	27	22.33726	0	0	3.08304	3.989351
28	22.05184	0	0	4.05648	4.349668	28	22.761	0	0	3.19824	3.709514
29	23.74059	0	0	4.406401	6.231323	29	22.75101	0	0	3.29184	3.60027
30	22.58225	0	0	4.09968	5.524029	30	21.74601	0.1	0	2.68848	3.930238
31	23.66934	0	0	4.35024	8.863444	31	20.33684	0	0	2.36592	5.375439

D	Sept.	Sept.	Sept.	Sept.	Sept.	D	October	October	October	October	October
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	Daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	20.40017	0	0	2.24352	3.928434	1	17.45226	0	0	1.77552	5.612792
2	19.74517	0	0	3.07872	5.326119	2	15.88518	0.7	0	0.91008	4.650223
3	20.69142	0	0	2.85984	4.15194	3	13.84559	24.2	0	1.46736	7.61483
4	21.90018	0	0	3.03552	3.927839	4	13.07976	0	0	1.67184	5.74125
5	22.11434	0	0	3.00528	3.355612	5	14.10601	0	0	1.53072	3.331967
6	17.72767	0	0	2.05776	11.80024	6	16.44684	0	0	1.68192	2.761996
7	16.01851	0	0	2.60352	15.97826	7	17.37684	0	0	1.6344	2.988951
8	15.11142	0	0	2.57616	12.87812	8	17.76975	0	0	1.66608	3.083902
9	16.20517	0	0	2.19888	5.111684	9	19.18101	0	0	1.81296	2.904594
10	16.88309	0.8	0	1.332	4.460409	10	19.16476	0	0	1.6992	2.745403
11	17.16309	0	0	2.48112	10.29219	11	16.73684	0	0	1.41552	5.769705
12	17.07767	1.2	0	2.412	10.85698	12	15.03226	1.5	0	1.30032	12.35891
13	16.16017	0	0	2.02752	4.373567	13	8.988091	4.5	0	1.47888	21.31723
14	16.44767	0	0	1.76256	2.957804	14	4.090174	0	0	0.95328	7.093603
15	17.91017	0	0	2.07072	3.458999	15	6.321007	0	0	1.07856	4.714572
16	19.00601	0	0	2.29104	3.457067	16	7.517257	3.4	0	1.52208	8.511562
17	16.01392	6.8	0	1.48608	4.33352	17	8.105174	0	0	1.08864	4.301946
18	17.23684	0	0	2.11824	2.936929	18	9.938506	7.399999	0	0.80928	7.393345
19	18.23809	0	0	2.1672	4.26204	19	10.66892	2.1	0	1.0008	7.512704
20	16.72976	0	0	1.8864	3.907615	20	8.642259	0.2	0	1.1808	7.786402
21	16.31184	0	0	1.8288	3.03977	21	8.69559	0	0	1.04256	3.9357
22	15.76101	0	0	1.7856	3.887264	22	11.25434	8.9	0	0.44064	4.244924
23	16.536	0	0	1.8864	3.994324	23	15.03601	13.5	0	1.8648	10.07895
24	17.00017	0	0	1.93392	3.928191	24	14.14309	0.4	0	1.5192	11.82359
25	18.04809	0	0	1.84176	6.154834	25	14.76684	1.6	0	2.05056	15.42509
26	17.69393	0	0	2.0304	10.98513	26	14.47726	0.5	0	1.1376	8.715391
27	17.23101	0	0	1.95408	9.734776	27	14.07601	0	0	1.01952	4.142618
28	15.96934	0	0	1.51776	2.929663	28	11.82601	0	0	1.5768	8.866315
29	15.92559	0	0	1.6272	4.633067	29	10.33268	0	0	1.03104	4.463381
30	16.58934	0	0	1.61424	3.376079	30	8.322674	0	0	1.35792	13.30605
31						31	4.106007	0	0	1.04976	12.52239

D A Y	November Temp. °C daily	November Precip T. mm daily	November Snowfall cm daily	November Evapot. mm daily	November Wind S. km/h daily	D A Y	December Temp. °C daily	December Precip T. mm daily	December Snowfall cm daily	December Evapot. mm daily	December Wind S. km/h daily
1	3.475174	0	0	0.8496	8.286311	1	10.84476	0	0	0.4752	10.20674
2	4.904758	0	0	0.80064	5.350111	2	10.87309	4.5	0	0.82224	12.39706
3	5.517674	17.9	0	0.46656	7.595919	3	9.211424	0.4	0	0.92304	6.373117
4	6.646841	0	0	0.69696	9.210184	4	7.453091	0	0	0.52128	5.165172
5	11.14642	0	0	0.89136	13.62139	5	7.935174	0	0	0.828	10.6907
6	14.55351	3.1	0	1.08288	11.03941	6	7.00934	0	0	0.49536	3.882753
7	13.32893	25.4	0	1.20672	9.75893	7	6.62434	0	0	0.4464	1.833429
8	11.89643	2.5	0	1.25136	10.94632	8	7.558924	0	0	0.60624	3.93522
9	9.192258	20.5	0	0.39024	3.974037	9	6.918091	3.7	0	0.49968	8.048357
10	8.768924	38.5	0	1.21392	11.98815	10	4.08559	0.2	0	1.35216	21.0559
11	7.322256	3	0	0.8568	5.684531	11	2.68684	0	0	0.57888	8.081157
12	6.498507	0	0	0.85248	6.207506	12	2.19184	6.4	4.48	0.66528	9.832395
13	6.546423	0	0	0.8424	2.817282	13	1.98434	0.5	0.35	0.41904	4.695983
14	8.893924	0	0	0.85248	3.302417	14	3.447257	2.2	0	0.37584	8.794518
15	7.986424	0	0	0.78192	5.830364	15	7.27059	12.5	0	0.73008	14.47514
16	9.588923	0	0	0.88992	4.503871	16	6.241423	0	0	0.52416	7.445911
17	10.95934	0	0	0.84672	2.517682	17	4.367673	9.1	0	0.58176	16.97184
18	11.78684	0	0	0.8496	2.551631	18	2.38684	14.3	4.76	0.24336	11.73357
19	12.20101	0	0	0.6696	2.856134	19	2.19434	18.1	0	0.61776	15.26972
20	11.54309	0	0	0.70272	2.12628	20	2.157673	8.800001	3.57	0.57456	18.1742
21	12.65726	0	0	0.78912	1.651618	21	-0.73608	0	0	0.4176	8.802665
22	13.73809	0	0	0.85536	1.950923	22	4.560173	0	0	0.79056	8.840553
23	11.04434	0	0	0.82368	3.646218	23	9.711007	0	0	1.17216	20.68023
24	9.034757	0	0	0.55296	2.378298	24	11.19184	0	0	0.82656	7.366605
25	9.657257	0	0	0.60624	3.767924	25	12.15142	7.5	0	1.38384	21.99582
26	10.27142	0	0	0.61632	2.697015	26	10.76059	1.1	0	0.684	11.61551
27	8.678091	0	0	0.59184	3.756186	27	10.94142	5.099999	0	0.90288	17.19686
28	9.064757	0.1	0	0.6192	9.203218	28	4.857256	0.4	0	0.93168	15.25794
29	8.598506	0	0	0.70416	4.538003	29	4.91559	0	0	0.70704	4.813162
30	9.43309	0	0	0.50256	3.019395	30	7.61434	0	0	0.612	8.046289
31						31	12.06809	0	0	1.40256	14.67683

Ohrid Lake - 2010 daily climatic data

D	January	January	January	January	January	D	February	February	February	February	February
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	9.246425	4.799999	0	1.43424	27.85076	1	3.84309	0	0	0.71136	9.291537
2	5.858923	0.3	0	0.9	24.99465	2	6.011424	0	0	0.84816	9.655079
3	2.14684	1.9	0	0.7632	16.1327	3	7.988506	0	0	0.77328	7.61661
4	-0.51149	0	0	0.83088	4.470941	4	8.199758	0.1	0	0.78912	15.04633
5	2.084757	24.9	16.24	0.1584	8.050662	5	6.471423	0	0	0.792	11.86905
6	7.67684	0	0	2.12256	24.10549	6	6.734339	0.4	0	0.76032	3.724207
7	7.531424	0	0	0.77616	13.61007	7	9.035176	0	0	1.01088	9.279885
8	8.977674	0	0	0.48672	8.988042	8	6.561007	1.7	0	1.36224	20.25263
9	8.051841	0.8	0	0.80352	11.32299	9	4.471424	5.3	0.35	0.5184	9.094594
10	3.594756	0	0	0.8352	16.40193	10	3.30934	0	0	0.76608	11.53554
11	3.21059	0.4	0.28	0.63648	16.09768	11	5.31184	2.4	1.4	0.77472	20.16522
12	4.418506	0.4	0	0.56016	4.162408	12	2.085174	6.8	4.76	0.83376	11.51581
13	4.14559	0	0	0.38304	4.706104	13	0.427257	0.2	0.14	0.82224	5.182639
14	4.080591	0	0	0.66816	5.791188	14	-1.39858	0	0	1.0224	11.92418
15	4.803923	0	0	0.78912	9.423392	15	-1.53441	0	0	1.4256	20.39059
16	3.41309	0.3	0.21	0.83376	15.53245	16	-0.79649	0	0	0.61488	4.823904
17	2.322257	0	0	0.54432	4.204261	17	-0.60316	0	0	0.8208	12.12649
18	3.15684	0	0	0.79776	8.294436	18	2.245174	2.1	1.47	0.64512	16.66522
19	0.026007	0	0	0.87696	12.73628	19	-0.61024	1.4	0.98	1.06848	12.9083
20	-0.83983	0	0	0.5184	4.093035	20	-1.47899	0	0	1.20816	15.63941
21	0.504757	0	0	0.64224	5.124118	21	-1.02649	0	0	0.99792	9.710236
22	0.893507	0.4	0.21	0.56448	9.559971	22	-0.78649	0.1	0	0.7272	8.213243
23	-1.39108	0	0	0.69696	11.22019	23	-1.30524	0	0	0.98064	4.393775
24	-1.49691	0	0	0.64944	4.713752	24	1.01559	0	0	1.02528	5.720102
25	-1.70358	0	0	0.61056	4.431726	25	1.153924	0	0	1.46016	14.03177
26	0.015174	0	0	0.24336	2.715228	26	0.78809	0	0	1.36512	8.342524
27	0.35434	2.8	1.96	0.15408	5.636601	27	2.046007	0	0	1.09728	3.715189
28	1.94434	0.5	0.28	0.28656	8.627394	28	4.09684	0	0	1.04832	7.215129
29	3.816424	0.9	0	1.01808	10.3465	29					
30	4.497257	0	0	0.55728	13.47971	30					
31	4.388091	19.7	0	0.88416	24.28314	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	10.08267	0	0	1.29888	6.099882	1	8.466841	0	0	1.79136	9.880002
2	7.862674	0.7	0	1.26432	15.65948	2	8.743091	0	0	1.66032	5.622545
3	6.666007	0	0	0.9576	3.484589	3	8.749341	0	0	1.72224	4.312666
4	7.351008	4.6	0	0.57024	5.930708	4	11.74934	0	0	1.8864	3.545569
5	5.608091	0.3	0	0.92304	14.3936	5	9.461841	0	0	1.32768	6.683806
6	-1.23316	8.799999	6.16	0.51264	9.604159	6	7.021841	0	0	1.48752	7.909841
7	1.488924	0	0	1.66464	11.21237	7	8.267674	0	0	2.1312	8.782718
8	0.582674	1.5	1.05	1.33344	24.15875	8	9.098508	0	0	1.92528	4.770376
9	2.517257	0.2	0.07	1.06848	10.25871	9	11.45059	0	0	2.16432	3.390487
10	2.32059	4.3	2.87	0.67968	13.33545	10	10.79059	0	0	1.74672	4.805954
11	2.918924	7.3	5.04	0.59616	7.953863	11	9.368506	0	0	1.98144	4.92043
12	2.956841	1.4	0.98	0.87984	20.44255	12	9.649341	0	0	1.87344	3.534463
13	2.709757	0	0	1.3536	5.844733	13	8.297256	14.7	0	0.98064	4.385925
14	2.777257	0	0	1.78416	13.33888	14	10.43101	0	0	2.20176	6.002597
15	3.073507	0	0	1.49472	8.543115	15	11.31601	3.1	0	1.86624	8.015864
16	3.828924	0	0	1.404	5.10287	16	13.28476	0	0	2.60064	3.487541
17	4.358923	0	0	1.65168	7.836737	17	13.11018	0	0	2.51712	5.107648
18	5.124756	0	0	1.66752	6.532988	18	13.74559	4.2	0	2.80368	7.462929
19	7.142257	0	0	1.66752	3.099045	19	11.32601	12.2	0	1.05552	7.836783
20	7.149757	0	0	1.87488	5.877647	20	8.528091	0.1	0	1.68048	11.82627
21	8.144757	0	0	1.9152	7.218399	21	10.21184	0	0	2.87136	5.609139
22	11.37892	0	0	1.58112	3.108302	22	11.51517	0	0	3.24576	5.887737
23	11.44809	7.6	0	0.82368	2.390769	23	12.39101	0	0	1.94688	3.23937
24	11.42809	6.5	0	1.3464	2.894912	24	13.67392	1.9	0	2.60064	6.374222
25	11.46184	0	0	1.69632	2.536227	25	14.03309	0.5	0	2.8368	9.592181
26	11.57559	0	0	1.75104	4.019271	26	14.45184	0	0	3.65616	10.1633
27	11.88226	0	0	1.91952	5.448238	27	13.45309	0	0	3.23856	3.655536
28	8.352674	1	0	2.04624	15.01609	28	13.41184	0	0	3.05568	6.217742
29	7.800174	0	0	1.81008	5.469383	29	14.10559	0	0	3.74688	10.39334
30	10.64309	0	0	2.05776	4.238483	30	13.69267	0	0	3.29472	4.61553
31	10.12351	0	0	1.53648	11.71391	31					

D	May	May	May	May	May	D	June	June	June	June	June
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	14.80226	0	0	3.5352	4.457842	1	12.55893	0.6	0	3.72096	14.59969
2	15.54184	0	0	3.51936	2.784313	2	12.95601	0	0	3.41712	3.997634
3	15.39392	0	0	3.48624	4.329049	3	14.84392	0	0	4.11696	3.861769
4	17.41101	0	0	3.48336	3.031496	4	14.62642	0	0	3.71232	4.125468
5	19.156	0	0	2.80368	6.012306	5	15.036	2.8	0	2.088	5.463814
6	15.7835	2.5	0	2.22624	6.475075	6	16.96017	0	0	3.66336	5.357237
7	11.28101	0	0	2.68272	9.455259	7	17.71559	0	0	4.59504	3.60058
8	13.21309	2.5	0	3.26592	6.556753	8	18.08267	0	0	4.65408	3.634068
9	11.94017	0	0	3.18528	9.874394	9	19.63309	0	0	4.91328	3.335229
10	13.98226	0	0	3.47184	5.302269	10	21.00059	0	0	4.98384	3.359649
11	17.43767	0	0	3.5064	4.513965	11	22.71184	0	0	5.33664	3.087415
12	17.76767	0	0	3.46032	6.101753	12	24.31559	0	0	5.65488	3.051989
13	16.43392	0	0	4.02336	8.412704	13	24.93434	0	0	5.14224	2.457224
14	15.65142	0	0	3.77136	6.516577	14	24.0985	0	0	5.33376	5.186546
15	14.65017	13	0	3.00096	18.23014	15	23.42934	0	0	4.78512	2.926539
16	10.24559	0.6	0	2.26512	28.46135	16	23.79559	0	0	5.66784	5.469971
17	9.493923	0	0	2.70288	17.68315	17	23.50768	0	0	5.150879	3.418036
18	8.744757	0	0	2.42208	9.505721	18	23.31517	0	0	5.1192	4.523262
19	10.24559	0	0	3.23712	5.158235	19	19.94559	0.6	0	4.02192	5.600382
20	11.33934	1.8	0	2.53728	4.963884	20	16.07642	5	0	3.03408	8.653083
21	11.27309	0.4	0	2.97792	11.40813	21	13.54059	13	0	1.98432	6.244067
22	11.65642	0	0	3.29616	4.882666	22	12.61517	0	0	2.884321	10.55767
23	13.21601	0	0	3.57984	2.873529	23	13.86767	2.1	0	2.86992	6.611993
24	13.61476	0	0	3.61584	3.489369	24	15.46726	0	0	4.04496	8.600782
25	15.39976	0	0	4.24944	3.009018	25	16.03851	0	0	4.43952	8.081512
26	17.88767	0	0	4.8528	4.697995	26	15.66142	0	0	4.09104	5.842451
27	17.42851	0	0	5.03568	5.424196	27	15.83601	0	0	3.71952	4.178563
28	15.73267	0	0	3.04704	5.669481	28	16.33142	0	0	2.83392	4.8016
29	16.94268	0	0	3.960001	4.601668	29	18.03767	0	0	4.14	4.425107
30	16.95726	0	0	3.9816	6.835043	30	18.55601	0	0	2.91024	4.358709
31	16.34726	0	0	4.11984	12.4393	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	19.23684	0	0	3.42576	4.605499	1	20.73476	0	0	4.245121	6.864925
2	19.43018	0.1	0	2.80944	3.393479	2	21.94142	0	0	4.24368	5.333281
3	19.32351	0.2	0	3.14352	3.796447	3	23.71017	0	0	4.47984	2.948453
4	20.64184	0	0	4.8528	3.950429	4	22.70642	0.7	0	3.134881	3.663721
5	20.78767	0	0	4.99536	4.46145	5	21.69976	0	0	4.2768	3.771562
6	21.08892	0	0	5.015521	4.498524	6	21.78267	0	0	4.18032	4.78167
7	20.44601	0.2	0	4.77216	6.919295	7	19.96142	0	0	3.86496	4.361299
8	16.79684	7	0	5.225761	14.4957	8	21.06184	0	0	4.14432	5.903896
9	18.03059	0	0	5.07312	13.54816	9	21.46559	0	0	4.164481	6.856142
10	19.45142	0	0	4.815361	7.020193	10	22.316	0	0	4.35888	6.09547
11	20.03892	0	0	4.4784	4.627241	11	23.16059	0	0	3.944161	4.472886
12	21.01226	0	0	4.60944	3.471134	12	24.31559	0	0	4.17744	3.878223
13	21.71101	0	0	4.73184	3.056744	13	25.62767	0	0	4.35888	3.388811
14	22.78892	0	0	4.66272	3.49153	14	25.41934	0	0	4.16016	3.103803
15	24.39976	0	0	5.08032	5.750879	15	25.91809	0	0	4.3416	3.342547
16	25.05892	0	0	5.217121	7.438924	16	25.35809	0	0	4.41072	4.72244
17	23.93643	0	0	4.2624	4.317109	17	21.32934	0	0	3.96288	7.655403
18	23.88642	0	0	4.69584	4.07905	18	20.52101	0	0	3.74832	3.268235
19	22.81142	0.2	0	3.59424	6.634062	19	22.26809	0	0	3.888	3.861429
20	21.94309	0	0	4.74768	5.339146	20	23.66392	0	0	3.924	5.725346
21	22.7485	0	0	4.71312	4.349611	21	23.28809	0	0	3.87936	6.547577
22	22.77518	0	0	4.05792	3.063624	22	21.88309	0	0	3.81744	8.625785
23	23.87934	0	0	4.92048	3.061516	23	21.21892	0	0	3.4128	4.217367
24	23.66476	0	0	5.014081	7.247326	24	22.67809	0	0	3.56832	3.47016
25	19.85684	0	0	3.66336	5.823679	25	23.79351	0	0	3.623041	3.063942
26	17.69892	0.5	0	2.39328	5.182766	26	24.68642	0	0	3.6504	6.329042
27	16.11559	0	0	3.34656	8.248267	27	24.39184	0	0	3.52224	3.341395
28	15.99726	0	0	3.61296	4.446031	28	23.68351	0	0	3.528	6.603714
29	19.05267	0	0	4.10544	3.365738	29	21.57642	0	0	3.10176	6.863906
30	21.47475	0	0	4.34592	3.122207	30	19.08517	0	0	2.99232	7.233512
31	20.69767	0	0	4.15008	4.96391	31	16.41934	0	0	2.304	14.05096

D A Y	Sept. Temp. °C daily	Sept. Precip T. mm daily	Sept. Snowfall cm daily	Sept. Evapot. mm daily	Sept. Wind S. km/h daily	D A Y	October Temp. °C daily	October Precip T. mm daily	October Snowfall cm daily	October Evapot. mm daily	October Wind S. km/h daily
1	13.02101	0	0	2.11536	6.400289	1	12.42684	0	0	1.82304	3.384794
2	14.15184	0	0	2.43936	4.62627	2	14.19351	0	0	1.91808	3.28806
3	17.13893	0	0	2.53008	3.242465	3	14.38767	0	0	1.67904	2.816743
4	15.55393	9.9	0	1.5264	6.344215	4	14.45476	0	0	1.50624	3.251146
5	16.86643	0	0	2.82672	4.977034	5	14.20268	0.5	0	0.83664	2.198928
6	17.05892	0	0	2.83392	4.094736	6	14.84059	3.6	0	1.404	7.927478
7	18.51559	0	0	2.97072	2.592936	7	12.58226	1.5	0	1.01664	6.483543
8	19.88684	0	0	3.00096	3.758382	8	8.798091	0	0	1.72944	10.80898
9	19.43893	0	0	2.0016	2.96637	9	6.55559	0	0	1.3248	4.646434
10	19.88851	0.1	0	1.94544	4.226775	10	8.901423	0	0	1.39392	3.743622
11	16.50976	14.9	0	1.50192	8.061399	11	9.67184	6.3	0	0.83952	6.893489
12	15.88559	0.3	0	2.09952	4.907038	12	13.43684	3.2	0	1.57824	4.825865
13	16.26684	0	0	2.776321	4.083753	13	15.34142	2.4	0	1.1808	3.795893
14	18.00767	0	0	3.06576	4.083142	14	13.94809	7.6	0	0.68544	6.027008
15	16.76559	0	0	2.66832	4.066269	15	12.80726	0	0	1.4184	4.819976
16	17.05559	0	0	2.74032	5.444181	16	12.31017	0.3	0	1.37808	5.280958
17	17.30726	0	0	2.75472	4.943373	17	12.71434	0.4	0	1.39536	3.912002
18	18.55059	0	0	2.9376	5.116942	18	14.09767	1	0	1.18656	9.740037
19	19.82892	0	0	2.9304	5.139785	19	13.86642	1.1	0	1.8504	10.31651
20	17.67643	0	0	2.57616	7.525549	20	12.18351	2.3	0	1.60128	10.69108
21	15.58726	0	0	2.61504	5.508831	21	11.35518	0	0	1.35792	9.090302
22	17.22976	0	0	2.62944	5.703003	22	8.748091	0	0	1.46016	5.72291
23	16.81017	0	0	2.11536	4.489741	23	10.07142	0	0	1.09152	2.946832
24	16.28017	0	0	2.06352	2.96899	24	10.60392	0	0	1.1088	3.994267
25	15.99434	5.2	0	1.30752	9.192416	25	9.941007	19.5	0	0.53136	5.244772
26	14.94017	1.6	0	1.9008	15.20501	26	12.84601	1.9	0	1.3176	3.90222
27	13.92684	0	0	1.88496	9.543737	27	9.065174	12.3	0	1.48752	10.9623
28	15.65142	4.5	0	1.94976	7.716211	28	4.92559	0.1	0	1.9152	15.06619
29	13.46892	2.5	0	0.78912	5.057409	29	6.031424	0	0	1.2096	5.672926
30	12.07726	0	0	1.7712	3.344903	30	8.519757	0	0	1.02384	2.282118
31						31	9.704341	0	0	0.99072	3.004737

D	November	November	November	November	November	D	December	December	December	December	December
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	11.13142	0	0	1.14048	3.4071	1	13.45267	0	0	1.06272	22.57066
2	11.28934	0	0	1.12464	3.719544	2	10.81142	0	0	0.74736	14.42527
3	12.60101	1.4	0	1.28736	3.248657	3	11.22851	4.4	0	0.81072	12.41936
4	15.16809	0	0	1.16496	2.812666	4	6.517256	23.1	0	0.21168	6.814449
5	15.68851	0	0	1.16352	2.56604	5	4.495174	0	0	0.23616	4.464788
6	13.86476	0	0	1.18944	4.537364	6	4.254757	0	0	0.81936	6.357834
7	13.98018	0	0	1.29744	5.828871	7	8.121007	0	0	0.63216	3.012858
8	12.68934	13.4	0	1.91232	25.61769	8	10.31476	0	0	0.6696	3.634069
9	12.31517	13.4	0	1.44288	27.37403	9	10.97684	0	0	0.70416	11.69776
10	12.98934	0	0	1.38096	24.77061	10	0.668924	0.3	0	1.45152	22.75488
11	13.07684	0	0	1.18512	15.58745	11	-3.59608	0	0	1.224	17.21916
12	10.27476	0	0	0.82224	6.463553	12	-1.10566	0	0	0.54864	4.564433
13	11.42267	0	0	0.8712	3.41191	13	-0.03524	12.4	8.54	1.01376	13.27741
14	12.79392	0	0	0.83376	3.679956	14	-2.12566	0	0	0.73008	10.46158
15	13.99434	0	0	0.85824	3.165957	15	-4.16649	0	0	0.73872	8.793397
16	13.48976	0	0	0.83952	2.863602	16	-4.14233	3.8	2.59	0.87264	9.49859
17	9.814341	9.800001	0	0.24912	5.644339	17	-3.87191	0	0	0.4032	13.06906
18	8.261842	0	0	0.81072	7.647482	18	2.278924	0.2	0	1.13616	30.29157
19	9.213508	7.1	0	0.33696	5.089906	19	3.76684	0	0	0.45504	9.187008
20	8.703091	0	0	0.68976	3.240156	20	7.341424	3.1	0	0.6696	4.713362
21	8.968923	0	0	0.59328	2.63853	21	8.501841	0.9	0	0.4896	3.073756
22	11.37184	1.7	0	0.94176	13.48145	22	8.578506	0	0	0.49824	2.163056
23	8.40684	3.7	0	1.1304	16.93634	23	8.742256	0	0	0.62208	4.366324
24	5.678507	3.8	0	0.69984	18.33624	24	9.710589	1.8	0	0.6984	10.28128
25	5.18559	1.6	0	0.8064	12.77013	25	6.664757	0	0	0.63648	14.31612
26	5.534757	16	0	0.37296	13.768	26	5.659757	0.6	0	0.39024	2.827912
27	6.966425	0.1	0	0.93168	16.55957	27	4.338923	2.8	0	0.58896	3.646509
28	10.96059	0	0	0.78192	7.080162	28	1.540173	0	0	0.77328	7.868676
29	10.72726	2.8	0	0.9792	16.29441	29	1.957674	0	0	0.89136	5.236039
30	10.01059	0.9	0	0.93312	15.77228	30	2.886424	0	0	0.60336	2.46883
31						31	3.465174	0	0	0.51696	1.726871

Ohrid Lake - 2011 daily climatic data

D	January	January	January	January	January	D	February	February	February	February	February
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	Mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	Daily	daily	daily	daily		daily	daily	daily	daily	daily
1	3.741424	0	0	0.43776	1.43078	1	0.587257	0	0	1.12896	6.83153
2	5.216839	0	0	0.50976	3.005513	2	1.476007	0	0	1.01376	6.342112
3	2.82059	0	0	0.95616	9.717814	3	2.183924	0	0	1.3536	12.48694
4	-1.17941	0	0	0.69696	8.240651	4	1.808507	0	0	1.4544	9.161469
5	0.292257	0	0	0.45936	2.929807	5	4.411007	0	0	0.87264	2.470766
6	2.34309	0	0	0.46512	2.352241	6	8.88184	0	0	0.96912	3.604539
7	3.341424	0	0	0.4464	3.528202	7	8.94684	0	0	1.2312	7.841692
8	4.773508	0	0	0.52128	3.273434	8	9.123923	0	0	1.0872	1.802323
9	6.515589	0	0	0.46512	2.148065	9	8.155591	0	0	1.27152	6.500952
10	8.00184	0	0	0.35136	1.814233	10	5.941424	0	0	1.27296	5.53693
11	7.457256	0	0	0.42912	2.330207	11	5.34559	0	0	1.2456	7.55894
12	6.848925	0.9	0	0.68544	3.376591	12	3.526424	0	0	0.45216	12.09492
13	5.536424	0	0	0.45792	4.076928	13	5.148507	0	0	0.828	4.417442
14	6.799339	0	0	0.48816	2.217941	14	4.673507	0	0	0.88272	5.235513
15	8.49184	0	0	0.72	4.361612	15	4.947257	0	0	0.93024	2.630721
16	4.64559	0	0	0.97344	13.33079	16	5.623507	0.1	0	0.9288	4.991446
17	5.497674	0	0	0.5616	4.114905	17	7.638924	1.8	0	1.78128	16.18178
18	7.698508	0	0	0.53136	1.457923	18	8.856008	3.7	0	1.16784	13.67126
19	7.779341	0	0	0.51552	2.302385	19	7.583923	0.6	0	1.90656	16.90971
20	5.86059	0	0	0.37872	2.561853	20	6.115174	0.2	0	1.49904	7.0427
21	5.19434	7.8	0	0.22896	4.275936	21	5.965173	2.2	0	1.03824	10.20016
22	4.927674	4	1.82	0.85392	7.267996	22	4.850174	0	0	0.95328	6.852743
23	3.01559	5.5	2.38	0.6336	11.80876	23	3.661424	0	0	1.32624	10.02188
24	0.357673	15.1	10.57	0.14976	13.14417	24	1.458507	0	0	0.82656	16.15322
25	-4.19233	0	0	1.4976	12.07336	25	2.278924	0	0	1.368	10.6062
26	-2.91483	0	0	0.62928	2.62646	26	3.238507	0	0	1.45008	10.57393
27	0.583507	0	0	0.57312	5.076864	27	3.923924	0	0	0.97344	2.861467
28	1.48809	1.9	1.33	1.02672	18.89265	28	4.543507	0	0	1.0584	2.917465
29	1.81559	0.8	0.56	0.93024	11.08593	29					
30	2.384757	0	0	0.71856	2.798112	30					
31	3.007258	0	0	0.83232	4.855787	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	Mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	5.435174	0	0	1.26432	10.08235	1	9.201841	0	0	1.18224	6.56239
2	3.376007	1.2	0.84	0.66816	11.27389	2	9.446839	0	0	1.59408	11.23561
3	5.24684	0.9	0.63	0.73008	6.752956	3	9.918506	0	0	1.35072	6.239934
4	3.620174	9.7	0	0.87408	6.561618	4	11.29101	0	0	1.46592	2.560506
5	5.622257	23.5	7.91	0.89856	6.399269	5	12.02351	0	0	1.30176	3.691466
6	5.306424	8.200001	0	1.5048	7.396268	6	8.977674	0	0	1.04256	10.68313
7	-1.06483	0	0	2.10672	29.33372	7	9.988091	0	0	1.5192	8.295261
8	-2.65024	0	0	2.14992	26.91119	8	14.05142	0.2	0	1.63008	6.641792
9	-0.34566	0	0	1.16496	8.734731	9	13.61559	0	0	1.73808	7.472749
10	3.033924	0	0	1.10016	4.120156	10	10.78517	0	0	1.60848	7.950374
11	6.954341	0	0	1.35216	5.451308	11	8.059341	0	0	1.27008	11.85325
12	9.28184	0	0	1.47888	5.129665	12	9.788091	0	0	1.5192	5.413414
13	9.597674	0	0	1.61424	10.47315	13	9.666841	4.4	0	1.0296	9.481972
14	10.66059	0	0	1.2816	6.385153	14	6.66309	2.6	0	1.78992	9.840183
15	10.85601	0	0	1.16928	7.106194	15	7.649341	0	0	1.01808	3.117054
16	10.93476	3.4	0	0.8352	7.885111	16	6.999756	0.2	0	0.77904	7.373911
17	10.51142	11.5	0	1.2456	11.12273	17	6.766007	0	0	0.70992	8.796626
18	8.748924	0.1	0	0.85104	5.227141	18	7.951841	0	0	1.34352	13.12782
19	8.815591	7.7	0	0.58608	2.669187	19	8.700173	0	0	1.13904	10.11442
20	8.436423	0.9	0	1.47168	7.332016	20	10.88309	0	0	1.65888	7.066082
21	6.108091	0	0	1.07424	7.977842	21	12.88434	0	0	1.81584	2.352333
22	5.592257	0	0	1.04544	7.844096	22	13.70434	0	0	1.92528	2.07162
23	5.461841	0	0	1.18224	9.532524	23	13.68434	0	0	1.74096	2.899168
24	8.300591	0	0	1.26144	6.882908	24	14.27851	0	0	2.11968	3.46891
25	10.52934	0	0	1.55808	4.927446	25	15.20851	0.5	0	1.85328	5.563368
26	8.98684	0	0	1.37232	6.446106	26	12.15226	0.3	0	1.92816	7.561706
27	8.633924	0	0	0.96624	4.558544	27	9.039757	9.700001	0	1.24848	7.163149
28	9.713923	0.3	0	1.21536	7.262427	28	11.26809	0	0	1.32336	4.058057
29	8.786424	6.5	0	0.95184	7.551826	29	12.28017	5.8	0	1.16208	1.934036
30	9.334757	0	0	1.21392	3.335859	30	13.02726	3.6	0	1.95984	6.194922
31	10.22851	0.5	0	1.19808	6.559412	31					

D	May	May	May	May	May	D	June	June	June	June	June
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	Mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	Daily	daily	daily	daily		daily	daily	daily	daily	daily
1	12.71684	1.9	0	1.8936	6.863268	1	16.61601	0	0	4.28832	3.134044
2	13.25101	0	0	2.02752	4.883278	2	17.60226	0.1	0	3.31776	4.009578
3	12.82684	12.2	0	1.34352	7.383137	3	17.77517	0.3	0	3.62592	5.337847
4	12.14768	17.4	0	2.0304	4.512268	4	17.27726	0.3	0	2.7	3.214542
5	11.28601	0.6	0	2.89584	12.03389	5	18.32101	0	0	4.16592	3.439825
6	9.730174	0	0	3.65328	9.682506	6	19.51434	0	0	3.25296	5.660993
7	11.13768	0	0	3.54672	8.109322	7	20.52767	0	0	4.58352	3.96102
8	11.18142	0	0	3.29904	6.288136	8	20.98351	0	0	5.2272	3.891302
9	8.365591	16.4	0	1.78992	10.51638	9	17.54392	0.6	0	4.80096	7.933328
10	11.40184	0.1	0	4.04208	14.52939	10	15.03851	0	0	4.432321	5.919579
11	12.08601	0.7	0	2.70576	10.21512	11	15.49684	6.6	0	4.252321	5.384074
12	12.66559	0.1	0	3.97584	10.68095	12	15.11643	12.3	0	3.81456	4.745168
13	13.69017	0	0	3.73536	4.278823	13	16.50934	0	0	4.84272	4.890608
14	15.95726	0	0	4.36032	4.294242	14	18.00226	0	0	5.198401	4.570787
15	16.09309	0	0	4.39776	5.125701	15	17.75184	1	0	3.45024	5.401167
16	14.42392	0	0	3.1824	6.742803	16	17.46392	0	0	4.8096	3.526085
17	12.07976	1.5	0	1.99584	2.64485	17	18.67476	0	0	5.106239	3.339918
18	13.73851	0	0	4.45536	13.05884	18	19.15184	0	0	5.225761	4.160585
19	14.52267	0.6	0	3.41424	9.022525	19	19.21642	0	0	5.61888	6.176731
20	15.40267	0	0	4.04784	3.649427	20	19.80517	0	0	5.2848	6.728426
21	17.34642	0	0	3.9384	3.233247	21	19.55517	0	0	5.752801	5.091168
22	17.44517	0.3	0	3.40992	6.322742	22	21.19268	0	0	5.49936	3.614812
23	17.44434	0	0	3.94848	7.276301	23	22.16892	0	0	5.34816	2.977342
24	17.14976	1	0	3.51504	7.206864	24	23.26642	0	0	5.56704	3.045482
25	18.35851	0	0	4.03344	7.883623	25	21.01601	0	0	5.36544	11.58708
26	18.10434	0	0	4.644	9.070274	26	15.42643	0	0	5.46912	18.60878
27	17.56684	0	0	4.5576	4.451558	27	14.87892	0	0	3.84768	10.23122
28	17.15226	0	0	4.5648	3.699658	28	14.70892	0	0	3.83616	4.845339
29	17.30101	0.1	0	3.38256	5.008727	29	16.38684	0	0	4.19184	3.015999
30	17.33476	0	0	4.85712	5.63509	30	17.87059	0	0	4.51872	6.427141
31	16.80434	0	0	4.68576	4.168589	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	Mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	Daily	daily	daily	daily		daily	daily	daily	daily	daily
1	17.95517	0	0	3.93408	4.199763	1	19.67976	0	0	3.80304	4.04816
2	17.80476	0	0	4.46688	5.4265	2	19.61601	0	0	4.115521	6.471424
3	16.17017	0	0	3.67344	9.139831	3	19.83684	0	0	4.212	6.559395
4	16.39601	0	0	4.86144	4.43998	4	21.46726	0	0	4.001761	4.323379
5	18.24809	0	0	4.63392	7.144022	5	21.30184	0	0	3.028321	3.821381
6	18.22226	0	0	4.29264	4.627125	6	21.14142	0	0	4.25088	3.703709
7	20.57851	0	0	4.88304	3.50143	7	22.28809	0	0	4.18896	3.341632
8	22.73017	0	0	5.36544	3.714276	8	23.47475	0	0	4.44096	3.337133
9	24.08726	0	0	5.37552	2.896355	9	23.63517	0	0	4.7016	4.054476
10	24.44309	0	0	5.328	2.768798	10	19.78809	0.6	0	3.23712	10.38499
11	24.53767	0	0	5.47056	3.736906	11	16.30184	0	0	4.4208	15.4557
12	25.49934	0	0	5.686561	7.348637	12	17.98309	0	0	3.94416	4.011329
13	24.06601	0	0	5.2416	3.512459	13	20.77601	0	0	4.101121	3.016537
14	24.79434	0	0	5.356801	3.259383	14	22.23267	0	0	4.07808	3.280044
15	25.39059	0	0	5.3568	3.78159	15	22.53601	0	0	4.00896	3.216258
16	24.08476	0	0	5.1408	6.20633	16	23.04559	0	0	4.098241	4.802942
17	20.86101	0	0	4.9536	5.27837	17	22.93976	0	0	4.06368	5.562628
18	21.90934	0	0	4.92192	2.580546	18	23.40143	0	0	4.10688	4.693984
19	23.75726	0	0	4.98816	4.047141	19	23.62184	0	0	4.04928	4.093803
20	21.61267	0	0	4.14288	10.21973	20	24.82517	0	0	4.71456	10.26442
21	16.74726	0	0	3.9168	10.76686	21	22.97226	0	0	4.33152	10.20619
22	18.00934	0	0	4.19328	8.051208	22	23.31017	0	0	3.967201	5.172756
23	18.80892	0	0	3.096	4.789089	23	23.91892	0	0	3.86352	4.230667
24	20.15309	0.1	0	4.456801	6.905451	24	24.87101	0	0	3.7656	3.374823
25	18.23225	0	0	3.70656	8.685123	25	25.49767	0	0	3.75408	2.916687
26	17.09517	0	0	3.45744	6.0398	26	25.92059	0	0	3.9384	6.366989
27	18.81559	0	0	4.08384	3.623577	27	22.00517	0	0	3.08304	3.649133
28	22.09142	0	0	4.44528	3.252111	28	21.93684	0	0	3.35952	6.140933
29	20.33684	0.5	0	4.2408	7.353003	29	20.75934	0	0	3.28752	4.599393
30	17.81976	0	0	3.50496	5.76656	30	21.18518	0	0	3.37392	5.111411
31	19.61476	0	0	3.89232	3.557818	31	20.83434	0	0	3.25584	2.995886

