Socioeconomic influence of natural disasters in the Western Balkan countries

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The Western Balkan region is a region of south-eastern Europe that presents pronounced activities of various types of natural hazards and natural disasters. This paper analyses data sets from two international databases of the main types of natural disasters namely geophysical, hydrological, climatological and meteorological disaster events during the period 1900-2008. The following have been analysed: the number of natural disaster events, natural disaster occurrence by disaster type, the total number of fatalities, the total number of affected people and the corresponding economic damages expressed as a percentage of selected types of natural disasters. The data analysis in this paper aims to confirm the importance of data collection and analysis as a foundation for planning and preparing disaster reduction programs for the Western Balkan countries.

Statistical methods applied to aftershock sequences

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Temporal distribution of triggered seismicity following a strong earthquake has been the subject of many studies that focus on applying statistics to earthquake sequences. The earthquake occurrence can be described by stochastic processes and therefore probabilistic models are developed in order to assess the seismicity rate changes resulted after a strong event. The several statistical methods that serve this purpose are based on different assumptions. The seismicity rate changes during three earthquake sequences that took place in the territory of Greece are investigated. The first is the 1981 Corinth Gulf seismic sequence, with three strong (M=6.7, M=6.5 and M=6.3) events between February 24 and March 4, the second one the 2001 Skyros Island sequence, with the main shock occurring on July 26 with M=6.3, and the last one the 2003 Lefkada Island, with a main shock of M=6.2 occurring on August 14. An attempt is made for modeling the aftershocks, as they comprise a major portion of an earthquake catalog including important information about the rate changes. Firstly, a homogeneous Poisson model is tested to fit the data, with the waiting times of the point process being exponentially distributed and the rate λ of the Poisson process constant in time. The process has no memory and any particular event is regarded as unrelated to any other. Substituting a function $\lambda(t)$ for the rate λ leads to a non–homogeneous Poisson process with intensity function $\lambda(t)$. In this case the rate parameter is time dependant and the appropriate form of the function has to be chosen in order to describe the way seismicity rate evolves with time. In the present work two forms were tested, both allowing the rate decaying as time passes. The first one is an exponential function with two unknown parameters, whereas the second one is a non-homogeneous Poisson process with a Power Law intensity function $\lambda(t)$. Because of the rate's form the particular model is also known as a Weibull process. The third statistical method applied to the data is the Autoregressive model of second order (AR(2)), which is used in time series analysis to describe stationary time series, and is a linear regression of the current value of the series against two previous values of the series. In order to apply the AR model to the above earthquake sequences, a random variable Z(t) was

considered to represent the number of earthquakes at any time t and the parameters of the model were estimated using the Yule–Walker equations.

Weathering of building stones of the Medieval Sasov Castle in Slovakia: Indication and impact of the mineral alteration

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The ruin of the medieval Sasov castle, a cultural heritage object in the Middle Slovakia, suffers from a strong deterioration. Besides the weathered binder, a reasonable part of the damages is caused by the intensive weathering of the building stone. The walls are built mainly of Neogene andesite, which is common in this area of the volcanic Stiavnicke Vrchy Mts. The sound rock is of dark grey colour, but most of the building stones have yellowish-brown coatings of iron oxyhydroxides on the surface and in the fissures. Highly macro-porous stones are most affected by the alteration. Weathering of the andesite was studied within the project VEGA 1/0413/09 of the Ministry of Education of the Slovak Republic.

The X-ray diffractometry (XRD) of the powdered weathered building stone showed that the mineral assemblage is dominated by the plagioclase andesine (63 wt%) and the main alteration product smectite (up to 22 wt%), the rest are amorphous phases/volcanic glass (13 wt%), augite (1 wt%), magnetite (1 wt%) and traces of mica. The building stone material was compared with the rock material from an old local quarry, which was assumed to be the source of the building material for the castle walls. The study with polarized light microscopy (PM) of thin sections revealed the glomeroporphyritic character of this rock, i.e. phenocrysts of the same type (here plagioclase) are partly grouping into distinct clusters. There are three types of plagioclase: 1. sound plagioclase with regular shape and typical crystal twinning, 2. phenocrysts exhibiting growth zoning, and 3. plagioclase disintegrated due to magmatic corrosion. The corrosion creates alteration rims around the plagioclase grains or intrudes the whole mineral. A secondary mineralisation can be seen in some fine cracks cutting the phenocrysts, as well. The alteration of mafic minerals (augite, magnetite, mica) resulted in opaque phases. The rock matrix is built of volcanic glass, fine-grained plagioclase and some not identified brown phases. These are probably products of a post-magmatic alteration, i.e. weathering and/or post-volcanic hydrothermal alteration processes, very common in Neovolcanites.

The results from XRD, PM and tests on physical properties confirmed a very good match of the building stone material with the most altered parts of the rock mass in the local quarry. Therefore, a comparison with the sound rock from the deeper parts of the quarry was used for the illustration of the alteration impact on the rock properties. The sound rock consists of andesine (≈ 62 wt%), the rest are amorphous phases (27 wt%), augite (8 wt%) and magnetite (3 wt%), no smectite is present. It means that amorphous phases are the most unstable components of the rock. With the alteration, smectite appears and its content is increasing (up to 22 wt%), while amorphous phases, augite, and magnetite are decreasing. A considerable part of the macro-pores is the result of selective leaching of weathering products. Total porosity increased from 2.4 % to 21.2 %, the effective porosity from 2.2 % to 15.0 % when compared with the sound rock. The uniaxial strength (tested by the point load test) dropped from 270 MPa (sound rock) to 51 MPa in the weathered, but still coherent macro-porous stone. However, the most altered building stones are almost white and disintegrate into sand. Cyclic volume changes due to smectite swelling and water freezing in the effective pores probably weaken the structure and enhance the deterioration. Both processes are supported by the high water uptake due to the high smectite content, reflected also in the results of the Enslin-Neff tests. Therefore, ruins should be prevented from the infiltrating