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THE NEW CROSS-BORDER BOUGUER ANOMALY MAP OF GREECE AND ALBANIA ACCORDING TO WGS 84

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ABSTRACT

The unification parameters of the gravity data which lead to the compilation of the cross-border Bouguer anomaly map of Albania and Greece will be presented. The specifications of the WEEGP were used.

ΠΕΡΙΛΗΨΗ

Οι παράμετροι ενοποίησης των βαρυτομετρικών δεδομένων της Αλβανίας και Ελλάδας παρουσιάζονται στην παρούσα μελέτη οι οποίοι οδήγησαν στη σύνταξη του πρώτου χάρτη Ανωμαλιών Bouguer εκατέρωθεν των συνόρων. Οι παράμετροι αυτοί είναι σύμφωνοι με τις προδιαγραφές του προγράμματος WEEGP.

1. INTRODUCTION

This study is aimed at unifying the gravity fields of Albania and Greece and intended to be extended to the rest of the Balkan Countries.

The data sets to be unified have been acquired and compiled at different periods and with different processing parameters. The Greek data are those used to compile the BOUGUER map (which is under publication from IGME by LAGIOS E., ANGELOPOULOS A., et al. 1988) and the Albanian those used by BUSHATI and others, 1984, to compile the respective map.

2. UNIFICATION PROCEDURES

2.1 Unification of networks

The most important step in the unification of different gravity data sets is the link of their 1st order networks. The data from Albania were refereed to the "0" station of Albania in Tirana.

Since the Greek 1st order network is linked to the international Gravity network through its East Air Terminal station (E 23o 44'31'' N 37o 53' 24'' h=30m Gravity value 980042.605±0.010 mgals IGSN 71) it was decided to link the "0" station of Albania to that point.

Two ZSM-II gravity meters were used to performe this operation which have 0.01 mGal sensitivity and +0.03 mGal accuracy. The itinerary Argirokastron Kakavia-Athens and the intermediate stations (Table I) were measured at repeated measuring cycles and the "0" station of Albania in Tirana obtained the value 980173.285±0,10 mGal (Bushati et al 1994).

2.2 Processing-correction parameters

The second important step is the use of a common set of processing parameters i.e. the formulas for the calculation of the Normal field and the corrections

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Table I

Station	Location Name	Average value of sides for every instrument (mGal) G - 468	G - 470	Mean value of the siders of polygon (mGal)	Absolute Gravity value (mGal)
1	ATHENS*				980042,605±010
2	Megara	2,06	2,09	2,07	
3	Likoporia	-59,18	-59,17	-59,17	
4	Dolcini	-60,84	-60,84	-60,84	
5	Antirio	-21,41	-21,42	-21,41	
6	Lisimakeia	27,30	27,38	27,34	
7	Amfilochia	36,58	36,42	36,50	
8	Hani Terovon	-23,92	-23,92	-23,92	
9	IOANNINA airport	-22,59	-22,59	-22,59	
10	Kakavia	-43,24	-43,20	43,22	
11	Jergucat	68,91	68,91	68,91	
PM-6	Gjirokastra	23,11	23,10	23,10	980055,805±010

*By R,G, Hipkin et all,, (1987)

which will be applied to obtain the unified anomaly maps. The formulas of the WEEGP project were adopted according to the Progress Report I of West-East Europe Gravity Project which both countries joined in 1993 and 1994 respectively.

According to what is reported, the main source for the height differences between different Countries with small changes in the geoid is due to the definition of the mean sea level. This fact influences the correction which is applied to obtain the anomaly maps.

In this study, we wish to quote Free air and Bouguer anomalies with at least 0.1 mGal accuracy. A height accuracy of 0.32m for Free air and 0.51m for Bouguer (density=2.67g/cm^3) is needed to give gravity 0.1 mGal accuracy.