D	Sept.	Sept.	Sept.	Sept.	Sept.	D	October	October	October	October	October
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	Mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	Daily	daily	daily	daily		daily	daily	daily	daily	daily
1	20.84226	0	0	3.348	3.259314	1	15.79351	0	0	2.11824	6.029318
2	20.92976	0	0	3.2472	2.782015	2	16.14351	0	0	2.38896	10.57113
3	21.74476	0	0	2.87136	5.689423	3	16.01309	0	0	1.99728	5.25553
4	21.74517	0	0	3.18096	4.199057	4	16.35267	0	0	1.90512	3.8518
5	22.30976	0	0	3.25008	4.188457	5	16.83976	0	0	1.85472	3.7311
6	21.86892	1	0	2.45808	4.174059	6	16.27517	0	0	1.8288	4.690633
7	19.42392	0	0	2.93184	4.551154	7	14.43809	0	0	1.52928	9.187869
8	19.94851	0	0	3.11616	4.777578	8	12.41434	10.9	0	0.87984	11.59649
9	20.49559	0	0	2.96208	3.007087	9	8.427257	3	0	2.20752	15.01762
10	21.91559	0	0	3.1248	4.154632	10	7.451841	0	0	1.90944	24.39547
11	22.80809	0	0	3.14496	3.015828	11	8.932257	0	0	2.0664	13.16284
12	22.74351	0	0	3.03984	2.810204	12	12.96226	0	0	1.48752	3.928515
13	23.87476	0	0	3.22704	3.838534	13	15.02184	0	0	1.67472	4.500863
14	23.25892	0	0	2.97072	3.395787	14	9.201008	2.3	0	1.61424	12.28542
15	23.41892	0	0	2.9376	3.189008	15	6.42059	10.9	0	1.89792	14.85546
16	22.91393	0	0	2.79504	3.994538	16	4.046007	0	0	1.84608	20.60402
17	23.08684	0	0	2.82672	3.469832	17	3.387257	0	0	1.62576	15.62567
18	21.49559	0	0	2.66832	3.907721	18	4.298507	0	0	1.30752	6.527105
19	20.11976	2.1	0	2.74752	9.930635	19	7.734339	0	0	1.58544	4.593548
20	16.07184	32.3	0	1.70208	7.878143	20	10.27517	0	0	1.47312	2.996784
21	14.16934	7.9	0	2.06928	9.822252	21	12.05226	0	0	1.3392	2.666341
22	16.49934	0	0	3.09024	11.81132	22	12.99184	0	0	1.40112	3.181985
23	17.57476	0	0	2.61504	4.363336	23	10.93517	1.6	0	0.72576	3.899468
24	18.44017	0	0	2.6136	4.116382	24	11.09392	0	0	1.26144	3.415904
25	18.64393	0	0	2.49264	3.848443	25	10.86517	0	0	1.14192	4.186236
26	18.02392	0	0	2.23632	3.616621	26	10.73601	0	0	0.91728	3.83871
27	17.36726	0	0	2.82816	10.19901	27	10.52726	0	0	1.14048	5.711069
28	15.59559	0	0	2.78928	9.816508	28	8.786006	0	0	0.93312	3.008407
29	16.00559	0	0	2.664	9.422946	29	9.317674	0	0	1.04688	4.32089
30	15.56642	0	0	2.52144	10.22185	30	8.376424	0	0	0.8568	3.347545
31						31	8.49934	0	0	0.82944	3.114629

D	November	November	November	November	November	D	December	December	December	December	December
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	9.847675	0	0	0.97632	2.408091	1	8.590591	0	0	0.53424	1.658048
2	9.99809	0	0	1.09728	4.946649	2	7.66184	0	0	0.54288	4.041984
3	9.243091	0	0	0.7488	3.040294	3	6.677256	0	0	0.42624	3.772519
4	9.390174	0	0	0.75312	2.730423	4	6.935591	0	0	0.41616	7.019952
5	9.962673	0	0	0.85536	2.883248	5	8.916008	0	0	0.52848	16.94066
6	10.26642	0	0	0.91008	5.331679	6	9.266425	1	0	0.77616	21.24025
7	9.675174	0	0	0.69984	5.772793	7	5.672674	1.3	0	0.56448	7.790548
8	9.992673	0	0	0.5544	2.729755	8	3.589757	0	0	0.64944	9.368381
9	11.63059	0	0	0.81216	2.98661	9	3.81184	0	0	0.54288	3.436895
10	11.78059	0	0	0.86688	3.651881	10	6.55559	0	0	0.46656	8.031524
11	9.311008	1.8	0	0.9144	7.560438	11	8.405174	0	0	0.50256	6.395194
12	5.422256	0	0	0.95328	11.11475	12	9.25434	0	0	0.56016	7.900217
13	1.800174	0	0	0.81504	10.93431	13	7.279757	1.2	0	0.24912	4.769756
14	1.934757	0	0	0.72288	8.989953	14	5.99434	0	0	0.49104	4.03311
15	3.53309	0	0	0.6912	5.616152	15	6.916007	0	0	0.49968	7.783727
16	4.732257	0	0	0.58464	4.206926	16	6.731006	0.1	0	0.65232	18.20866
17	4.11684	0	0	0.64512	4.867653	17	6.750174	2.7	1.54	0.70848	23.67768
18	5.261007	0	0	0.5184	2.405954	18	2.681423	0	0	0.65808	8.455216
19	7.307674	0	0	0.67536	2.152778	19	3.345174	12.8	5.39	0.63504	5.810058
20	7.707673	0	0	0.67968	2.537712	20	3.06309	5.7	3.85	0.648	7.716193
21	6.969341	0	0	0.57024	2.771053	21	2.07934	2.7	1.89	0.50544	11.94434
22	7.300173	0	0	0.46512	2.766216	22	-2.14608	4.3	3.01	1.92096	35.17138
23	8.390174	0.5	0	0.71856	5.811373	23	-2.04274	0	0	1.29744	19.18352
24	8.158923	0	0	0.57888	8.073607	24	-0.85024	0	0	0.3888	3.586318
25	7.287674	0	0	0.5688	5.593626	25	-0.32066	0	0	0.64224	8.270696
26	5.477673	0	0	0.39312	3.638979	26	-0.12316	0	0	0.6048	11.40715
27	5.70809	0	0	0.4896	3.498603	27	0.140174	0	0	0.55584	7.672091
28	8.778506	0	0	0.64512	3.979615	28	2.29934	0	0	0.55008	4.291184
29	8.309757	0	0	0.66528	5.022101	29	2.531007	0	0	0.55872	2.422427
30	7.925173	0	0	0.45792	2.481728	30	3.49559	0	0	0.52992	2.910304
31						31	1.597257	0	0	0.90576	14.2154

Ohrid Lake - 2012 daily climatic data

D	January	January	January	January	January	D	February	February	February	February	February
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	0.558924	0	0	0.85968	6.869286	1	-3.06483	3.5	2.45	1.3464	17.99235
2	3.879341	0	0	0.6192	1.476005	2	-1.40608	6.099999	4.270001	0.72864	16.36514
3	5.62059	0	0	0.5976	1.813076	3	1.627257	8.4	5.88	0.60912	9.332408
4	5.58934	0	0	0.56592	2.626459	4	4.579341	6.9	0	1.12464	20.34197
5	5.134757	0	0	0.54432	8.087851	5	3.507257	1.9	0	0.78624	5.01778
6	2.744341	22.9	9.03	0.76752	30.98661	6	-0.64274	0.9	0.63	0.80496	18.53849
7	-1.79358	0	0	2.10672	33.67321	7	-3.20649	0	0	1.67904	23.65659
8	-1.02149	0	0	0.57888	3.055728	8	-3.59816	0	0	1.15776	14.94859
9	0.628924	0	0	0.58176	6.787019	9	-2.79941	0	0	1.2816	8.175963
10	-0.02608	0	0	1.15776	11.03452	10	-2.16399	1	0.7	0.81792	14.75564
11	-0.74566	0	0	1.03392	12.91216	11	0.827257	4.9	3.43	0.82368	18.8839
12	0.677257	0	0	0.88416	6.769342	12	3.42934	8.000001	3.5	0.972	11.63341
13	1.508924	0	0	0.81936	8.38915	13	1.139757	2.4	1.68	0.40032	12.29643
14	-0.21191	7.3	4.55	0.76752	10.4529	14	1.329757	0	0	0.59904	7.765999
15	-2.82483	0	0	0.94032	5.789271	15	-0.58649	0	0	1.08432	16.22418
16	-4.59233	0	0	1.58832	9.955276	16	-0.72149	1.1	0.77	0.70416	15.85098
17	-4.58066	0	0	0.96912	3.873966	17	-2.64191	0	0	1.65456	8.756346
18	-1.93608	0	0	0.74448	2.848345	18	-0.11691	0	0	0.99504	4.439659
19	-1.29149	0	0	0.7704	5.63057	19	2.21559	0	0	1.13472	4.445867
20	1.98684	0	0	0.80784	19.53231	20	4.42934	0	0	1.01664	3.489475
21	2.179757	0	0	0.7344	12.83517	21	5.39559	0	0	1.19952	6.675386
22	0.72684	0	0	1.32336	10.69953	22	5.50309	0	0	1.50192	16.44269
23	4.64809	0	0	0.62784	4.34702	23	5.533923	0	0	1.3392	7.572117
24	5.303507	1.6	0	0.52704	6.1339	24	5.901424	0	0	1.28592	4.042808
25	1.48684	4.4	1.12	1.28592	16.42377	25	8.375175	0	0	1.46016	2.118429
26	-2.00858	1	0.49	1.27584	26.06507	26	5.79184	5.9	1.89	0.65664	6.580906
27	-1.38941	0	0	1.2312	9.567984	27	-0.34191	0.4	0.28	2.57904	41.84445
28	-0.41649	0	0	0.80064	5.277644	28	-3.01358	0	0	2.2608	21.20747
29	0.92559	0	0	1.15632	11.13249	29	0.466424	0	0	1.21248	18.25407
30	-1.61316	0	0	1.37808	13.51817	30					
31	-3.47858	0	0	1.49184	10.22025	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	1.696424	0	0	2.08944	19.50188	1	8.210174	0	0	1.92096	9.724124
2	4.11684	0	0	1.6488	4.592941	2	7.45059	0	0	2.0592	5.682513
3	6.429756	0	0	1.53216	2.898345	3	12.19851	0	0	2.31408	4.658305
4	5.678507	0	0	1.56528	4.04416	4	13.04059	0.4	0	1.25568	4.664618
5	6.668924	0	0	1.30608	3.98486	5	11.89809	10.2	0	1.58976	5.029132
6	5.25559	0	0	1.49904	4.21205	6	10.85392	0	0	2.2176	11.09832
7	4.058091	4.8	3.36	0.94032	7.776372	7	10.50934	5.7	0	2.06208	9.916663
8	4.04309	11.2	0	1.08288	7.063799	8	7.56559	0	0	1.548	17.57156
9	5.395174	4.9	0	1.37808	8.382672	9	6.206425	0	0	1.9656	11.65234
10	5.592674	0.6	0	2.08224	13.58078	10	7.428091	0.1	0.07	1.64736	7.332527
11	4.566841	0	0	1.7424	17.11227	11	7.26309	0	0	1.44288	6.236094
12	1.84559	0	0	2.51136	33.35849	12	8.812674	0	0	2.08512	7.585453
13	2.401007	0	0	2.38896	19.0244	13	9.373508	9.8	0	0.96912	4.802476
14	4.522674	0	0	1.81152	7.036296	14	10.61101	0.9	0	1.65312	11.043
15	6.05434	0	0	2.14704	8.646897	15	8.449758	0.1	0	1.9296	17.79066
16	6.316841	0	0	1.75104	4.798447	16	9.23684	4.7	0	1.78992	10.29001
17	7.387257	0	0	2.052	5.83554	17	9.760591	2.3	0	2.72448	14.78122
18	7.860174	0	0	2.02752	4.033454	18	8.247258	13.5	0	1.94544	12.52323
19	10.69184	0	0	2.20608	2.621896	19	7.827258	0	0	2.08512	16.29627
20	13.22601	0	0	2.22192	3.509051	20	8.305174	7.599999	0	2.20752	15.07181
21	13.31392	0	0	2.2248	3.131565	21	7.73809	0	0	2.06784	15.91894
22	12.75601	0	0	2.3616	4.417302	22	8.634341	0	0	2.66976	9.627793
23	12.01434	0	0	2.242081	3.432102	23	11.75226	0	0	2.93328	5.5862
24	11.86059	5.7	0	2.2752	3.24056	24	13.05017	1.7	0	3.42	10.38842
25	11.62601	0.2	0	2.21472	5.280129	25	11.23767	0	0	2.89728	15.53515
26	10.40351	0.1	0	2.93616	11.378	26	12.00184	0	0	3.53232	3.561644
27	7.626007	0	0	2.35872	6.262148	27	16.65267	0	0	4.02624	7.45141
28	8.848924	0	0	2.6208	10.90946	28	16.50226	0	0	4.190401	11.6015
29	8.809757	0	0	2.27664	7.696028	29	16.92851	0	0	3.6	5.789791
30	9.00434	0	0	2.11824	16.04941	30	17.60184	0	0	3.94992	3.015052
31	8.982257	0	0	2.08224	6.988449	31					

D	May	May	May	May	May	D	June	June	June	June	June
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	19.10351	0	0	3.97296	2.696297	1	15.96059	0	0	4.64976	6.11028
2	19.38226	0	0	4.057921	2.933114	2	17.12643	0	0	4.95216	2.844693
3	18.22267	0	0	3.1824	3.18923	3	18.31726	0	0	5.28336	3.862616
4	15.01851	0	0	3.63168	7.304018	4	18.04559	0	0	5.26464	5.433372
5	12.79559	0	0	3.6216	7.789972	5	13.85934	2.3	0	2.5128	8.312531
6	13.63434	0	0	3.64752	6.924755	6	15.07309	0	0	4.33152	3.898328
7	15.20142	0	0	2.7216	4.138654	7	17.78017	0	0	5.06592	3.690154
8	15.40226	0	0	3.746879	5.335999	8	20.36976	0	0	5.46192	2.473407
9	15.60267	0	0	3.83472	3.973894	9	23.71726	0	0	5.57424	2.523816
10	17.13851	0	0	4.4928	7.084476	10	23.75726	0	0	5.397121	3.6774
11	17.50267	0	0	4.6008	8.953155	11	20.92267	0	0	5.59008	6.602662
12	17.95142	0	0	4.14144	4.575513	12	20.20934	0	0	5.656321	5.770461
13	18.42101	0	0	3.81312	4.2759	13	19.27601	0	0	5.47344	9.915137
14	14.33434	11.5	0	1.76112	8.258641	14	18.21601	0	0	5.36832	3.791124
15	10.94392	2.6	0	2.47248	15.57991	15	20.17059	0	0	5.32368	5.153814
16	10.48642	0	0	2.98512	14.98062	16	21.36726	0	0	6.179041	8.692197
17	9.480591	13	0	2.4192	15.5629	17	22.54976	0	0	5.78592	6.04714
18	11.57018	0	0	4.23936	17.13837	18	22.67642	0	0	5.472	3.955749
19	13.72392	0	0	4.0176	5.528585	19	23.62934	0	0	5.986081	6.256058
20	15.77351	0	0	4.36608	3.31443	20	23.25267	0	0	5.52816	5.034998
21	17.55184	0.1	0	3.6072	7.021503	21	23.52351	0	0	5.46336	3.542424
22	13.03059	5.4	0	3.04704	12.51218	22	24.74435	0	0	5.722561	2.958719
23	11.50642	0	0	2.09376	7.71541	23	24.901	0	0	5.59296	4.736719
24	13.11643	1.3	0	3.13344	4.004883	24	24.29017	0	0	5.3928	5.078187
25	14.70226	0	0	3.11184	3.209272	25	22.00684	0	0	5.2416	5.328432
26	13.52851	3.1	0	2.06784	3.093402	26	21.94392	0	0	5.35248	5.816772
27	11.35476	2.8	0	1.60272	2.979534	27	19.32101	0	0	5.54688	11.07284
28	11.90476	2.2	0	4.09968	4.902724	28	19.45642	0	0	5.163841	4.339926
29	11.91101	0	0	3.78288	4.964206	29	22.21434	0	0	5.11632	4.232999
30	13.1335	0	0	4.24224	3.650906	30	23.78309	0	0	5.3856	4.817438
31	15.71142	0	0	4.3848	3.353703	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	24.53184	0	0	5.43168	3.984162	1	22.35017	0	0	3.65184	7.621573
2	23.80559	0	0	5.1912	5.062012	2	21.47434	0	0	4.07664	4.58213
3	22.31059	0	0	4.80384	2.911033	3	22.69892	0	0	4.22784	3.974204
4	23.13059	0	0	4.98816	3.078582	4	24.00768	0	0	4.27536	3.398449
5	23.97517	0	0	5.11632	2.83748	5	25.32476	0	0	4.55472	3.06173
6	24.231	0	0	5.26752	2.707465	6	25.96767	0	0	4.73184	2.791376
7	23.93434	0	0	5.279039	3.100718	7	28.30892	0	0	4.80528	5.92811
8	24.76476	0	0	5.28768	3.358586	8	26.996	0	0	4.38912	4.07176
9	25.66892	0	0	5.29632	2.811863	9	25.30726	0	0	4.49856	6.414762
10	25.88018	0	0	5.53824	4.052717	10	22.55517	0.2	0	3.168	6.591499
11	24.651	0	0	5.52096	3.641662	11	19.78559	0.1	0	3.03984	4.674787
12	24.47101	0	0	5.57856	5.348511	12	18.50726	0	0	3.88512	5.319785
13	23.57476	0	0	5.05728	3.527558	13	18.79142	0	0	3.85344	4.743663
14	24.62184	0	0	5.1336	2.945084	14	20.30976	0	0	3.7584	3.219999
15	26.286	0	0	5.44032	4.879257	15	21.29101	0	0	3.76992	2.909676
16	24.09225	0	0	5.07888	6.661257	16	22.43726	0	0	3.92832	2.912481
17	19.82851	0	0	4.864321	13.68821	17	23.62976	0	0	3.564	6.335189
18	19.92434	0	0	5.00832	11.39853	18	22.12851	0	0	4.24944	9.586015
19	21.25809	0	0	4.5936	4.787428	19	21.14392	0	0	3.76848	7.152111
20	24.14601	0	0	4.72176	3.454321	20	21.97059	0	0	3.61584	5.196822
21	25.24101	0	0	5.02128	3.727948	21	23.51851	0	0	3.61584	3.931508
22	24.59642	0	0	4.99536	4.716688	22	24.75434	0	0	3.71952	2.954669
23	23.49434	0	0	4.73904	12.59921	23	26.07892	0	0	3.888	2.729934
24	22.27184	1.3	0	3.81024	8.197651	24	26.58684	0	0	3.8376	2.516289
25	21.16767	0	0	4.02048	4.923265	25	26.52142	0	0	3.86784	2.683577
26	21.09892	0	0	4.12272	4.028536	26	25.40934	0	0	3.84048	4.739548
27	22.21309	0	0	3.18384	8.457768	27	20.74559	0	0	3.4488	9.03481
28	23.24934	0	0	4.608	6.95597	28	18.14934	0	0	3.31488	12.49574
29	25.16767	0	0	4.55184	3.456977	29	20.42726	0	0	3.15648	4.247849
30	26.32351	0	0	5.05728	9.459418	30	22.01559	0	0	3.18384	4.340845
31	24.08101	0	0	4.654079	7.082033	31	22.46726	0	0	3.11616	3.818276

D	Sept.	Sept.	Sept.	Sept.	Sept.	D	October	October	October	October	October
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	21.96184	0	0	2.92608	3.294703	1	22.17017	0	0	1.86768	3.577806
2	21.06809	0	0	2.72448	4.536415	2	20.24101	0	0	2.08512	6.098314
3	20.66976	0	0	2.6856	3.267876	3	16.48017	0	0	1.58832	4.437435
4	22.00434	0	0	2.8872	2.854781	4	15.72101	0	0	1.5696	3.305348
5	21.20184	0	0	2.74032	4.248969	5	16.70017	0.2	0	1.66032	4.584117
6	19.00392	0	0	2.19888	4.40495	6	17.71517	0	0	1.65168	3.140442
7	19.42476	0	0	2.8656	11.61243	7	16.71643	0	0	1.76976	6.865759
8	19.55309	0	0	2.78352	5.992032	8	14.57642	0	0	1.78128	8.371706
9	20.20101	0	0	2.83104	6.786408	9	12.08267	0	0	1.38096	6.069471
10	20.17309	0	0	2.53584	4.644218	10	12.49392	3.1	0	0.90288	5.210683
11	18.73101	0.1	0	2.1456	3.054143	11	14.15726	0	0	1.25856	2.771657
12	18.33934	0	0	2.5056	5.057744	12	15.57392	0.1	0	1.38384	5.442349
13	18.64559	0	0	2.29248	6.79595	13	16.27809	0.7	0	1.53216	7.259473
14	18.52601	5.1	0	1.3824	11.2442	14	15.76726	0.9	0	1.5408	8.756056
15	17.50518	1.1	0	1.64592	3.600266	15	16.25059	0	0	1.36224	7.812065
16	16.02559	15	0	2.81088	10.28697	16	15.16684	20.6	0	0.70704	5.640597
17	16.60226	2	0	2.26368	5.088721	17	15.99351	0	0	1.65744	2.871343
18	17.45434	0	0	2.32128	3.492209	18	16.01976	0	0	1.62432	4.681492
19	17.17809	0	0	2.21328	6.047758	19	16.29017	0	0	1.53216	3.407016
20	14.68517	2.2	0	1.5768	7.0926	20	16.74101	0	0	1.50192	2.44795
21	12.08267	0	0	2.28816	6.453548	21	14.99476	0	0	1.38816	5.15275
22	13.88351	0	0	2.31696	5.303978	22	13.69059	0	0	1.30464	4.037068
23	17.67059	0	0	2.41632	2.511136	23	13.63684	0	0	1.2312	5.502874
24	19.64059	0	0	2.52432	5.679768	24	14.14184	0	0	1.07568	3.782002
25	20.10351	0	0	1.9656	6.807437	25	13.18059	0	0	1.02672	5.11219
26	18.26059	0	0	2.13696	7.571447	26	12.51476	0	0	1.03104	5.563906
27	20.10392	0	0	2.30256	2.434243	27	13.68601	8.800001	0	0.91872	15.45113
28	22.16351	0	0	2.40048	2.530899	28	15.63059	7.9	0	1.332	19.75825
29	23.05559	0	0	2.29248	2.948822	29	10.64809	3.1	0	0.95904	12.96445
30	22.51017	0	0	2.00736	3.55663	30	6.95184	2.5	0	0.85104	15.27715
31						31	9.313507	0	0	1.03392	4.171138

D A Y	November Temp. °C daily	November Precip T. mm daily	November Snowfall cm daily	November Evapot. mm daily	November Wind S. km/h daily	D A Y	December Temp. °C daily	December Precip T. mm daily	December Snowfall cm daily	December Evapot. mm daily	December Wind S. km/h daily
1	11.90184	26.7	0	0.82224	12.67369	1	7.323508	0.2	0	0.90432	9.114801
2	11.68018	0.1	0	1.03104	7.923694	2	6.752674	5.9	0	0.45792	6.058361
3	11.74726	0	0	1.0584	2.633688	3	3.426007	10.4	2.73	0.7344	15.58721
4	12.19601	0	0	1.29744	4.530658	4	0.475174	0	0	0.59904	8.463087
5	13.98642	0	0	1.08144	10.05977	5	4.681007	8.400001	0	0.9072	22.18815
6	13.26143	0	0	0.95184	16.12774	6	2.90059	3.6	2.52	0.38736	7.426653
7	9.219758	3.1	0	1.24128	8.96779	7	1.10184	0.6	0.35	0.54288	6.671558
8	6.228507	0	0	1.32336	8.374055	8	3.95809	10.9	2.94	0.9936	17.77276
9	8.162257	0	0	0.96912	3.327916	9	1.309757	0.4	0.07	0.64368	13.83809
10	8.073507	0	0	0.85824	5.035387	10	-1.24233	0	0	0.87408	6.960719
11	9.191007	0	0	0.756	2.877354	11	0.133507	17.1	11.83	0.51264	17.28878
12	11.74143	0	0	0.67824	1.762449	12	-3.00066	0	0	0.324	2.661726
13	13.38767	0	0	0.8496	3.286616	13	-2.04733	0	0	0.52416	4.850269
14	10.68642	0	0	0.93888	7.929873	14	0.77434	0	0	0.2664	1.633921
15	9.337257	3.8	0	0.68832	7.840778	15	4.11434	0	0	0.4464	3.739155
16	8.788091	0	0	0.96768	8.341008	16	7.86809	0	0	0.73152	12.39485
17	9.006006	0	0	0.66816	4.163419	17	7.425173	0.8	0	0.64224	4.938074
18	8.966842	0	0	0.60768	2.5775	18	5.28434	17.1	0	0.47952	4.56023
19	9.618922	1.7	0	0.52848	5.916139	19	2.455591	0.2	0	1.17072	14.70758
20	11.24309	3.5	0	1.05408	10.16649	20	0.20559	0	0	0.98496	13.18503
21	11.49309	0	0	0.93888	8.691119	21	0.71684	0.1	0.07	0.52992	4.000884
22	9.824757	0	0	0.64656	2.901258	22	2.06434	0	0	0.79056	7.783209
23	9.348924	0	0	0.59472	2.492372	23	1.221007	0	0	0.58608	2.232035
24	9.643924	0	0	0.60048	3.078444	24	6.191008	0	0	0.65376	1.096649
25	8.33934	0	0	0.51984	2.488643	25	9.156008	0	0	0.63216	1.461193
26	8.117673	0	0	0.49104	2.224724	26	8.654341	0	0	0.52128	4.145301
27	7.860591	0	0	0.55152	3.066501	27	6.876007	0	0	0.47232	6.635895
28	11.23101	0	0	0.48528	4.118756	28	6.82434	3.9	0	0.59616	6.456298
29	10.58434	16.1	0	1.3104	19.89413	29	4.402257	0.7	0	1.32624	20.12111
30	8.215591	3.2	0	0.8784	16.30233	30	3.775591	0	0	0.58608	6.513023
31						31	4.964341	0	0	0.52704	5.060123

Ohrid Lake - 2013 daily climatic data

D	January	January	January	January	January	D	February	February	February	February	February
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	4.57434	0	0	0.42048	2.247194	1	4.33184	0	0	1.41696	6.391411
2	4.708507	0	0	0.44928	1.818575	2	6.622257	0	0	1.31472	15.70846
3	5.442257	0	0	0.4824	2.749994	3	6.377258	5.3	0	0.6408	18.52498
4	4.704757	0	0	0.56016	2.897521	4	3.872674	0	0	0.81504	7.045965
5	3.010174	0	0	0.40464	4.703596	5	5.136424	0	0	0.89424	3.019828
6	0.654757	0.1	0.07	1.0296	17.29178	6	5.438507	0.4	0	1.14624	8.443135
7	-0.91233	0	0	0.9	13.02089	7	3.918507	27.3	8.89	0.52992	12.08529
8	-3.41233	0	0	0.90288	10.92799	8	0.894757	3.9	2.73	0.68688	6.826097
9	-0.96524	0	0	0.55584	3.704473	9	2.38559	1.1	0.77	0.76032	10.38058
10	2.242673	0	0	0.57312	4.213389	10	1.33559	0.8	0.56	0.49104	13.87293
11	5.107674	5.2	0	0.68688	7.753254	11	0.692257	0	0	0.94176	9.184013
12	3.875173	3.3	0.14	0.90864	9.039907	12	6.166841	0	0	1.03392	12.80585
13	2.890174	0	0	0.6912	3.324851	13	5.78684	1.7	0	1.67616	20.85134
14	6.634757	0.1	0	0.7272	7.000989	14	5.40059	0	0	1.43136	10.6921
15	7.572674	0.1	0	0.5976	13.18892	15	4.64559	0	0	1.20384	6.136857
16	5.57309	2.9	1.12	1.11456	22.35219	16	4.642674	0.5	0	0.82368	3.495008
17	4.06059	17.8	0	0.4392	15.20106	17	4.503507	0	0	1.11168	6.482815
18	4.303507	8.8	0	1.1808	12.18973	18	4.882257	3.2	2.03	0.5256	3.690721
19	2.10559	0	0	0.50112	15.68171	19	3.036007	1.7	1.12	0.69264	4.316009
20	6.717674	0	0	0.94464	9.773879	20	2.487674	0	0	1.07136	6.42785
21	7.690174	1.5	0	0.80928	9.276708	21	3.69559	2.4	0.21	0.59472	4.534916
22	5.316007	0.6	0	0.6624	15.11394	22	5.809757	0.8	0	1.14912	4.252659
23	3.992257	0.3	0	0.70848	14.72025	23	7.63559	0	0	1.29456	6.156426
24	3.733924	7.099999	0	0.63936	13.32268	24	10.35517	2.2	0	1.74528	13.28212
25	3.648924	8.5	0	0.69264	13.8747	25	8.903091	12.6	0	0.6408	5.976252
26	1.15309	0.1	0.07	1.20816	13.03431	26	6.354756	0	0	1.12896	4.634555
27	1.006424	0	0	0.93744	6.864483	27	4.502257	1	0.14	0.89136	3.853423
28	2.01934	0	0	0.45648	7.780633	28	4.75309	0	0	1.26864	3.960817
29	3.523924	0	0	0.73152	3.396445	29	0.466424	0	0	1.21248	18.25407
30	3.88309	0	0	0.9432	2.942104	30					
31	4.518507	0.1	0	0.62352	4.366281	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	4.990173	0	0	1.12752	3.019302	1	7.825591	0	0	2.09088	10.82331
2	5.08059	1.9	0	0.60768	7.669514	2	9.03434	12.8	0	0.67968	3.777571
3	5.222673	0	0	1.65456	6.812925	3	7.758091	0.2	0	1.8288	9.075467
4	6.600174	0	0	1.55232	5.29394	4	7.457258	0	0	1.99008	13.365
5	5.817673	0	0	1.52208	5.154414	5	9.440173	0.7	0	0.94608	10.44907
6	6.621007	0.3	0	1.19664	3.923703	6	11.01226	0	0	2.33136	5.970396
7	6.956423	6.3	0	0.88848	3.769447	7	9.162674	5.1	0	1.7352	18.20779
8	8.926424	0	0	1.43856	5.883181	8	7.646841	0.2	0	2.15856	10.24034
9	8.733923	0.5	0	1.5192	9.915978	9	7.06184	0	0	1.92528	10.10279
10	8.849757	0	0	1.53936	14.44492	10	8.55184	0	0	2.0664	9.260013
11	8.186423	0	0	1.52928	17.96585	11	9.723091	0	0	2.4624	5.043569
12	5.812257	0.9	0	1.12032	14.20071	12	11.70767	0	0	2.76336	5.839424
13	6.952258	5.1	0	1.73664	15.30827	13	12.37184	0	0	2.63952	6.890056
14	8.615589	11.9	2.38	1.69632	19.83659	14	12.47476	0	0	3.54096	13.37728
15	3.584757	3.7	2.52	1.29744	16.88584	15	9.661422	0	0	3.13056	15.2186
16	0.14559	0.4	0.28	1.50192	10.85363	16	9.419757	0	0	2.9736	13.1132
17	0.710173	0	0	1.34352	4.485773	17	10.76976	0	0	2.91456	7.50438
18	4.218924	5.6	0	0.82656	7.521915	18	12.59226	0	0	3.00816	8.212836
19	7.345174	0	0	2.1312	22.17967	19	10.60226	0	0	2.89728	10.95728
20	8.282674	0	0	1.84608	2.854924	20	11.66809	0	0	2.62944	4.923244
21	8.70059	0.3	0	1.66608	9.391555	21	12.47351	0	0	2.75328	4.056891
22	3.709757	0	0	1.56528	15.45619	22	12.79392	0	0	2.40768	3.168573
23	4.376424	0	0	1.97856	5.971444	23	11.88642	1.7	0	1.47888	2.825678
24	9.778091	0	0	2.21616	4.007977	24	15.57642	0	0	3.06288	3.508359
25	10.12309	0	0	2.16576	16.0528	25	17.64601	0	0	3.5784	3.631899
26	7.46309	2.4	0	1.82016	12.30395	26	18.57851	0	0	3.57264	2.832808
27	6.839341	2.2	0	1.89648	12.39178	27	17.65267	0	0	3.31344	6.094655
28	8.653924	0	0	1.89504	3.806903	28	16.56934	0	0	3.76128	2.903761
29	10.92809	5.3	0	1.91232	7.578783	29	19.52392	0	0	3.69936	3.138116
30	13.07059	0	0	3.17952	16.93372	30	19.97351	0	0	3.77568	3.309337
31	10.11476	4.9	0	1.8792	15.74302	31					

D	May	May	May	May	May	D	June	June	June	June	June
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	20.80434	0	0	3.82608	4.215269	1	11.32767	0	0	3.48768	10.32991
2	20.98517	0	0	3.98736	3.788985	2	11.53434	0	0	2.94048	8.360134
3	18.74101	0	0	3.24864	4.588216	3	12.56559	0	0	3.67488	7.84605
4	18.36976	0	0	4.01472	3.042708	4	12.85267	0	0	3.17088	4.538192
5	20.17892	0.8	0	4.2768	2.973881	5	12.60142	0.1	0	3.42864	4.307281
6	19.83601	0.1	0	3.915361	8.081944	6	14.36684	0	0	4.11984	3.742547
7	17.32434	0	0	4.24944	7.026285	7	16.42684	0	0	4.43808	4.393987
8	15.62684	1.9	0	2.52432	4.968138	8	16.78267	0	0	4.1184	5.207409
9	13.24101	1.2	0	2.4048	5.724143	9	18.05934	0	0	4.7808	3.361059
10	15.89226	0	0	3.84912	3.474109	10	18.92768	0	0	4.22208	4.291944
11	14.99392	3	0	2.52288	4.133173	11	17.34434	0.1	0	3.8304	3.686687
12	13.19767	1.2	0	2.26368	4.643221	12	14.19726	4.6	0	2.42784	6.252426
13	11.62642	11.2	0	1.54944	7.145307	13	17.21851	0	0	5.16528	11.34339
14	14.12517	0.1	0	4.36752	8.267413	14	18.45517	0	0	4.35024	6.077457
15	14.20142	0	0	4.06944	5.966723	15	19.78892	0	0	5.14368	4.019286
16	15.36017	0.5	0	3.28032	4.977627	16	21.36684	0	0	5.4	4.211499
17	16.66142	1.4	0	4.54176	9.24787	17	22.82351	0	0	5.518081	4.248562
18	17.32601	0	0	4.79808	5.531589	18	23.65851	0	0	5.58576	3.247871
19	19.95434	0	0	5.36832	5.404089	19	24.58476	0	0	5.526721	3.970338
20	15.73601	0	0	4.248001	9.466559	20	25.14475	0	0	5.66496	3.156598
21	17.26809	0	0	4.85568	2.896192	21	24.75892	0	0	5.56272	2.779444
22	18.34476	0.5	0	4.68288	6.713144	22	25.176	0	0	5.804639	2.52612
23	14.396	1	0	2.75472	17.24156	23	23.68309	0.3	0	5.58576	3.507801
24	11.88976	0.3	0	2.82384	16.66799	24	21.14059	0	0	5.40864	6.00114
25	11.59351	0	0	2.14848	15.36192	25	17.78184	0	0	4.43232	9.437702
26	10.20934	0.4	0	2.04048	17.08734	26	17.56351	0	0	4.1976	8.05197
27	9.888507	0	0	3.28464	10.24284	27	16.50101	0	0	3.6792	6.262951
28	14.30017	1.6	0	3.46752	3.350628	28	17.40726	0	0	4.68144	4.459548
29	16.06142	0.6	0	4.792319	7.170177	29	16.51017	0.7	0	3.61296	5.196851
30	12.64434	0.1	0	2.84544	11.47049	30	15.05559	0	0	3.333601	5.691046
31	10.22018	0	0	2.72304	16.38529	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	16.78226	0	0	4.70016	5.710654	1	21.68893	0	0	4.62816	8.839736
2	18.05309	0	0	4.89456	4.392368	2	22.43809	0	0	4.39776	6.234757
3	20.08351	0	0	5.0184	3.587354	3	23.54976	0	0	4.478401	6.629709
4	20.61684	0	0	4.87728	3.013483	4	25.08851	0	0	5.029919	9.55722
5	20.77309	0	0	5.513761	8.859505	5	24.17142	0	0	4.5504	6.438961
6	19.67351	0	0	4.69008	11.4204	6	23.99434	0	0	4.34592	5.608929
7	20.72851	0	0	5.02848	8.814856	7	24.66434	0	0	4.20912	4.84941
8	20.61934	0.1	0	4.392	6.060215	8	25.14059	0	0	4.24368	4.606298
9	20.56267	0.6	0	4.27248	4.77041	9	24.45725	0	0	4.08672	3.345499
10	20.00517	0	0	4.56624	4.033024	10	21.99267	1.8	0	3.04848	4.19522
11	20.20476	0	0	4.74336	3.759203	11	22.14726	0	0	4.10976	8.714771
12	20.03476	0	0	3.68496	4.947849	12	22.19976	0	0	3.81744	4.299554
13	20.17767	0	0	4.85856	4.825162	13	23.61059	0	0	3.94128	3.306772
14	20.51476	0	0	4.995359	5.45196	14	24.21684	0	0	3.9168	2.73133
15	19.43101	0	0	4.78224	6.439119	15	23.47267	0.1	0	2.96784	6.02319
16	19.12934	0	0	4.06512	11.48202	16	22.00851	0.3	0	3.19104	5.3992
17	19.15184	0	0	4.9032	9.382848	17	22.39142	0	0	3.70224	4.783405
18	20.33684	0	0	4.67136	4.979039	18	22.72768	0	0	3.72816	3.824391
19	20.88017	0	0	4.66128	3.485634	19	23.21267	0	0	3.76128	3.689377
20	21.14226	0	0	4.65264	4.464733	20	23.35559	0	0	3.72384	3.218824
21	21.78851	0	0	4.73184	6.76866	21	21.97851	0.9	0	3.1536	8.412501
22	20.43434	0	0	4.829761	6.6258	22	20.7885	0	0	3.47904	7.012188
23	20.35851	0	0	4.74768	3.984741	23	20.73642	0	0	3.50496	4.591295
24	22.16726	0	0	4.955041	3.371053	24	20.67226	0	0	3.45456	4.711361
25	22.81934	0	0	4.78368	3.27519	25	19.91976	0	0	3.26736	3.682587
26	23.66267	0	0	4.8744	5.495041	26	20.32726	0	0	3.16656	5.238465
27	23.72767	0	0	5.06736	6.60403	27	20.51392	0	0	2.73168	5.720156
28	24.45101	0	0	4.8456	3.689772	28	19.93726	0	0	2.86416	7.696566
29	25.61059	0	0	4.93056	2.763985	29	18.49642	0	0	2.96064	4.897869
30	25.3185	0	0	4.94496	4.875533	30	18.43601	0	0	2.10816	5.173763
31	22.21517	0	0	4.907519	16.18794	31	18.15976	0	0	1.55952	4.745845

DAY	Sept. Temp. °C daily	Sept. Precip T. mm daily	Sept. Snowfall cm daily	Sept. Evapot. mm daily	Sept. Wind S. km/h daily	DAY	October Temp. °C daily	October Precip T. mm daily	October Snowfall cm daily	October Evapot. mm daily	October Wind S. km/h daily
1	18.91934	0	0	3.04704	4.290848	1	14.04351	8.799999	0	0.94896	9.121734
2	19.52309	0	0	2.63376	4.417047	2	12.92767	0	0	0.82224	5.35004
3	18.46392	0	0	2.78064	4.743494	3	10.06309	0	0	0.9504	7.228452
4	17.78767	0	0	3.20832	10.80479	4	7.344341	0	0	0.85968	4.861373
5	17.49101	0	0	2.8368	6.970259	5	9.557257	0	0	1.01952	3.995317
6	18.29392	0	0	2.68704	3.158566	6	13.83934	0	0	0.86976	5.435562
7	19.40934	0	0	2.77632	4.425366	7	11.87642	7.8	0	0.55872	6.230702
8	19.75851	0	0	2.84112	5.308513	8	12.61309	2.9	0	0.71712	5.210219
9	19.82684	0	0	2.62368	5.601867	9	13.70142	0.7	0	0.71136	6.752635
10	19.74351	0	0	2.50128	6.841914	10	13.87226	0.9	0	0.8856	8.110086
11	18.24059	1	0	1.7784	10.10107	11	15.69726	0	0	1.50768	6.132578
12	17.73393	0.6	0	1.89792	8.862485	12	18.94392	0	0	1.77984	3.570397
13	15.07976	0	0	1.88208	11.96841	13	19.63101	0	0	1.73808	2.740325
14	13.25851	0	0	2.07504	6.948948	14	18.71726	0	0	1.71936	3.781887
15	14.81434	0	0	2.2176	6.484678	15	16.45142	0	0	1.24272	6.464402
16	13.72893	7.2	0	0.84528	4.253839	16	14.08392	0.3	0	0.8712	11.31917
17	14.95601	0.3	0	1.56672	11.76259	17	10.48101	0.3	0	1.34064	8.516681
18	14.79434	0	0	2.28672	12.29669	18	11.67226	0	0	1.29168	4.670017
19	14.84559	0	0	2.14848	8.879477	19	13.23309	0	0	1.29312	3.548853
20	15.79309	0	0	2.1816	5.952521	20	13.97767	0	0	1.26288	3.041965
21	15.88642	0	0	2.34144	7.156404	21	14.67226	0	0	1.34928	2.214112
22	13.55767	0	0	2.18304	9.928546	22	16.67226	0	0	1.39536	2.615275
23	12.79684	0	0	1.82304	5.99955	23	17.35809	0	0	1.28016	3.63169
24	14.81351	0	0	1.93248	3.89717	24	15.61642	0	0	1.09008	2.882675
25	16.44559	0	0	2.10384	5.379816	25	15.89768	0	0	1.09584	3.104625
26	15.93017	0	0	1.99296	6.483604	26	15.93976	0	0	1.08864	3.166546
27	16.16726	0	0	1.66032	2.644753	27	15.78976	0	0	1.20384	2.728277
28	16.89643	0	0	1.7712	4.859905	28	15.95017	0	0	0.99648	1.998493
29	17.70392	0	0	1.75392	4.836861	29	17.30392	0	0	1.12464	2.735237
30	16.22726	3.5	0	1.07424	10.10128	30	17.41851	0	0	1.09728	3.810615
31						31	16.59517	0	0	1.09152	4.93661

D	November	November	November	November	November	D	December	December	December	December	December
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	14.85184	0	0	0.82656	3.416996	1	6.324757	6.2	0	1.35648	17.02412
2	13.17892	0	0	0.828	5.26977	2	7.05559	0	0	0.792	10.9939
3	12.09476	0	0	0.69408	7.527183	3	2.022674	0	0	0.88416	14.81924
4	13.13768	0	0	0.78336	7.527006	4	2.881007	0	0	0.648	5.368664
5	13.97643	3.2	0	0.94752	11.96684	5	6.09934	0	0	0.73728	4.073268
6	13.38184	4.5	0	0.78048	4.57526	6	5.124757	0	0	0.61344	9.89044
7	13.19476	0	0	0.86832	4.359725	7	1.52934	0.2	0.14	1.12896	11.75981
8	14.77184	0	0	0.87552	2.454181	8	1.66809	0	0	0.5184	1.219407
9	13.94101	0	0	0.81216	2.911575	9	3.136007	0	0	0.6696	8.783917
10	12.12226	0	0	0.468	6.870601	10	1.528507	0	0	0.63936	8.715473
11	13.73351	0.1	0	0.8136	11.71451	11	0.137257	0	0	0.7776	7.106554
12	14.34101	0.3	0	0.6408	14.98437	12	3.739757	0	0	0.60912	3.08538
13	13.74184	0	0	1.11168	13.49296	13	5.601841	0	0	0.5616	2.092708
14	11.60101	0	0	0.84096	9.559715	14	6.062674	0	0	0.55008	1.492822
15	9.258507	0	0	0.79488	9.915921	15	4.731424	0	0	0.37008	2.939424
16	8.25059	0	0	0.71136	8.549714	16	2.148924	0	0	0.648	8.967938
17	8.453507	0	0	0.50832	4.017016	17	1.90059	0	0	0.62928	7.469125
18	8.384339	0	0	0.46224	3.711685	18	1.868924	0	0	0.46944	4.459903
19	8.936841	2	0	0.47664	5.181562	19	3.440591	0	0	0.47664	1.548558
20	10.84767	0	0	1.0512	14.23675	20	4.837674	0	0	0.4752	1.657891
21	9.887258	0	0	0.60048	16.2413	21	5.554757	0	0	0.4536	4.516601
22	7.754341	0	0	0.46368	4.658279	22	5.695174	0	0	0.4824	2.828214
23	7.452674	6.4	0	0.39888	10.46541	23	6.766841	0	0	0.65952	1.849539
24	4.478091	11.2	0	0.38304	6.440953	24	6.478507	0	0	0.504	2.050036
25	5.691007	0	0	0.47664	3.37295	25	5.24184	0	0	0.42768	2.507654
26	2.109341	6.300001	4.27	0.73152	11.73301	26	6.930591	0	0	0.50544	8.453122
27	0.216424	4	2.8	0.28656	5.2804	27	8.303507	7.2	0	0.40752	11.22799
28	2.106424	0	0	0.43488	3.166313	28	8.106422	0	0	0.78336	10.04207
29	3.762257	0	0	0.4536	2.675422	29	8.194758	0	0	0.39312	2.395255
30	4.236841	4.2	0	0.37728	5.995371	30	8.069757	0	0	0.51984	4.095731
31						31	6.634756	0	0	0.29088	4.225859

Ohrid Lake - 2014 daily climatic data

D	January	January	January	January	January	D	February	February	February	February	February
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	5.709757	0	0	0.4176	2.06439	1	4.201423	0	0	1.02816	8.666571
2	4.876423	0	0	0.23904	1.974543	2	3.25309	0	0	0.91296	10.06462
3	5.631424	0	0	0.40464	1.887583	3	2.111424	0	0	1.16064	8.801847
4	6.111007	0	0	0.24192	2.572849	4	1.93559	0	0	0.83088	5.558879
5	6.754757	1.3	0	0.27792	4.440837	5	4.410591	0	0	0.504	2.263087
6	8.912673	3.5	0	0.72576	7.351553	6	4.15434	6.1	0	0.252	5.129625
7	8.194341	0	0	0.38016	2.922961	7	5.098923	0	0	0.8424	3.951978
8	8.55434	0	0	0.4392	1.921976	8	6.78434	1.5	0	1.15056	8.254795
9	9.18809	0	0	0.4968	1.494523	9	6.370592	0.1	0	1.02384	14.45413
10	7.536841	0	0	0.68832	7.163048	10	6.886424	0	0	1.27008	9.624105
11	6.541424	0	0	0.43632	2.69462	11	10.45392	0	0	1.06992	4.298873
12	7.408506	0	0	0.39744	2.107675	12	7.379757	2.6	0	0.45936	9.12745
13	7.50559	0	0	0.41904	2.970646	13	5.500173	0	0	0.96192	11.09788
14	7.00309	0	0	0.3816	3.299981	14	4.039757	1.5	0	0.69264	10.64843
15	7.23309	11.2	0	0.17856	4.653287	15	5.906424	0	0	0.78192	5.193522
16	6.688923	6.5	0	0.63936	4.461396	16	8.513924	0	0	1.16352	4.947966
17	5.97559	0	0	0.73152	3.796517	17	10.37517	0	0	1.19952	5.919929
18	6.863091	0	0	0.58032	5.229733	18	11.02851	0	0	1.26	2.954038
19	8.726423	1	0	0.44928	4.371803	19	11.48601	0	0	1.54224	8.396611
20	8.852673	0	0	0.99072	19.96632	20	10.55226	0	0	1.35936	6.598278
21	6.198924	0	0	0.70992	22.00609	21	11.59434	0	0	1.19808	4.573719
22	6.575591	0	0	0.66816	17.25963	22	8.382674	0	0	0.9432	7.860158
23	5.705174	0.4	0	0.66096	10.45637	23	7.416007	0	0	1.01232	5.487804
24	6.344757	3.5	0	0.6336	9.065347	24	7.747674	0	0	1.41264	9.561358
25	4.205174	14.3	7.49	0.77904	6.318308	25	4.807674	0	0	1.2528	6.246437
26	-0.30024	0.1	0.07	1.296	11.10135	26	5.378924	0	0	1.06128	5.899431
27	-0.73649	0	0	0.80352	7.377519	27	5.261007	0	0	0.95472	4.357401
28	1.912257	2.4	1.68	0.33408	7.237177	28	5.684758	0	0	0.97776	5.506659
29	2.29059	3.1	2.17	0.70416	18.12701	29					
30	4.39309	0	0	0.58896	5.91054	30					
31	5.107257	0	0	0.85824	12.24434	31					

D	**March**	**March**	**March**	**March**	**March**	**D**	**April**	**April**	**April**	**April**	**April**
A	**Temp.**	**Precip T.**	**Snowfall**	**Evapot.**	**Wind S.**	**A**	**Temp.**	**Precip T.**	**Snowfall**	**Evapot.**	**Wind S.**
Y	**°C**	**mm**	**cm**	**mm**	**km/h**	**Y**	**°C**	**mm**	**cm**	**mm**	**km/h**
	daily	**daily**	**daily**	**daily**	**daily**		**daily**	**daily**	**daily**	**daily**	**daily**
1	7.005173	0.2	0	1.1016	5.003868	1	10.69059	0	0	2.1024	5.729251
2	5.377257	4.4	0	1.33776	14.43262	2	10.64476	0	0	1.92096	5.680662
3	5.224757	4.3	2.31	1.28592	11.24096	3	11.00476	0	0	2.02608	4.3928
4	5.225174	0.1	0	0.95472	6.906977	4	12.80517	0	0	1.55952	4.806581
5	5.476007	1.2	0	1.17792	4.529516	5	12.75809	0.2	0	2.14992	6.262559
6	7.388924	0	0	1.80864	11.02152	6	10.98851	0.9	0	1.58256	6.748938
7	7.846007	0	0	1.57104	15.24739	7	12.55309	0	0	2.46384	8.718494
8	7.77809	0	0	1.9008	15.85545	8	12.14184	0	0	2.44656	7.947794
9	5.687256	0	0	2.24352	21.03424	9	10.80684	2.6	0	1.89792	8.131108
10	3.371424	0	0	1.45728	18.40243	10	7.440591	11.6	0	2.96928	16.18362
11	4.031424	0	0	1.7064	19.28626	11	5.075173	3	0	1.14912	8.207181
12	6.570173	0	0	1.65168	10.2233	12	7.35809	0	0	1.83888	6.052506
13	7.785173	0	0	1.52928	6.126829	13	8.028091	0	0	2.05056	3.838121
14	9.646424	0	0	1.47456	2.143258	14	10.05267	0	0	2.28384	6.650105
15	8.951424	0	0	1.61424	8.63868	15	9.238925	0	0	2.16432	14.28391
16	7.57559	0	0	1.5696	6.109911	16	4.657673	10.7	1.96	1.88064	20.16304
17	9.815173	0	0	1.5768	4.999601	17	5.77059	0.1	0	1.2528	4.606216
18	11.55767	0	0	1.7928	5.376765	18	5.08309	9.2	0	1.18944	13.46801
19	11.03017	0	0	1.77552	9.911292	19	9.043924	1.8	0	2.37888	21.54601
20	9.743091	0	0	1.95552	12.36854	20	10.42976	0.2	0	2.5416	11.10798
21	10.27851	0	0	1.44432	4.203909	21	13.45309	0	0	2.71152	5.237709
22	9.989341	0	0	1.47744	6.336448	22	14.67851	0	0	3.12192	5.725961
23	10.34851	0	0	1.64736	6.459479	23	16.99392	0.1	0	2.40624	13.61158
24	6.521423	3.4	0.21	1.16496	16.21071	24	13.94517	0.1	0	2.655361	7.912152
25	4.721424	0.1	0	1.32768	15.44201	25	12.57059	0.1	0	2.34576	3.413702
26	6.379341	0.4	0	1.3824	6.765295	26	11.31934	8.299999	0	1.2888	3.481735
27	8.289758	5.6	0	1.3392	12.88879	27	11.73392	0.8	0	3.23856	2.954401
28	6.125591	9.000001	0	1.56384	6.702851	28	9.90059	2.5	0	1.78128	5.377764
29	9.888507	0	0	2.58912	11.25346	29	7.90184	8.6	0	1.8576	8.853185
30	10.36726	0	0	1.81008	4.218115	30	8.716008	7.9	0	2.95344	11.46235
31	10.72559	0	0	1.98576	5.363799	31					

D	May	May	May	May	May	D	June	June	June	June	June
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	8.20309	6.6	0	1.64304	7.623476	1	11.80142	0	0	3.47904	5.776733
2	10.03642	0	0	2.91888	3.759064	2	12.40434	0	0	3.82032	5.578526
3	11.40392	8.799999	0	1.86048	6.029187	3	14.12101	0	0	4.37328	11.74137
4	9.164758	0.7	0	2.67984	6.396257	4	14.88351	0	0	3.22128	7.867537
5	9.972257	0.7	0	2.59632	9.14605	5	15.15517	0	0	4.2624	4.313295
6	10.90976	0	0	3.19392	5.321456	6	18.12684	0	0	5.3136	8.511983
7	12.68018	0	0	3.33792	2.97668	7	18.58726	0	0	5.626081	12.77882
8	13.17142	2	0	2.63232	4.528251	8	20.35684	0	0	6.29856	14.40652
9	14.22517	0	0	4.412159	10.57128	9	20.63934	0	0	6.094079	13.62525
10	14.58601	0	0	3.83328	8.898549	10	20.58726	0	0	5.44032	6.399899
11	15.43892	0	0	4.210561	7.040207	11	21.67351	0	0	5.27184	9.537655
12	14.31434	0	0	3.36528	10.28295	12	21.24726	0	0	5.8464	7.896341
13	14.15601	0.6	0	3.78144	7.535791	13	20.78101	0	0	5.45328	4.695452
14	11.27726	1	0	2.47104	16.32521	14	20.07309	0	0	5.1768	4.974576
15	8.868506	0.1	0	2.71008	23.15609	15	17.99851	0.4	0	3.41712	4.786926
16	8.450172	0	0	2.53152	17.06535	16	17.85392	0	0	4.3776	5.234541
17	9.426841	0.1	0	1.64016	6.805336	17	17.79726	5.3	0	4.340159	7.085971
18	11.37434	0	0	2.85264	3.30891	18	17.94434	0	0	4.400641	3.956004
19	14.87559	0	0	3.18096	5.441886	19	14.86351	0	0	3.3192	8.561535
20	13.67559	4.5	0	1.44432	2.463527	20	14.50351	0	0	3.30768	5.55212
21	16.62643	0	0	3.83328	3.989585	21	15.40101	0	0	4.25088	5.72494
22	19.14267	0	0	3.83616	3.140652	22	17.61101	0	0	4.97664	3.414565
23	19.26351	0.1	0	3.56112	1.997712	23	19.13017	0	0	5.29344	5.212457
24	17.91517	0.3	0	3.3984	3.58577	24	20.37267	0	0	5.48784	6.957139
25	18.47351	0	0	4.41216	2.06685	25	21.40017	0	0	5.04432	10.23269
26	17.74267	3.4	0	3.024	4.377992	26	19.65309	0	0	4.465441	12.03099
27	17.37559	0	0	4.50288	5.988021	27	19.46767	0	0	4.658401	7.49489
28	15.70351	0	0	4.200481	6.036833	28	19.25768	0	0	5.17824	6.229623
29	13.31434	12.7	0	1.71216	4.479932	29	20.53142	0	0	4.82256	3.599443
30	11.83851	10.6	0	1.74528	5.0075	30	19.84226	0	0	3.5136	6.992746
31	13.01601	2.8	0	2.11104	3.658558	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	18.41225	0	0	4.736159	5.62866	1	16.92434	0	0	3.4848	3.609206
2	19.49726	0	0	5.05296	5.319726	2	18.72184	0	0	4.10976	4.750272
3	19.79018	0	0	5.25168	6.959854	3	20.66267	0	0	4.59792	4.978028
4	17.54142	0	0	5.59872	18.19933	4	21.00017	0	0	4.66704	5.526184
5	19.11476	0	0	4.97664	6.653908	5	21.33767	0	0	4.6152	6.188038
6	21.8885	0	0	5.15376	3.017444	6	20.13517	0.2	0	2.91312	4.70495
7	22.51309	0	0	5.01984	2.858817	7	19.07892	0	0	4.15152	5.132873
8	22.90309	0	0	5.1696	6.307037	8	19.62267	0	0	3.64896	4.162608
9	18.45392	0	0	4.2048	14.27063	9	21.02267	0	0	4.36464	3.763895
10	17.05601	0	0	4.21488	11.13628	10	22.69101	0	0	4.57488	3.399161
11	15.12934	0	0	3.04992	16.19938	11	23.59017	0	0	4.59504	2.799732
12	15.55601	0	0	3.27888	11.67223	12	24.71393	0	0	4.66272	2.756691
13	17.56684	0	0	4.0176	6.384347	13	25.49642	0	0	4.703041	2.771928
14	17.77434	0	0	4.05648	3.866787	14	24.53101	0	0	4.5288	3.921426
15	15.71892	42.3	0	0.99936	5.973798	15	21.61726	0	0	4.56192	10.33462
16	18.58726	0	0	4.317121	11.14838	16	17.99101	0	0	3.78144	7.334528
17	19.36559	0	0	4.116961	7.046215	17	16.94517	0	0	2.92752	6.019514
18	19.27351	0	0	3.51792	8.312551	18	17.22559	0	0	3.7584	7.361647
19	20.07726	0	0	4.789439	11.79036	19	19.52434	0	0	3.6432	4.099775
20	21.07267	0	0	5.104799	7.62579	20	20.78851	0	0	3.88656	5.783846
21	22.05601	0	0	5.10336	6.153772	21	21.65184	0	0	3.87216	5.35894
22	19.75726	0	0	2.49696	5.623874	22	22.25392	0	0	3.85776	5.091899
23	17.46642	0.2	0	3.5568	4.420742	23	21.69267	0	0	3.85056	5.781776
24	18.26059	0	0	4.35888	3.090921	24	20.65143	0	0	3.63744	8.841758
25	20.17767	0	0	4.32144	4.341463	25	18.99559	0	0	3.29904	5.525522
26	21.13517	0	0	4.779359	4.376066	26	20.06143	0	0	3.32784	7.186548
27	22.09725	0	0	4.94064	5.515493	27	20.73976	0	0	3.73536	7.110737
28	19.14559	0	0	4.06368	4.794015	28	21.15892	0	0	3.5856	8.522013
29	19.41642	0	0	4.59792	4.111313	29	19.75934	0	0	3.46464	6.970285
30	22.61517	0	0	4.62816	5.959971	30	20.30475	0	0	2.8584	3.882051
31	18.14892	1.4	0	3.51936	7.92358	31	20.30726	0	0	3.1104	4.747027

D	Sept.	Sept.	Sept.	Sept.	Sept.	D	October	October	October	October	October
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	19.79934	0	0	3.15936	5.966176	1	16.61809	0	0	2.31552	3.654568
2	18.47767	19.4	0	1.9368	10.79362	2	16.55267	0	0	2.04768	3.611598
3	16.48434	1.5	0	1.93968	3.565324	3	15.34434	1.2	0	1.62288	3.395151
4	16.55434	0	0	2.01456	3.939544	4	14.58767	0.3	0	2.14128	4.537157
5	17.11809	0	0	1.77984	2.365821	5	12.30559	4.9	0	1.04832	5.730966
6	17.22392	0.8	0	2.13984	3.338775	6	12.64476	16.9	0	1.3464	11.04976
7	16.43976	1.9	0	1.44576	4.017343	7	15.15726	0.1	0	1.5192	8.343101
8	16.78976	0.2	0	2.19312	2.9943	8	14.99934	0	0	1.84176	3.823693
9	17.40434	0	0	2.18736	3.679491	9	15.38601	0	0	1.75968	3.319036
10	17.56767	0	0	3.01248	3.904496	10	15.6535	0	0	1.68624	3.132351
11	17.64476	0.1	0	2.7216	5.535201	11	16.09142	0	0	1.76832	2.772623
12	18.04309	0	0	2.6064	4.104757	12	16.46142	0	0	1.9944	2.037488
13	18.57268	0	0	2.90592	4.047781	13	16.53059	0	0	1.85472	2.452967
14	17.32142	1.7	0	1.53504	2.598058	14	17.39643	0	0	1.83168	3.682735
15	15.96892	0	0	2.76624	6.370318	15	18.89184	0	0	1.82016	3.628903
16	15.22351	0	0	2.57184	4.063016	16	17.77559	0	0	1.95408	13.8381
17	15.45267	0	0	1.91088	4.902057	17	16.11642	0	0	1.31328	13.98227
18	15.72767	0	0	2.14128	4.05963	18	15.68017	0	0	1.48464	9.468694
19	16.57809	0	0	2.66256	4.659678	19	12.10018	0	0	1.54944	6.469781
20	17.83976	0	0	1.97136	4.061499	20	13.09809	0	0	1.39536	3.075369
21	17.80267	0	0	2.22768	10.832	21	13.94809	0	0	1.57392	8.039658
22	17.88892	0	0	2.46384	11.67143	22	13.44517	0.1	0	1.32048	13.95078
23	13.97351	0.1	0	2.51712	15.89967	23	6.244341	4.4	0	1.51632	11.16988
24	10.95351	0	0	2.44224	7.485231	24	6.11934	5.7	0	1.9584	21.25739
25	14.55601	0	0	1.944	9.137548	25	6.419757	0.3	0	2.26512	22.62084
26	13.54976	14.8	0	2.00448	10.32318	26	5.709341	0	0	1.54944	13.15946
27	11.06892	0	0	2.95488	20.34769	27	6.58559	0	0	1.30176	8.241262
28	11.76934	0	0	2.87424	14.85913	28	7.053091	0	0	1.25136	8.500447
29	13.02226	0	0	2.08224	5.287751	29	8.346007	0.9	0	0.81216	4.82822
30	15.57142	0	0	2.20896	2.62108	30	8.80184	0	0	0.96336	5.651278
31						31	7.687258	0	0	1.34496	12.70988

D A Y	November Temp. °C daily	November Precip T. mm daily	November Snowfall cm daily	November Evapot. mm daily	November Wind S. km/h daily	D A Y	December Temp. °C daily	December Precip T. mm daily	December Snowfall cm daily	December Evapot. mm daily	December Wind S. km/h daily
1	7.179757	0	0	1.02528	6.315155	1	13.33892	0	0	0.8136	7.875221
2	8.739341	0	0	1.05264	4.543912	2	12.52892	1.7	0	1.38816	9.591025
3	8.583924	0	0	0.81792	2.695881	3	11.38892	0	0	0.92304	7.91592
4	9.186841	0	0	0.96624	3.126591	4	9.787256	0	0	0.648	4.514965
5	11.09226	0	0	0.8712	4.60827	5	9.733923	16.5	0	0.16272	4.033281
6	13.33392	2.6	0	0.99648	6.660919	6	8.362257	19.9	0	0.65376	8.146553
7	13.90184	1.8	0	0.62496	12.16244	7	7.226841	0.5	0	0.58176	5.239109
8	13.16809	7.6	0	1.23696	7.394751	8	6.617258	0	0	0.99072	9.613351
9	11.59517	0	0	0.83952	2.266539	9	4.211423	0.9	0	1.49616	21.68291
10	11.37267	0	0	0.77616	3.374225	10	3.434757	0	0	0.9504	11.02721
11	12.72934	0	0	0.85536	3.413992	11	5.533508	0.6	0	0.45504	4.156322
12	12.93976	6.3	0	1.008	7.46817	12	5.466841	0	0	0.91296	10.04759
13	12.06559	2.8	0	0.88416	4.612698	13	6.162674	0	0	0.53856	3.627648
14	11.58392	0.1	0	1.15344	7.487094	14	6.257673	0	0	0.64656	2.261637
15	10.64184	0	0	0.67824	3.936209	15	6.99934	0	0	0.53568	1.561063
16	11.52268	0	0	0.83952	4.466474	16	8.246424	4.1	0	0.29808	3.528812
17	10.79726	6.1	0	1.1376	9.350684	17	8.358091	2.9	0	1.00656	11.66136
18	11.22184	0.5	0	0.80784	13.37242	18	6.861006	0.2	0	0.61344	5.674508
19	10.39851	5.9	0	1.15632	17.06657	19	5.666424	0	0	0.396	2.487965
20	6.413923	0	0	0.75312	6.37958	20	5.772257	0	0	0.58176	5.758527
21	5.37559	0	0	0.6912	3.741551	21	3.698923	0.1	0	0.7056	11.91364
22	5.37809	0	0	0.72288	4.609274	22	1.925174	0	0	0.67104	6.842756
23	7.253924	0	0	0.75168	4.072095	23	4.611007	0	0	0.61488	4.679189
24	7.247674	0	0	0.71712	2.58174	24	7.204341	0	0	0.59184	3.513095
25	4.155174	0	0	0.64224	5.416893	25	5.751839	0	0	0.7128	6.286191
26	5.893923	0	0	0.64368	5.042369	26	3.233507	5.4	3.78	0.648	9.702859
27	7.513924	0.1	0	0.5472	1.098299	27	-2.12316	0.1	0.07	0.792	12.24191
28	8.827257	0	0	0.6912	1.487317	28	1.743507	34.5	0	1.39536	20.90284
29	11.19392	0	0	0.9072	7.771637	29	-3.07899	0.6	0	1.50192	23.60259
30	12.43392	0.5	0	0.6912	3.776167	30	-10.6232	0	0	1.63872	28.68727
31						31	-9.10691	0	0	2.052	38.5305

Ohrid Lake - 2015 daily climatic data

DAY	January Temp. °C daily	January Precip T. mm daily	January Snowfall cm daily	January Evapot. mm daily	January Wind S. km/h daily	DAY	February Temp. °C daily	February Precip T. mm daily	February Snowfall cm daily	February Evapot. mm daily	February Wind S. km/h daily
1	-10.2732	0	0	1.65456	26.10234	1	5.135591	12.2	0.07	1.32336	18.59412
2	-3.89691	0	0	0.99792	9.84141	2	2.196424	4.7	3.29	0.68544	20.81796
3	2.92809	0	0	0.46512	4.427275	3	1.36184	0	0	0.80352	12.80833
4	2.741007	0	0	0.54288	21.49831	4	5.433508	0.5	0	1.2528	23.74657
5	-4.14066	0	0	1.5408	23.14375	5	7.128089	0	0	1.10736	14.52734
6	-4.36566	0	0	1.39104	18.8407	6	5.137257	8.9	2.59	0.78768	15.67008
7	-6.32233	0	0	1.62576	14.08564	7	3.964757	0	0	1.02672	9.478416
8	-1.65399	0	0	0.8352	1.672985	8	1.738507	2.9	2.03	0.71424	9.229951
9	0.225174	0	0	0.69408	8.047464	9	-3.16941	0.6	0.42	2.20896	43.40845
10	4.01559	0	0	0.53568	17.70372	10	-3.99274	0	0	1.52928	29.57066
11	6.333924	0	0	0.64512	13.03849	11	-2.68566	0	0	1.5624	21.58212
12	0.748507	0.1	0.07	1.0008	18.45114	12	-1.75899	0	0	1.12896	8.38169
13	2.83309	0	0	0.66384	3.047025	13	2.141007	0	0	0.9648	3.892101
14	5.070174	0	0	0.88848	3.782338	14	3.769341	0	0	0.98352	3.058906
15	4.011424	0	0	0.80928	4.061731	15	3.289758	0	0	0.95472	3.084314
16	5.283507	0	0	0.73008	1.921147	16	3.12559	0	0	0.98784	6.163696
17	4.832257	0	0	0.75168	3.600205	17	1.463924	0	0	1.38672	13.87291
18	7.069757	2.9	0	0.93888	7.346566	18	-2.12608	0	0	1.87488	14.88665
19	7.150174	0.6	0	0.77616	12.2164	19	0.223924	0	0	1.3464	6.681648
20	7.958507	0	0	0.98928	11.46533	20	4.372257	0	0	1.35072	1.40751
21	8.857257	0.4	0	0.95472	8.083174	21	6.117258	0	0	1.20672	3.898289
22	7.697673	0	0	0.97776	8.768685	22	5.722257	8.4	0	1.06272	17.85346
23	7.711424	4.6	0	1.21248	10.44549	23	7.51184	2.3	0	1.07568	7.229221
24	5.189757	9.8	0	0.43632	4.668673	24	7.296007	0	0	0.80064	2.497425
25	3.947673	5.6	0.49	0.88848	7.261142	25	5.447258	0.1	0	0.94464	11.29749
26	2.833924	5.1	0.21	1.12464	10.87597	26	6.582674	0.3	0	1.44432	8.317143
27	3.523924	1.2	0.84	1.09728	6.247671	27	7.403507	2.7	0	2.0664	14.64746
28	3.56184	0	0	1.03968	11.40701	28	7.669757	0.8	0	1.41552	5.325092
29	3.038507	0	0	0.7128	6.886217	29					
30	5.133507	1.9	0	0.83664	29.49102	30					
31	2.85559	20.2	1.33	0.74592	17.55327	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	7.067674	1.6	0	1.50192	5.61234	1	8.591841	0	0	1.88784	14.38427
2	5.273923	0	0	1.30896	14.63723	2	4.94559	0	0	2.1816	7.286933
3	6.558924	0	0	1.38384	13.40897	3	3.963507	1	0	1.42272	11.47486
4	5.581007	0	0	1.37808	5.10441	4	4.294341	0	0	1.66032	6.129881
5	7.45434	11.3	0	1.8504	18.50406	5	7.314341	5.8	0	1.584	11.71334
6	3.033091	7.1	1.54	1.99728	24.92316	6	6.003507	2.6	0	2.16864	14.97212
7	0.873507	0.8	0.56	2.16576	34.37303	7	3.199757	2.9	2.03	1.32192	20.76037
8	1.648507	0	0	1.86912	28.76115	8	4.128924	0	0	2.28096	29.63037
9	3.532673	0	0	1.3248	10.86765	9	6.131841	0	0	2.76048	20.01737
10	4.456008	0	0	1.30608	3.481495	10	7.027673	0	0	2.3976	7.287101
11	3.967257	0.2	0	0.99648	2.842202	11	8.733507	0	0	2.40192	5.579022
12	4.735174	0	0	1.04112	7.667866	12	11.32851	0	0	2.73168	5.197422
13	4.094757	0	0	1.43568	7.009779	13	12.54226	0	0	2.72736	5.377853
14	4.357257	0	0	1.37088	4.862094	14	12.24601	0	0	2.443681	5.282677
15	6.000174	0	0	1.44288	4.38017	15	11.65476	0	0	3.384	8.829656
16	7.550591	0	0	1.5696	6.353375	16	11.77309	0	0	2.89584	8.398702
17	7.06934	0	0	1.78128	7.837369	17	11.15726	0	0	2.81664	9.598344
18	4.638923	0	0	1.332	2.806871	18	11.91892	0	0	2.8872	12.47157
19	3.658507	0.2	0.14	1.39824	8.12127	19	9.543507	0	0	1.9368	9.808858
20	1.780174	0	0	2.08656	18.73699	20	8.48309	0	0	2.78784	8.730679
21	3.95309	0	0	1.72512	4.628616	21	8.53309	0	0	2.92464	9.750778
22	6.814757	2.7	0	1.1376	4.332507	22	8.881423	0	0	2.61936	8.634103
23	8.74059	3.6	0	2.11392	7.639161	23	10.23809	0	0	2.79072	7.450345
24	9.043924	0	0	1.96848	7.355117	24	10.44892	0	0	2.6136	6.756271
25	6.861006	3.8	0	1.14336	12.68428	25	10.66059	4.2	0	2.85696	3.780259
26	9.82309	0.6	0	1.51776	10.63133	26	12.41226	0	0	2.9592	6.31797
27	9.787256	8.800001	0	1.93536	10.97506	27	13.75434	0	0	2.87136	3.085543
28	6.909757	4.4	0	1.35504	9.729489	28	11.77559	0.1	0	2.22768	10.92584
29	6.369341	0	0	2.33424	9.711635	29	11.08476	0.6	0	2.75616	5.487784
30	5.832257	0	0	1.30752	9.645227	30	10.91642	0	0	2.63664	7.582614
31	7.300591	0	0	2.22192	10.95385	31					

D A Y	May Temp. °C daily	May Precip T. mm daily	May Snowfall cm daily	May Evapot. mm daily	May Wind S. km/h daily	D A Y	June Temp. °C daily	June Precip T. mm daily	June Snowfall cm daily	June Evapot. mm daily	June Wind S. km/h daily
1	10.92101	0	0	2.91312	9.414552	1	17.78976	0	0	4.76064	2.999768
2	10.14226	0	0	2.1744	11.54058	2	17.83684	0	0	4.81968	4.043989
3	13.48892	0	0	3.49344	5.00546	3	19.27226	0	0	5.37552	6.160159
4	16.21684	0	0	3.83472	4.417256	4	19.73351	0.7	0	4.89024	7.632609
5	18.59934	0	0	4.12992	4.251605	5	19.78101	0	0	4.66416	11.2416
6	21.14184	0	0	4.6944	5.269454	6	19.31892	0	0	5.29056	8.060744
7	20.83434	0.3	0	4.60944	10.55397	7	18.36476	0	0	4.45392	7.200344
8	17.70726	0	0	4.482721	9.035678	8	17.60851	0.1	0	4.4568	3.206959
9	16.96101	0	0	3.26448	4.366253	9	16.47393	0.1	0	4.0032	4.766183
10	15.09934	0	0	3.60864	10.67814	10	17.98101	0	0	4.21344	9.056224
11	13.12017	0	0	4.3992	19.49941	11	19.07101	0	0	5.1192	5.703363
12	14.05309	0	0	4.10112	12.10762	12	20.02101	0	0	5.12928	2.937138
13	14.80517	0	0	4.15728	5.282069	13	20.47642	0	0	5.2488	3.217661
14	15.04851	0	0	4.42368	11.59119	14	20.93892	0	0	5.22864	4.74987
15	17.77934	0	0	4.8672	7.2626	15	19.47726	0	0	5.4792	8.201837
16	20.29392	0	0	5.28192	5.368866	16	18.41934	0	0	5.08752	8.067048
17	20.83434	0	0	4.966559	6.437174	17	18.08768	3.8	0	3.97008	4.835681
18	19.80101	0	0	4.844161	8.265108	18	15.42642	16.1	0	3.58992	13.16974
19	17.6485	0.7	0	2.95488	5.758966	19	15.87267	0	0	4.53456	6.738368
20	17.74684	0	0	4.80672	5.585348	20	16.63892	0	0	4.5792	3.970578
21	17.70767	0	0	4.48992	4.234523	21	15.12559	1.9	0	3.92112	9.831806
22	19.70017	0	0	3.91824	13.31638	22	14.95101	0	0	4.69728	9.61644
23	14.06059	0	0	3.89232	9.451257	23	16.19101	0	0	4.80816	6.30046
24	12.96267	0	0	3.35952	6.584156	24	17.10226	0	0	4.92048	5.015196
25	11.48684	0.1	0	3.4128	14.87955	25	16.82351	0	0	4.58352	8.045974
26	12.40268	0	0	3.65184	9.028053	26	15.04018	0	0	4.792319	11.96928
27	14.57309	0	0	3.34656	6.923461	27	16.48976	0	0	4.46976	12.96191
28	12.67434	0	0	3.75696	11.53346	28	15.83142	0.2	0	2.8944	5.285869
29	12.59392	0	0	4.47552	10.38497	29	18.08392	0	0	4.44096	9.802528
30	14.7585	0	0	4.70016	3.968779	30	17.81226	0.4	0	4.0392	7.448437
31	16.52059	0	0	4.54896	2.896453	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	16.76934	0.8	0	3.0888	6.980779	1	23.91059	0	0	4.42944	4.96842
2	17.99934	0	0	4.61088	6.630895	2	24.34434	0	0	4.32288	3.867089
3	20.28892	0	0	5.088959	9.372933	3	24.22184	0	0	3.69216	3.684697
4	19.51517	0	0	5.201281	7.738216	4	22.62267	0	0	3.85488	4.97588
5	20.31934	0	0	4.89456	5.547168	5	23.76851	0	0	4.69584	4.184115
6	21.84309	0	0	5.11632	4.995816	6	24.24142	0.3	0	4.37472	10.22531
7	22.97726	0	0	5.28048	4.37347	7	24.61684	0.4	0	4.921919	11.49688
8	23.76809	0	0	5.40288	2.656758	8	22.90517	0	0	4.22208	4.644118
9	23.43725	0	0	5.31936	2.804817	9	22.16142	0	0	4.176	3.519379
10	21.98892	0	0	5.5944	9.939513	10	21.98643	0	0	4.28112	4.179784
11	20.27559	0	0	5.188321	6.357328	11	21.7885	0	0	4.11264	2.830389
12	21.92851	0	0	5.13072	4.59829	12	22.60143	0	0	4.28256	4.53192
13	21.416	0	0	5.217121	6.294299	13	24.16059	0	0	4.610881	5.107563
14	21.92809	0	0	5.032799	4.987447	14	23.64809	0	0	4.15296	4.054714
15	22.15059	0	0	5.221439	8.17426	15	23.00559	0	0	4.02192	3.732958
16	22.96892	0	0	5.10336	7.812361	16	21.93892	0	0	3.5424	6.411074
17	23.95476	0	0	5.02992	4.828469	17	18.02267	0	0	3.36816	14.04132
18	25.26768	0	0	5.05728	4.17264	18	18.56892	0	0	3.61584	4.143875
19	24.62434	0	0	4.81248	2.994043	19	20.27934	0	0	3.6648	5.497428
20	25.22976	0	0	4.932	4.644155	20	19.53267	0	0	3.4488	5.452136
21	26.48642	0	0	5.292	8.804803	21	19.04642	0	0	2.72304	4.516902
22	24.70767	0	0	4.77216	4.929041	22	18.21226	0	0	3.05136	4.552014
23	24.08392	0	0	4.5	3.317955	23	17.51976	0	0	3.176641	4.423478
24	23.18642	0	0	4.713121	3.942025	24	19.31393	0	0	3.27312	3.111378
25	21.85143	0	0	4.14576	5.976117	25	21.50351	0	0	3.6216	2.837823
26	22.57809	0	0	4.43808	3.773435	26	21.78642	0	0	3.32784	2.788779
27	22.54726	0	0	4.6368	6.935539	27	22.16434	0	0	3.46752	3.740176
28	22.18684	0	0	4.64688	3.935123	28	22.11142	0	0	3.39264	2.751265
29	23.80934	0	0	4.487041	4.45505	29	23.93309	0	0	3.75552	3.594155
30	24.10976	0	0	4.63968	3.687093	30	23.26309	0	0	3.57696	3.307283
31	25.07517	0	0	4.47264	4.427016	31	23.72642	0	0	3.40848	3.43436