The Word Geodetic System 1984 (WGS84) is been used to define the normal gravity formula expressed as follows:

$$\gamma 84 = 978032.67714 \frac{(1+.001931851318639 \sin^2\Phi)}{(1-.00669437999013 \sin^2\Phi)} \text{ mGal}$$

Φ=Latitude

The atmosphere correction applied is 0.87 and 0.82 for Albania and Greece respectively since the size of the area considered is negligible and the mean elevation of stations is .5Km. This is because gobs (Observed gravity) at a point on the Earth's surface is not influenced by the mass of the atmosphere above it. The formula for this correction is as follows:

$\delta gA = 0.87e - 0.116H^{1.047}$ mGal H=Kilometers

The Free air correction is a non linear function of Φ, latitude and h altitude and is calculated according to the formula (Balmino 1991).

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Free Air Correction (FAC) : $(0.3083293357 + 0.0004397732\cos^2\varphi)h + 7.2125*10^{-8}h^2$
h=altitule in meters

According to WEEGP for the elevation ranges of Europe the differences between the classic formula is 0.086 mgal/meter and that of WEEGP results in less than 1.5 mgal.

The Bouguer correction for the infinite slab of constant density and thickness is:

Bouguer correction(BC)=-0.0419*d*h mGal

Where: d(density)=2.67g/cm^3 for land

and d=2.20g/cm^3 for marine areas.

The Free Air Anomaly (FAA)=$g_{obs} - \gamma_{84} + \delta gA + FAC$

and the Simple Bouguer Anomaly(SBA)=FAA - 0.0419*d*h

Terrain Corrections (TC) were applied to the extend of 166.7Km with d=2.67 g/cm^3 for land and d=1.17g/cm^3 for marine stations.

Curvature corrections (CC) were also be applied according to WEEGP norms where the infinite slab is replaced by a spherical cap of radius equal to the outer radius of Hayford 02 zone (10 29' 58'' or 166735m) according to Cordell et all 1981 for land stations is:

CC= - $1.4639108x10^{-3}*h+3.532715*10^{-7}*h^2-4.449648*10^{-14}*h^3$ mGal

where h elevation of observation point in meters and for marine stations

CC= - 6.40427*10-4*h-1.54751*10-7*h2-4.06303*10-14*h3 mGal

where h is negative and represents water depth in meter

Finally the complete Bouguer anomaly

CBA = FAA-0,04191*d*h + TC + CC

In Table II the Normal field values, within the range 30^o to 50^o Latitude

Table II

I	degre^o	γ84	γHelmert	γGreece	I
I	30	979323,7	979320,1	979334,3	I
I	31	979402,6	979398,9	979414,1	I
I	32	979483,0	979479,3	979495,3	I
I	33	979564,8	979561,1	979577,9	I
I	34	979647,9	979644,2	979661,8	I
I	35	979732,3	979728,4	979746,8	I
I	36	979817,6	979813,8	979832,8	I
I	37	979904,0	979900,1	979919,7	I
I	38	979991,3	979987,4	980007,4	I
I	39	980079,3	980075,4	980095,8	I
I	40	980168,0	980164,1	980184,8	I
I	41	980257,3	980253,3	980274,3	I
I	42	980347,0	980343,1	980364,0	I
I	43	980437,1	980433,1	980454,0	I
I	44	980527,4	980523,4	980544,1	I
I	45	980617,9	980613,9	980634,2	I
I	46	980708,3	980704,3	980724,2	I
I	47	980798,7	980794,6	980813,9	I
I	48	980888,8	980884,8	980903,4	I
I	49	980978,7	980974,7	980992,4	I
I	50	981068,1	981064,1	981080,9	I

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N (South Greece-North Albania) are tabulated according to the respective formulas (WGS84, IGSN71, HELMERT). A considerable fluctuation between the calculated normal fields is observed between North Albania and South Greece.

The map which appear in fig 1 is the complete Bouguer anomaly map across the Albanian and Greek borders, the first computed after the linking of their gravity networks, of which it is important to note that this map is invaluable in its informational content.