D	Sept.	Sept.	Sept.	Sept.	Sept.	D	October	October	October	October	October
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	23.16767	0	0	3.2544	2.815632	1	13.55809	0	0	1.89648	5.428541
2	22.64517	0	0	3.30912	5.028118	2	13.91851	0	0	1.8648	4.378363
3	21.56642	0	0	3.33072	4.797194	3	14.59809	0	0	1.75536	3.444235
4	21.34017	0	0	3.22704	5.442316	4	15.72351	0	0	1.75104	6.091299
5	22.94226	0	0	3.33216	6.672077	5	14.50726	0	0	1.59984	4.702408
6	20.69892	0	0	2.72304	14.70078	6	14.85268	0	0	1.78848	5.997966
7	18.72142	0	0	2.59776	4.747272	7	14.92601	1.4	0	1.0368	5.994635
8	16.096	0	0	2.56176	7.888238	8	14.45684	0	0	1.49328	6.174191
9	15.98809	6.7	0	2.14128	9.046128	9	14.67017	0	0	1.69488	6.563911
10	16.87351	20.1	0	2.34144	6.813968	10	15.15892	41	0	0.54432	7.052196
11	17.11643	0	0	2.04048	4.200544	11	15.75309	6.3	0	2.72448	19.07405
12	17.04267	0	0	2.63376	4.407463	12	11.63309	0	0	1.8504	14.89439
13	17.97809	0	0	2.93904	4.158833	13	11.62017	0	0	1.67616	3.270995
14	18.64809	0	0	2.7072	4.005281	14	14.93393	0	0	1.71504	3.144006
15	20.59309	0	0	2.81952	2.220769	15	15.18851	0	0	1.5552	2.990741
16	22.17434	0	0	2.92608	2.516324	16	14.30559	1.7	0	1.38672	3.418169
17	23.74559	0	0	2.95488	2.02178	17	14.18184	0	0	1.48464	4.599654
18	25.42267	0	0	3.06288	3.587399	18	13.80518	0	0	1.52928	2.773194
19	24.42267	0	0	3.00528	4.570304	19	14.94309	0	0	1.50192	4.109148
20	21.71475	1.2	0	2.74752	5.912251	20	14.40142	0.1	0	1.5192	8.848887
21	18.27392	6.8	0	2.72016	12.60801	21	13.19059	0	0	1.8144	7.467211
22	16.65226	0.5	0	2.13552	8.877179	22	8.534758	17.7	0	1.73808	13.9186
23	17.05684	0	0	2.09664	4.111763	23	8.52809	1.2	0	2.6424	19.29933
24	16.78476	0	0	1.9584	4.607153	24	8.359341	0	0	1.81728	13.0374
25	14.05351	29	0	0.7776	5.885918	25	9.365174	0	0	1.24128	3.960204
26	14.19434	0	0	1.80576	4.322695	26	12.78726	0	0	1.49904	3.568661
27	15.01184	0	0	2.1384	6.665193	27	12.60601	0	0	1.368	4.130032
28	14.45393	0	0	2.0592	7.921326	28	10.26642	0	0	0.97344	2.540303
29	13.55184	0	0	2.082241	7.040032	29	9.838508	0	0	1.00656	2.471916
30	13.19684	0	0	1.72656	5.988815	30	9.599757	0	0	1.4184	9.623132
31						31	8.206841	0	0	1.35792	17.06305

D	November	November	November	November	November	D	December	December	December	December	December
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	7.108091	0	0	1.54512	18.39841	1	4.637674	0	0	0.67536	8.066564
2	8.386424	0	0	1.2528	7.173533	2	7.169341	0	0	0.65376	2.190372
3	12.34142	0	0	1.16208	2.963383	3	8.573508	0	0	0.60768	2.66723
4	12.68476	0	0	1.12608	3.382875	4	8.300591	0	0	0.58752	1.879343
5	12.24767	0	0	1.09584	2.651082	5	7.33934	0	0	0.43632	1.97491
6	12.17476	0	0	1.06704	4.518935	6	7.194758	0	0	0.50832	1.611335
7	10.95684	0	0	1.01376	5.439678	7	8.120591	0	0	0.55872	3.38716
8	11.85309	0	0	1.01952	7.869485	8	8.46059	0	0	0.66672	5.547894
9	12.36684	0	0	1.00224	4.283381	9	6.906841	0	0	0.54432	2.5275
10	13.30434	0	0	0.936	4.187598	10	5.740173	0	0	0.79344	7.658056
11	14.59767	0	0	0.90576	2.164822	11	3.167257	0	0	0.94032	13.23048
12	15.80434	0	0	0.88272	2.453828	12	3.602257	0	0	0.49824	2.752281
13	14.80892	0	0	0.80496	2.570354	13	6.57309	0	0	0.59184	3.279324
14	12.31309	0	0	0.84816	6.119586	14	6.461423	0	0	0.69552	4.568632
15	9.137673	0	0	0.82224	7.210674	15	5.992673	0	0	0.5184	3.954933
16	10.78392	0	0	0.75312	2.492282	16	5.24684	0	0	0.72432	7.921293
17	12.10267	0	0	0.68544	3.912942	17	2.04559	0	0	0.64944	11.38515
18	10.76517	0	0	0.75168	5.724591	18	3.119757	0	0	0.43056	2.343376
19	12.29684	0	0	0.68688	2.56715	19	6.201841	0	0	0.53424	2.34531
20	9.016423	0	0	0.612	13.32292	20	6.100174	0	0	0.49536	4.661556
21	10.22226	0	0	0.6408	21.76605	21	5.903507	0	0	0.45072	2.241749
22	10.27476	3.9	0	0.612	23.14241	22	6.982673	0	0	0.47952	4.052543
23	8.448508	1.3	0	0.9144	7.505766	23	8.821839	0	0	0.49968	2.043793
24	10.15517	2.1	0	0.74592	10.88766	24	8.544757	0	0	0.49824	2.242293
25	8.631423	43	0	0.3816	7.091894	25	6.021423	0	0	0.49248	5.534277
26	7.771006	0.7	0	1.18368	11.1844	26	6.243507	0	0	0.53136	6.432933
27	5.491841	9.3	0	1.22256	14.49648	27	8.602674	0	0	0.46656	3.356751
28	5.332674	0.5	0	0.88848	12.99831	28	9.481841	0	0	0.49248	2.262929
29	4.163923	0	0	0.54	9.358199	29	7.948924	0	0	0.50688	2.900096
30	3.716007	0	0	0.84528	5.219326	30	1.864757	0	0	0.68976	13.94956
31						31	-2.67483	0	0	0.76464	10.71397

Ohrid Lake - 2016 daily climatic data

D	January	January	January	January	January	D	February	February	February	February	February
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	-2.80774	0	0	0.49968	6.035873	1	6.642674	0	0	0.78336	10.74835
2	0.363507	0	0	0.4536	5.853397	2	9.038089	0	0	1.02384	5.663452
3	3.894341	20.9	0	0.34416	8.562136	3	8.452257	0	0	1.32336	11.37993
4	4.888924	8.4	0	0.5976	19.17567	4	5.869757	0.2	0.14	1.1304	19.7822
5	7.110174	0.4	0	0.60336	13.57664	5	0.77434	0	0	1.89792	28.09191
6	9.641423	24.3	0	0.4752	17.20191	6	1.513924	0	0	1.06128	8.278423
7	4.516007	2.2	0	0.91008	19.07919	7	4.387257	0	0	0.93312	2.790873
8	2.906424	0	0	0.5976	9.722066	8	4.342674	0	0	0.9	4.310295
9	7.023507	0	0	0.62784	10.90223	9	5.886007	0	0	0.82368	11.98627
10	8.593091	0	0	0.70992	16.70181	10	7.444757	0.7	0	1.1304	27.42861
11	8.272258	0	0	0.78912	16.47783	11	4.377257	4.2	0	0.68832	19.40669
12	7.88184	0	0	0.8928	26.60988	12	5.462675	7.1	0	1.2528	9.790942
13	3.851007	0	0	0.4608	14.70675	13	6.77809	4.9	0	0.5688	17.40936
14	2.73184	0	0	0.56592	8.059821	14	9.467257	3.3	0	1.39536	15.7778
15	6.213507	0	0	0.95904	20.44702	15	13.08101	1.3	0	2.33424	20.9892
16	2.616007	13.6	9.45	0.71136	23.16056	16	14.31934	0	0	2.0376	9.779057
17	-3.61066	1	0.7	2.18448	38.40271	17	13.70517	0	0	1.584	6.61918
18	-6.90608	0	0	1.55232	27.53817	18	12.08059	0	0	1.67904	11.44776
19	-5.17649	0	0	0.648	7.14896	19	7.633507	0	0	1.08576	10.75515
20	-1.16274	0	0	0.42336	4.074308	20	3.772257	2.1	0	0.6408	7.013734
21	-1.42233	0	0	0.37584	2.96226	21	3.527257	0	0	1.07856	9.789187
22	-3.32066	0	0	1.23264	14.62537	22	8.408505	0	0	1.60128	7.987633
23	-4.72649	0	0	0.80928	6.487757	23	11.74226	0	0	1.76688	6.997983
24	-1.73108	0	0	0.59184	1.724656	24	8.458924	1.9	0	1.40688	8.181653
25	-0.00274	0	0	0.4464	2.578606	25	7.153091	0	0	1.27008	3.781262
26	2.17434	0	0	0.25776	4.648632	26	6.401424	2.1	0	0.96048	9.867867
27	5.987258	0	0	0.5616	3.273031	27	6.966423	0	0	1.3032	6.112087
28	5.555174	0	0	0.64368	7.106173	28	9.516423	0	0	1.8	14.18908
29	4.795174	0	0	0.56448	2.55444	29	10.36517	0	0	1.3464	17.72367
30	6.091424	0	0	0.59184	3.264227	30					
31	6.23559	0	0	0.90144	13.52669	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	7.722258	0.4	0	1.67184	9.571161	1	14.04934	0	0	2.282401	2.115061
2	6.361424	0	0	1.19376	4.434298	2	17.32226	0	0	2.9232	5.126276
3	5.35934	1.7	0	1.26432	15.62273	3	14.24643	0	0	2.24352	3.102088
4	2.848923	0.3	0.21	0.78336	19.02451	4	13.76226	0	0	2.4624	3.784591
5	4.172674	0	0	1.03248	11.14882	5	15.85642	0	0	2.4192	2.34149
6	9.118507	0	0	1.93824	10.88551	6	16.85726	0	0	2.66832	2.851666
7	8.238091	8.5	0	1.36224	17.09272	7	17.36268	0	0	2.94768	6.358578
8	5.586423	0	0	1.4256	7.366529	8	13.50934	2.6	0	1.95264	6.789599
9	7.324341	2.2	0	1.0512	3.821763	9	10.11601	1.2	0	1.72512	11.76049
10	4.65934	0	0	1.10448	9.710712	10	9.200173	0	0	1.50768	4.801182
11	5.487674	0	0	1.73952	9.706244	11	9.963507	0	0	2.27088	8.560993
12	6.756008	1.8	0	1.12752	13.6523	12	11.19226	0	0	2.72448	6.412722
13	6.95309	8	0	2.28528	17.85258	13	15.04892	0	0	3.183841	6.571875
14	6.045174	0	0	2.56464	21.46676	14	14.78267	0	0	3.46464	15.21629
15	4.081423	1	0	1.16784	5.427061	15	11.21142	0	0	2.64672	6.097033
16	5.33059	0	0	1.6416	8.784789	16	14.00684	0	0	3.4128	6.953568
17	5.562257	0	0	1.47024	6.11074	17	17.77767	0	0	3.31344	2.957927
18	6.052674	0	0	1.30032	3.261371	18	19.71059	0	0	3.47904	3.664297
19	7.914757	0	0	1.19232	3.721824	19	18.66642	0	0	3.94272	9.381192
20	7.158924	0	0	1.78848	6.592491	20	12.83392	0	0	3.38544	14.47571
21	8.295174	0	0	1.81008	7.728432	21	10.83184	0	0	2.9952	8.538642
22	12.00184	0	0	2.52288	12.59449	22	11.74309	0	0	2.60496	7.860035
23	11.73267	6.4	0	2.07072	13.69999	23	12.20476	2.2	0	2.53296	8.231616
24	6.494341	6.499999	0.42	1.1304	6.852724	24	9.211007	11.4	0	1.332	15.6067
25	3.519757	0.5	0.35	2.268	11.18172	25	8.717673	1.7	0	2.39904	14.4977
26	3.90059	0	0	1.76544	4.598457	26	5.588507	2.8	0	2.51424	13.2645
27	4.118507	0	0	1.19376	3.56034	27	8.168922	0	0	2.75472	9.110868
28	5.778923	0	0	1.9872	7.193636	28	11.60726	0	0	2.77056	4.925069
29	7.44934	0.2	0	1.67904	7.779558	29	12.28517	7.3	0	2.25504	3.665999
30	9.776423	0	0	2.13552	5.364607	30	13.79642	0	0	3.14928	4.079687
31	11.49559	0	0	2.54304	6.404191	31					

D A Y	May Temp. °C daily	May Precip T. mm daily	May Snowfall cm daily	May Evapot. mm daily	May Wind S. km/h daily	D A Y	June Temp. °C daily	June Precip T. mm daily	June Snowfall cm daily	June Evapot. mm daily	June Wind S. km/h daily
1	12.67059	3.5	0	2.06784	3.820103	1	16.15601	0	0	4.34736	5.692299
2	11.63059	7.5	0	2.31984	10.96504	2	14.48101	0	0	4.34304	9.040199
3	7.298091	2.8	0	2.11824	7.534277	3	13.65059	0	0	3.61296	8.258073
4	7.921007	0.1	0	2.35872	5.84314	4	14.40434	0	0	4.2768	4.808223
5	10.43851	0	0	3.86496	13.97552	5	15.88559	0	0	4.284	5.22872
6	11.52976	0	0	3.28032	6.478566	6	15.68017	0	0	4.4136	3.853317
7	12.23642	0	0	3.50496	3.863597	7	17.27351	0	0	5.34528	11.82731
8	12.71976	0	0	3.48192	3.283059	8	16.14476	0	0	4.48992	5.140966
9	13.50726	0	0	3.2328	3.444944	9	15.42351	0	0	4.32432	4.901734
10	14.02184	0	0	2.95488	3.190831	10	15.67851	0	0	4.11408	4.078473
11	15.45851	0	0	3.54384	4.671346	11	16.11351	0	0	4.85136	6.413532
12	15.93559	5	0	3.26592	11.95535	12	16.55351	0	0	4.651201	7.837868
13	12.70267	0.5	0	3.45744	15.20641	13	13.95184	3.3	0	2.2824	9.412822
14	11.05809	0	0	2.70864	16.83248	14	14.05726	0	0	3.73248	11.54052
15	11.32559	0	0	3.096	12.26127	15	14.77559	0	0	4.176	11.79462
16	10.91101	0	0	2.8008	14.06266	16	20.38434	0	0	5.52528	3.148275
17	9.908923	0	0	3.26592	5.753005	17	24.76559	0	0	6.31872	6.522788
18	11.11184	0	0	3.88368	6.836522	18	23.91809	0	0	6.50592	6.718853
19	11.69226	0	0	3.97872	7.782592	19	21.74726	0	0	2.6496	4.200832
20	10.76017	21.7	0	1.31472	7.862759	20	23.55893	0	0	5.16816	3.649916
21	12.67059	15.9	0	2.52432	14.03352	21	25.10726	0	0	5.60016	3.761502
22	14.82684	0	0	5.06592	8.66891	22	24.96226	0	0	5.78304	6.422206
23	15.31934	0	0	4.644001	7.77726	23	24.90184	0	0	5.86512	9.708274
24	11.45559	0.5	0	3.44304	15.15454	24	24.41184	0	0	6.07968	12.45751
25	11.31351	0	0	3.58272	14.82806	25	23.44892	0	0	5.84064	9.085573
26	13.69017	0	0	4.30992	3.640518	26	22.45726	0	0	4.90896	3.753799
27	16.55559	0	0	4.64256	4.32633	27	21.64101	0	0	5.20416	4.464483
28	18.96059	0	0	5.08608	3.945904	28	19.88309	0	0	4.4496	7.388209
29	18.92975	0	0	4.92768	5.725613	29	19.11059	0	0	4.99248	11.07465
30	18.04809	0	0	5.16528	7.595173	30	19.80059	0	0	5.02704	6.733973
31	15.92309	0	0	4.854241	8.520909	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	20.70351	0	0	4.94064	2.999327	1	23.82392	0	0	4.272481	3.200663
2	22.13726	0	0	4.83696	3.03432	2	23.12892	0	0	4.073761	6.268114
3	21.90267	0	0	4.92912	4.079605	3	21.59559	0	0	4.10688	12.7959
4	22.23934	0	0	4.993919	10.47075	4	21.08809	0	0	4.03056	5.591739
5	20.76726	0	0	4.93488	5.619729	5	22.64559	0	0	3.99312	4.42151
6	21.31726	0	0	4.642561	3.645116	6	22.78934	0.2	0	3.24	3.684319
7	20.64309	0	0	5.41008	15.03689	7	22.30892	3.1	0	3.35808	9.131344
8	19.15934	0	0	5.02992	8.519317	8	19.01517	2.6	0	2.01312	9.933539
9	21.32351	0	0	4.87872	4.506265	9	20.75851	1.7	0	3.456	5.122277
10	22.89309	0	0	4.910401	5.929931	10	21.05059	0	0	3.7152	3.586947
11	22.67059	0	0	4.95072	4.545485	11	20.45059	0	0	3.725281	5.009952
12	23.09684	0	0	4.67856	2.982733	12	18.41726	0	0	3.74256	14.35315
13	23.49059	0	0	4.75632	3.931793	13	16.70392	0	0	3.81888	15.06625
14	22.25184	0	0	4.811039	6.670954	14	17.05476	0	0	3.18672	5.634531
15	21.67226	3.5	0	3.50064	5.174121	15	19.98851	0	0	3.38256	4.867692
16	15.94684	0	0	3.64032	8.94872	16	21.40267	0	0	3.63456	3.462679
17	15.02392	0	0	3.44304	6.389635	17	20.80184	0	0	3.55536	4.559446
18	17.11851	0	0	4.1976	9.012248	18	21.03725	0	0	3.37824	3.60856
19	19.91767	0	0	4.829759	16.35015	19	21.17184	0	0	3.17664	3.592816
20	19.69517	0	0	4.67424	14.75208	20	21.11726	0	0	3.22272	4.4273
21	20.04309	0	0	4.41504	7.148861	21	22.09851	0	0	3.3336	3.561092
22	21.75684	0	0	4.46544	3.83442	22	22.40392	0	0	3.29904	3.199715
23	23.39893	0	0	4.54608	2.907617	23	20.07309	4.3	0	2.84544	11.38968
24	24.42226	0	0	4.691519	6.026743	24	20.5585	0	0	3.12048	10.66462
25	23.28851	0.2	0	3.8664	6.196833	25	21.23975	0	0	3.36816	11.07528
26	20.63351	0.3	0	2.98224	6.544283	26	19.92309	0	0	2.84688	6.376156
27	20.65017	0	0	3.87936	4.537775	27	18.97267	0	0	2.99088	6.012281
28	22.04142	0	0	4.22496	3.034703	28	19.27684	0	0	2.911681	4.284811
29	22.09142	0	0	4.1832	3.632918	29	20.26767	0	0	2.88144	3.529669
30	22.76559	0	0	4.3848	7.25155	30	21.02017	0	0	2.93328	5.240035
31	22.9485	0	0	4.33728	4.888007	31	20.95892	0	0	2.87424	5.541206

D	Sept.	Sept.	Sept.	Sept.	Sept.	D	October	October	October	October	October
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	20.77976	0	0	2.3616	2.928801	1	15.45642	0	0	1.92096	3.573195
2	19.78726	0	0	2.02752	5.863331	2	16.59351	0	0	2.09808	5.055235
3	19.57934	0	0	2.96064	9.062469	3	15.51184	0	0	1.71216	8.194552
4	19.05809	0	0	2.63376	4.674389	4	13.63642	0	0	1.34208	5.519095
5	18.46559	0.6	0	2.2536	5.67256	5	11.06059	0	0	1.34352	4.308259
6	16.09768	9.599999	0	1.45296	12.32348	6	10.19726	0	0	1.29312	6.444914
7	17.08976	8.8	0	2.57904	17.33909	7	11.38476	26.9	0	0.55584	7.930651
8	17.47267	8.299999	0	1.73664	14.15	8	11.16684	0.4	0	1.68912	7.553358
9	17.66017	7.4	0	2.43792	11.49709	9	11.62934	0	0	1.53936	3.801852
10	18.76559	0	0	2.68272	6.781723	10	12.24476	2.7	0	0.91008	6.532928
11	18.31434	0	0	2.44656	4.183329	11	11.44101	7.5	0	1.49616	7.079871
12	18.67476	0.2	0	1.98288	3.222518	12	8.698506	0.1	0	1.48896	16.68011
13	18.59267	0	0	2.7936	3.466888	13	7.73809	0	0	1.40544	5.620747
14	18.29934	0	0	2.76768	3.169035	14	15.06267	0	0	1.75248	3.109298
15	18.36434	0	0	2.80512	2.42055	15	15.89976	0	0	1.3104	3.727404
16	18.87809	0	0	2.83104	3.284542	16	15.40642	0	0	1.512	4.392907
17	18.69684	0	0	2.84112	6.416874	17	13.43101	0	0	1.65744	10.61658
18	17.29017	0	0	2.27376	6.593317	18	10.96601	0	0	1.04976	2.409817
19	14.13101	4	0	1.8504	11.68719	19	10.59434	0.3	0	0.8856	4.654597
20	13.14518	0	0	1.78704	8.973697	20	11.60934	0	0	1.09296	2.37178
21	13.79226	0	0	1.38096	3.358454	21	12.92351	1.5	0	1.12896	4.016481
22	12.64184	1.6	0	1.656	6.122799	22	13.28268	4.8	0	1.25136	6.89882
23	12.41059	0	0	2.12256	6.001396	23	13.29892	0	0	1.02096	2.455727
24	14.24267	0	0	2.02608	4.428142	24	14.23684	0	0	1.09008	2.763341
25	14.29351	0	0	2.05776	4.477229	25	14.43517	0	0	1.01952	2.427812
26	13.98934	0	0	2.04768	5.553584	26	15.11517	0	0	1.23696	6.213873
27	13.20517	0	0	1.76976	4.567936	27	13.64392	0	0	1.33632	15.2163
28	14.37601	0	0	1.79568	3.433743	28	9.560591	0	0	1.17504	15.4193
29	15.29851	0	0	1.93248	2.587701	29	7.728923	0	0	0.9072	5.012521
30	15.57059	0	0	1.81872	3.24464	30	9.231008	0	0	1.008	6.894867
31						31	5.22934	0	0	1.10736	17.0219

D	November	November	November	November	November	D	December	December	December	December	December
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	6.222674	0	0	0.78336	3.896549	1	0.73934	0	0	0.5328	4.366795
2	8.126007	0	0	0.96048	11.23141	2	3.10934	0	0	0.3816	15.31383
3	9.680173	0	0	0.78336	11.1966	3	4.094757	0	0	0.48528	5.332604
4	10.61268	0.5	0	0.72	4.566155	4	4.506424	0	0	0.6408	8.714451
5	10.37267	0	0	0.8496	8.184423	5	4.044757	0	0	0.43056	5.661054
6	11.92351	0	0	0.7632	14.51381	6	4.82434	0	0	0.30384	2.235763
7	13.42559	0	0	0.84672	14.80644	7	3.946424	0	0	0.69264	9.386404
8	13.43351	14.6	0	1.15056	23.31158	8	1.77184	0	0	0.3816	3.869983
9	8.430174	21.7	0	0.6192	15.91999	9	4.968507	0	0	0.57168	1.632368
10	6.586424	0	0	0.7632	16.23833	10	7.303925	0	0	0.54576	1.795131
11	7.138507	0	0	0.88272	12.536	11	6.145174	0	0	0.69408	5.686936
12	6.937674	15	0	0.67536	20.41244	12	3.864757	0	0	0.47664	5.64208
13	4.88684	0	0	0.7272	14.17901	13	-0.52358	0	0	0.90432	17.34678
14	4.386007	0	0	0.83664	7.258211	14	-0.33608	0	0	0.47952	7.337135
15	3.480173	0	0	0.7848	5.970051	15	1.66059	0	0	0.53424	8.960137
16	3.664341	0	0	0.57024	2.464924	16	-0.21316	0	0	0.64656	13.85739
17	6.175591	0	0	0.70704	3.460161	17	-0.49774	0	0	0.55152	7.720959
18	8.391007	0	0	0.63792	2.506147	18	2.68184	0	0	0.4896	2.003141
19	8.87434	0	0	0.57168	3.302179	19	4.24559	0	0	0.4392	1.574937
20	9.593923	0	0	0.64368	2.904094	20	5.14934	0	0	0.50688	2.134375
21	9.454757	0	0	0.612	2.80907	21	1.262257	0	0	0.73584	11.01146
22	8.126424	0	0	0.53712	1.810146	22	1.870174	0	0	0.96768	10.50682
23	8.082674	0	0	0.48816	2.005812	23	2.614757	0	0	0.85104	11.07768
24	9.012257	0	0	0.55584	1.573837	24	3.657257	0	0	0.6048	6.234841
25	8.945174	0.1	0	0.45216	1.794476	25	5.331007	0	0	0.5976	5.085501
26	9.245589	0	0	0.50976	1.961381	26	4.295174	0	0	0.4176	1.449996
27	9.28934	0.1	0	0.5472	4.092372	27	4.222257	4	0.14	0.34128	5.08394
28	5.967257	22	0.49	0.7632	13.23819	28	-0.87774	0	0	1.4688	17.77544
29	-1.35108	0	0	1.36368	37.88052	29	-2.48774	0	0	1.7928	34.44876
30	-2.41983	0	0	0.87984	28.9146	30	-3.94941	0	0	1.4976	25.36724
31						31	-2.02316	0	0	0.96912	10.33663

Ohrid Lake - 2017 daily climatic data

D	January	January	January	January	January	D	February	February	February	February	February
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	0.68434	0	0	0.5544	3.383616	1	3.238091	0	0	0.61056	4.65777
2	0.12559	0	0	0.44784	9.284314	2	4.743924	0	0	0.79056	5.645934
3	2.44059	0	0	0.34848	14.55666	3	6.127257	0	0	1.00512	11.56456
4	3.793506	0.3	0	0.67104	14.33125	4	6.41309	0	0	0.88704	16.52364
5	0.533507	11	7.49	0.61056	27.26987	5	6.818924	0	0	0.9288	18.4465
6	-8.42733	0	0	1.96704	41.35083	6	7.87309	4.2	0	1.45728	18.83548
7	-13.604	0	0	1.4616	34.6747	7	4.483091	0	0	1.03104	5.456383
8	-12.0036	0	0	1.14912	18.85733	8	4.156007	0	0	0.88704	4.322895
9	-9.47691	0	0	1.656	18.10397	9	4.61059	0	0	0.92448	10.79251
10	-9.47566	0	0	1.20096	14.61266	10	3.97059	0	0	1.26144	13.47572
11	-5.76274	0	0	0.56448	7.405893	11	3.088924	0	0	0.92016	5.488888
12	-4.51774	0	0	0.34992	18.40123	12	2.724757	0	0	0.52848	2.873537
13	0.714757	0	0	0.468	17.8983	13	3.078507	0	0	0.64512	3.195218
14	1.377257	0	0	0.684	20.74986	14	1.723924	0	0	0.864	4.871195
15	0.457673	0	0	0.7128	8.224384	15	4.160173	0	0	1.10448	5.815754
16	-0.07941	0.9	0.63	1.116	23.98495	16	5.546007	0	0	1.02384	4.141253
17	1.482674	0.8	0.56	0.93456	20.49277	17	4.43809	0	0	0.9216	8.709487
18	1.38434	0.8	0.42	1.14336	27.57485	18	4.438924	0.6	0	1.0728	6.94293
19	0.973507	0.5	0.35	1.03104	20.53286	19	4.29684	0.5	0	1.16784	9.058581
20	0.538507	0	0	0.612	8.092968	20	2.623507	0	0	0.8208	4.434338
21	0.762257	0	0	0.576	4.765995	21	3.26309	0	0	1.11456	5.195232
22	1.028507	0	0	0.8568	9.588742	22	5.38934	0	0	1.29312	5.426772
23	1.35684	0	0	0.85536	9.65319	23	5.266424	0	0	1.3824	11.3357
24	2.545174	2	1.4	0.91584	9.935256	24	6.034758	0	0	1.32912	10.21041
25	1.281424	0.3	0.21	1.08288	10.99497	25	7.989758	3.4	0	0.77616	11.08417
26	-1.07191	0	0	1.12176	8.148223	26	8.966423	1.7	0	1.56672	6.197127
27	-2.22858	0	0	0.90288	3.960778	27	8.966426	0	0	1.14912	3.426376
28	1.231007	0	0	0.51408	2.69588	28	8.474757	0	0	1.28736	6.258946
29	1.678924	0.6	0.42	0.32256	2.483339	29	10.36517	0	0	1.3464	17.72367
30	2.807674	0	0	0.45072	2.322901	30					
31	2.058924	0	0	0.69264	3.21814	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	6.658506	2	0	0.98784	14.53449	1	11.30934	0	0	1.83024	3.140551
2	5.054757	0	0	1.19088	5.181821	2	11.20893	0	0	1.91664	4.133069
3	7.753091	0	0	1.3824	4.093597	3	7.959757	0.9	0	1.01952	5.903635
4	9.351007	0	0	1.48752	6.817884	4	7.097674	1.8	0	1.34496	5.368306
5	8.49809	0	0	1.47456	8.296924	5	8.461006	0	0	1.69056	4.581897
6	6.197257	0	0	1.34928	16.17794	6	7.712673	0.5	0	1.74384	7.47575
7	7.45809	1.7	0	1.14912	14.55924	7	5.497674	3.7	0	1.66752	7.060455
8	8.55059	0.8	0	2.34432	21.97166	8	6.69684	0	0	1.87488	4.864423
9	9.573923	0.1	0	2.04768	14.36833	9	9.778508	0	0	2.19456	6.378973
10	7.913508	1.3	0	1.87488	14.08452	10	10.73267	0	0	2.29248	5.599977
11	6.018507	0	0	2.49984	28.48294	11	11.86892	0	0	2.3184	2.715474
12	4.565174	0	0	1.60704	13.21424	12	12.74017	0	0	2.47968	6.360765
13	4.169341	0	0	0.97344	4.81086	13	11.88976	0	0	2.38032	6.178278
14	5.583507	0	0	1.52928	11.97794	14	11.74809	0	0	2.43936	4.52438
15	6.158507	0	0	1.69056	7.148333	15	12.09351	0	0	2.40768	5.389631
16	6.623091	0	0	1.79712	10.296	16	11.34101	0.2	0	2.01312	4.62691
17	6.533924	0	0	1.46736	4.736868	17	8.226841	4.8	0	2.2536	10.75768
18	7.467673	0	0	1.70064	12.80294	18	7.553924	0	0	2.4768	7.239853
19	7.457257	0	0	1.29168	11.81084	19	7.54684	0	0	2.04048	20.32146
20	10.68017	0	0	1.6632	3.442602	20	3.426841	0	0	1.56096	19.72292
21	13.62976	0	0	1.7856	2.910884	21	2.587674	0.2	0.14	1.35072	10.52599
22	12.85809	0	0	1.79136	2.583475	22	3.964757	0	0	2.02752	8.359609
23	13.58392	0	0	1.77696	2.786885	23	6.347257	0	0	2.10672	10.72382
24	14.01393	0	0	1.80144	2.828392	24	8.517258	0	0	2.35296	3.785564
25	14.44517	0	0	2.06352	4.326984	25	10.68767	0	0	2.53872	4.704957
26	10.00101	0.1	0	1.7568	11.31723	26	11.35059	0	0	3.02688	5.35043
27	6.856006	0.1	0	1.91808	14.91693	27	14.05351	0	0	3.2256	3.580039
28	7.98809	0	0	1.89648	7.188196	28	16.53643	0	0	3.708	4.758837
29	11.07101	0	0	2.21184	7.763958	29	15.76142	0	0	2.58192	5.945732
30	12.79226	0	0	2.62368	15.29603	30	15.36684	0.5	0	2.06208	10.17283
31	11.61851	0	0	2.04048	7.564335	31					

D	May	May	May	May	May	D	June	June	June	June	June
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	14.83892	0	0	3.10176	4.645261	1	18.26392	0	0	5.0544	3.454108
2	15.98809	0	0	3.3696	4.109421	2	19.36267	0	0	4.824	2.735742
3	16.23601	0	0	3.47184	3.797399	3	18.17892	0.5	0	3.33216	3.268781
4	14.58351	0	0	3.23856	5.188205	4	18.09017	0	0	4.22064	2.702512
5	12.63517	0	0	3.29472	8.286973	5	18.26017	0	0	4.05792	2.906205
6	11.02642	0	0	2.91024	9.866859	6	18.57267	0	0	4.75488	3.31674
7	11.96392	0.1	0	2.56752	13.73226	7	19.45726	0	0	4.64832	2.935602
8	10.29601	4.1	0	2.69856	7.897382	8	18.95267	0	0	4.60368	5.933325
9	10.57142	4	0	2.08224	3.677266	9	16.69851	0	0	5.4864	10.12929
10	10.46392	1.4	0	3.15792	6.390047	10	17.63434	0	0	5.06448	4.796922
11	13.47226	0	0	3.11616	6.263874	11	15.97517	1.6	0	3.94848	11.69638
12	18.33642	0	0	4.87008	12.16496	12	16.94684	0	0	4.79952	5.015654
13	16.81892	0	0	4.17024	10.17239	13	19.51601	0	0	5.08464	2.873375
14	14.56976	0	0	3.96432	7.128523	14	21.40684	0	0	5.614561	3.384581
15	16.92767	0.5	0	3.51936	6.241602	15	19.77351	0.4	0	3.0672	4.123708
16	15.48017	0	0	3.37968	7.467946	16	19.20101	0	0	4.05504	2.709444
17	14.02226	0	0	3.15504	14.82273	17	18.21476	0.2	0	3.88224	4.599437
18	14.61601	0	0	4.55616	11.53279	18	14.46309	0.8	0	5.70384	15.8519
19	13.87059	0	0	4.10112	5.760771	19	16.35851	0	0	4.772161	13.86709
20	13.78851	0	0	4.2408	7.936449	20	17.31601	0	0	4.74624	4.50482
21	11.93851	2.3	0	2.28528	7.175526	21	19.16059	0	0	5.20992	2.526586
22	14.28976	0	0	3.88368	7.11236	22	20.58017	0	0	5.274721	2.805777
23	15.20643	0	0	3.43152	3.63924	23	21.14768	0	0	5.66208	4.955709
24	13.84142	0	0	3.32208	3.296655	24	22.11809	0	0	5.351039	4.584571
25	11.91101	5.5	0	1.9368	2.965766	25	23.14059	0	0	5.65056	3.818922
26	12.06142	7.4	0	2.66256	10.36397	26	22.69226	0	0	5.61168	2.960421
27	13.80267	0	0	4.4496	14.71555	27	22.43517	0	0	5.470561	4.473892
28	14.49101	0	0	4.71168	14.76087	28	22.17809	0	0	5.757121	5.557148
29	14.48767	0	0	4.409281	4.682264	29	23.93767	0	0	6.02784	7.551596
30	15.07434	0	0	4.57632	5.345043	30	24.38809	0	0	5.92848	4.833042
31	15.63351	0	0	4.788	5.975219	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	26.15309	0	0	6.40512	9.086097	1	26.05643	0	0	2.59776	6.816725
2	21.76934	0.5	0	4.6368	6.347971	2	25.73351	0	0	2.48112	8.158878
3	16.52309	0	0	3.348	11.0135	3	25.81851	0	0	2.3688	5.867226
4	18.02725	0	0	5.378399	15.34954	4	27.2685	0	0	2.32272	4.651278
5	18.78184	0	0	4.83408	6.334482	5	27.74767	0	0	2.21616	4.412958
6	20.85309	0	0	4.71744	5.297345	6	27.62101	0	0	2.12688	5.123839
7	22.18225	0	0	4.975201	4.601034	7	27.53434	0	0	2.02176	4.18783
8	23.24434	0	0	5.08608	2.943697	8	27.22975	0	0	1.92816	4.239904
9	24.07517	0	0	4.956481	4.502854	9	27.31559	0	0	1.89216	4.035858
10	24.65142	0	0	5.08176	3.337714	10	26.98933	0	0	1.86336	4.349912
11	24.48017	0	0	5.3208	3.98551	11	26.27517	0	0	1.7784	7.45232
12	24.51892	0	0	5.400001	3.003865	12	22.45351	0	0	1.50336	9.412749
13	24.44434	0	0	5.22432	7.745205	13	17.36017	0	0	1.10448	9.494805
14	22.30059	0	0	5.112001	8.172676	14	20.14142	0	0	1.43856	10.76958
15	22.15309	0	0	4.44384	5.234788	15	21.27642	0	0	1.41264	7.526424
16	14.23893	14.3	0	1.64016	16.66675	16	23.71934	0	0	1.50336	11.02071
17	17.05767	1.4	0	4.52016	18.92115	17	24.19851	0	0	1.5264	11.56566
18	18.62059	0	0	4.20192	7.805841	18	23.89017	0	0	1.54656	7.723531
19	20.14017	0	0	4.30704	4.292273	19	23.41851	0	0	1.47168	5.523692
20	21.81517	0	0	3.8448	3.133158	20	23.47809	0	0	1.40976	5.175348
21	23.44267	0	0	3.3624	3.835351	21	20.511	0	0	0.95616	9.078021
22	24.76267	0	0	3.54096	4.581623	22	18.79892	0	0	1.37088	16.82707
23	24.78601	0	0	3.4632	5.258534	23	18.22267	0	0	1.39104	5.910681
24	24.45601	0	0	3.21552	5.897786	24	19.79476	0	0	1.41264	6.827148
25	20.5885	0	0	2.47536	11.93965	25	21.79309	0	0	1.476	5.462454
26	18.40184	0	0	2.18304	7.804427	26	23.52725	0	0	1.48464	4.470668
27	17.32225	0	0	1.93536	4.676166	27	23.94559	0	0	1.42992	3.903356
28	18.32726	0	0	2.16144	4.88045	28	25.14892	0	0	1.4256	7.261795
29	22.56809	0	0	2.60928	3.681489	29	20.45017	2.8	0	1.5264	8.125251
30	24.48476	0	0	2.68416	4.354663	30	19.02767	0	0	1.07424	6.832542
31	25.75642	0	0	2.60064	5.048812	31	19.95475	0	0	1.13904	5.970373

DAY	Sept. Temp. °C daily	Sept. Precip T. mm daily	Sept. Snowfall cm daily	Sept. Evapot. mm daily	Sept. Wind S. km/h daily	DAY	October Temp. °C daily	October Precip T. mm daily	October Snowfall cm daily	October Evapot. mm daily	October Wind S. km/h daily
1	20.57017	0	0	1.15344	6.604235	1	12.91017	0	0	0.89568	4.65692
2	21.52351	0	0	1.15776	6.909189	2	13.08392	0	0	0.79488	3.840518
3	17.17226	0	0	0.63072	12.37664	3	12.96601	0	0	0.81216	5.320649
4	15.19351	0	0	0.74448	6.257324	4	14.13934	0	0	0.9072	3.159747
5	15.79642	0	0	0.72	5.190444	5	14.41351	0	0	0.90432	7.192434
6	15.44892	0	0	0.78048	6.641539	6	13.62226	0	0	0.81216	8.551559
7	17.30851	0	0	0.90432	5.606636	7	7.04059	12.8	0	1.38816	20.19629
8	18.53976	0.1	0	0.91728	4.873208	8	6.623507	0	0	0.71136	7.598034
9	16.96476	0.7	0	1.008	7.471908	9	10.30017	0	0	0.79632	3.96068
10	18.46684	0	0	0.9936	3.321187	10	11.39642	0	0	0.7776	5.556662
11	21.18559	0.7	0	1.28304	11.31314	11	12.62517	0	0	0.76608	2.878007
12	16.47059	0	0	0.86976	17.49344	12	13.62809	0	0	0.80496	3.602697
13	15.82684	0	0	0.75744	12.81603	13	15.12726	0	0	0.96624	7.572632
14	17.44434	0	0	1.06848	6.466713	14	14.31309	0	0	0.95328	13.62306
15	18.91851	0	0	1.13472	3.184262	15	14.15809	0	0	0.7488	6.154238
16	21.76476	0	0	1.15488	3.717718	16	17.39184	0	0	0.89856	4.08283
17	22.42309	0	0	1.11888	6.843318	17	17.53184	0	0	0.83952	3.969198
18	19.72184	0	0	0.98784	8.224898	18	17.11559	0	0	0.82656	3.519855
19	16.50601	0	0	0.86688	7.732768	19	15.92851	0	0	0.76176	3.06889
20	13.30017	0	0	0.52704	10.53224	20	14.05018	0	0	0.6048	4.08659
21	10.46559	0	0	0.38592	11.48622	21	13.38934	0	0	0.6264	4.588801
22	10.35476	0	0	0.53856	7.252863	22	12.33059	0	0	0.54432	8.102475
23	12.43018	0	0	0.6552	5.132945	23	9.960174	1.6	0	0.46368	14.02231
24	15.14768	0	0	0.70704	4.277812	24	5.740591	2.5	0	0.5472	7.966715
25	12.89392	12.7	0	1.29456	6.36184	25	9.16809	0	0	0.75744	17.80722
26	13.94059	7.8	0	1.52064	6.80075	26	10.24351	0	0	0.50976	4.381768
27	14.35643	0.3	0	0.82224	4.572206	27	12.35392	0	0	0.70848	7.44121
28	14.34059	5.6	0	1.35936	3.457925	28	8.548507	6	0	1.36944	15.66533
29	14.54059	0	0	1.34352	8.06025	29	6.457674	0	0	0.48816	12.68453
30	13.22809	0	0	0.95616	4.690489	30	7.227257	0	0	0.57888	6.445766
31						31	4.548507	0	0	0.54432	8.348911