3. COMMENTS

We consider the realization of the above map important since will greatly help in the understanding of the very complex geology of the area. Abnormal

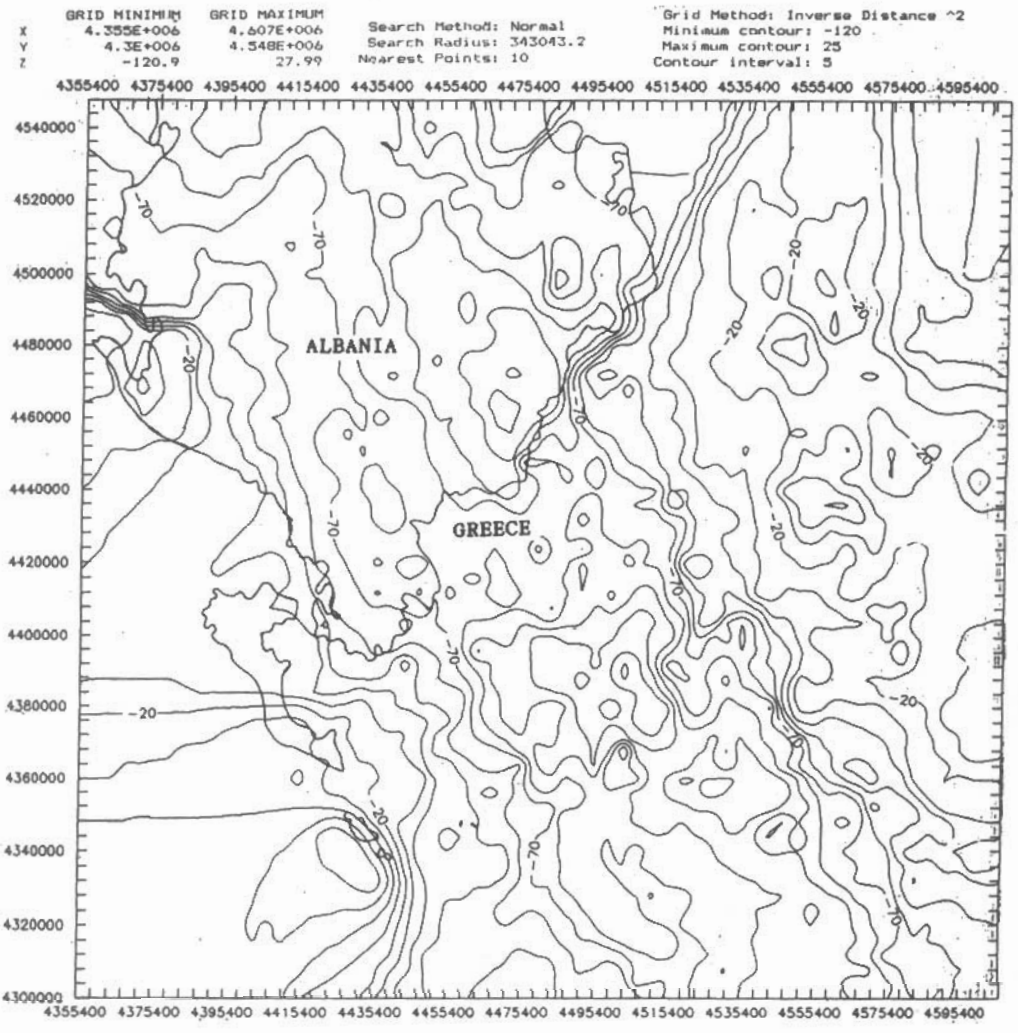

Fig.1: Complete Bouguer Anomaly map of Albanian and Greek boundary zone according to WEEGP

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features of the behaviour of isolines are readily identified on the map which previously were not.

The most important observed feature is that close to the borders where the isolines are deflected and can be related to a major tectonic event like a strike slip fault zone. It is obvious though how important the compilation of cross-border maps is. It is recommended though that the potential field data of neighbouring countries become unified for their mutual benefit.

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