D	November	November	November	November	November	D	December	December	December	December	December
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	5.69309	0	0	0.52128	6.58647	1	6.96809	44.3	0	0.1944	6.450722
2	7.23559	0	0	0.48816	4.490661	2	8.500175	2.4	0	0.90864	8.036605
3	8.073508	0	0	0.47808	5.634605	3	5.614339	0.8	0	0.79776	13.25605
4	8.997257	0	0	0.60912	8.482439	4	2.968924	0	0	0.57024	10.06937
5	7.618507	0	0	0.38304	3.142564	5	1.376841	0	0	0.40608	8.705562
6	8.852674	3.4	0	0.46512	4.987135	6	0.882674	0	0	0.41472	3.45799
7	11.27351	5.6	0	1.0224	12.60734	7	3.436841	0	0	0.49104	2.923559
8	9.403923	4.5	0	1.28448	12.81869	8	3.316007	0	0	0.60768	9.73047
9	6.933091	0	0	0.70848	3.917617	9	4.645591	0.3	0	0.61344	22.26328
10	8.417256	0	0	0.5544	2.475591	10	-0.30316	0	0	0.504	17.72989
11	9.00684	1	0	0.54288	4.522217	11	2.899757	0	0	0.43488	11.08491
12	11.37809	0.4	0	1.12464	15.14929	12	7.307674	0	0	0.5544	12.60326
13	11.34559	1.9	0	0.82368	14.77873	13	7.44684	0	0	0.63792	12.47082
14	11.25392	5.3	0	0.66384	10.18426	14	4.246007	1.5	0	0.56736	17.31027
15	11.48768	2	0	1.02816	13.23132	15	6.096424	0	0	0.55152	17.47216
16	10.21892	14.4	0	1.24848	13.59485	16	7.091839	6.2	0	0.504	18.60701
17	9.832673	4.2	0	0.82656	13.25718	17	2.936007	0	0	0.83376	11.15354
18	9.638091	0	0	0.72432	4.028449	18	0.837674	1.7	1.19	0.62928	14.04913
19	7.65309	0	0	0.62352	7.772259	19	-1.31108	0	0	0.63216	16.23525
20	3.246007	0	0	0.63648	11.09736	20	-1.94691	0	0	0.4968	6.370369
21	1.899757	0	0	0.648	8.532159	21	-1.56691	0	0	0.6624	8.676093
22	4.017256	0	0	0.48672	6.788996	22	-1.05649	0	0	0.88848	13.3733
23	6.53559	0	0	0.55584	3.182449	23	0.294757	0	0	0.91728	17.94329
24	6.470173	0	0	0.46656	2.209484	24	2.491841	0	0	0.44208	1.896492
25	5.918924	0	0	0.4248	4.326772	25	6.404758	0	0	0.5256	1.792086
26	7.404756	0.4	0	0.53856	10.73044	26	5.58934	0	0	0.56016	4.871655
27	3.430174	0.3	0	0.9648	18.71556	27	5.182257	0	0	0.58032	16.67232
28	-0.20733	0	0	0.66816	9.294605	28	5.36684	2.5	0	0.68832	20.59561
29	2.616007	0	0	0.66672	11.90394	29	2.511007	0	0	0.71136	10.78402
30	9.904756	0.6	0	1.008	31.34853	30	1.491424	0.8	0.56	0.27792	6.491851
31						31	3.01184	0	0	0.39456	1.912987

Ohrid Lake - 2018 daily climatic data

D	January	January	January	January	January	D	February	February	February	February	February
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	4.757674	0	0	0.53712	9.072717	1	3.62184	0	0	0.47376	12.25543
2	4.55059	1.3	0	0.74592	15.76657	2	5.906007	5.9	0	0.52416	18.77912
3	2.820591	1.3	0	0.86112	11.16013	3	8.061423	19.3	0	1.12464	27.81726
4	2.052257	0.3	0.21	0.50688	9.195594	4	2.708507	14.4	0	1.09296	13.39451
5	4.296423	0	0	0.71424	5.385855	5	3.349757	0	0	0.86256	5.71425
6	6.732674	0	0	0.36864	2.026723	6	4.095173	0	0	0.61632	4.558737
7	7.13309	0	0	0.38448	2.593423	7	5.766007	0.1	0	0.99216	14.53696
8	8.91809	0	0	0.49104	2.493383	8	3.666007	0	0	0.56448	14.6896
9	9.496425	0	0	0.48816	4.655564	9	4.18184	0	0	0.7128	5.681784
10	7.343924	0	0	0.25632	6.161894	10	3.686423	10.9	0	1.27008	24.42062
11	5.935591	6.1	0	0.47952	2.960338	11	2.828924	1.1	0.77	1.07856	16.77198
12	6.074339	0	0	0.59184	6.263216	12	1.557257	0	0	0.5616	13.08846
13	3.69434	0	0	0.60624	18.59742	13	3.106423	9.8	0	0.74592	14.34106
14	1.783507	0	0	0.5904	8.764487	14	2.04434	0	0	1.14192	18.74638
15	3.453507	2.9	0.49	0.47376	8.647467	15	1.042674	0	0	1.37232	20.01457
16	3.960174	0	0	0.51264	17.46206	16	2.788091	0	0	1.05264	6.355732
17	5.81059	0.7	0	0.72864	27.96921	17	6.278924	0	0	0.99216	2.332763
18	0.196007	0	0	1.10736	22.16249	18	5.944757	0.1	0	0.81936	2.955478
19	1.368924	0	0	0.70416	16.27663	19	5.730174	2.5	0	0.92016	6.36396
20	5.409757	0.2	0	0.58464	17.20859	20	5.00434	0.3	0	0.9072	13.509
21	3.80309	11.5	0	0.45936	12.69646	21	5.707257	0.2	0	1.2312	16.45022
22	0.420174	0	0	1.51056	16.4599	22	6.062257	0.8	0	1.24128	7.468683
23	1.54559	0.4	0.28	0.612	3.738823	23	6.821006	0	0	1.35216	10.71189
24	0.321007	0	0	0.91008	12.1972	24	5.280174	0.2	0	1.1448	9.061973
25	0.840174	0	0	0.63648	1.711375	25	-0.01899	5.8	4.06	0.87984	16.23878
26	4.14059	0	0	0.67536	1.358328	26	-2.09149	12.7	8.89	1.20672	20.45595
27	5.522673	0	0	0.61488	1.735001	27	-0.84983	5.7	3.99	0.684	20.35466
28	6.471425	0	0	0.64656	2.053844	28	-2.89066	0	0	0.4608	17.15985
29	7.04184	0	0	0.6552	1.931161	29					
30	6.53184	0	0	0.6192	3.542474	30					
31	5.625173	0	0	0.53424	5.418208	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	-0.98108	0	0	0.47664	7.085892	1	5.987258	4.5	0	1.67328	22.04457
2	7.357673	4.3	0	1.30896	24.53337	2	6.067673	0	0	1.63296	8.293949
3	5.929757	0.3	0	1.692	24.72363	3	9.649341	0	0	1.9224	3.550105
4	6.998924	2.9	0	1.55088	16.26588	4	11.89392	0	0	2.23776	5.740652
5	8.698506	2.5	0	0.98496	12.34005	5	13.24601	0	0	2.08656	4.271667
6	7.625589	5.8	0	1.49904	17.95407	6	11.01726	4.9	0	2.23776	11.93697
7	5.902257	0	0	1.24704	13.85696	7	12.77476	0	0	2.45664	9.602987
8	5.560175	6.6	0	1.68624	15.61676	8	14.23268	0	0	2.34288	5.110521
9	5.108923	0	0	1.16496	3.020424	9	13.55392	0	0	2.41488	6.071018
10	7.133507	0	0	1.56384	6.309517	10	12.99267	0	0	2.17296	2.760286
11	8.898089	0	0	1.28448	6.157514	11	13.96267	0	0	1.86912	3.562934
12	10.86851	1.6	0	1.49328	9.58787	12	16.55892	0	0	2.422081	5.443119
13	5.69184	0	0	1.03104	16.58201	13	15.18892	0	0	2.29536	4.216986
14	4.612674	0	0	1.0512	12.59159	14	18.08642	0	0	2.66976	7.341901
15	4.84559	0	0	1.06128	8.448994	15	16.41267	0	0	1.84608	10.05678
16	8.575173	0.8	0	1.23552	10.10354	16	14.06976	0	0	2.0304	8.156033
17	12.92892	0	0	1.77408	20.34126	17	13.83309	0	0	2.06208	3.243171
18	8.19559	0.2	0	1.44432	15.83221	18	15.53601	0	0	2.1456	5.864723
19	6.026006	7	0	0.5544	13.39374	19	14.71517	0	0	2.18448	6.763034
20	5.090591	0	0	1.65168	18.639	20	14.86393	0	0	3.09888	16.44125
21	6.073507	1.3	0	1.42848	17.09605	21	12.40517	0	0	2.20032	5.322757
22	3.878924	0.6	0	1.62864	26.69702	22	13.91809	0	0	2.41488	4.296761
23	3.725174	0.8	0.56	1.01088	9.493633	23	15.84184	0	0	2.42784	2.889715
24	3.138507	0	0	1.30032	5.89604	24	16.84392	0	0	2.84976	6.172911
25	4.75809	4.7	0	1.13904	13.04676	25	15.89892	0	0	2.98512	4.079345
26	5.890173	1.7	0	1.68768	12.98919	26	17.57225	0	0	2.89872	2.749703
27	4.804757	0	0	1.69488	12.56038	27	19.37976	0	0	3.09888	4.547069
28	4.196006	0	0	1.46016	4.240692	28	18.88642	0	0	3.11472	6.421925
29	6.593506	0	0	1.89504	6.666658	29	17.69726	0	0	3.20976	9.855627
30	9.801008	0	0	2.05776	5.055647	30	16.82684	0	0	2.70144	3.63999
31	12.72517	0	0	2.76768	19.7815	31					

D	May	May	May	May	May	D	June	June	June	June	June
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	17.36809	0	0	2.89008	2.935519	1	19.94892	0	0	4.5216	3.520273
2	18.91434	0	0	3.39408	8.566636	2	19.82892	0	0	4.38768	3.75796
3	17.01392	0.7	0	2.28816	14.41895	3	18.97684	0	0	4.41504	4.235099
4	16.66559	0	0	2.07504	7.608156	4	18.78684	0	0	4.517281	5.586819
5	15.51476	2.5	0	1.29744	5.146093	5	18.99601	0	0	4.10544	4.606684
6	13.66101	3.8	0	1.64592	2.942236	6	18.19851	0.3	0	3.74688	3.677214
7	16.99559	0.4	0	3.24432	8.486197	7	20.37476	0	0	4.33728	3.783943
8	14.57101	0	0	2.52144	4.08803	8	23.02642	0	0	5.01408	9.743722
9	14.21892	0	0	2.63376	3.391577	9	17.10517	0.1	0	3.08592	9.105811
10	13.77267	3.3	0	2.76912	2.885645	10	17.15184	0	0	3.45456	5.196477
11	14.53392	0	0	3.0672	5.286755	11	20.16184	0	0	4.32576	4.360651
12	15.45517	0	0	3.77712	4.720551	12	21.53892	0	0	4.60368	4.454492
13	14.29601	0	0	3.27312	7.089951	13	19.73267	0	0	4.01184	7.377391
14	14.01434	0	0	3.61872	8.105077	14	17.02934	0	0	3.5568	5.032246
15	14.36017	2.2	0	3.54528	13.12744	15	16.15809	2.2	0	2.54304	5.924908
16	11.62017	0.1	0	3.9096	8.304284	16	16.27726	1.2	0	2.80224	6.327916
17	13.14601	0	0	3.8088	5.03396	17	17.71309	0	0	3.6216	4.603002
18	13.93892	0.9	0	2.1528	5.417818	18	18.85767	0.1	0	3.47472	7.388238
19	15.94184	0.1	0	3.16224	5.697178	19	18.48142	1.1	0	3.11328	7.345842
20	16.95184	0	0	4.02048	7.77363	20	19.836	0	0	4.21344	6.617388
21	16.93351	0	0	3.71664	6.181995	21	19.89601	0	0	4.459681	3.476097
22	17.48101	0	0	3.81888	3.740295	22	18.26309	0	0	4.05792	6.881491
23	16.96434	3.6	0	2.55888	4.632022	23	15.46768	5.3	0	2.90304	7.066644
24	16.22726	0.4	0	2.78064	5.816778	24	15.80517	0	0	4.13712	8.169373
25	17.12059	0	0	3.650399	5.123584	25	14.75559	19.8	0	1.60848	6.481339
26	19.11893	0	0	4.528801	6.492916	26	16.04726	2.2	0	4.15296	15.51643
27	19.25143	0	0	4.38912	6.989652	27	15.02309	10.2	0	2.41776	10.39325
28	19.06726	0	0	4.24224	5.922376	28	13.47309	9	0	2.29104	6.713529
29	18.95101	0	0	4.38048	6.284675	29	14.21267	0	0	2.9736	11.9618
30	19.17684	0	0	4.4568	4.056743	30	16.85226	0	0	3.45888	7.005219
31	19.47601	0	0	4.39344	3.657127	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	19.71767	0	0	4.4784	4.19153	1	22.4885	0	0	3.63168	4.876137
2	21.08476	0	0	5.016959	4.917275	2	22.37434	0	0	3.40128	4.11819
3	22.01142	0	0	4.9464	3.341723	3	21.16851	0	0	2.29968	4.267237
4	22.00309	0	0	4.63104	5.372682	4	21.53684	0	0	3.73824	4.421252
5	21.15226	0	0	4.60944	5.68963	5	21.67517	0	0	3.74256	3.510888
6	21.98559	0	0	4.81392	4.052876	6	22.08726	0	0	3.66336	3.271634
7	20.20851	0.2	0	3.5064	4.754449	7	22.60601	0	0	3.59424	4.062426
8	18.63517	0	0	2.80224	7.392171	8	23.39392	0	0	3.53088	3.366835
9	16.71559	0.8	0	3.10032	7.70192	9	23.39142	0	0	3.3624	3.451829
10	17.25601	0	0	3.8736	3.803994	10	23.25226	0	0	3.24576	4.464455
11	19.32934	0	0	4.15152	3.370838	11	22.33809	0	0	3.08304	4.157075
12	20.82184	0	0	4.50576	3.591252	12	22.33726	0	0	3.05568	3.984804
13	21.37976	0	0	4.44096	4.338151	13	22.14184	0	0	3.0816	5.126695
14	21.24892	0	0	4.31712	7.950407	14	21.79767	0	0	2.74032	3.451605
15	21.18017	0	0	4.2264	5.356988	15	21.90476	0.6	0	2.17296	3.301986
16	21.38726	0	0	4.140001	6.26745	16	19.45476	3.4	0	2.26368	6.534163
17	20.35434	0	0	3.59136	7.650171	17	20.46267	0	0	2.71584	3.049786
18	18.98517	0	0	3.55248	6.449368	18	22.36476	0	0	2.87856	4.162346
19	19.06726	0	0	3.52224	8.192352	19	23.07476	0.2	0	2.53296	4.512491
20	20.66851	0	0	3.53088	4.141041	20	22.37059	0.1	0	2.71008	4.918973
21	21.93517	0	0	4.0536	5.150121	21	21.98434	0	0	2.52288	4.353658
22	22.63184	0	0	4.16016	7.813176	22	22.3085	0	0	2.56032	3.376068
23	19.14892	1.6	0	2.85408	6.779291	23	22.44976	0	0	2.50272	3.299326
24	19.27601	0	0	3.25872	9.173836	24	21.91892	0	0	2.38896	3.788895
25	19.08059	0	0	2.20464	5.432869	25	21.22809	0	0	2.19744	3.766809
26	19.34767	1.1	0	2.32848	6.100874	26	19.90851	0	0	1.87488	4.98441
27	19.75809	0	0	3.4488	3.747029	27	17.92434	0.8	0	1.30608	7.386982
28	19.336	0	0	3.52944	4.707285	28	20.16809	0	0	2.53872	10.81402
29	20.94309	0	0	3.01248	7.299631	29	21.28976	0	0	2.44224	6.340684
30	21.99892	0.1	0	3.02112	8.368915	30	22.13059	0	0	2.3976	3.914567
31	22.31267	0	0	2.83104	6.741403	31	22.40142	0	0	2.29104	3.487934

D	Sept.	Sept.	Sept.	Sept.	Sept.	D	October	October	October	October	October
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	22.70809	0	0	2.30544	3.570042	1	12.79601	0	0	0.63936	8.877655
2	22.65393	0	0	2.26512	3.247562	2	14.10642	0	0	0.78624	4.307212
3	20.50017	0	0	2.05632	6.650229	3	15.70184	0	0	0.6768	4.362321
4	17.40601	0	0	1.7712	6.784221	4	16.01643	0	0	0.97632	7.627504
5	16.14768	0	0	1.45872	6.501248	5	15.48726	0	0	0.83808	5.382729
6	17.19726	0	0	1.66464	5.648974	6	15.45392	0	0	0.69984	3.061173
7	17.54476	0	0	1.68336	5.243488	7	14.93101	0	0	0.66672	3.810078
8	18.20642	0	0	1.5552	4.886409	8	15.07476	0	0	0.756	4.042058
9	18.84476	0	0	1.85472	8.508308	9	16.04601	0	0	0.83664	5.478603
10	18.68351	0	0	1.8864	7.755415	10	14.60184	0	0	0.83088	5.349982
11	19.19309	0	0	1.73952	12.44582	11	13.98684	0	0	0.72576	4.981928
12	18.96226	0	0	1.86768	10.58549	12	14.63226	0	0	0.75456	5.970481
13	18.35101	0	0	1.59264	5.442774	13	15.12434	0	0	0.82368	6.937452
14	18.28392	0	0	1.51776	4.409483	14	14.20018	0	0	0.68256	4.629208
15	18.85809	0	0	1.49184	3.881591	15	14.22893	0	0	0.63504	4.714306
16	19.746	0	0	1.6848	11.05928	16	14.39559	0	0	0.59328	3.773735
17	18.85684	0	0	1.53792	5.240732	17	15.55934	0	0	0.67104	4.731266
18	19.63517	0	0	1.37088	4.032648	18	15.67476	0	0	0.648	4.12906
19	19.45559	0	0	1.29456	3.689937	19	15.71267	0	0	0.63792	4.360293
20	19.81726	0	0	1.3104	4.021326	20	14.17851	0	0	0.54288	9.719427
21	19.35726	0	0	1.3032	3.345238	21	12.32351	0	0	0.49968	7.562553
22	19.32976	0	0	1.28736	4.0188	22	12.59184	5.099999	0	1.01088	10.79834
23	20.20809	0	0	1.26144	3.644259	23	13.05184	0	0	0.83232	12.4167
24	18.62726	0	0	1.18944	7.997826	24	10.58684	0	0	0.60336	6.223984
25	10.75934	0	0	0.8136	24.39036	25	5.546007	0	0	0.48096	7.986767
26	8.575173	0	0	0.69696	21.45385	26	10.05059	0	0	0.5616	7.828174
27	8.005174	0	0	0.73872	17.023	27	13.22767	0	0	0.6192	7.75695
28	10.89851	0.3	0	0.83376	10.02532	28	14.64184	0	0	0.67392	4.27091
29	15.28851	0	0	1.008	12.26556	29	16.03559	0	0	0.71712	7.044261
30	13.02892	0	0	0.75888	8.887445	30	16.02517	0.2	0	0.6552	9.17543
31						31	15.80642	0	0	0.61488	3.742701

D A Y	November Temp. °C daily	November Precip T. mm daily	November Snowfall cm daily	November Evapot. mm daily	November Wind S. km/h daily	D A Y	December Temp. °C daily	December Precip T. mm daily	December Snowfall cm daily	December Evapot. mm daily	December Wind S. km/h daily
1	17.54309	0	0	0.62928	2.865568	1	4.338507	0	0	0.42912	4.167805
2	17.99642	0	0	0.55152	5.483461	2	6.246007	0	0	0.47088	3.172042
3	16.66726	0	0	0.76464	7.482218	3	5.96684	0.1	0	0.46368	3.238396
4	12.75184	0	0	0.57168	5.789186	4	6.38934	0	0	0.40464	2.654797
5	10.78684	0	0	0.38016	4.284182	5	5.252674	0	0	0.84384	15.97014
6	11.98601	0	0	0.47808	4.731093	6	1.53309	0	0	0.50544	9.873726
7	10.81101	0	0	0.37728	3.372093	7	3.609341	0	0	0.4176	2.711201
8	10.55351	4.3	0	0.4968	3.238042	8	5.12309	1.2	0	0.46656	11.38699
9	9.902256	0	0	0.29232	3.810362	9	5.24934	0.3	0	0.6408	11.06262
10	9.230174	0	0	0.30384	3.325179	10	4.592674	1.9	0	0.63216	10.08189
11	9.658507	0	0	0.3168	2.941794	11	1.818924	0	0	0.35136	5.45747
12	10.43601	0	0	0.3384	4.139767	12	0.546424	0	0	0.3672	2.246282
13	10.49309	0	0	0.3528	4.361987	13	1.546424	0	0	0.33408	5.459324
14	10.31142	0	0	0.4176	6.918846	14	5.932674	0.3	0.07	0.49392	5.496339
15	5.871424	0	0	0.324	15.83761	15	7.487257	1.2	0	0.44064	5.250032
16	4.816841	0	0	0.24336	12.71439	16	3.271841	0.1	0	0.5256	6.163833
17	4.368507	1.1	0.49	0.3528	23.32929	17	2.662257	11.5	5.32	0.59472	5.257766
18	3.174341	19	0.63	0.92016	21.28335	18	0.068507	0.7	0.49	1.548	21.42705
19	5.376423	0.3	0	0.65664	6.522491	19	0.003924	0	0	0.77904	9.816243
20	10.14393	49.6	0	0.84096	12.79672	20	1.546424	0	0	0.45648	2.306785
21	9.091006	11.6	0	0.94608	9.673165	21	3.61059	0	0	0.28368	7.395311
22	8.430591	0	0	0.68544	2.953032	22	3.78059	0	0	0.15408	17.37155
23	7.94434	0	0	0.48528	3.486448	23	5.348507	0	0	0.27216	5.933493
24	7.788508	0	0	0.46512	3.606669	24	5.61684	4.9	1.75	0.45792	16.97847
25	9.56809	13	0	0.50256	4.228937	25	-1.56733	3.4	2.31	1.21392	24.83068
26	9.940173	2	0	1.35936	19.07539	26	-0.93774	0	0	0.70416	13.11826
27	8.877673	1.9	0	1.02384	12.3244	27	1.18309	0	0	0.4464	2.744618
28	5.42934	2.4	0	1.29168	16.3465	28	3.356423	0	0	0.50112	1.264992
29	1.50559	0	0	0.79056	17.4134	29	3.20059	0	0	0.58608	7.589371
30	0.973507	0	0	0.37008	4.926073	30	1.259757	0	0	0.52704	6.731758
31						31	1.641007	0	0	0.76896	13.90246

Ohrid Lake - 2019 daily climatic data

DAY	January Temp. °C daily	January Precip T. mm daily	January Snowfall cm daily	January Evapot. mm daily	January Wind S. km/h daily	DAY	February Temp. °C daily	February Precip T. mm daily	February Snowfall cm daily	February Evapot. mm daily	February Wind S. km/h daily
1	0.59684	0	0	0.96624	23.84349	1	4.128507	0	0	0.96912	15.61276
2	0.703507	2.2	1.54	0.56448	4.799354	2	9.058089	0	0	1.404	11.46451
3	-2.45608	1	0.7	1.49616	43.84868	3	9.551841	0	0	1.4328	15.06701
4	-4.34441	0	0	1.22688	35.03472	4	9.576841	0	0	0.75024	12.13554
5	-4.05941	0	0	0.92304	16.39591	5	8.05559	0	0	1.512	18.73813
6	-2.20316	0	0	0.64944	9.066436	6	4.61184	1.1	0	1.24848	22.82446
7	-5.34441	0	0	1.19376	23.50905	7	3.44184	0	0	0.96912	10.06664
8	-5.17608	0	0	1.02384	9.788013	8	3.358507	0	0	0.72576	2.277098
9	-0.87316	28.9	18.9	0.16272	12.64585	9	2.736424	0	0	0.73872	5.034643
10	0.03559	9.6	6.720001	0.27072	10.48966	10	2.59059	0	0	0.92304	7.422363
11	-1.85524	0	0	0.2952	10.66001	11	4.827257	0.3	0	1.04544	18.55198
12	-4.28233	0	0	0.61632	10.81972	12	2.205174	0.1	0.07	1.2168	18.77119
13	-2.30774	0	0	0.70992	5.772463	13	-1.15524	0	0	1.38816	37.38688
14	-0.12441	0.9	0.63	0.09504	11.3513	14	0.721424	0	0	1.40544	21.11794
15	-5.96024	0	0	1.40688	22.08563	15	2.000173	0	0	1.47888	23.49288
16	-3.98441	0	0	0.60912	9.239019	16	2.140591	0	0	1.30752	15.48134
17	-0.42483	0	0	0.53424	4.927726	17	5.239757	0	0	0.99792	3.67771
18	2.361424	0.5	0	0.22752	6.064055	18	7.354757	0	0	1.01664	2.436282
19	4.714757	2.2	0	0.49824	3.882609	19	6.767674	0	0	0.91296	3.323957
20	4.595173	1.2	0	0.89424	9.390649	20	5.707674	0	0	0.87408	3.070714
21	3.73309	0	0	0.67968	4.892385	21	6.878924	0	0	1.03248	7.559567
22	5.651841	5.7	0	0.69984	11.09925	22	4.283507	0	0	0.59472	3.214643
23	2.99934	23.9	13.72	0.75168	10.09974	23	-3.03608	0.3	0.21	0.92304	40.37658
24	2.31559	10	6.65	0.63216	9.938184	24	-4.28441	0	0	0.94896	31.41796
25	1.90684	8	4.83	1.01952	18.25104	25	-1.60941	0	0	1.296	20.32804
26	0.543507	0	0	1.01088	13.868	26	3.691007	0	0	1.12752	5.782525
27	1.97434	0	0	0.61488	4.20421	27	3.33059	0	0	1.3392	18.63729
28	4.77434	3.4	0	1.11312	21.23008	28	2.741423	0	0	1.08288	8.94445
29	4.402673	13.9	0	0.98352	6.270195	29					
30	2.759757	5.1	3.57	0.57168	5.636113	30					
31	2.155174	3.3	2.31	0.63936	15.73482	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	4.499757	0	0	1.1448	7.348614	1	11.88601	0	0	1.70352	6.380468
2	7.318508	0.1	0	1.28304	9.573572	2	11.44434	0	0	1.55952	3.550818
3	5.328091	0	0	0.99792	6.904144	3	9.507674	0.3	0	1.13184	3.070692
4	5.537674	0	0	1.06272	7.389841	4	9.422256	0	0	1.61856	4.3562
5	5.894757	0	0	1.08144	10.12425	5	10.92809	0	0	1.72224	9.399201
6	7.439341	0	0	1.01808	6.656578	6	11.21684	0	0	1.8936	8.808609
7	9.453924	0	0	1.2384	4.852665	7	9.701424	0.3	0	1.64592	4.183299
8	10.53017	0	0	1.47312	5.425611	8	7.78309	6	0	1.24272	5.870396
9	9.41184	0	0	1.28304	8.111194	9	7.102257	15.5	0	1.2744	6.360017
10	8.036424	0	0	1.11456	10.47354	10	8.972257	3.1	0	1.84608	9.12057
11	7.337675	0	0	1.03104	14.22249	11	7.50684	0	0	2.03616	10.41353
12	3.186841	3.2	1.47	1.74384	40.65497	12	8.023925	0	0	1.66896	5.623927
13	3.97684	0	0	1.1016	16.54074	13	9.035174	0.5	0	1.78272	2.669361
14	4.186424	1.2	0	0.96048	7.31503	14	7.907673	3.4	0	1.90656	4.870446
15	4.288924	0	0	1.17504	7.171936	15	7.52559	6.7	0	1.45152	4.897081
16	5.942674	0	0	1.18512	10.49368	16	8.340174	0	0	2.1672	5.569774
17	9.705174	0	0	1.51632	7.201776	17	8.525591	0	0	1.9512	3.702266
18	9.281424	0	0	1.24416	6.550728	18	9.028924	0	0	1.728	7.65682
19	9.823506	0	0	1.25424	3.636061	19	9.376841	0	0	2.33136	7.991201
20	12.18226	0	0	1.68336	8.34105	20	10.41642	0	0	2.71008	10.06835
21	9.761424	0	0	1.60848	13.4497	21	8.652258	0	0	2.06208	4.785193
22	9.42934	0	0	1.5408	10.14138	22	11.06767	0.2	0	1.86912	4.608986
23	10.03934	0	0	1.63584	8.172942	23	11.31934	0	0	2.06352	17.68211
24	10.16684	0	0	1.44	6.169611	24	13.73017	0	0	2.6136	4.618296
25	10.11309	0	0	1.5984	7.543921	25	15.77851	0	0	2.46816	2.853337
26	9.327256	0	0	1.60416	10.2663	26	17.85851	0	0	3.16656	2.936117
27	7.679758	0	0	1.73232	14.84273	27	14.17726	0	0	2.4048	9.642651
28	8.060174	0	0	1.61136	18.73522	28	10.02559	0	0	2.67696	8.39132
29	6.989758	0	0	1.78848	18.0266	29	9.621423	0	0	2.18736	11.17034
30	8.04309	0	0	1.60848	14.4694	30	7.90309	0	0	1.71648	16.64136
31	10.30059	0	0	1.73808	9.974031	31					

D	May	May	May	May	May	D	June	June	June	June	June
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	7.29309	0	0	1.66896	12.70166	1	13.64684	0	0	3.61152	4.469142
2	8.763507	0	0	2.12688	6.295857	2	12.70017	8	0	1.98288	4.919312
3	9.617675	0	0	2.07792	7.52787	3	10.62642	3	0	1.82304	4.487199
4	11.82476	10.6	0	2.58336	4.484274	4	13.56726	0.4	0	3.73968	3.685374
5	11.88476	1.8	0	2.15856	9.789407	5	14.38434	0	0	3.63312	4.662703
6	7.593924	1.8	0	1.84752	11.47556	6	16.05226	0	0	4.13712	5.96055
7	6.549341	0.1	0	2.14848	6.189438	7	18.71934	0	0	5.02128	5.070422
8	7.961841	0	0	2.31552	7.241593	8	21.35351	0	0	5.33664	2.390608
9	9.610173	0	0	2.11824	6.943696	9	23.54726	0	0	5.87952	12.89737
10	11.01017	0	0	2.47392	8.975202	10	21.24768	0	0	4.674241	7.713259
11	13.20517	0	0	3.23568	4.144747	11	19.97518	0	0	4.58208	4.301615
12	14.04851	0.5	0	2.52576	4.392036	12	21.15601	0	0	4.80672	3.137502
13	10.33017	32.2	0	1.4904	7.633486	13	23.22851	0	0	5.89104	2.330621
14	11.72809	2.6	0	2.75904	7.659908	14	23.81934	0	0	6.31584	4.644241
15	9.986008	0	0	2.91312	3.588345	15	23.21268	0	0	6.336	5.925547
16	11.44059	0.2	0	2.4984	3.053918	16	22.26434	0.2	0	5.72544	3.064158
17	12.36851	0.6	0	3.42864	3.815155	17	21.44101	0.4	0	4.25664	4.057706
18	14.44767	0	0	3.73104	4.459271	18	20.64851	0	0	4.87584	3.399119
19	16.61601	0	0	3.90672	8.427266	19	20.50976	0	0	5.94576	2.99286
20	11.61601	0	0	2.79504	10.40002	20	20.14267	0	0	5.892479	3.003771
21	10.31601	0	0	2.94624	10.82829	21	20.95976	0	0	5.90544	2.965032
22	11.68267	0	0	3.2256	8.175476	22	22.23643	0	0	6.13872	4.025174
23	12.75476	0	0	3.61008	3.44902	23	22.42143	0	0	6.495841	6.454151
24	12.79267	0	0	3.11904	5.956935	24	19.94518	0	0	5.43744	7.391186
25	12.90059	0	0	3.40704	5.2321	25	20.94476	0	0	6.58368	10.94619
26	16.67809	0	0	3.8376	3.208792	26	21.53351	0	0	6.67152	14.82395
27	16.95017	0.9	0	2.67984	10.31351	27	21.67892	0	0	6.264	7.812625
28	14.76267	0	0	3.39408	10.35833	28	22.38726	0	0	6.97824	13.13452
29	13.09434	0	0	3.28608	11.0354	29	19.62434	0	0	7.17984	14.12929
30	13.03184	0	0	3.57984	6.02896	30	19.54559	0	0	6.324481	8.54682
31	12.87101	0	0	3.28464	3.984065	31					

D A Y	July Temp. °C daily	July Precip T. mm daily	July Snowfall cm daily	July Evapot. mm daily	July Wind S. km/h daily	D A Y	August Temp. °C daily	August Precip T. mm daily	August Snowfall cm daily	August Evapot. mm daily	August Wind S. km/h daily
1	21.66934	0	0	5.79888	3.980444	1	23.42017	0	0	5.60448	5.623936
2	24.69309	0	0	6.282721	3.017455	2	23.32309	0	0	5.85936	5.505521
3	24.98725	0	0	6.405121	3.221262	3	21.90851	0	0	5.75136	6.595645
4	24.23851	0	0	6.20208	4.26648	4	18.96017	0	0	5.46768	8.669339
5	22.61309	0	0	6.17616	3.942394	5	18.86476	0	0	5.53968	7.105027
6	22.4385	0	0	5.99472	3.057528	6	20.79851	0	0	5.35248	3.421059
7	22.40309	0	0	6.64992	5.309486	7	22.40892	0	0	5.49504	2.928565
8	22.04642	0	0	6.46128	5.476317	8	23.49434	0	0	5.41296	2.107826
9	21.6435	0	0	6.32736	6.189907	9	24.84601	0	0	5.72112	2.684491
10	19.31184	8.7	0	4.302721	11.08381	10	25.35559	0	0	5.53104	4.203754
11	16.61642	0.3	0	6.6888	14.4909	11	26.23809	0	0	5.621761	3.615205
12	17.57351	0	0	5.67648	5.633244	12	25.87601	0	0	5.539681	3.846342
13	17.426	3.5	0	5.59584	6.080785	13	25.17726	0	0	5.52384	2.123331
14	15.60559	4.4	0	4.31856	4.094364	14	24.17767	0	0	5.70528	4.762256
15	17.10892	0	0	5.12928	3.912857	15	20.48892	0	0	5.27184	6.186045
16	15.00767	21.2	0	2.02464	12.38448	16	19.08684	0	0	5.14512	5.973225
17	17.52976	0	0	5.5944	8.777082	17	18.68559	0	0	5.37696	8.15224
18	18.89517	0	0	5.40576	3.815577	18	20.20725	0	0	4.93776	3.797587
19	19.87892	0	0	5.3856	2.751448	19	21.98226	0	0	4.998241	2.219638
20	20.98517	0	0	5.54976	2.642883	20	23.20934	0	0	5.01696	2.252425
21	21.97559	0	0	5.6808	2.421444	21	22.62517	0	0	4.88304	3.37153
22	22.9885	0	0	5.89968	6.116747	22	23.30476	0	0	5.0976	3.697332
23	22.28017	0	0	6.65136	12.67174	23	23.99434	0	0	5.042881	3.380319
24	21.41684	0	0	6.47712	12.68488	24	23.966	0	0	5.01696	4.998944
25	21.03892	0	0	5.52384	5.247519	25	23.46976	0	0	4.835521	2.771483
26	21.68392	0	0	5.77584	4.576541	26	24.14226	0	0	5.06016	4.37082
27	22.33309	0	0	5.662079	2.99519	27	23.09101	0	0	4.56336	3.365454
28	22.72851	0	0	5.9328	6.543339	28	22.70642	0	0	4.7736	2.448903
29	18.57351	0	0	5.10624	12.29468	29	22.20934	0	0	4.6944	2.630274
30	18.98517	0	0	4.66848	3.858349	30	22.40809	0	0	4.6512	3.132173
31	21.54142	0	0	5.30496	5.620897	31	22.39767	0	0	4.698721	5.257675

D	Sept.	Sept.	Sept.	Sept.	Sept.	D	October	October	October	October	October
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	21.37476	0	0	4.65984	3.635834	1	17.84601	0	0	2.91312	3.094169
2	20.36684	0	0	4.29696	5.934108	2	17.64434	0	0	2.916	5.207592
3	20.52851	0	0	4.14144	3.732698	3	14.36809	3.9	0	1.66896	7.622574
4	20.33059	0	0	4.67568	6.401168	4	13.45434	5.5	0	2.35584	5.497995
5	20.62559	0	0	4.2984	3.205824	5	11.90351	0	0	2.56032	11.60338
6	20.76142	0	0	4.161601	2.319361	6	11.90309	0	0	2.40912	6.008041
7	20.17517	0	0	4.01616	2.6295	7	11.09434	0	0	2.25216	9.927042
8	19.35392	0	0	3.76992	2.27341	8	12.75767	0	0	2.84688	9.35745
9	18.21184	0	0	3.60288	5.083645	9	13.19101	0	0	2.2176	5.643285
10	19.38892	0.2	0	3.91968	3.193953	10	16.20892	0	0	2.86128	6.396516
11	19.97684	0	0	3.86208	3.794242	11	16.16726	0	0	2.42064	4.272856
12	19.96726	0	0	4.73472	8.629128	12	16.72684	0	0	2.15136	3.695965
13	18.02517	0	0	5.38704	15.15848	13	17.40226	0	0	2.1168	2.810677
14	17.91434	0	0	4.53312	11.90847	14	17.98642	0	0	2.24064	2.442162
15	18.45559	0	0	3.7584	5.218269	15	17.28976	0	0	2.23776	2.981425
16	19.09476	0	0	3.86352	3.742902	16	16.25392	0	0	2.17728	2.690533
17	18.83267	0	0	3.89664	5.25171	17	16.84267	0	0	2.16432	2.438461
18	17.80434	0	0	3.70656	4.624346	18	16.27309	0	0	2.0448	2.191597
19	17.12517	0.7	0	3.24	4.964522	19	15.56726	0	0	1.86912	2.165739
20	12.90892	0.2	0	4.0968	14.47214	20	16.34934	0	0	1.94112	2.348117
21	12.34934	0	0	3.32352	5.606062	21	17.21892	0	0	1.95696	3.017086
22	14.57226	0	0	3.024	5.314814	22	17.70184	0	0	2.20032	4.802184
23	15.84767	0.2	0	2.68704	7.327986	23	16.65392	0	0	2.01312	4.448176
24	15.54017	2.3	0	2.86416	11.12326	24	16.04601	0	0	1.97136	2.88225
25	14.46101	0	0	2.93472	8.034198	25	15.87267	0	0	1.92672	3.527887
26	15.10434	0	0	2.7792	8.835221	26	16.61892	0	0	1.99152	5.05156
27	15.73101	0	0	2.82816	5.06518	27	16.22059	0	0	1.97712	1.92537
28	17.37684	0	0	3.084481	5.03054	28	15.32851	0	0	1.92816	1.606709
29	17.94309	0	0	3.284641	4.72881	29	13.82517	0	0	2.05776	4.949976
30	16.75476	0	0	3.03264	7.044067	30	13.49434	0	0	1.97424	4.111161
31						31	12.90392	0.6	0	1.70064	3.13507

D	November	November	November	November	November	D	December	December	December	December	December
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	11.19101	0	0	1.75248	5.731729	1	4.15434	0	0	0.5544	6.430874
2	12.56559	0	0	1.7712	6.388434	2	5.760591	0	0	0.47232	3.378215
3	14.10101	2.2	0	2.21616	19.7659	3	7.313923	0.3	0.21	0.57312	8.16233
4	12.53017	16.5	0	1.5984	21.63463	4	0.310174	2.2	1.54	1.04112	19.4102
5	11.91309	0	0	1.83456	13.13087	5	3.205174	0	0	0.288	5.771645
6	13.45434	0	0	1.85616	16.22013	6	7.417257	0	0	0.37008	3.50846
7	13.53934	20.5	0	1.17936	13.45045	7	8.59934	0.8	0	0.53568	11.71763
8	11.78184	0.1	0	1.56096	9.272072	8	6.864757	0	0	0.47952	4.438448
9	11.41267	0.4	0	1.00656	7.036854	9	6.02434	0	0	0.43632	4.279524
10	9.775174	13.2	0	1.41552	11.86675	10	5.983923	11.9	0	0.62208	8.791987
11	9.337673	0	0	0.77904	5.786708	11	5.294757	2.1	0	1.53936	21.75748
12	12.91601	1.1	0	1.1088	17.93404	12	4.590591	0.8	0	0.53424	5.845773
13	12.97309	0.4	0	1.24128	13.99356	13	5.546841	0	0	0.65664	14.21595
14	10.29143	0	0	0.67968	4.212784	14	6.59184	5.1	0	0.864	10.56666
15	10.54559	0	0	0.684	3.55608	15	8.027257	0	0	0.468	3.252981
16	11.55059	0	0	0.5976	5.124764	16	8.381007	0	0	0.53712	2.964942
17	11.6535	0	0	0.69408	8.531328	17	8.76934	0	0	0.49392	2.07292
18	11.06726	4.6	0	0.9432	9.000095	18	9.956424	0	0	0.40608	1.922582
19	11.90351	0	0	0.63936	9.232118	19	11.07267	0	0	0.37008	2.592537
20	10.26893	16.7	0	1.36656	10.8195	20	9.142673	0	0	0.46656	12.50957
21	8.818923	0	0	0.67968	3.383162	21	8.868923	0	0	0.5976	21.0283
22	8.911006	0	0	0.54288	3.099456	22	9.48559	6.9	0	0.42768	24.11286
23	8.589757	0	0	0.49968	4.254278	23	6.61184	1.2	0	1.008	19.50674
24	9.919758	0.3	0	0.76464	13.12894	24	3.521841	0	0	0.71856	15.73026
25	11.05309	2.8	0	1.3176	20.54513	25	2.378924	0	0	0.58752	9.605661
26	10.43351	0.2	0	1.06704	7.831429	26	2.231007	0	0	0.40464	5.385583
27	8.26809	0	0	0.55296	6.91751	27	1.891424	0	0	0.70416	10.15063
28	9.838925	0.2	0	0.64224	14.37221	28	-0.03316	0	0	0.91008	20.80131
29	8.558923	1.1	0	0.61056	18.13122	29	-2.55733	0	0	1.07424	25.04357
30	7.60059	0	0	0.55584	12.16853	30	-2.53983	0	0	1.0728	24.83225
31						31	0.667674	0	0	0.66384	6.287081

Ohrid Lake - 2020 daily climatic data

D	January	January	January	January	January	D	February	February	February	February	February
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	1.90684	0	0	1.00512	14.60085	1	5.309341	0	0	0.52128	5.074488
2	0.29934	0	0	0.93456	11.38716	2	6.473507	0	0	0.55872	6.019689
3	3.688924	0	0	0.5616	2.924651	3	6.530173	0	0	0.54	13.11927
4	6.297257	0	0	0.58608	1.701031	4	7.820591	0	0	0.73728	15.19032
5	1.642257	0	0	1.18368	26.4603	5	1.726424	0	0	1.22688	24.72521
6	-2.59774	0	0	1.3032	35.47002	6	-4.57733	0	0	2.39472	37.61631
7	-2.21149	0	0	0.94608	15.68663	7	-2.14024	0	0	1.02096	11.79754
8	0.486424	0	0	0.86544	8.206368	8	0.714757	0	0	0.82656	8.122583
9	3.141007	0	0	0.51696	1.523558	9	2.286007	0	0	0.72	5.953425
10	5.854757	0	0	0.60624	1.459638	10	3.496424	0	0	0.8136	16.96275
11	6.84059	9.299999	0	0.72	7.595745	11	7.853507	0	0	1.00944	29.21965
12	4.071007	0.3	0	0.85248	9.272815	12	6.246423	0	0	0.89136	9.546721
13	3.991424	0	0	0.35856	2.82077	13	5.646841	0	0	0.82368	3.768124
14	4.77559	0	0	0.35568	2.452798	14	5.480591	10.2	0	0.5184	12.99823
15	5.861008	0	0	0.45504	4.718908	15	4.811841	0	0	1.74528	23.11428
16	6.413091	0	0	0.55296	6.16893	16	4.884757	0	0	0.75456	5.179732
17	5.181424	0	0	0.55296	6.030994	17	7.108091	0	0	0.82224	2.350973
18	4.061841	0	0	0.35712	2.381433	18	9.463923	0	0	0.94896	4.16237
19	3.64684	0	0	0.2808	4.138041	19	6.428507	0	0	0.80496	7.81554
20	1.462257	0	0	0.55872	8.008914	20	4.617673	1	0	1.08	17.70001
21	2.048507	0	0	0.57168	6.088443	21	2.993923	0	0	0.94896	12.77064
22	5.10684	0	0	0.6336	2.342382	22	3.029757	0	0	1.2168	17.48196
23	3.942257	0	0	0.8424	9.95468	23	5.709757	0	0	1.08432	5.067854
24	2.86059	0	0	0.5328	3.829174	24	7.677673	0	0	1.09872	7.663344
25	3.821424	0	0	0.3168	4.914188	25	8.983924	0	0	1.11024	9.373515
26	6.448925	0.2	0	0.39456	2.897828	26	8.119758	0	0	1.16208	17.84695
27	6.271423	1.5	0	0.69264	13.62152	27	3.382257	2.3	0.63	0.92016	27.10016
28	4.780174	0	0	0.45792	15.40558	28	2.601007	0	0	0.76032	21.69751
29	6.039757	0	0	0.6048	20.32688	29	2.19059	0	0	0.9792	6.155245
30	3.43184	0	0	0.48672	9.008676	30					
31	3.280174	0	0	0.73152	12.98458	31					

D	March	March	March	March	March	D	April	April	April	April	April
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	5.943506	0	0	1.42416	8.171881	1	1.861007	20.6	9.87	0.7344	14.68878
2	9.111424	0	0	1.20384	17.10293	2	0.458924	0	0	0.9072	13.20383
3	10.75392	0	0	1.15488	20.63612	3	6.726841	0	0	1.25424	3.967189
4	6.096424	21.2	0	1.43568	9.937387	4	8.192674	1.7	0	2.25072	21.06536
5	4.833924	0	0	1.13904	4.494607	5	8.028091	0	0	2.463841	27.99912
6	6.268508	0.2	0	1.3608	12.64082	6	7.613506	0	0	2.8512	22.81313
7	7.536425	7.8	0	0.8568	7.199042	7	7.46434	0	0	3.04704	18.41737
8	7.496006	0.1	0	1.41696	5.132368	8	7.76559	0	0	2.52864	12.45317
9	6.145174	0.2	0	1.19232	5.298031	9	9.66934	0	0	2.05632	5.508932
10	5.763507	0	0	1.19664	6.04604	10	13.07101	0	0	2.54304	8.821496
11	6.486008	0	0	1.20096	3.936788	11	12.64601	0	0	2.27808	7.749505
12	10.99142	0	0	1.33056	3.271638	12	12.77768	0	0	1.93968	5.268532
13	12.40851	0	0	1.57824	4.733434	13	11.46809	0	0	2.17008	7.660686
14	12.97601	0	0	1.45584	4.407001	14	9.361008	0.8	0	1.78992	6.977801
15	7.229757	2.1	0	1.4904	14.49941	15	5.680173	0.9	0.56	2.74608	33.24538
16	4.357257	0	0	1.78416	16.81226	16	9.880174	0	0	1.86624	5.90815
17	6.063924	0	0	1.48608	2.37458	17	11.35934	0	0	2.41344	5.843622
18	9.026423	0	0	2.04192	11.85911	18	14.34976	0	0	2.48112	3.309608
19	6.265591	0	0	1.40688	5.454611	19	14.37601	0	0	2.28528	7.424732
20	9.733508	0	0	1.4544	2.538525	20	14.71309	3.9	0	1.72656	2.943897
21	10.87101	0	0	1.65312	4.9182	21	12.30017	7.9	0	2.2536	8.142928
22	9.843924	7.4	0	1.40688	6.055775	22	8.043508	2.7	0	2.0736	9.290888
23	2.44059	2.8	1.61	1.39824	14.08953	23	8.152257	0.6	0	2.71008	9.906526
24	0.543507	0.1	0.07	0.79776	9.427224	24	9.017257	0	0	2.38608	6.075115
25	4.192257	0.1	0.07	1.19808	20.25046	25	9.628508	0	0	2.59776	9.828534
26	6.223923	0	0	1.56384	31.1318	26	10.17851	0	0	2.51136	6.278187
27	6.023506	3.1	0	1.3392	15.27653	27	12.53184	0	0	2.6856	2.929464
28	6.117674	3	0	1.0944	3.06725	28	12.91892	0	0	2.79936	6.46994
29	7.537258	0	0	1.51488	4.015594	29	12.05684	0	0	2.54448	12.07566
30	9.584757	0	0	1.6416	4.35921	30	10.74101	0	0	2.3832	8.569838
31	7.143089	2.2	0	1.30752	6.138882	31					

D	May	May	May	May	May	D	June	June	June	June	June
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	11.39267	0	0	2.68704	10.32126	1	11.10476	0.7	0	3.03264	4.922924
2	10.73309	0	0	1.87632	10.74232	2	12.31559	0	0	3.40704	6.018109
3	10.76434	0.6	0	2.76048	6.922134	3	12.53559	0	0	3.3192	6.819787
4	9.579758	0	0	3.2832	10.72518	4	14.31309	0	0	4.02624	8.957782
5	10.80309	0	0	3.38112	8.73223	5	16.71517	0	0	3.27744	5.728516
6	12.49268	0.1	0	3.11472	10.03919	6	16.15934	1	0	4.00464	12.1287
7	11.05601	0	0	3.7296	16.36896	7	15.09892	0	0	3.64176	8.262313
8	11.91976	0	0	3.2832	6.558073	8	16.08518	0	0	3.07872	4.780207
9	14.16851	0	0	3.5424	6.783131	9	18.13684	0	0	4.29552	3.685767
10	14.77393	0	0	3.3696	4.832641	10	15.67976	0	0	3.75696	7.822834
11	18.01601	0	0	4.51584	8.451703	11	13.83267	0	0	3.63024	8.101791
12	14.32684	0	0	3.31632	12.89269	12	13.49642	0	0	3.6792	8.583535
13	16.95892	0	0	3.94128	3.915511	13	15.18976	0	0	3.95712	7.252533
14	21.86517	0	0	5.122079	10.29774	14	17.17142	0	0	4.37184	8.025758
15	22.67517	0	0	5.363999	10.19945	15	16.02059	0	0	4.263841	8.817591
16	23.08351	0	0	4.188961	4.113782	16	14.66142	0	0	3.49344	4.425983
17	24.49475	0	0	4.937759	4.940614	17	14.35684	0.3	0	2.92032	8.443792
18	24.55851	0	0	4.5648	6.495374	18	15.11392	0	0	3.63744	10.00635
19	22.24017	0	0	3.49632	4.569311	19	16.28142	0	0	4.222081	8.741347
20	19.56642	0.5	0	4.0464	8.498587	20	17.19559	0	0	4.4208	5.270751
21	13.59976	1.1	0	1.33344	11.16257	21	15.82226	0	0	3.7224	5.918073
22	13.49726	0	0	3.86208	15.66061	22	15.83559	0	0	3.30624	6.024685
23	13.99059	0	0	3.49056	5.466544	23	16.34518	0.8	0	2.87712	4.284339
24	16.39809	0	0	3.74832	7.399972	24	19.20809	0	0	4.06656	5.545046
25	14.03309	0	0	3.43728	12.10187	25	19.66976	0	0	4.0464	4.377341
26	9.817258	0.5	0	1.99872	8.483114	26	21.14559	0	0	4.40208	3.688099
27	10.61559	0	0	2.73456	13.47635	27	21.63226	0	0	4.6008	3.957094
28	11.13309	0	0	2.74176	5.347927	28	22.19518	0	0	4.85856	3.162776
29	11.66892	0	0	3.06576	4.499238	29	21.82268	0	0	5.02128	4.705272
30	11.48059	0	0	2.82096	6.606356	30	22.16226	0	0	5.12352	4.281393
31	11.01476	0	0	2.58768	7.666692	31					

D	July	July	July	July	July	D	August	August	August	August	August
A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.	A	Temp.	Precip T.	Snowfall	Evapot.	Wind S.
Y	°C	mm	cm	mm	km/h	Y	°C	mm	cm	mm	km/h
	daily	daily	daily	daily	daily		daily	daily	daily	daily	daily
1	23.91517	0	0	5.08608	3.835686	1	25.59268	0.2	0	3.30336	7.189699
2	24.26226	0	0	4.92912	3.028608	2					
3	24.17559	0	0	5.07024	3.783339	3					
4	22.80476	0	0	4.91184	6.21904	4					
5	21.69892	3.7	0	4.66128	11.53774	5					
6	20.96934	0.2	0	3.56832	10.84249	6					
7	21.07184	0	0	4.96224	13.47988	7					
8	18.77809	0	0	5.0616	10.91571	8					
9	20.37976	0	0	4.828319	5.355984	9					
10	22.14226	0	0	4.56912	3.541193	10					
11	22.21976	0	0	4.610879	3.217945	11					
12	22.98101	0	0	4.623841	7.45314	12					
13	17.68934	0	0	4.61232	18.21502	13					
14	17.73018	0	0	3.9816	6.273779	14					
15	18.98517	0	0	3.94848	5.786285	15					
16	19.32101	0	0	4.0536	3.995941	16					
17	20.12267	0	0	3.91248	3.223729	17					
18	18.70392	0.8	0	2.59632	4.039348	18					
19	17.66059	0	0	3.57984	6.225334	19					
20	19.28517	0	0	3.81888	5.507822	20					
21	21.42184	0	0	4.10688	7.982996	21					
22	22.57101	0	0	4.109761	8.243629	22					
23	23.10767	0	0	3.91536	4.681146	23					
24	23.32184	0	0	3.91824	4.063186	24					
25	21.91851	0	0	3.71376	6.703185	25					
26	19.79142	0	0	3.18672	5.481463	26					
27	22.55726	0	0	3.62592	9.301157	27					
28	23.16059	0	0	3.64032	7.594423	28					
29	25.04809	0	0	3.57984	5.685727	29					
30	26.91142	0	0	3.564	5.645195	30					
31	26.56309	0	0	3.44016	4.515476	31					

APPENDIX D

Ohrid and Prespa Lake daily level database 2008 – 2019

& Tushemisht Spring daily level database 2008 – 2019

Ohrid Lake level 2010 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	693.167	693.237	693.337	693.447	693.477	693.577	693.707	693.567	693.477	693.347	693.447	693.467
2	693.167	693.237	693.347	693.447	693.477	693.587	693.717	693.567	693.477	693.347	693.447	693.487
3	693.157	693.237	693.347	693.457	693.477	693.597	693.717	693.567	693.467	693.347	693.447	693.487
4	693.157	693.247	693.357	693.457	693.487	693.597	693.707	693.577	693.467	693.337	693.447	693.507
5	693.157	693.247	693.357	693.457	693.497	693.607	693.707	693.577	693.467	693.337	693.437	693.517
6	693.167	693.267	693.357	693.457	693.487	693.617	693.707	693.597	693.437	693.347	693.447	693.517
7	693.167	693.267	693.357	693.457	693.497	693.617	693.687	693.597	693.437	693.347	693.437	693.527
8	693.167	693.267	693.367	693.457	693.507	693.617	693.687	693.597	693.427	693.367	693.437	693.537
9	693.167	693.267	693.367	693.447	693.507	693.637	693.677	693.587	693.417	693.367	693.427	693.537
10	693.157	693.257	693.367	693.447	693.507	693.627	693.677	693.567	693.427	693.367	693.427	693.547
11	693.157	693.257	693.367	693.447	693.517	693.637	693.677	693.587	693.417	693.357	693.437	693.547
12	693.157	693.257	693.377	693.457	693.517	693.637	693.657	693.557	693.377	693.357	693.427	693.567
13	693.187	693.267	693.377	693.457	693.527	693.647	693.657	693.557	693.387	693.377	693.417	693.557
14	693.187	693.267	693.387	693.457	693.537	693.657	693.657	693.557	693.377	693.377	693.417	693.567
15	693.187	693.267	693.387	693.457	693.537	693.657	693.647	693.547	693.377	693.387	693.417	693.567
16	693.187	693.267	693.387	693.467	693.537	693.657	693.647	693.547	693.377	693.387	693.437	693.577
17	693.197	693.277	693.397	693.467	693.547	693.667	693.657	693.537	693.357	693.407	693.447	693.597
18	693.197	693.277	693.397	693.477	693.547	693.677	693.637	693.527	693.357	693.407	693.447	703.607
19	693.197	693.277	693.407	693.477	693.547	693.677	693.637	693.527	693.357	693.397	693.447	693.607
20	693.197	693.277	693.417	693.477	693.547	693.677	693.637	693.527	693.347	693.417	693.447	693.607
21	693.197	693.287	693.417	693.477	693.557	693.687	693.627	693.517	693.337	693.427	693.457	693.617
22	693.207	693.307	693.417	693.467	693.557	693.687	693.627	693.507	693.337	693.437	693.447	693.617
23	693.207	693.307	693.427	693.467	693.557	693.687	693.627	693.497	693.337	693.437	693.437	693.607
24	693.207	693.317	693.427	693.467	693.557	693.677	707.617	693.497	693.337	693.437	693.447	693.617
25	693.217	693.327	693.427	693.467	693.557	693.677	693.607	693.497	693.337	693.427	693.457	693.627
26	693.217	693.337	693.437	693.457	693.567	693.687	693.607	693.507	693.347	693.427	693.447	693.647
27	693.217		693.437	693.457	693.567	693.697	693.607	693.507	693.347	693.427	693.467	693.667
28	693.217		693.447	693.457	693.557	693.697	693.597	693.487	693.337	693.417	693.467	693.667
29	693.227		693.447	693.457	693.567	693.697	693.597	693.487	693.337	693.427	693.467	693.657
30	693.227		693.447	693.457	693.567	693.707	693.597	693.487	693.337	693.427	693.467	693.667
31	693.227		693.447		693.567		693.577	693.487		693.427		693.667

Ohrid Lake level 2014 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	692.377	692.237	692.157	692.257	692.277	692.367	692.377	692.437	692.417	692.417	692.367	692.307
2	692.377	692.237	692.157	692.257	692.277	692.367	692.387	692.437	692.417	692.417	692.367	692.307
3	692.367	692.237	692.167	692.267	692.277	692.367	692.387	692.437	692.417	692.427	692.357	692.297
4	692.367	692.227	692.147	692.267	692.277	692.377	692.397	692.447	692.417	692.427	692.357	692.297
5	692.367	692.227	692.147	692.267	692.297	692.377	692.397	692.437	692.417	692.427	692.357	692.297
6	692.357	692.207	692.147	692.257	692.297	692.377	692.397	692.437	692.427	692.417	692.357	692.307
7	692.357	692.207	692.157	692.257	692.297	692.377	692.407	692.437	692.427	692.417	692.347	692.307
8	692.357	692.217	692.157	692.257	692.297	692.377	692.407	692.437	692.417	692.417	692.347	692.307
9	692.337	692.217	692.157	692.267	692.287	692.387	692.427	692.437	692.417	692.427	692.337	692.317
10	692.337	692.217	692.167	692.267	692.287	692.387	692.427	692.427	692.407	692.437	692.337	692.317
11	692.327	692.217	692.167	692.267	692.287	692.387	692.427	692.427	692.407	692.437	692.337	692.317
12	692.317	692.197	692.167	692.267	692.287	692.377	692.427	692.427	692.407	692.417	692.337	692.317
13	692.317	692.207	692.177	692.267	692.287	692.377	692.417	692.427	692.407	692.417	692.327	692.307
14	692.307	692.197	692.177	692.277	692.297	692.377	692.417	692.427	692.407	692.417	692.327	692.307
15	692.307	692.197	692.177	692.277	692.297	692.377	692.417	692.427	692.407	692.407	692.327	692.307
16	692.307	692.197	692.187	692.277	692.297	692.377	692.427	692.427	692.417	692.407	692.327	692.307
17	692.297	692.187	692.187	692.287	692.307	692.387	692.427	692.417	692.407	692.407	692.317	692.307
18	692.297	692.187	692.187	692.287	692.317	692.387	692.427	692.417	692.417	692.397	692.317	692.317
19	692.287	692.177	692.197	692.277	692.317	692.377	692.427	692.417	692.417	692.397	692.317	692.317
20	692.287	692.177	692.197	692.277	692.327	692.377	692.427	692.417	692.417	692.397	692.317	692.307
21	692.287	692.177	692.197	692.287	692.327	692.387	692.417	692.417	692.417	692.387	692.317	692.307
22	692.277	692.167	692.207	692.287	692.327	692.377	692.417	692.427	692.417	692.387	692.317	692.307
23	692.277	692.167	692.217	692.277	692.337	692.377	692.417	692.427	692.427	692.387	692.327	692.307
24	692.277	692.167	692.217	692.277	692.337	692.387	692.427	692.427	692.427	692.387	692.327	692.327
25	692.267	692.167	692.237	692.267	692.337	692.387	692.437	692.427	692.417	692.377	692.327	692.347
26	692.267	692.157	692.237	692.267	692.337	692.387	692.437	692.427	692.417	692.377	692.327	692.257
27	692.267	692.157	692.247	692.277	692.357	692.387	692.447	692.427	692.417	692.377	692.317	692.377
28	692.257	692.157	692.247	692.277	692.357	692.377	692.447	692.427	692.427	692.377	692.317	692.427
29	692.257	692.157	692.247	692.267	692.357	692.377	692.447	692.427	692.427	692.367	692.317	692.427
30	692.247		692.257	692.267	692.357	692.377	692.437	692.417	692.417	692.367	692.307	692.457
31	692.247		692.257		692.367		692.437	692.417		692.367		692.477

Ohrid Lake level 2015 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	692.477	692.577	692.717	692.797	692.877	692.817	692.727	692.637	692.547	692.457	692.687	692.647
2	692.477	692.597	692.717	692.797	692.877	692.817	692.727	692.637	692.537	692.447	692.687	692.637
3	692.477	692.617	692.717	692.807	692.877	692.817	692.727	692.627	692.537	692.447	692.677	692.637
4	692.467	692.617	692.707	692.807	692.887	692.817	692.717	692.627	692.537	692.437	692.677	692.627
5	692.467	692.657	692.707	692.807	692.887	692.807	692.717	692.627	692.527	692.437	692.677	692.627
6	692.467	692.657	692.707	692.817	692.887	692.807	692.717	692.627	692.527	692.427	692.667	692.617
7	692.467	692.677	692.707	692.817	692.887	692.807	692.717	692.617	692.527	692.417	692.667	692.617
8	692.477	692.677	692.707	692.817	692.887	692.797	692.707	692.617	692.517	692.417	692.657	692.617
9	692.477	692.677	692.717	692.817	692.897	692.797	692.707	692.617	692.517	692.407	692.657	692.607
10	692.477	692.677	692.717	692.827	692.897	692.797	692.697	692.617	692.517	692.407	692.647	692.607
11	692.487	692.677	692.727	692.827	692.897	692.787	692.697	692.607	692.507	692.527	692.647	692.947
12	692.487	692.687	692.727	692.827	692.887	692.787	692.687	692.607	692.507	692.567	692.647	692.947
13	692.477	692.687	692.747	692.817	692.887	692.777	692.687	692.607	692.507	692.617	692.637	692.947
14	692.477	692.687	692.747	692.817	692.887	692.777	692.687	692.597	692.507	692.657	692.637	692.947
15	692.477	692.687	692.747	692.817	692.877	692.777	692.687	692.597	692.507	692.727	692.627	692.937
16	692.487	692.687	692.747	692.817	692.877	692.777	692.677	692.597	692.507	692.727	692.627	692.937
17	692.487	692.687	692.757	692.827	692.867	692.777	692.677	692.587	692.497	692.727	692.617	692.937
18	692.487	692.697	692.757	692.827	692.847	692.767	692.677	692.587	692.497	692.727	692.617	692.927
19	692.487	692.697	692.757	692.827	692.847	692.767	692.677	692.587	692.487	692.727	692.617	692.927
20	692.477	692.717	692.767	692.827	692.847	692.767	692.677	692.577	692.487	692.727	692.607	692.927
21	692.477	692.717	692.767	692.837	692.837	692.767	692.667	692.577	692.487	692.727	692.607	692.917
22	692.477	692.717	692.767	692.837	692.837	692.757	692.667	692.577	692.477	692.717	692.597	692.917
23	692.467	692.717	692.777	692.847	692.837	692.757	692.667	692.567	692.477	692.717	692.587	692.907
24	692.467	692.707	692.777	692.847	692.827	692.757	692.657	692.567	692.477	692.717	692.587	692.907
25	692.467	692.707	692.767	692.857	692.827	692.747	692.657	692.567	692.467	692.707	692.577	692.907
26	692.477	692.707	692.767	692.857	692.827	692.747	692.647	692.557	692.467	692.707	692.617	692.907
27	692.477	692.707	692.777	692.867	692.827	692.737	692.647	692.557	692.467	692.697	692.617	692.897
28	692.477	692.717	692.777	692.877	692.817	692.737	692.647	692.547	692.457	692.697	692.627	692.897
29	692.537		692.797	692.877	692.817	692.737	692.647	692.547	692.457	692.697	692.627	692.897
30	692.557		692.797	692.877	692.817	692.727	692.647	692.547	692.457	692.697	692.647	692.887
31	692.477		692.797		692.817		692.637	692.547		692.687		692.887

Ohrid Lake level 2016 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	692.877	692.977	693.077	693.247	693.307	693.347	693.277	693.207	693.087	693.087	692.937	692.897
2	692.877	692.977	693.077	693.247	693.307	693.347	693.277	693.207	693.077	693.087	692.937	692.897
3	692.877	692.977	693.087	693.247	693.317	693.337	693.277	693.207	693.077	693.087	692.937	692.897
4	692.867	692.977	693.097	693.247	693.317	693.337	693.277	693.207	693.077	693.087	692.937	692.887
5	692.867	692.967	693.097	693.237	693.327	693.327	693.267	693.197	693.067	693.077	692.937	692.887
6	692.867	692.967	693.107	693.237	693.327	693.327	693.267	693.197	693.067	693.077	692.927	692.887
7	692.857	692.967	693.117	693.237	693.327	693.327	693.267	693.197	693.067	693.077	692.927	692.877
8	692.857	692.967	693.117	693.237	693.327	693.317	693.267	693.197	693.067	693.077	692.927	692.877
9	692.857	692.967	693.127	693.237	693.327	693.317	693.267	693.197	693.067	693.067	692.917	692.867
10	692.857	692.967	693.137	693.237	693.337	693.307	693.267	693.187	693.077	693.067	692.917	692.867
11	692.857	692.977	693.137	693.237	693.337	693.307	693.267	693.187	693.077	693.067	692.927	692.867
12	692.857	692.977	693.147	693.227	693.337	693.297	693.257	693.187	693.077	693.067	692.937	692.857
13	692.877	692.987	693.147	693.227	693.347	693.287	693.257	693.187	693.077	693.057	692.887	692.847
14	692.917	693.017	693.157	693.227	693.347	693.297	693.257	693.187	693.087	693.057	692.887	692.847
15	692.937	693.017	693.157	693.227	693.347	693.297	693.257	693.187	693.087	693.057	692.967	692.847
16	692.977	693.037	693.157	693.227	693.347	693.297	693.247	693.087	693.097	693.057	692.967	692.847
17	692.997	693.037	693.167	693.237	693.337	693.297	693.247	693.167	693.097	693.047	692.887	692.837
18	692.997	693.047	693.177	693.237	693.337	693.297	693.247	693.167	693.097	693.037	692.887	692.847
19	692.987	693.047	693.177	693.237	693.347	693.287	693.247	693.157	693.097	693.037	692.887	692.837
20	692.987	693.057	693.197	693.247	693.357	693.287	693.237	693.147	693.107	693.037	692.947	692.837
21	692.987	693.057	693.207	693.247	693.357	693.287	693.237	693.147	693.107	693.027	692.947	692.837
22	692.987	693.057	693.217	693.257	693.357	693.287	693.227	693.137	693.107	693.017	692.937	692.837
23	692.997	693.057	693.217	693.257	693.357	693.287	693.227	693.137	693.097	693.017	692.937	692.827
24	692.997	693.067	693.217	693.257	693.347	693.287	693.227	693.127	693.097	693.007	692.927	692.827
25	692.997	693.067	693.217	693.267	693.347	693.287	693.217	693.117	693.097	692.997	692.927	692.807
26	692.987	693.067	693.227	693.267	693.347	693.277	693.217	693.117	693.097	692.987	692.917	692.807
27	692.987	693.067	693.227	693.267	693.347	693.277	693.217	693.107	693.097	692.977	692.917	692.797
28	692.977	693.077	693.227	693.287	693.347	693.277	693.217	693.107	693.087	692.977	692.907	692.767
29	692.977		693.237	693.287	693.347	693.277	693.217	693.097	693.087	692.967	692.907	692.767
30	692.977		693.247	693.297	693.347	693.277	693.207	693.097	693.087	692.967	692.907	692.737
31	692.977		693.847		693.347		693.207	693.087		692.947		692.737

Ohrid Lake level 2017 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	692.767	692.647	692.747	692.667	692.797	692.757	692.967	692.857	692.817	692.867	692.817	692.977
2	692.767	692.647	692.747	692.677	692.797	692.757	692.967	692.847	692.817	692.867	692.817	692.997
3	692.767	692.647	692.757	692.697	692.807	692.777	692.967	692.837	692.827	692.857	692.827	692.997
4	692.767	692.667	692.757	692.727	692.817	692.777	692.967	692.837	692.827	692.847	692.827	693.007
5	692.777	692.667	692.767	692.737	692.837	692.797	692.977	692.837	692.827	692.847	692.827	693.017
6	692.777	692.667	692.777	692.727	692.837	692.817	692.977	692.837	692.837	692.847	692.847	693.017
7	692.787	692.677	692.777	692.727	692.847	692.817	692.977	692.827	692.837	692.837	692.857	693.017
8	692.787	692.687	692.807	692.677	692.877	692.837	692.977	692.827	692.837	692.837	692.857	693.007
9	692.787	692.687	692.807	692.677	692.897	692.837	692.887	692.827	692.837	692.827	692.867	693.007
10	692.787	692.687	692.807	692.657	692.897	692.837	692.887	692.827	692.847	692.817	692.867	693.007
11	692.787	692.707	692.807	692.647	692.917	692.837	692.887	692.827	692.847	692.817	692.867	693.007
12	692.767	692.707	692.797	692.627	692.917	692.877	692.887	692.827	692.847	692.817	692.867	693.007
13	692.757	692.707	692.797	692.627	692.897	692.877	692.887	692.827	692.857	692.817	692.867	693.007
14	692.737	692.717	692.797	692.627	692.897	692.877	692.977	692.817	692.847	692.817	692.867	692.997
15	692.707	692.717	692.797	692.627	692.897	692.877	692.987	692.817	692.847	692.817	692.867	692.997
16	692.677	692.717	692.777	692.627	692.897	692.877	692.987	692.817	692.857	692.807	692.867	692.997
17	692.677	692.717	692.747	692.627	692.887	692.947	692.977	692.817	692.857	692.807	692.867	692.977
18	692.687	692.727	692.737	692.637	692.887	692.947	692.977	692.817	692.857	692.807	692.877	692.967
19	692.677	692.727	692.727	692.737	692.887	692.977	692.967	692.817	692.867	692.807	692.877	692.887
20	692.677	692.727	692.677	692.737	692.887	692.977	692.967	692.817	692.867	692.807	692.887	692.947
21	692.677	692.747	692.637	692.717	692.877	692.967	692.967	692.817	692.867	692.807	692.887	692.947
22	692.667	692.747	692.637	692.717	692.847	692.967	692.967	692.817	692.867	692.807	692.887	692.937
23	692.667	692.747	692.637	692.717	692.847	692.967	692.887	692.817	692.867	692.807	692.897	692.937
24	692.667	692.747	692.647	692.717	692.847	692.967	692.887	692.807	692.867	692.807	692.907	692.947
25	692.657	692.757	692.647	692.717	692.817	692.967	692.967	692.807	692.877	692.807	692.917	692.947
26	692.657	692.757	692.647	692.757	692.817	692.947	692.887	692.807	692.877	692.817	692.937	692.947
27	692.657	692.757	692.647	692.757	692.797	692.947	692.887	692.807	692.877	692.817	692.887	692.947
28	692.647	692.747	692.637	692.757	692.777	692.947	692.947	692.807	692.877	692.817	692.887	692.947
29	692.647		692.637	692.767	692.767	692.947	692.947	692.807	692.877	692.817	692.967	692.947
30	692.647		692.637	692.767	692.767	692.947	692.947	692.807	692.877	692.817	692.967	692.947
31	692.647		692.637		692.767		692.947	692.807		692.817		692.947

Ohrid Lake level 2018 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	692.957	692.947	693.157	693.607	693.487	693.467	693.427	693.277	693.177	692.637	692.607	692.607
2	692.957	692.947	693.157	693.607	693.487	693.467	693.427	693.277	693.157	692.627	692.607	692.607
3	692.977	692.957	693.167	693.597	693.487	693.457	693.427	693.267	693.127	692.627	692.607	692.607
4	692.987	692.957	693.177	693.577	693.487	693.457	693.407	693.267	693.107	692.627	692.607	692.607
5	692.987	692.957	693.177	693.557	693.487	693.457	693.407	693.267	693.077	692.627	692.617	692.617
6	692.987	692.957	693.177	693.557	693.487	693.457	693.407	693.267	693.047	692.617	692.617	692.617
7	692.987	692.957	693.227	693.557	693.487	693.457	693.387	693.267	693.027	692.617	692.627	692.627
8	692.977	692.977	693.237	693.557	693.487	693.457	693.387	693.267	693.007	692.617	692.627	692.627
9	692.977	692.987	693.237	693.557	693.497	693.447	693.377	693.257	692.977	692.617	692.647	692.647
10	692.987	692.997	693.247	693.557	693.497	693.447	693.377	693.257	692.917	692.617	692.647	692.647
11	692.987	692.997	693.307	693.547	693.497	693.447	693.357	693.257	692.897	692.617	692.687	692.687
12	692.977	693.007	693.357	693.547	693.497	693.447	693.347	693.257	692.877	692.617	692.687	692.687
13	692.977	693.007	693.357	693.547	693.497	693.447	693.327	693.257	692.867	692.617	692.687	692.687
14	692.967	693.017	693.377	693.547	693.497	693.427	693.327	693.257	692.827	692.617	692.687	692.687
15	692.967	693.037	693.417	693.537	693.497	693.427	693.317	693.247	692.797	692.597	692.687	692.687
16	692.967	693.037	693.417	693.537	693.497	693.427	693.317	693.247	692.757	692.597	692.687	692.687
17	692.997	693.067	693.417	693.537	693.497	693.427	693.317	693.247	692.747	692.597	692.697	692.697
18	692.997	693.107	693.447	693.537	693.487	693.427	693.317	693.247	692.737	692.597	692.697	692.697
19	692.987	693.117	693.457	693.537	693.487	693.427	693.317	693.237	692.697	692.597	692.697	692.697
20	692.987	693.127	693.477	693.537	693.487	693.417	693.307	693.237	692.667	692.597	692.707	692.707
21	692.977	693.127	693.537	693.537	693.487	693.417	693.297	693.227	692.657	692.587	692.707	692.707
22	692.977	693.127	693.557	693.537	693.487	693.417	693.297	693.227	692.647	692.587	692.707	692.707
23	692.967	693.127	693.577	693.517	693.477	693.417	693.297	693.217	692.647	692.587	692.717	692.717
24	692.967	693.137	693.577	693.517	693.477	693.417	693.287	693.217	692.647	692.587	692.717	692.717
25	692.967	693.137	693.587	693.517	693.477	693.427	693.287	693.217	692.647	692.587	692.717	692.717
26	692.967	693.137	693.587	693.497	693.477	693.427	693.287	693.217	692.637	692.587	692.717	692.717
27	692.947	693.137	693.587	693.497	693.477	693.427	693.287	693.217	692.637	692.587	692.717	692.717
28	692.947	693.137	693.587	693.497	693.477	693.427	693.287	693.207	692.637	692.587	692.717	692.717
29	692.947		693.587	693.497	693.467	693.427	693.277	693.207	692.637	692.587	692.707	692.707
30	692.947		693.587	693.497	693.467	693.427	693.277	693.207	692.637	692.597	692.707	692.707
31	692.947		693.587		693.467		693.277	693.197		692.597		692.077

Ohrid Lake level 2019 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	692.897	693.007	692.817	692.727	692.727	692.727	692.687	692.627	692.587	692.697	692.667	692.757
2	692.897	693.007	692.807	692.727	692.727	692.727	692.687	692.627	692.587	692.697	692.667	692.757
3	692.917	693.007	692.807	692.727	692.727	692.727	692.687	692.617	692.587	692.687	692.677	692.767
4	692.917	693.007	692.797	692.737	692.727	692.717	692.687	692.617	692.587	692.687	692.677	692.767
5	692.917	693.007	692.797	692.737	692.727	692.717	692.687	692.617	692.587	692.687	692.677	692.767
6	692.927	693.007	692.777	692.737	692.727	692.717	692.687	692.617	692.607	692.677	692.677	692.767
7	692.927	693.007	692.777	692.737	692.727	692.717	692.687	692.617	692.607	692.677	692.677	692.767
8	692.927	693.007	692.757	692.737	692.727	692.717	692.687	692.607	692.607	692.677	692.707	692.777
9	692.927	692.987	692.757	692.737	692.727	692.717	692.687	692.607	692.607	692.677	692.707	692.787
10	692.937	692.977	692.757	692.747	692.737	692.717	692.687	692.607	692.607	692.667	692.707	692.787
11	692.937	692.957	692.737	692.747	692.737	692.707	692.697	692.607	692.607	692.667	692.717	692.787
12	692.937	692.957	692.737	692.747	692.737	692.707	692.697	692.607	692.607	692.667	692.717	692.797
13	692.937	692.947	692.737	692.757	692.737	692.707	692.697	692.607	692.617	692.667	692.717	692.797
14	692.937	692.947	692.727	692.757	692.737	692.707	692.697	692.607	692.617	692.667	692.737	692.797
15	692.947	692.927	692.727	692.757	692.737	692.707	692.697	692.607	692.617	692.667	692.737	692.797
16	692.947	692.927	692.727	692.767	692.737	692.697	692.697	692.607	692.617	692.667	692.737	692.807
17	692.947	692.927	692.697	692.767	692.747	692.697	692.687	692.607	692.617	692.667	692.747	692.807
18	692.957	692.907	692.697	692.767	692.747	692.697	692.687	692.607	692.617	692.657	692.757	692.827
19	692.977	692.907	692.697	692.757	692.747	692.697	692.677	692.607	692.637	692.657	692.757	692.827
20	692.977	692.877	692.697	692.757	692.747	692.697	692.677	692.597	692.637	692.657	692.757	692.827
8	692.977	692.877	692.687	692.757	692.747	692.697	692.667	692.597	692.647	692.657	692.757	692.857
22	692.977	692.867	692.687	692.757	692.737	692.697	692.667	692.597	692.657	692.657	692.757	692.857
23	692.987	692.847	692.687	692.757	692.737	692.697	692.667	692.597	692.657	692.657	692.757	692.867
24	692.987	692.837	692.697	692.737	692.737	692.687	692.657	692.597	692.677	692.657	692.747	692.867
25	692.997	692.827	692.697	692.737	692.737	692.687	692.657	692.597	692.697	692.647	692.747	692.867
26	692.997	692.827	692.697	692.727	692.737	692.687	692.647	692.597	692.697	692.647	692.747	692.867
27	692.997	692.827	692.697	692.727	692.737	692.687	692.637	692.597	692.697	692.647	692.747	692.867
28	692.997	692.827	692.697	692.727	692.727	692.687	692.637	692.597	692.697	692.647	692.747	692.867
29	693.007		692.687	692.727	692.727	692.687	692.627	692.597	692.697	692.647	692.747	692.867
30	693.007		692.687	692.727	692.727	692.687	692.627	692.597	692.697	692.647	692.747	692.867
31	693.007		692.687		692.727		692.627	692.597		692.647		692.867

Big Prespa Lake level 2009 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	844.566	844.656	844.736	844.866	844.986	845.066	844.986	844.786	844.636	844.516	844.596	844.676
2	844.566	844.726	844.736	844.866	844.996	845.056	844.976	844.776	844.646	844.516	844.586	844.666
3	844.556	844.726	844.736	844.876	845.006	845.056	844.986	844.776	844.646	844.536	844.576	844.656
4	844.566	844.736	844.746	844.876	845.016	845.066	844.986	844.776	844.636	844.556	844.566	844.646
5	844.576	844.746	844.756	844.886	845.026	845.056	844.976	844.766	844.636	844.566	844.566	844.646
6	844.576	844.746	844.766	844.886	845.026	845.046	844.976	844.756	844.626	844.546	844.586	844.646
7	844.566	844.746	844.776	844.896	845.036	845.036	844.966	844.756	844.616	844.546	844.596	844.646
8	844.576	844.756	844.776	844.896	845.026	845.036	844.956	844.746	844.616	844.556	844.606	844.646
9	844.576	844.756	844.786	844.896	845.036	845.026	844.946	844.746	844.606	844.556	844.626	844.656
10	844.576	844.766	844.796	844.906	845.036	845.026	844.946	844.756	844.596	844.546	844.646	844.656
11	844.576	844.766	844.796	844.906	845.036	845.026	844.946	844.756	844.596	844.546	844.646	844.666
12	844.566	844.766	844.806	844.906	845.046	845.016	844.936	844.746	844.586	844.546	844.656	844.656
13	844.576	844.776	844.806	844.906	845.046	845.026	844.926	844.746	844.576	844.566	844.656	844.656
14	844.576	844.776	844.806	844.916	845.046	845.026	844.916	844.736	844.566	844.556	844.656	844.666
15	844.586	844.776	844.806	844.916	845.036	845.016	844.906	844.736	844.566	844.556	844.656	844.666
16	844.576	844.766	844.796	844.926	845.036	845.016	844.906	844.736	844.566	844.546	844.656	844.676
17	844.576	844.766	844.796	844.926	845.046	845.006	844.896	844.736	844.556	844.536	844.646	844.676
18	844.576	844.766	844.796	844.926	845.046	844.996	844.886	844.736	844.556	844.526	844.646	844.686
19	844.566	844.766	844.806	844.926	845.036	844.986	844.876	844.726	844.546	844.546	844.646	844.686
20	844.576	844.776	844.816	844.936	845.036	844.986	844.876	844.716	844.546	844.546	844.646	844.706
21	844.576	844.776	844.826	844.936	845.036	844.976	844.876	844.706	844.546	844.556	844.656	844.726
22	844.576	844.766	844.826	844.946	845.036	844.976	844.866	844.696	844.536	844.546	844.656	844.736
23	844.596	844.756	844.836	844.946	845.036	844.976	844.866	844.686	844.526	844.546	844.666	844.746
24	844.606	844.756	844.836	844.956	845.026	844.966	844.856	844.686	844.536	844.546	844.666	844.756
25	844.626	844.746	844.836	844.956	845.026	844.966	844.836	844.676	844.536	844.566	844.666	844.766
26	844.636	844.746	844.826	844.956	845.026	844.976	844.826	844.666	844.546	844.586	844.666	844.776
27	844.646	844.746	844.826	844.966	845.026	844.976	844.816	844.666	844.546	844.596	844.666	844.776
28	844.666	844.736	844.836	844.966	845.036	844.976	844.806	844.656	844.546	844.596	844.666	844.796
29	844.676		844.836	844.986	845.056	844.986	844.796	844.656	844.536	844.606	844.676	844.806
30	844.686		844.826	844.996		844.986	844.796	844.646	844.526	844.606	844.676	844.826
31	844.706		844.826				844.846	844.646		844.606		844.836

Big Prespa Lake level 2010 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	844.866	845.096	845.466	846.952	847.312	847.472	847.492	847.412	847.282	847.172	847.192	847.212
2	844.906	845.096	845.486	846.972	847.312	847.482	847.482	847.412	847.272	847.172	847.192	847.222
3	844.926	845.096	845.496	846.982	847.322	847.482	847.482	847.422	847.262	847.162	847.182	847.232
4	844.946	845.096	845.516	846.992	847.322	847.482	847.492	847.422	847.262	847.162	847.172	847.262
5	844.946	845.106	845.526	847.002	847.322	847.482	847.502	847.422	847.252	847.172	847.162	847.282
6	844.946	845.106	845.546	847.012	847.322	847.482	847.502	847.412	847.252	847.172	847.162	847.302
7	844.956	845.116	845.556	847.022	847.312	847.482	847.492	847.412	847.242	847.172	847.152	847.312
8	844.966	845.116	845.566	847.032	847.312	847.472	847.492	847.412	847.232	847.162	847.162	847.312
9	844.976	845.126	845.596	847.032	847.322	847.462	847.492	847.402	847.222	847.172	847.172	847.322
10	844.986	845.126	845.626	847.042	847.332	847.462	847.482	847.402	847.212	847.162	847.182	847.322
11	844.986	845.136	845.646	847.042	847.342	847.472	847.472	847.392	847.212	847.152	847.192	847.332
12	844.996	845.146	845.646	847.052	847.342	847.482	847.472	847.392	847.212	847.152	847.182	847.342
13	845.006	845.156	845.666	847.072	847.352	847.492	847.462	847.392	847.202	847.142	847.172	847.342
14	845.016	845.166	845.676	847.092	847.362	847.492	847.452	847.382	847.202	847.182	847.162	847.342
15	845.016	845.176	845.686	847.102	847.372	847.482	847.452	847.382	847.202	847.202	847.152	847.342
16	845.026	845.186	845.706	847.122	847.392	847.482	847.462	847.382	847.202	847.202	847.162	847.352
17	845.036	845.206	845.716	847.132	847.392	847.492	847.442	847.372	847.192	847.292	847.172	847.352
18	845.036	845.226	845.706	847.132	847.392	847.492	847.432	847.362	847.192	847.212	847.172	847.362
19	845.046	845.246	845.716	847.152	847.392	847.472	847.482	847.352	847.182	847.212	847.172	847.372
20	845.046	845.246	845.726	847.172	847.402	847.512	847.492	847.352	847.182	847.212	847.182	847.382
21	845.056	845.266	845.736	847.132	847.412	847.512	847.402	847.342	847.182	847.202	847.182	847.382
22	845.056	845.306	845.746	847.212	847.422	847.512	847.402	847.332	847.172	847.202	847.182	847.392
23	845.066	845.326	845.766	847.232	847.432	847.522	847.412	847.342	847.172	847.202	847.172	847.392
24	845.076	845.346	845.776	847.242	847.432	847.512	847.412	847.332	847.162	847.202	847.172	847.392
25	845.076	845.356	845.786	847.252	847.432	847.502	847.422	847.322	847.162	847.192	847.162	847.392
26	845.086	845.366	845.796	847.272	847.432	847.502	847.422	847.322	847.162	847.182	847.172	847.402
27	845.086	845.406	845.806	847.282	847.442	847.492	847.432	847.312	847.152	847.172	847.182	847.402
28	845.076	845.446	845.816	847.292	847.442	847.492	847.432	847.312	847.142	847.182	847.192	847.402
29	845.076		845.826	847.312	847.452	847.482	847.422	847.302	847.152	847.192	847.202	847.412
30	845.076		845.846	845.912	847.452	847.482	847.422	847.302	847.162	847.182	847.212	847.422
31	845.086		846.932		847.462		847.412	847.302		847.182		847.432

Big Prespa Lake level 2011 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	847.412	847.482	847.492	847.542	847.572	847.592	847.522	847.432	847.302	847.192	847.102	847.202
2	847.412	847.482	847.492	847.542	847.582	847.582	847.522	847.432	847.292	847.192	847.102	847.202
3	847.422	847.472	847.492	847.542	847.592	847.582	847.512	847.432	847.272	847.182	847.102	847.192
4	847.422	847.462	847.502	847.542	847.582	847.582	847.512	847.432	847.262	847.182	847.112	847.182
5	847.422	847.462	847.502	847.552	847.582	847.572	847.512	847.412	847.262	847.182	847.112	847.182
6	847.432	847.452	847.492	847.552	847.592	847.572	847.522	847.412	847.252	847.162	847.112	847.182
7	847.442	847.452	847.502	852.062	847.592	847.572	847.512	847.422	847.252	847.162	847.122	847.192
8	847.442	847.452	847.502	847.572	847.592	847.572	847.502	847.412	847.252	847.152	847.142	847.172
9	847.452	847.442	847.512	847.582	847.592	847.572	847.502	847.402	847.252	847.142	847.132	847.172
10	847.452	847.442	847.512	847.572	847.592	847.572	847.492	847.382	847.242	847.142	847.142	847.152
11	847.452	847.432	847.512	847.572	847.592	847.572	847.502	847.382	847.232	847.142	847.142	847.152
12	847.452	847.432	847.512	847.562	847.592	847.572	847.502	847.362	847.242	847.132	847.142	847.152
13	847.462	847.432	847.522	847.572	847.592	847.562	847.492	847.372	847.242	847.132	847.152	847.142
14	847.462	847.422	847.522	847.582	847.592	847.562	847.492	847.362	847.232	847.112	847.172	847.142
15	847.472	847.422	847.512	847.582	847.592	847.572	847.492	847.362	847.232	847.112	847.152	847.132
16	847.472	847.422	847.522	847.572	847.592	847.572	847.482	847.352	847.232	847.112	847.172	847.142
17	847.482	847.432	847.522	847.572	847.592	847.562	847.482	847.342	847.242	847.122	847.162	847.142
18	847.492	847.442	847.532	847.562	847.592	847.552	847.492	847.332	847.232	847.122	847.162	847.132
19	847.492	847.452	847.532	847.562	847.592	847.552	847.482	847.322	847.232	847.122	847.182	847.132
20	847.482	847.462	847.542	847.582	847.592	847.552	847.482	847.322	847.222	847.112	847.202	847.122
21	847.482	847.472	847.542	847.582	847.592	847.552	847.482	847.322	847.222	847.112	847.202	847.112
22	847.472	847.482	847.542	847.582	847.592	847.542	847.482	847.312	847.222	847.112	847.202	847.102
23	847.472	847.492	847.542	847.582	847.592	847.542	847.472	847.312	847.212	847.122	847.192	847.102
24	847.472	847.492	847.542	847.572	847.602	847.542	847.472	847.312	847.222	847.122	847.192	847.102
25	847.462	847.492	847.542	847.572	847.592	847.542	847.472	847.322	847.212	847.122	847.202	847.102
26	847.462	847.492	847.532	847.572	847.602	847.552	847.472	847.312	847.212	847.102	847.212	847.092
27	847.452	847.492	847.532	847.572	847.592	847.552	847.462	847.312	847.202	847.112	847.212	847.102
28	847.462	847.492	847.532	847.572	847.602	847.542	847.462	847.322	847.202	847.112	847.212	847.102
29	847.462		847.542	847.572	847.592	847.542	847.452	847.322	847.202	847.122	847.212	847.092
30	847.472		847.542	847.572	847.592	847.532	847.442	847.312	847.202	847.122	847.212	847.102
31	847.472		847.542		845.912		847.442	847.302		847.102		847.092

Big Prespa Lake level 2013 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	847.072	846.992	847.102	847.212	847.312	847.442	847.402	847.352	847.582	847.452	847.262	847.272
2	847.072	847.002	847.102	847.212	847.322	847.442	847.402	847.352	847.582	847.442	847.262	847.272
3	847.062	847.002	847.102	847.212	847.342	847.452	847.402	847.352	847.582	847.432	847.252	847.272
4	847.052	847.002	847.112	847.212	847.352	847.452	847.392	847.352	847.582	847.412	847.252	847.282
5	847.032	847.012	847.132	847.222	847.372	847.472	847.402	847.342	847.572	847.412	847.242	847.282
6	847.032	847.012	847.132	847.222	847.362	847.472	847.392	847.342	847.562	847.412	847.252	847.282
7	847.032	847.012	847.132	847.232	847.362	847.472	847.392	847.332	847.562	847.392	847.252	847.282
8	847.032	847.012	847.142	847.232	847.382	847.462	847.392	847.332	847.562	847.372	847.252	847.282
9	847.022	847.032	847.142	847.232	847.382	847.462	847.402	847.342	847.552	847.372	847.252	847.282
10	847.012	847.042	847.142	847.222	847.372	847.452	847.402	847.352	847.552	847.352	847.242	847.282
11	847.012	847.032	847.142	847.222	847.372	847.452	847.382	847.362	847.552	847.352	847.242	847.282
12	847.012	847.042	847.162	859.232	847.382	847.452	847.382	847.372	847.542	847.342	847.252	847.272
13	847.022	847.042	847.162	847.232	847.392	847.462	847.392	847.362	847.542	847.342	847.262	847.262
14	847.022	847.042	847.152	847.232	847.392	847.462	847.402	847.372	847.542	847.342	847.262	847.262
15	847.022	847.062	847.142	847.242	847.392	847.462	847.382	847.372	847.552	847.332	847.262	847.262
16	847.032	847.052	847.152	847.242	847.392	847.442	847.382	847.382	847.552	847.332	847.262	847.252
17	847.012	847.062	847.172	847.242	847.402	847.442	847.382	847.392	847.552	847.312	847.262	847.252
18	847.012	847.062	847.172	847.262	847.392	847.432	847.372	847.382	847.552	847.302	847.262	847.252
19	847.012	847.072	847.172	847.252	847.392	847.432	847.362	847.402	847.542	847.292	847.262	847.252
20	847.012	847.072	847.172	847.262	847.402	847.432	847.362	847.402	847.542	847.292	847.272	847.252
21	847.012	847.072	847.182	847.262	847.402	847.432	847.372	847.412	847.542	847.292	847.272	847.242
22	847.002	847.072	847.182	847.272	847.402	847.412	847.372	847.412	847.532	847.282	847.272	847.242
23	847.002	847.082	847.192	847.272	847.402	847.422	847.372	847.432	847.532	847.272	847.262	847.242
24	846.992	847.072	847.182	847.272	847.412	847.412	847.362	847.442	847.512	847.272	847.272	847.242
25	846.992	847.072	847.182	847.272	847.422	847.422	847.362	847.452	847.502	847.262	847.272	847.242
26	846.992	847.072	847.192	847.272	847.422	847.412	847.372	847.452	847.502	847.262	847.272	847.232
27	846.992	847.082	847.192	847.292	847.442	847.412	847.352	847.472	847.502	847.252	847.282	847.232
28	846.982	847.082	847.202	847.292	847.442	847.412	847.352	847.472	847.492	847.242	847.282	847.232
29	846.982		847.202	847.292	847.442	847.422	847.352	847.502	847.482	847.242	847.282	847.222
30	846.982		847.202	847.292	847.442	847.412	847.352	847.532	847.472	847.232	847.282	847.222
31	846.992		847.202		847.442		847.352	847.552		847.232		847.212

Big Prespa Lake level 2014 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	847.232	847.152	847.072	847.022	847.132	847.182	847.132	846.972	845.656	845.596	845.466	845.546
2	847.232	847.142	847.072	847.022	847.142	847.182	847.122	846.952	845.656	845.596	845.466	845.556
3	847.232	847.142	847.062	847.022	847.142	847.182	847.112	846.932	845.656	845.586	845.476	845.566
4	847.222	847.142	847.062	847.032	847.142	847.192	847.102	845.846	845.646	845.576	845.476	845.566
5	847.222	847.142	847.062	847.032	847.152	847.182	847.082	845.826	845.646	845.576	845.476	845.566
6	847.222	847.132	847.062	847.042	847.162	847.172	847.092	845.806	845.646	845.576	845.486	845.566
7	847.212	847.122	847.052	847.052	847.162	847.172	847.092	845.796	845.636	845.596	845.486	845.566
8	847.212	847.122	847.052	847.052	847.162	847.162	847.082	845.786	845.646	845.596	845.496	845.566
9	847.212	847.122	847.052	847.062	847.162	847.152	847.082	845.786	845.646	845.596	845.486	845.576
10	847.202	847.122	847.052	847.062	847.162	847.152	847.082	845.786	845.656	845.596	845.486	845.576
11	847.202	847.112	847.052	847.072	847.172	847.142	847.072	845.766	845.666	845.596	845.486	845.586
12	847.202	847.112	847.042	847.072	847.172	847.142	847.072	845.746	845.666	845.586	845.486	845.586
13	847.192	847.112	847.042	847.082	847.172	847.132	847.072	845.746	845.656	845.586	845.496	845.586
14	847.192	847.102	847.042	847.092	847.152	847.132	847.062	845.726	845.646	845.576	845.496	845.586
15	847.182	847.102	847.042	847.092	847.162	847.142	847.062	845.726	845.646	845.576	845.496	845.596
16	847.182	847.102	847.042	847.112	847.162	847.152	847.052	845.716	845.656	845.566	845.506	845.606
17	847.172	847.092	847.042	847.112	847.162	847.152	847.052	845.706	845.646	845.566	845.506	845.606
18	847.172	847.082	847.042	847.112	847.172	847.152	847.042	845.706	845.646	845.556	845.506	845.606
19	847.162	847.082	847.042	847.122	847.172	847.152	847.032	845.696	845.646	845.546	845.516	845.606
20	847.162	847.082	847.032	847.122	847.172	847.152	847.022	845.686	845.646	845.546	845.516	845.606
21	847.152	847.082	847.032	847.122	847.172	847.152	847.022	845.686	845.646	845.546	845.526	845.616
22	847.152	847.082	847.032	847.122	847.182	847.152	847.022	845.686	845.636	845.536	845.526	845.616
23	847.152	847.082	847.022	847.132	847.172	847.152	847.012	845.686	845.626	845.536	845.526	845.616
24	847.182	847.072	847.022	847.132	847.172	847.142	847.002	845.686	845.626	845.526	845.536	845.626
25	847.182	847.072	847.022	847.132	847.172	847.142	847.002	845.676	845.626	845.506	845.546	845.626
26	847.132	847.072	847.032	847.132	847.172	847.142	847.002	845.676	845.626	845.506	845.546	845.626
27	847.132	847.072	847.032	847.132	847.172	847.142	847.002	845.666	845.616	845.496	845.546	845.626
28	847.132	847.072	847.032	847.142	847.162	847.132	847.002	845.666	845.616	845.496	845.546	845.616
29	847.132		847.032	847.142	847.172	847.132	846.992	845.666	845.606	845.486	845.556	845.626
30	847.132		847.032	847.152	847.182	847.132	846.992	845.666	845.596	845.486	845.566	845.626
31	847.132		847.032		847.182		846.992	845.656		845.476		845.636

Big Prespa Lake level 2015 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	845.626	845.726	847.002	847.142	847.352	847.412	847.242	847.112	847.012	846.982	846.982	846.922
2	845.626	845.786	847.012	847.152	847.362	847.412	847.232	847.112	847.012	846.982	846.982	846.922
3	845.616	845.786	847.022	847.152	847.362	847.422	847.222	847.112	847.012	846.982	846.982	845.846
4	845.616	845.796	847.022	847.192	847.362	847.422	847.212	847.112	847.012	846.982	846.992	845.846
5	845.606	845.796	847.042	847.212	847.362	847.422	847.212	847.132	847.012	846.982	846.992	845.846
6	845.606	845.796	847.052	847.232	847.362	847.422	847.212	847.122	847.002	846.972	846.982	845.846
7	845.596	845.816	847.062	847.232	847.362	847.412	847.212	847.112	847.002	846.972	846.982	845.846
8	845.596	845.836	847.082	847.232	847.372	847.402	847.202	847.102	846.992	846.972	846.972	845.836
9	845.586	845.836	847.092	847.242	847.382	847.392	847.202	847.092	846.992	846.972	846.962	845.826
10	845.576	845.846	847.102	847.242	847.382	847.372	847.192	847.092	847.012	846.992	846.962	845.846
11	845.576	846.932	847.112	847.242	847.402	847.362	847.192	847.082	847.012	846.992	846.952	846.932
12	845.566	846.942	847.112	847.242	847.402	847.342	847.192	847.082	847.012	846.992	846.952	846.932
13	845.556	846.942	847.112	847.252	847.402	847.322	847.192	847.072	847.012	846.992	846.952	846.932
14	845.556	846.952	847.122	847.252	847.402	847.312	847.192	847.072	847.002	846.992	846.952	846.932
15	845.546	846.952	847.122	847.262	847.412	847.302	847.192	847.072	846.992	846.992	846.942	846.942
16	845.546	846.952	847.122	847.262	847.442	847.292	847.192	847.062	846.982	847.002	846.942	846.942
17	845.536	846.962	847.132	847.272	847.452	847.282	847.182	847.052	846.982	847.002	846.932	846.932
18	845.536	846.972	847.132	847.262	847.452	847.272	847.172	847.052	846.982	847.002	846.932	846.932
19	845.546	846.972	847.132	847.262	847.452	847.272	847.162	847.052	846.972	847.002	846.932	846.922
20	845.556	846.972	847.132	847.272	847.462	847.262	847.162	847.052	846.972	846.992	846.922	846.922
21	845.556	846.982	847.132	847.312	847.472	847.262	847.152	847.052	846.972	846.992	846.922	846.922
22	845.556	846.982	847.142	847.312	847.472	847.252	847.152	847.052	846.972	846.992	846.922	846.922
23	845.556	846.982	847.142	847.322	847.462	847.252	847.142	847.052	846.972	846.992	846.932	846.922
24	845.566	846.982	847.142	847.322	847.452	847.252	847.142	847.042	846.972	846.992	846.932	846.922
25	845.576	846.982	847.142	847.322	847.442	847.242	847.132	847.042	846.972	846.992	846.932	846.922
26	845.586	846.992	847.142	847.332	847.432	847.242	847.132	847.032	846.982	846.982	846.932	845.846
27	845.586	846.992	847.142	847.342	847.432	847.252	847.132	847.032	846.982	846.992	846.932	845.846
28	845.596	846.992	847.142	847.342	847.432	847.252	847.112	847.032	846.982	846.992	846.932	845.846
29	845.596		847.142	847.342	847.422	847.252	847.112	847.022	846.982	846.992	846.932	845.846
30	845.596		847.142	847.352	847.422	847.252	847.112	847.012	846.982	846.992	846.932	845.846
31	845.646		847.142		847.412		847.112	847.012		846.982		845.836

Big Prespa Lake level 2016 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	845.846	846.982	847.052	847.132	847.242	847.352	847.262	847.102	846.972	846.942	846.922	846.922
2	845.846	846.982	847.062	847.132	847.242	847.352	847.262	847.102	846.972	846.952	845.846	845.846
3	845.836	846.992	847.062	847.132	847.252	847.342	847.262	847.092	846.972	846.952	845.846	845.846
4	845.846	846.982	847.062	847.142	847.252	847.252	847.252	847.092	846.972	846.952	845.846	845.826
5	845.846	846.982	847.062	847.142	847.262	847.342	847.242	847.092	846.962	846.952	845.846	845.826
6	845.846	846.982	847.072	847.142	847.262	847.332	847.242	847.092	846.962	846.962	845.836	845.826
7	846.922	846.982	847.072	847.152	847.272	847.332	847.232	847.082	846.972	846.962	845.846	845.816
8	846.932	846.982	847.072	847.152	847.272	847.332	847.222	847.082	846.982	846.962	845.846	845.816
9	846.932	846.972	847.082	847.152	847.272	847.332	847.212	847.082	846.992	846.952	846.922	845.806
10	846.932	846.972	847.082	847.162	847.272	847.322	847.202	847.072	846.992	846.952	846.932	845.806
11	846.942	846.972	847.082	847.162	847.272	847.322	847.202	847.072	846.992	846.952	846.932	845.806
12	846.942	846.962	847.082	847.162	847.272	847.322	847.192	847.062	846.992	846.952	846.932	845.786
13	846.942	846.972	847.092	847.162	847.272	847.322	847.192	847.052	846.992	846.952	846.952	845.786
14	846.942	846.972	847.092	847.172	847.272	847.322	847.192	847.052	846.982	846.962	846.952	845.786
15	846.942	846.982	847.092	847.172	847.252	847.322	847.182	847.042	846.982	846.962	846.952	845.776
16	846.952	847.002	847.102	847.172	847.282	847.322	847.182	847.032	846.982	846.972	846.942	845.776
17	846.952	847.002	847.102	847.172	847.282	847.312	847.172	847.032	846.972	846.962	846.942	845.776
18	846.952	847.012	847.102	847.182	847.292	847.302	847.172	847.042	846.972	846.952	846.932	845.766
19	846.952	847.012	847.102	847.182	847.292	847.302	847.162	847.042	846.972	846.952	846.932	845.766
20	846.952	847.012	847.102	847.192	847.302	847.302	847.162	847.032	846.962	846.952	846.932	845.766
21	846.962	847.022	847.102	847.192	847.302	847.302	847.152	847.032	846.962	846.952	846.932	845.766
22	846.962	847.022	847.102	847.202	847.302	847.292	847.152	847.022	846.962	846.952	846.932	845.766
23	846.962	847.022	847.102	847.212	847.302	847.292	847.142	847.022	846.952	846.942	846.932	845.756
24	846.962	847.032	847.102	847.222	847.312	847.292	847.142	847.012	846.952	846.932	846.932	845.746
25	846.972	847.032	847.102	847.222	847.322	847.292	847.132	846.992	846.952	846.932	846.932	845.746
26	846.972	847.032	847.112	847.232	847.332	847.282	847.132	846.992	846.942	846.932	846.932	845.746
27	846.972	847.042	847.112	847.232	847.332	847.272	847.132	846.992	846.942	846.932	846.932	845.746
28	846.972	847.042	847.122	847.232	847.332	847.272	847.122	846.982	846.942	846.932	846.942	845.736
29	846.982	847.052	847.122	847.232	847.342	847.272	847.112	846.972	846.942	846.932	846.942	845.736
30	846.982		847.122	847.232	847.342	847.272	847.112	846.972	846.942	846.932	845.912	845.736
31	846.982		847.132		847.342		847.112	846.972		846.922		845.726

Big Prespa Lake level 2017 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	845.726	845.686	845.726	845.726	845.716	845.716	845.626	845.426	845.236	845.066	844.956	844.966
2	845.726	845.686	845.726	845.726	845.716	845.706	845.616	845.426	845.236	845.066	844.946	845.046
3	845.726	845.696	845.726	845.726	845.716	845.706	845.606	845.416	845.236	845.066	844.946	845.056
4	845.716	845.696	845.716	845.726	845.716	845.706	845.606	845.416	845.226	845.056	844.946	845.056
5	845.716	845.706	845.716	845.716	845.716	845.706	845.596	845.406	845.226	845.046	844.946	845.056
6	845.716	845.706	845.716	845.716	845.716	845.706	845.586	845.406	845.226	845.046	844.946	845.046
7	845.706	845.706	845.716	845.716	845.706	845.706	845.586	845.396	845.216	845.046	844.936	845.046
8	845.706	845.706	845.726	845.716	845.706	845.706	845.586	845.396	845.216	845.046	844.936	845.036
9	845.706	845.706	845.726	845.706	845.706	845.696	845.586	845.386	845.216	845.046	844.936	845.036
10	845.706	845.716	845.716	845.706	845.706	845.696	845.586	845.386	845.206	845.036	844.936	845.046
11	845.706	845.716	845.716	845.716	845.706	845.696	845.586	845.386	845.206	845.026	844.926	845.046
12	845.706	845.716	845.716	845.716	845.716	845.696	845.586	845.376	845.196	845.026	844.926	845.046
13	845.696	845.716	845.716	845.716	845.716	845.686	845.576	845.366	845.186	845.016	844.926	845.046
14	845.696	845.726	845.716	845.716	845.716	845.686	845.576	845.356	845.176	845.006	844.946	845.046
15	845.696	845.726	845.716	845.706	845.716	845.686	845.576	845.346	845.176	844.996	844.956	845.046
16	845.696	845.726	845.716	845.706	845.716	845.686	845.576	845.336	845.166	844.986	844.956	845.046
17	845.696	845.716	845.716	845.716	845.726	845.676	845.576	845.326	845.156	844.986	844.956	845.046
18	845.696	845.716	845.716	845.726	845.726	845.676	845.576	845.316	845.146	844.976	844.956	845.056
19	845.706	845.716	845.716	845.726	845.716	845.666	845.566	845.306	845.146	844.976	844.956	845.056
20	845.706	845.706	845.706	845.726	845.716	845.666	845.546	845.296	845.136	844.976	844.946	845.056
21	845.706	845.706	845.706	845.726	845.716	845.666	845.546	845.286	845.126	844.976	844.946	845.056
22	845.706	845.706	845.716	845.726	845.726	845.656	845.526	845.286	845.126	844.976	844.946	845.056
23	845.706	845.706	845.726	845.716	845.726	845.646	845.516	845.276	845.116	844.976	844.956	845.056
24	845.706	845.706	845.726	845.716	845.716	845.646	845.506	845.276	845.106	844.976	844.956	845.056
25	845.706	845.716	845.726	845.716	845.716	845.646	845.496	845.266	845.096	844.976	844.956	845.066
26	845.706	845.716	845.726	845.706	845.716	845.636	845.486	845.266	845.096	844.966	844.956	845.066
27	845.696	845.716	845.726	845.706	845.716	845.636	845.486	845.256	845.086	844.966	844.956	845.066
28	845.696	845.716	845.726	845.706	845.716	845.196	845.466	845.256	845.086	844.966	844.956	845.066
29	845.696		845.726	845.706	845.716	845.186	845.466	845.246	845.076	844.966	844.946	845.066
30	845.696		845.726	845.716	845.716	845.186	845.446	845.246	845.076	844.966	844.946	845.066
31	845.696		844.846		845.716		845.436	845.236		844.956		845.066

Big Prespa Lake level 2018 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	**m (a.s.l.)**	**m (a.s.l.)**	**m (a.s.l.)**	**m (a.s.l.)**	**m (a.s.l.)**	**m (a.s.l.)**	**m (a.s.l.)**	**m (a.s.l.)**	**m (a.s.l.)**	**m (a.s.l.)**	**m (a.s.l.)**	**m (a.s.l.)**
1	845.076	845.006	845.206	845.566	845.716	845.806	845.766	845.716	845.586	845.426	845.256	845.276
2	845.076	845.006	845.216	845.576	845.716	845.796	845.766	845.716	845.586	845.416	845.256	845.276
3	845.076	845.006	845.226	845.576	845.726	845.796	845.766	845.716	845.586	845.406	845.246	845.286
4	845.076	845.016	845.246	845.586	845.726	845.796	845.756	845.716	845.586	845.406	845.246	845.286
5	845.066	845.026	845.256	845.596	845.736	845.786	845.756	845.716	845.576	845.396	845.246	845.286
6	845.066	845.066	845.266	845.606	845.736	845.786	845.756	845.706	845.576	845.396	845.236	845.276
7	845.066	845.066	845.286	845.616	845.746	845.786	845.756	845.706	845.576	845.386	845.236	845.276
8	845.056	845.076	845.296	845.626	845.746	845.776	845.756	845.706	845.566	845.376	845.236	845.276
9	845.056	845.086	845.306	845.636	845.756	845.776	845.756	845.706	845.556	845.366	845.226	845.276
10	845.056	845.096	845.316	845.646	845.756	845.776	845.756	845.706	845.546	845.366	845.226	845.276
11	845.046	845.106	845.326	845.646	845.756	845.776	845.746	845.696	845.536	845.356	845.226	845.276
12	845.046	845.116	845.326	845.656	845.756	845.766	845.746	845.696	845.536	845.356	845.216	845.276
13	845.046	845.126	845.336	845.666	845.766	845.766	845.746	845.696	845.536	845.346	845.216	845.276
14	845.036	845.136	845.346	845.666	845.776	845.766	845.746	845.686	845.526	845.336	845.216	845.276
15	845.026	845.146	845.366	845.676	845.776	845.766	845.746	845.686	845.526	845.326	845.216	845.276
16	845.026	845.156	845.376	845.676	845.786	845.766	845.746	845.676	845.526	845.316	845.216	845.266
17	845.026	845.156	845.396	845.686	845.786	845.766	845.736	845.666	845.516	845.306	845.216	845.266
18	845.026	845.156	845.406	845.686	845.786	845.766	845.736	845.666	845.516	845.306	845.216	845.266
19	845.026	845.166	845.426	845.696	845.786	845.766	845.736	845.666	845.516	845.296	845.226	845.266
20	845.026	845.166	845.446	845.696	845.786	845.756	845.736	845.646	845.506	845.286	845.236	845.266
21	845.026	845.166	845.456	845.696	845.786	845.756	845.736	845.646	845.506	845.276	845.236	845.256
22	845.026	845.166	845.456	845.696	845.786	845.746	845.726	845.626	845.496	845.276	845.236	845.256
23	845.016	845.176	845.486	845.706	845.786	845.746	845.726	845.626	845.496	845.276	845.246	845.256
24	845.016	845.176	845.486	845.706	845.786	845.746	845.726	845.616	845.496	845.276	845.256	845.256
25	845.016	845.196	845.496	845.706	845.786	845.746	845.726	845.616	845.486	845.276	845.256	845.256
26	845.016	845.206	845.526	845.706	845.796	845.756	845.726	845.606	845.476	845.276	845.256	845.246
27	845.016	845.206	845.536	845.706	845.796	845.756	845.726	845.606	845.466	845.276	845.266	845.246
28	845.016		845.546	845.706	845.806	845.766	845.726	845.606	845.456	845.266	845.266	845.236
29	845.016		845.556	845.716	845.806	845.766	845.726	845.596	845.446	845.266	845.276	845.236
30	845.006		845.556	845.716	845.806	845.766	845.716	845.596	845.436	845.266	845.276	845.236
31	845.006		845.206		845.806		845.716	845.586		845.266		845.226

Big Prespa Lake level 2019 (daily)

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)	m (a.s.l.)
1	845.226	845.246	845.226	845.196	845.206	845.206	845.126	845.006	844.826	844.756	845.802	845.852
2	845.226	845.246	845.226	845.196	845.206	845.206	845.126	845.006	844.826	844.756	845.802	845.852
3	845.226	845.246	845.226	845.196	845.206	845.206	845.116	844.996	844.826	844.746	845.802	845.852
4	845.216	845.256	845.216	845.196	845.206	845.196	845.116	844.986	844.826	844.746	845.802	845.852
5	845.216	845.256	845.216	845.206	845.206	845.196	845.116	844.976	844.826	844.746	845.812	845.852
6	845.216	845.266	845.216	845.206	845.206	845.186	845.106	844.976	844.816	844.746	845.812	845.842
7	845.216	845.266	845.216	845.206	845.206	845.186	845.106	844.956	844.816	844.746	845.812	845.842
8	845.206	845.266	845.206	845.206	845.196	845.186	845.106	844.946	844.816	844.736	845.822	845.842
9	845.206	845.266	845.206	845.196	845.196	845.176	845.096	844.946	844.816	844.736	845.822	845.842
10	845.206	845.256	845.206	845.196	845.196	845.176	845.096	844.946	844.806	844.736	845.822	845.842
11	845.216	845.256	845.206	845.196	845.196	845.166	845.106	844.946	844.806	844.736	845.822	845.842
12	845.216	845.256	845.206	845.196	845.206	845.166	845.106	844.926	844.806	844.736	845.822	845.842
13	845.216	845.256	845.206	845.206	845.206	845.166	845.106	844.926	844.806	844.726	845.822	845.832
14	845.216	845.246	845.206	845.206	845.206	845.166	845.096	844.906	844.806	844.726	845.832	845.832
15	845.216	845.246	845.206	845.206	845.206	845.156	845.096	844.906	844.796	844.726	845.832	845.832
16	845.226	845.246	845.216	845.206	845.206	845.146	845.096	844.906	844.806	844.726	845.832	845.832
17	845.226	845.246	845.216	845.206	845.206	845.146	845.086	844.896	844.796	844.726	845.832	845.832
18	845.226	845.246	845.216	845.206	845.206	845.146	845.076	844.886	844.796	844.716	845.832	845.832
19	845.226	845.246	845.216	845.196	845.206	845.146	845.076	844.886	844.796	844.716	845.832	845.822
20	845.236	845.246	845.206	845.196	845.206	845.146	845.066	844.876	844.796	844.716	845.832	845.822
21	845.236	845.236	845.206	845.196	845.206	845.136	845.056	844.876	844.786	844.706	845.842	845.822
22	845.236	845.236	845.206	845.206	845.206	845.136	845.046	844.876	844.786	844.706	845.842	845.822
23	845.236	845.236	845.206	845.206	845.206	845.136	845.046	844.866	844.786	844.706	845.842	845.822
24	845.236	845.236	845.206	845.206	845.206	845.136	845.026	844.866	844.776	845.822	845.842	845.822
25	845.236	845.236	845.206	845.206	845.206	845.136	845.026	844.866	844.776	845.822	845.842	845.812
26	845.236	845.226	845.206	845.206	845.206	845.126	845.016	844.856	844.776	845.812	845.842	845.812
27	845.246	845.226	845.206	845.206	845.206	845.126	845.016	844.856	844.766	845.812	845.842	845.812
28	845.246	845.226	845.206	845.206	845.206	845.126	845.016	844.856	844.766	845.812	845.842	845.802
29	845.246		845.206	845.206	845.206	845.126	845.006	844.846	844.766	845.802	845.842	845.802
30	845.246		845.206	845.206	845.206	845.126	845.006	844.846	844.766	845.802	845.852	845.802
31	845.246		845.206		845.206		845.006	844.846		845.802		845.802

Tushemisht S. - 2008

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)
1	207477.5	207477.5	207477.5	207477.5	205082.4	206279.3	206279.3	207477.5	205082.4	205082.4	203886.7	206279.3
2	207477.5	207477.5	207477.5	207477.5	205082.4	206279.3	206279.3	207477.5	205082.4	205082.4	203886.7	206279.3
3	207477.5	207477.5	208676.8	207477.5	206279.3	206279.3	206279.3	207477.5	203886.7	205082.4	203886.7	206279.3
4	207477.5	207477.5	208676.8	207477.5	206279.3	206279.3	206279.3	207477.5	203886.7	205082.4	203886.7	206279.3
5	207477.5	207477.5	208676.8	207477.5	206279.3	206279.3	206279.3	207477.5	203886.7	205082.4	203886.7	201499.1
6	207477.5	207477.5	208676.8	206279.3	206279.3	206279.3	206279.3	207477.5	203886.7	205082.4	203886.7	201499.1
7	207477.5	207477.5	208676.8	206279.3	206279.3	206279.3	206279.3	207477.5	203886.7	205082.4	203886.7	201499.1
8	206279.3	206279.3	208676.8	206279.3	206279.3	207477.5	206279.3	206279.3	203886.7	205082.4	205082.4	201499.1
9	206279.3	206279.3	208676.8	206279.3	206279.3	207477.5	206279.3	206279.3	202692.3	205082.4	205082.4	201499.1
10	206279.3	206279.3	209877.4	206279.3	206279.3	207477.5	205082.4	206279.3	202692.3	205082.4	205082.4	201499.1
11	206279.3	206279.3	209877.4	206279.3	207477.5	207477.5	205082.4	206279.3	202692.3	205082.4	205082.4	201499.1
12	206279.3	206279.3	209877.4	206279.3	207477.5	207477.5	205082.4	206279.3	202692.3	201499.1	206279.3	201499.1
13	206279.3	206279.3	209877.4	205082.4	207477.5	207477.5	205082.4	206279.3	202692.3	201499.1	206279.3	201499.1
14	206279.3	206279.3	209877.4	205082.4	207477.5	208676.8	205082.4	206279.3	202692.3	201499.1	206279.3	201499.1
15	206279.3	206279.3	209877.4	205082.4	207477.5	208676.8	205082.4	206279.3	202692.3	201499.1	206279.3	201499.1
16	206279.3	206279.3	209877.4	205082.4	207477.5	208676.8	205082.4	206279.3	202692.3	201499.1	206279.3	201499.1
17	206279.3	206279.3	209877.4	205082.4	207477.5	208676.8	205082.4	206279.3	202692.3	201499.1	206279.3	201499.1
18	206279.3	206279.3	209877.4	205082.4	207477.5	208676.8	205082.4	206279.3	203886.7	201499.1	206279.3	201499.1
19	205082.4	205082.4	208676.8	203886.7	208676.8	208676.8	205082.4	206279.3	203886.7	201499.1	207477.5	202692.3
20	205082.4	205082.4	208676.8	203886.7	208676.8	208676.8	205082.4	205082.4	203886.7	201499.1	207477.5	202692.3
21	205082.4	205082.4	208676.8	203886.7	208676.8	207477.5	206279.3	205082.4	203886.7	201499.1	207477.5	202692.3
22	205082.4	205082.4	207477.5	203886.7	208676.8	207477.5	206279.3	205082.4	203886.7	202692.3	207477.5	202692.3
23	205082.4	205082.4	207477.5	203886.7	208676.8	207477.5	206279.3	205082.4	203886.7	202692.3	207477.5	202692.3
24	205082.4	205082.4	207477.5	203886.7	208676.8	207477.5	206279.3	205082.4	203886.7	202692.3	207477.5	202692.3
25	205082.4	205082.4	207477.5	205082.4	205082.4	207477.5	206279.3	205082.4	203886.7	202692.3	207477.5	202692.3
26	201499.1	201499.1	207477.5	205082.4	205082.4	207477.5	206279.3	205082.4	203886.7	202692.3	206279.3	203886.7
27	201499.1	201499.1	207477.5	205082.4	205082.4	207477.5	206279.3	205082.4	203886.7	202692.3	206279.3	203886.7
28	201499.1	201499.1	207477.5	205082.4	205082.4	206279.3	207477.5	205082.4	203886.7	202692.3	206279.3	203886.7
29	201499.1		207477.5	205082.4	205082.4	206279.3	207477.5	205082.4	205082.4	202692.3	206279.3	203886.7
30	201499.1		207477.5		205082.4		207477.5	205082.4		203886.7		203886.7
Σ	6164487	5761489	6257917	5960569	6202774	6014459	6178808	6183600	5905552	6096323	5968951	6084385

Tushemisht S. -2012

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)
1	207477.5	209877.4	211079.3	209877.4	207477.5	209877.4	202692.3	197927.3	197927.3	200307.2	202692.3	206279.3
2	207477.5	209877.4	211079.3	209877.4	207477.5	209877.4	202692.3	197927.3	197927.3	200307.2	202692.3	206279.3
3	207477.5	209877.4	212282.3	209877.4	207477.5	209877.4	202692.3	197927.3	197927.3	200307.2	202692.3	206279.3
4	207477.5	209877.4	212282.3	209877.4	208676.8	209877.4	202692.3	199116.6	197927.3	200307.2	202692.3	205082.4
5	207477.5	209877.4	212282.3	209877.4	208676.8	209877.4	203886.7	199116.6	197927.3	200307.2	202692.3	205082.4
6	206279.3	208676.8	212282.3	209877.4	208676.8	209877.4	203886.7	199116.6	197927.3	200307.2	202692.3	205082.4
7	206279.3	208676.8	212282.3	211079.3	208676.8	209877.4	203886.7	199116.6	197927.3	201499.1	202692.3	205082.4
8	206279.3	208676.8	212282.3	211079.3	208676.8	211079.3	203886.7	199116.6	199116.6	201499.1	202692.3	205082.4
9	206279.3	208676.8	211079.3	211079.3	208676.8	211079.3	203886.7	198855	199116.6	201499.1	203886.7	205082.4
10	206279.3	208676.8	211079.3	211079.3	208676.8	211079.3	205082.4	198855	199116.6	201499.1	203886.7	206279.3
11	206279.3	208676.8	211079.3	211079.3	208676.8	211079.3	205082.4	198855	199116.6	201499.1	203886.7	206279.3
12	206279.3	208676.8	211079.3	211079.3	209877.4	211079.3	205082.4	198855	199116.6	201499.1	203886.7	206279.3
13	205082.4	207477.5	211079.3	211079.3	209877.4	211079.3	205082.4	198855	199116.6	201499.1	203886.7	206279.3
14	205082.4	207477.5	209877.4	212282.3	209877.4	209877.4	203355.9	200307.2	199116.6	202692.3	203886.7	206279.3
15	205082.4	207477.5	209877.4	212282.3	209877.4	209877.4	203355.9	200307.2	199116.6	202692.3	203886.7	206279.3
16	205082.4	207477.5	209877.4	212282.3	209877.4	209877.4	203355.9	198594.1	199116.6	203886.7	203886.7	207477.5
17	205082.4	207477.5	211079.3	213486.5	211079.3	209877.4	203355.9	198594.1	200307.2	203886.7	205082.4	207477.5
18	203886.7	208676.8	211079.3	213486.5	211079.3	209877.4	203355.9	198594.1	200307.2	203886.7	205082.4	207477.5
19	203886.7	208676.8	211079.3	213486.5	211079.3	208676.8	204815.5	198334.2	200307.2	203886.7	205082.4	207477.5
20	203886.7	208676.8	211079.3	213486.5	212282.3	208676.8	204815.5	198334.2	200307.2	203886.7	205082.4	207477.5
21	203886.7	208676.8	212282.3	213486.5	212282.3	208676.8	203091.7	198334.2	200307.2	203886.7	205082.4	207477.5
22	203886.7	209877.4	212282.3	213486.5	212282.3	208676.8	203091.7	198334.2	201499.1	205082.4	206279.3	207477.5
23	205082.4	209877.4	212282.3	213486.5	212282.3	208676.8	203091.7	198334.2	201499.1	205082.4	206279.3	206279.3
24	205082.4	209877.4	212282.3	213486.5	212282.3	207477.5	203091.7	199782.7	201499.1	205082.4	206279.3	206279.3
25	205082.4	211079.3	212282.3	214691.9	212282.3	207477.5	202828.5	199782.7	201499.1	205082.4	206279.3	206279.3
26	205082.4	211079.3	213486.5	214691.9	212282.3	207477.5	202828.5	199782.7	201499.1	206279.3	206279.3	206279.3
27	205082.4	211079.3	213486.5	214691.9	212282.3	207477.5	202828.5	199782.7	202692.3	206279.3	206279.3	206279.3
28	206279.3	211079.3	213486.5	214691.9	213486.5	207477.5	202828.5	199782.7	202692.3	206279.3	206279.3	206279.3
29	206279.3		213486.5	214691.9	213486.5	207477.5	202828.5	198594.1	202692.3	206279.3	207477.5	207477.5
30	206279.3		213486.5	214691.9	213486.5	207477.5	202566	198594.1	201499.1	206279.3	207477.5	208676.8
31	207477.5		213486.5		213486.5		202566	198594.1		206279.3		208676.8
Σ	6377915	5856169	6567528	6369709	6526676	6280731	6308584	6166403	5996149	6299048	6136954	6401857

Tushemisht - 2013

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)
1	208676.8	211079.3	217106.2	218315.1	207477.5	212282.3	206279.3	197927.3	197927.3	200307.2	202692.3	206279.3
2	208676.8	211079.3	217106.2	218315.1	207477.5	212282.3	206279.3	197927.3	197927.3	200307.2	202692.3	206279.3
3	208676.8	211079.3	217106.2	218315.1	207477.5	212282.3	206279.3	197927.3	197927.3	200307.2	202692.3	206279.3
4	208676.8	211079.3	217106.2	218315.1	208676.8	212282.3	206279.3	199116.6	197927.3	200307.2	202692.3	205082.4
5	208676.8	211079.3	217106.2	217106.2	208676.8	212282.3	206279.3	199116.6	197927.3	200307.2	202692.3	205082.4
6	208676.8	212282.3	215898.4	217106.2	208676.8	213486.5	206279.3	199116.6	197927.3	200307.2	202692.3	205082.4
7	209877.4	212282.3	215898.4	217106.2	208676.8	213486.5	206279.3	199116.6	197927.3	201499.1	202692.3	205082.4
8	209877.4	212282.3	215898.4	217106.2	208676.8	213486.5	206279.3	199116.6	199116.6	201499.1	202692.3	205082.4
9	209877.4	212282.3	215898.4	218315.1	208676.8	213486.5	206279.3	200307.2	199116.6	201499.1	203886.7	205082.4
10	209877.4	213486.5	215898.4	218315.1	208676.8	213486.5	205082.4	200307.2	199116.6	201499.1	203886.7	206279.3
11	209877.4	213486.5	215898.4	218315.1	208676.8	213486.5	205082.4	200307.2	199116.6	201499.1	203886.7	206279.3
12	209877.4	213486.5	215898.4	218315.1	209877.4	213486.5	205082.4	200307.2	199116.6	201499.1	203886.7	206279.3
13	209877.4	213486.5	214691.9	218315.1	209877.4	213486.5	205082.4	200307.2	199116.6	201499.1	203886.7	206279.3
14	209877.4	213486.5	214691.9	218315.1	209877.4	213486.5	205082.4	200307.2	199116.6	202692.3	203886.7	206279.3
15	209877.4	213486.5	214691.9	219525.2	209877.4	214691.9	205082.4	200307.2	199116.6	202692.3	203886.7	206279.3
16	209877.4	214967.9	215898.4	219525.2	209877.4	214691.9	205082.4	201499.1	199116.6	203886.7	203886.7	207477.5
17	211079.3	214691.9	215898.4	219525.2	211079.3	214691.9	205082.4	201499.1	202692.3	203886.7	205082.4	207477.5
18	211079.3	215898.4	217106.2	219525.2	211079.3	214691.9	205082.4	201499.1	203886.7	203886.7	205082.4	207477.5
19	211079.3	215898.4	217106.2	219525.2	211079.3	214691.9	205082.4	202692.3	203886.7	203886.7	205082.4	207477.5
20	211079.3	215898.4	217106.2	219525.2	212282.3	214691.9	205082.4	202692.3	203886.7	203886.7	205082.4	207477.5
21	207869.5	215898.4	217106.2	219525.2	212282.3	214691.9	206279.3	202692.3	203886.7	203886.7	205082.4	207477.5
22	207869.5	215898.4	217106.2	220736.4	212282.3	215898.4	206279.3	202692.3	203886.7	205082.4	206279.3	207477.5
23	207869.5	215898.4	217106.2	220736.4	212282.3	215898.4	206279.3	202692.3	203886.7	205082.4	206279.3	206279.3
24	207869.5	217106.2	217106.2	220736.4	212282.3	215898.4	206279.3	202692.3	203886.7	205082.4	206279.3	206279.3
25	207869.5	217106.2	217106.2	220736.4	212282.3	215898.4	206279.3	202692.3	203886.7	205082.4	206279.3	206279.3
26	207869.5	217106.2	218315.1	220736.4	212282.3	214691.9	206279.3	202692.3	203886.7	206279.3	206279.3	206279.3
27	209336.3	217106.2	218315.1	220736.4	212282.3	214691.9	206279.3	202692.3	203886.7	206279.3	206279.3	206279.3
28	209336.3	217106.2	218315.1		213486.5	214691.9	207477.5	202692.3	203886.7	206279.3	206279.3	206279.3
29	209336.3		218315.1		213486.5	214691.9	207477.5	201499.1	205082.4	206279.3	207477.5	207477.5
30	209336.3		218315.1		213486.5	214691.9	207477.5	201499.1	205082.4	206279.3	207477.5	208676.8
31	209336.3		218315.1		213486.5		207477.5	201499.1		206279.3		208676.8
Σ	6489050	5996026	6719433	5912671	6526676	6422686	6386285	6227433	6033152	6299048	6136954	6401857

Tushemisht - 2014

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)
1	205082.4	207477.5	207477.5	209877.4	208676.8	212282.3	214691.9	208676.8	206279.3	211079.3	206279.3	209877.4
2	205082.4	207477.5	207477.5	209877.4	208676.8	212282.3	214691.9	208676.8	206279.3	209877.4	206279.3	208676.8
3	205082.4	207477.5	206279.3	209877.4	209877.4	212282.3	214691.9	208676.8	206279.3	209877.4	206279.3	208676.8
4	205082.4	207477.5	206279.3	209877.4	209877.4	212282.3	214691.9	208676.8	206279.3	209877.4	206279.3	208676.8
5	205082.4	207477.5	206279.3	209877.4	209877.4	212282.3	213486.5	209877.4	207477.5	209877.4	206279.3	208676.8
6	205082.4	207477.5	206279.3	211079.3	209877.4	213486.5	213486.5	209877.4	207477.5	209877.4	206279.3	208676.8
7	203886.7	208676.8	206279.3	211079.3	209877.4	213486.5	213486.5	209877.4	207477.5	209877.4	206279.3	208676.8
8	203886.7	208676.8	205082.4	211079.3	209877.4	213486.5	213486.5	209877.4	207477.5	209877.4	206279.3	207477.5
9	203886.7	208676.8	205082.4	211079.3	209877.4	213486.5	213486.5	209877.4	207477.5	209877.4	207477.5	207477.5
10	203886.7	208676.8	205082.4	211079.3	211079.3	213486.5	213486.5	208676.8	207477.5	209877.4	207477.5	207477.5
11	203886.7	208676.8	205082.4	211079.3	211079.3	213486.5	212282.3	208676.8	207477.5	208676.8	207477.5	207477.5
12	205082.4	208676.8	205082.4	212282.3	211079.3	213486.5	212282.3	208676.8	208676.8	208676.8	207477.5	207477.5
13	205082.4	208676.8	205082.4	212282.3	211079.3	213486.5	212282.3	208676.8	208676.8	208676.8	207477.5	207477.5
14	205082.4	209877.4	205082.4	212282.3	211079.3	213486.5	212282.3	207477.5	208676.8	208676.8	207477.5	207477.5
15	206279.3	209877.4	206279.3	212282.3	211079.3	214691.9	211079.3	207477.5	208676.8	208676.8	207477.5	206279.3
16	206279.3	209877.4	206279.3	212282.3	212282.3	214691.9	211079.3	207477.5	208676.8	208676.8	207477.5	206279.3
17	206279.3	208676.8	206279.3	211079.3	212282.3	214691.9	211079.3	207477.5	209877.4	208676.8	207477.5	206279.3
18	206279.3	208676.8	206279.3	211079.3	213486.5	214691.9	211079.3	207477.5	209877.4	207477.5	207477.5	206279.3
19	206279.3	208676.8	207477.5	211079.3	213486.5	214691.9	211079.3	207477.5	209877.4	207477.5	208676.8	206279.3
20	206279.3	209877.4	207477.5	209877.4	213486.5	214691.9	211079.3	206279.3	209877.4	207477.5	208676.8	206279.3
21	206279.3	209877.4	207477.5	209877.4	213486.5	214691.9	215801.2	206279.3	209877.4	207477.5	208676.8	206279.3
22	207477.5	211079.3	207477.5	209877.4	213486.5	215898.4	215801.2	206279.3	209877.4	207477.5	208676.8	206279.3
23	207477.5	211079.3	207477.5	209877.4	209877.4	215898.4	215801.2	206279.3	211079.3	207477.5	208676.8	206279.3
24	207477.5	211079.3	208676.8	209877.4	209877.4	215898.4	215801.2	205082.4	211079.3	207477.5	208676.8	205082.4
25	207477.5	211079.3	208676.8	209877.4	209877.4	215898.4	214314.1	205082.4	211079.3	207477.5	208676.8	205082.4
26	207477.5	211079.3	208676.8	209877.4	211079.3	214691.9	208676.8	205082.4	211079.3	206279.3	208676.8	205082.4
27	206279.3	209877.4	208676.8	209877.4	209877.4	214691.9	208676.8	205082.4	211079.3	206279.3	209877.4	205082.4
28	206279.3	209877.4	208676.8	208676.8	209877.4	214691.9	208676.8	205082.4	211079.3	206279.3	209877.4	205082.4
29	206279.3		209877.4	208676.8	209877.4	214691.9	208676.8	205082.4	211079.3	206279.3	209877.4	205082.4
30	206279.3		209877.4	208676.8	211079.3	214691.9	208676.8	205082.4	211079.3	206279.3	209877.4	205082.4
31	206279.3				213486.5		208676.8	205082.4		206279.3		205082.4
Σ	6377914	5856171	6207572	6315562	6539878	6422686	6584871	6429443	6268742	6458210		6411454

Tushemisht - 2015

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)
1	205082.4	211079.3	209877.4	214691.9	217106.2	218315.1	214691.9	215898.4	221948.8	209877.4	217106.2	207477.5
2	206279.3	211079.3	209877.4	214691.9	217106.2	218315.1	214691.9	215898.4	221948.8	209877.4	215898.4	207477.5
3	206279.3	212282.3	212282.3	214691.9	215898.4	218315.1	213486.5	215898.4	221948.8	209877.4	215898.4	207477.5
4	206279.3	212282.3	212282.3	214691.9	217106.2	218315.1	213486.5	217106.2	221948.8	209877.4	215898.4	207477.5
5	206279.3	212282.3	212282.3	214691.9	217106.2	218315.1	213486.5	217106.2	223162.3	209877.4	215898.4	207477.5
6	205082.4	212282.3	212282.3	214691.9	217106.2	218315.1	212282.3	217106.2	223162.3	209877.4	214691.9	206279.3
7	205082.4	212282.3	213486.5	215898.4	217106.2	218315.1	212282.3	217106.2	223162.3	208676.8	214691.9	206279.3
8	205082.4	212282.3	213486.5	215898.4	218315.1	218315.1	212282.3	217106.2	223162.3	208676.8	214691.9	206279.3
9	205082.4	211079.3	213486.5	215898.4	218315.1	218315.1	212282.3	218315.1	223162.3	208676.8	212282.3	206279.3
10	206279.3	211079.3	213486.5	215898.4	218315.1	219525.2	211079.3	218315.1	223162.3	208676.8	212282.3	206279.3
11	206279.3	211079.3	214691.9	217106.2	219525.2	219525.2	211079.3	218315.1	221948.8	207477.5	212282.3	206279.3
12	206279.3	211079.3	214691.9	217106.2	219525.2	220736.4	211079.3	218315.1	221948.8	207477.5	211079.3	207477.5
13	206279.3	211079.3	215898.4	217106.2	219525.2	220736.4	211079.3	219525.2	221948.8	207477.5	211079.3	207477.5
14	206279.3	211079.3	215898.4	217106.2	219525.2	221948.8	211079.3	219525.2	221948.8	207477.5	211079.3	207477.5
15	207477.5	211079.3	217106.2	217106.2	219525.2	219525.2	212282.3	219525.2	220736.4	207477.5	211079.3	207477.5
16	207477.5	209877.4	217106.2	218315.1	219525.2	219525.2	212282.3	219525.2	220736.4	208676.8	211079.3	207477.5
17	207477.5	209877.4	217106.2	218315.1	219525.2	217106.2	213486.5	219525.2	220736.4	209877.4	211079.3	207477.5
18	207477.5	209877.4	217106.2	218315.1	219525.2	190818.8	213486.5	219525.2	220736.4	212282.3	211079.3	207477.5
19	207477.5	209877.4	217106.2	219525.2	219525.2	214691.9	213486.5	219525.2	220736.4	212282.3	211079.3	208676.8
20	207477.5	209877.4	215898.4	219525.2	219525.2	213486.5	214691.9	220736.4	219525.2	213486.5	209877.4	208676.8
21	207477.5	208676.8	214691.9	219525.2	220736.4	213486.5	214691.9	220736.4	219525.2	213486.5	209877.4	208676.8
22	208676.8	208676.8	214691.9	219525.2	220736.4	213486.5	214691.9	220736.4	219525.2	214691.9	209877.4	208676.8
23	208676.8	208676.8	214691.9	219525.2	220736.4	213486.5	213212.4	220736.4	219525.2	214691.9	209877.4	208676.8
24	208676.8	208676.8	214691.9	219525.2	220736.4	213486.5	213212.4	220736.4	217106.2	214691.9	209877.4	208676.8
25	208676.8	207477.5	214691.9	218315.1	219525.2	213486.5	213761.5	220736.4	217106.2	215898.4	209877.4	208676.8
26	208676.8	207477.5	215898.4	218315.1	219525.2	213486.5	212282.3	221948.8	217106.2	215898.4	209877.4	208676.8
27	209877.4	207477.5	215898.4	218315.1	220736.4	213486.5	212282.3	221948.8	214691.9	217106.2	209877.4	208676.8
28	209877.4	207477.5	215898.4	218315.1	220736.4	213486.5	212282.3	221948.8	214691.9	217106.2	209877.4	207477.5
29	209877.4		218315.1	218315.1	219525.2	213486.5	212282.3	221948.8	214691.9	217106.2	209877.4	207477.5
30	209877.4		218315.1	218315.1	219525.2	214691.9	214691.9	221948.8	214691.9	217106.2	209877.4	207477.5
31	209877.4		218315.1		219525.2		214691.9	221948.8		217106.2		207477.5
Σ	6427039	5887411	6661540	6519263	6790777	6478532	6602167	6799274	6606433	6562855	6358908	6435407

Tushemisht - 2016

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)
1	207477.5	202692.3	207477.5	207477.5	209877.4	206279.3	206279.3	208676.8	206279.3	203886.7	206279.3	207477.5
2	207477.5	202692.3	207477.5	207477.5	209877.4	206279.3	206279.3	208676.8	206279.3	203886.7	207477.5	207477.5
3	207477.5	202692.3	206279.3	207477.5	209877.4	206279.3	206279.3	208676.8	206279.3	203886.7	207477.5	207477.5
4	207477.5	202692.3	206279.3	207477.5	209877.4	206279.3	206279.3	207477.5	206279.3	205082.4	207477.5	207477.5
5	207477.5	203886.7	206279.3	208676.8	209877.4	206279.3	206279.3	207477.5	206279.3	205082.4	207477.5	207477.5
6	207477.5	203886.7	206279.3	208676.8	208676.8	206279.3	205082.4	207477.5	207477.5	205082.4	207477.5	206279.3
7	206279.3	203886.7	207477.5	209877.4	208676.8	206279.3	205082.4	207477.5	207477.5	205082.4	207477.5	206279.3
8	206279.3	203886.7	207477.5	209877.4	208676.8	207477.5	205082.4	207477.5	207477.5	205082.4	207477.5	206279.3
9	206279.3	203886.7	207477.5	212282.3	208676.8	207477.5	205082.4	207477.5	207477.5	205082.4	207477.5	206279.3
10	206279.3	203886.7	208676.8	212282.3	208676.8	207477.5	205082.4	207477.5	207477.5	205082.4	207477.5	206279.3
11	206279.3	203886.7	208676.8	212282.3	209877.4	207477.5	206279.3	205082.4	207477.5	205082.4	207477.5	206279.3
12	206279.3	205082.4	208676.8	213486.5	209877.4	207477.5	206279.3	205082.4	207477.5	205082.4	207477.5	206279.3
13	206279.3	205082.4	209877.4	213486.5	211079.3	207477.5	206279.3	205082.4	207477.5	205082.4	207477.5	206279.3
14	206279.3	205082.4	209877.4	213486.5	211079.3	207477.5	206279.3	205082.4	207477.5	205082.4	207477.5	206279.3
15	206279.3	205082.4	209877.4	213486.5	211079.3	208676.8	206279.3	205082.4	208676.8	205082.4	207477.5	206279.3
16	206279.3	205082.4	209877.4	213486.5	211079.3	208676.8	206279.3	205082.4	208676.8	205082.4	207477.5	206279.3
17	206279.3	205082.4	209877.4	212282.3	208676.8	208676.8	206279.3	205082.4	208676.8	205082.4	208676.8	206279.3
18	206279.3	205082.4	209877.4	212282.3	208676.8	208676.8	206279.3	205082.4	208676.8	205082.4	208676.8	206279.3
19	205082.4	205082.4	208676.8	212282.3	208676.8	208676.8	207477.5	206279.3	209877.4	205082.4	208676.8	206279.3
20	205082.4	206279.3	208676.8	211079.3	208676.8	208676.8	207477.5	206279.3	209877.4	205082.4	208676.8	206279.3
21	208018	206279.3	208676.8	211079.3	208676.8	207477.5	206011.4	206279.3	209877.4	205082.4	208676.8	206279.3
22	208018	206279.3	207477.5	211079.3	207477.5	207477.5	206011.4	206279.3	209877.4	205082.4	208676.8	206279.3
23	208018	206279.3	207477.5	211079.3	207477.5	207477.5	206011.4	206279.3	209877.4	205082.4	208676.8	206279.3
24	208562.1	206279.3	207477.5	211079.3	207477.5	207477.5	206011.4	206279.3	211079.3	205082.4	208676.8	205082.4
25	208562.1	206279.3	207477.5	211079.3	207477.5	207477.5	206011.4	206279.3	211079.3	206279.3	208676.8	205082.4
26	202692.3	207477.5	207477.5	209877.4	207477.5	207477.5	207477.5	206279.3	211079.3	206279.3	208676.8	205082.4
27	201499.1	207477.5	206279.3	209877.4	207477.5	207477.5	207477.5	206279.3	211079.3	206279.3	208676.8	205082.4
28	201499.1	207477.5	206279.3	209877.4	208676.8	207477.5	207477.5	206279.3	211079.3	206279.3	208676.8	205082.4
29	201499.1	207477.5	207477.5	209877.4	208676.8	206279.3	207477.5	206279.3	211079.3	206279.3	207477.5	205082.4
30	201499.1		207477.5	209877.4	208676.8	206279.3	207477.5	206279.3	212282.3	206279.3	207477.5	205082.4
31	201499.1				208676.8		207477.5	206279.3		206279.3		205082.4
Σ	6381747	5946221	6238731	6324007	6479800	6220737	6396920	6400663	6261546	6362346	6237518	6391074

Tushemisht - 2017

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	Q(m^3/day)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)
1	205082.4	209877.4	211079.3	214691.9	217106.2	218315.1	214691.9	215898.4	221948.8	211079.3	207477.5	212282.3
2	205082.4	209877.4	211079.3	214691.9	217106.2	218315.1	214691.9	215898.4	221948.8	211079.3	207477.5	212282.3
3	205082.4	209877.4	211079.3	214691.9	215898.4	217106.2	213486.5	215898.4	223162.3	211079.3	207477.5	214691.9
4	205082.4	209877.4	211079.3	214691.9	217106.2	217106.2	213486.5	217106.2	223162.3	211079.3	207477.5	214691.9
5	205082.4	209877.4	212282.3	214691.9	217106.2	217106.2	213486.5	217106.2	223162.3	209877.4	208676.8	214691.9
6	205082.4	211079.3	212282.3	215898.4	217106.2	218315.1	213486.5	217106.2	223162.3	209877.4	208676.8	214691.9
7	206279.3	211079.3	212282.3	215898.4	217106.2	218315.1	212282.3	217106.2	223162.3	207477.5	209877.4	214691.9
8	206279.3	211079.3	212282.3	215898.4	217106.2	218315.1	212282.3	217106.2	221948.8	207477.5	209877.4	217106.2
9	206279.3	211079.3	212282.3	215898.4	218315.1	219525.2	212282.3	218315.1	221948.8	207477.5	209877.4	217106.2
10	206279.3	211079.3	211079.3	215898.4	218315.1	219525.2	212282.3	218315.1	221948.8	207477.5	209877.4	217106.2
11	206279.3	211079.3	209877.4	217106.2	219525.2	219525.2	213486.5	218315.1	221948.8	203886.7	211079.3	217106.2
12	206279.3	211079.3	209877.4	217106.2	219525.2	219525.2	213486.5	218315.1	220736.4	203886.7	211079.3	217106.2
13	206279.3	211079.3	209877.4	217106.2	219525.2	219525.2	213486.5	218315.1	220736.4	203886.7	211079.3	214691.9
14	206279.3	211079.3	209877.4	218315.1	219525.2	219525.2	213486.5	218315.1	220736.4	203886.7	211079.3	214691.9
15	206279.3	211079.3	209877.4	218315.1	219525.2	218315.1	214691.9	218315.1	220736.4	203886.7	211079.3	217106.2
16	206279.3	211079.3	209877.4	218315.1	219525.2	218315.1	214691.9	218315.1	220736.4	203886.7	211079.3	214691.9
17	207477.5	211079.3	209877.4	218315.1	219525.2	215898.4	214691.9	219525.2	220736.4	203886.7	209877.4	214691.9
18	207477.5	212282.3	209877.4	219525.2	220736.4	215898.4	214691.9	219525.2	219525.2	203886.7	209877.4	214691.9
19	207477.5	212282.3	209877.4	219525.2	220736.4	215898.4	214691.9	219525.2	219525.2	205082.4	209877.4	214691.9
20	207477.5	212282.3	209877.4	219525.2	220736.4	215898.4	214691.9	219525.2	219525.2	205082.4	209877.4	214691.9
21	204549.5	212282.3	209877.4	218315.1	220736.4	215898.4	214416.7	220736.4	219525.2	205082.4	209877.4	212282.3
22	204284.3	212282.3	208676.8	218315.1	220736.4	214691.9	214416.7	220736.4	217106.2	205082.4	211079.3	212282.3
23	204284.3	212282.3	208676.8	218315.1	219525.2	214691.9	212939.1	220736.4	217106.2	205082.4	211079.3	214691.9
24	204284.3	212282.3	208676.8	218315.1	219525.2	214691.9	212939.1	220736.4	217106.2	205082.4	211079.3	214691.9
25	204284.3	212282.3	208676.8	218315.1	219525.2	214691.9	212939.1	221948.8	217106.2	205082.4	211079.3	217106.2
26	208676.8	212282.3	208676.8	217106.2	219525.2	214691.9	215898.4	221948.8	217106.2	200307.2	211079.3	217106.2
27	208676.8	212282.3	208676.8	217106.2	219525.2	213486.5	215898.4	221948.8	213486.5	200307.2	211079.3	217106.2
28	208676.8	212282.3	208676.8	217106.2	219525.2	213486.5	215898.4	221948.8	213486.5	200307.2	211079.3	214691.9
29	208676.8		208676.8	218315.1	218315.1	213486.5	215898.4	221948.8	213486.5	200307.2	211079.3	214691.9
30	208676.8		207477.5	218315.1	218315.1	213486.5	215898.4	221948.8	213486.5	200307.2	211079.3	214691.9
31	209877.4				218315.1		215898.4	221948.8		200307.2		214691.9
Σ	6398146	5917443	6302352	6515631	6784727	6503573	6637597	6794435	6589500	6362496	6302349	6667539

Tushemisht - 2018

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	Q(m^3/day)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)
1	211079.3	214691.9	220736.4	224376.9	229246.6	230466.7	231688	224376.9	214691.9	206279.3	203886.7	206279.3
2	211079.3	214691.9	220736.4	224376.9	229246.6	230466.7	230466.7	224376.9	214691.9	206279.3	202692.3	206279.3
3	211079.3	214691.9	220736.4	224376.9	229246.6	231688	230466.7	224376.9	212282.3	206279.3	202692.3	206279.3
4	212282.3	214691.9	221948.8	226809.5	229246.6	231688	230466.7	224376.9	212282.3	206279.3	202692.3	207477.5
5	212282.3	214691.9	221948.8	226809.5	229246.6	231688	230466.7	224376.9	211079.3	207477.5	202692.3	207477.5
6	212282.3	213486.5	221948.8	226809.5	229246.6	231688	228027.5	221948.8	211079.3	207477.5	202692.3	207477.5
7	211079.3	214691.9	221948.8	226809.5	229246.6	231688	228027.5	221948.8	211079.3	207477.5	202692.3	207477.5
8	211079.3	213486.5	219525.2	226809.5	231688	229246.6	228027.5	221948.8	211079.3	207477.5	202692.3	207477.5
9	213486.5	213486.5	219525.2	226809.5	231688	229246.6	228027.5	221948.8	211079.3	205082.4	205082.4	207477.5
10	213486.5	213486.5	219525.2	226809.5	231688	229246.6	228027.5	221948.8	211079.3	205082.4	205082.4	207477.5
11	213486.5	213486.5	219525.2	228027.5	231688	229246.6	228027.5	221948.8	209877.4	205082.4	205082.4	207477.5
12	213486.5	213486.5	219525.2	228027.5	231688	229246.6	228027.5	219525.2	209877.4	205082.4	205082.4	207477.5
13	213486.5	213486.5	219525.2	228027.5	230466.7	229246.6	228027.5	219525.2	209877.4	205082.4	205082.4	208676.8
14	214691.9	214691.9	219525.2	228027.5	230466.7	229246.6	228027.5	219525.2	209877.4	205082.4	205082.4	208676.8
15	214691.9	214691.9	217106.2	228027.5	230466.7	229246.6	229246.6	219525.2	209877.4	203886.7	205082.4	208676.8
16	217106.2	217106.2	217106.2	228027.5	230466.7	229246.6	229246.6	217106.2	209877.4	203886.7	205082.4	208676.8
17	217106.2	217106.2	217106.2	229246.6	230466.7	230466.7	229246.6	217106.2	209877.4	203886.7	205082.4	208676.8
18	217106.2	217106.2	217106.2	229246.6	231688	230466.7	229246.6	217106.2	207477.5	203886.7	205082.4	208676.8
19	217106.2	217106.2	217106.2	229246.6	231688	230466.7	228027.5	217106.2	207477.5	202692.3	205082.4	209877.4
20	219525.2	219525.2	217106.2	229246.6	231688	230466.7	226809.5	214691.9	207477.5	202692.3	205082.4	209877.4
21	219525.2	219525.2	219525.2	229246.6	231688	230466.7	226809.5	214691.9	207477.5	202692.3	206279.3	209877.4
22	219525.2	219525.2	219525.2	229246.6	229246.6	230466.7	226809.5	214691.9	207477.5	202692.3	206279.3	209877.4
23	219525.2	219525.2	219525.2	230466.7	229246.6	230466.7	226809.5	214691.9	207477.5	202692.3	205082.4	209877.4
24	219525.2	219525.2	219525.2	230466.7	229246.6	230466.7	226809.5	214691.9	207477.5	202692.3	205082.4	209877.4
25	219525.2	219525.2	219525.2	230466.7	229246.6	231688	226809.5	214691.9	206279.3	202692.3	205082.4	209877.4
26	219525.2	219525.2	221948.8	230466.7	229246.6	231688	226809.5	214691.9	206279.3	202692.3	206279.3	209877.4
27	219525.2	220736.4	221948.8	230466.7	229246.6	231688	229246.6	214691.9	206279.3	203886.7	206279.3	209877.4
28	218315.1	220736.4	221948.8	230466.7	229246.6	231688	229246.6	214691.9	206279.3	203886.7	206279.3	212282.3
29	218315.1		221948.8	230466.7	229246.6	231688	229246.6	214691.9	206279.3	203886.7	206279.3	212282.3
30	218315.1		221948.8	230466.7	229246.6	231688	229246.6	214691.9		203886.7	206279.3	212282.3
31	217106.2		221948.8		229246.6		229246.6	214691.9		203886.7		212282.3
Σ	6685737	6058514	6818636	6848176	7134717	6916454	7084716	6776405	6073305	6342040	6142924	6476222

Tushemisht - 2019

	January	February	March	April	May	June	July	August	Sept.	October	November	December
D	Q(m^3/day)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)	Q(m^3/d)
1	212282.3	214691.9	208676.8	207477.5	209877.4	221948.8	226809.5	217106.2	219525.2	214691.9	217106.2	226809.5
2	212282.3	214691.9	208676.8	207477.5	209877.4	221948.8	226809.5	217106.2	219525.2	214691.9	217106.2	226809.5
3	212282.3	212282.3	208676.8	207477.5	209877.4	221948.8	226809.5	217106.2	219525.2	214691.9	219525.2	226809.5
4	214691.9	212282.3	208676.8	207477.5	209877.4	221948.8	226809.5	217106.2	219525.2	217106.2	219525.2	229246.6
5	214691.9	212282.3	208676.8	207477.5	209877.4	221948.8	226809.5	217106.2	219525.2	217106.2	221948.8	229246.6
6	214691.9	212282.3	207477.5	207477.5	209877.4	224376.9	226809.5	217106.2	217106.2	217106.2	221948.8	226809.5
7	214691.9	212282.3	207477.5	207477.5	212282.3	224376.9	224376.9	217106.2	217106.2	217106.2	224376.9	226809.5
8	214691.9	209877.4	207477.5	205082.4	212282.3	224376.9	224376.9	217106.2	217106.2	217106.2	224376.9	226809.5
9	217106.2	209877.4	207477.5	205082.4	212282.3	224376.9	224376.9	214691.9	217106.2	217106.2	224376.9	229246.6
10	217106.2	209877.4	207477.5	205082.4	212282.3	224376.9	224376.9	214691.9	217106.2	217106.2	221948.8	229246.6
11	217106.2	207477.5	207477.5	206279.3	214691.9	226809.5	224376.9	214691.9	214691.9	214691.9	221948.8	229246.6
12	217106.2	207477.5	206279.3	206279.3	214691.9	226809.5	224376.9	214691.9	214691.9	214691.9	224376.9	229246.6
13	217106.2	207477.5	206279.3	206279.3	214691.9	226809.5	224376.9	214691.9	214691.9	214691.9	224376.9	231688
14	214691.9	207477.5	206279.3	206279.3	214691.9	226809.5	221948.8	212282.3	214691.9	214691.9	224376.9	231688
15	214691.9	207477.5	206279.3	206279.3	217106.2	226809.5	221948.8	212282.3	214691.9	214691.9	224376.9	231688
16	214691.9	207477.5	206279.3	207477.5	217106.2	226809.5	221948.8	212282.3	214691.9	214691.9	224376.9	229246.6
17	214691.9	207477.5	206279.3	207477.5	217106.2	226809.5	221948.8	212282.3	212282.3	212282.3	221948.8	229246.6
18	212282.3	207477.5	205082.4	207477.5	217106.2	226809.5	219525.2	214691.9	212282.3	214691.9	221948.8	229246.6
19	212282.3	207477.5	205082.4	207477.5	217106.2	226809.5	219525.2	214691.9	212282.3	214691.9	221948.8	229246.6
20	214691.9	207477.5	205082.4	207477.5	217106.2	229246.6	219525.2	214691.9	212282.3	214691.9	226809.5	229246.6
21	214691.9	207477.5	205082.4	208676.8	219525.2	229246.6	219525.2	214691.9	212282.3	214691.9	226809.5	226809.5
22	214691.9	207477.5	205082.4	208676.8	219525.2	229246.6	219525.2	214691.9	212282.3	212282.3	226809.5	226809.5
23	217106.2	207477.5	205082.4	208676.8	219525.2	229246.6	219525.2	217106.2	212282.3	212282.3	226809.5	226809.5
24	217106.2	207477.5	205082.4	208676.8	219525.2	226809.5	219525.2	217106.2	209877.4	212282.3	226809.5	226809.5
25	217106.2	205082.4	205082.4	208676.8	219525.2	226809.5	217106.2	217106.2	209877.4	212282.3	229246.6	224376.9
26	217106.2	205082.4	205082.4	208676.8	219525.2	226809.5	217106.2	217106.2	209877.4	214691.9	229246.6	224376.9
27	214691.9	205082.4	207477.5	208676.8	219525.2	226809.5	217106.2	219525.2	209877.4	214691.9	229246.6	224376.9
28	214691.9	205082.4	207477.5	209877.4	219525.2	226809.5	217106.2	219525.2	209877.4	214691.9	229246.6	224376.9
29	214691.9		207477.5	209877.4	219525.2	226809.5	217106.2	219525.2	209877.4	217106.2	226809.5	224376.9
30	214691.9		207477.5	209877.4	221948.8	226809.5	217106.2	219525.2	209877.4	217106.2	226809.5	221948.8
31	214691.9		207477.5		221948.8		217106.2	219525.2		217106.2		221948.8
Σ	6665129	5845441	6409054	6226743	6689423	6777567	6875710	6698948	6426426	6667543	6726572	7050654