

ΓΕΩΔΑΙΣΙΑ.— **The Gravity Field of Northern Greece. II. Western Macedonia**, by *L. N. Mavridis - D. Arabelos - I. Karrinti* *.

Ἀνεκοινώθη ὑπὸ τοῦ Ἀκαδημαϊκοῦ κ. Ἰωάννου Ξανθάκη.

1. INTRODUCTION

A large scale gravity survey of Greece was conducted under the auspices of the Greek National Committee for Geodesy and Geophysics in three phases between 1971 and 1975.

During the first phase (1971) the survey was conducted in the area of Attica, the Peloponnese and Kithira by the following institutions:

- a) the Department of Geodetic Astronomy, University of Thessaloniki,
- b) the Institut für Geophysik, Universität Hamburg,
- c) the National Institute of Geological and Mineral Research, Athens and
- d) the Surveying Laboratory, National Technical University, Athens.

A total of approximately 1200 stations were established. The results including free-air and Bouguer maps of the surveyed area were published by Makris et al. (1973).

During the second phase (1972 and first half of 1973) the survey was carried out by the following institutions:

- a) the Department of Geodetic Astronomy, University of Thessaloniki,
- b) the Institut für Geophysik, Universität Hamburg and
- c) the National Institute of Geological and Mineral Research, Athens,

and covered the following areas:

i) the part of the Greek mainland south of the parallel $\varphi = 40^\circ$ (approximately), which was not covered during the first phase,

ii) the part of the Greek mainland north of the parallel $\varphi = 40^\circ$ (approximately) included between the meridians $\lambda = 22^\circ 15'$ and $\lambda = 24^\circ 30'$, and

iii) the Ionian islands and the island of Euboea.

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A total of approximately 2.600 stations were established. The results have not yet been published.

The third phase (second half of 1973, 1974 and 1975) of the survey was carried out by the Department of Geodetic Astronomy, University of Thessaloniki and covered the following areas :

i) the part of Eastern Macedonia, east of the meridian $\lambda = 24^{\circ} 30'$ (including the island of Thasos),

ii) Western Thrace (including the island of Samothrace),

iii) the part of the Greek mainland north of the parallel $\varphi = 40^{\circ}$ (approximately) and west of the meridian $\lambda = 22^{\circ} 15'$, which was not covered during the second phase (Western Macedonia and part of Epirus).

In a recent paper (Mavridis et al., 1981) the results concerning Eastern Macedonia and Western Thrace have been given. In the present paper there will be presented the technical details and the evaluation and compilation into maps of the data obtained during the third phase of the survey for Western Macedonia and the northern part of Epirus.

2. SOME TECHNICAL DETAILS

The measurements were carried out by one field party equipped with :

Two LaCoste and Romberg Gravity Meters, Type G (Nos. 201 and 265).

Six Thommen Altimeters, Type 3B4.

One Land-Rover was available for the transportation of the field party.

Every topographic map 1:50.000 was covered by approximately 15-20 stations at which the gravity field and the altitude had to be measured. A total of approximately 400 stations were thus established.

2. 1. The Gravity Measurements.

A gravity net was established in Northern Greece by means of repeated measurements with two LaCoste and Romberg Gravity Meters, Type G (Nos. 201 and 265). More details about this gravity net will be

given elsewhere. Here we will only mention that the net was connected with the base point Athens, Hellenikon, East Air Terminal, Station A, for which the value (Torge, 1971)

$$g = 980058.28 \pm 0.08 \text{ mgal}$$

has been used, in accordance with Makris et al. (1973).

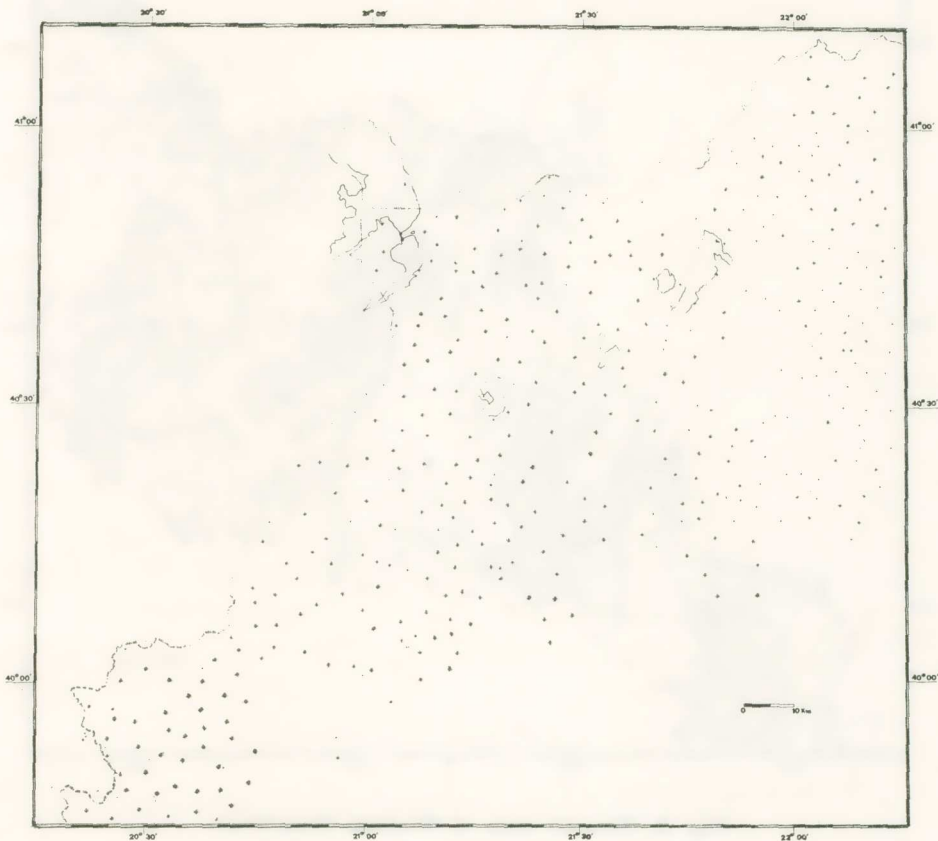


Fig. 1. Surface distribution of the gravity stations.

The field points were all connected with the stations of the net and the accuracy with which the gravity differences were obtained for the net is ± 0.03 mgal.

2.2. Altitude Measurements.

The altitudes of the stations were tied to the Greek National Levelling Net by using a set of six Thommen Altimeters (Type 3B4). In this way an accuracy of the order of $\pm 1-2$ meters was achieved for

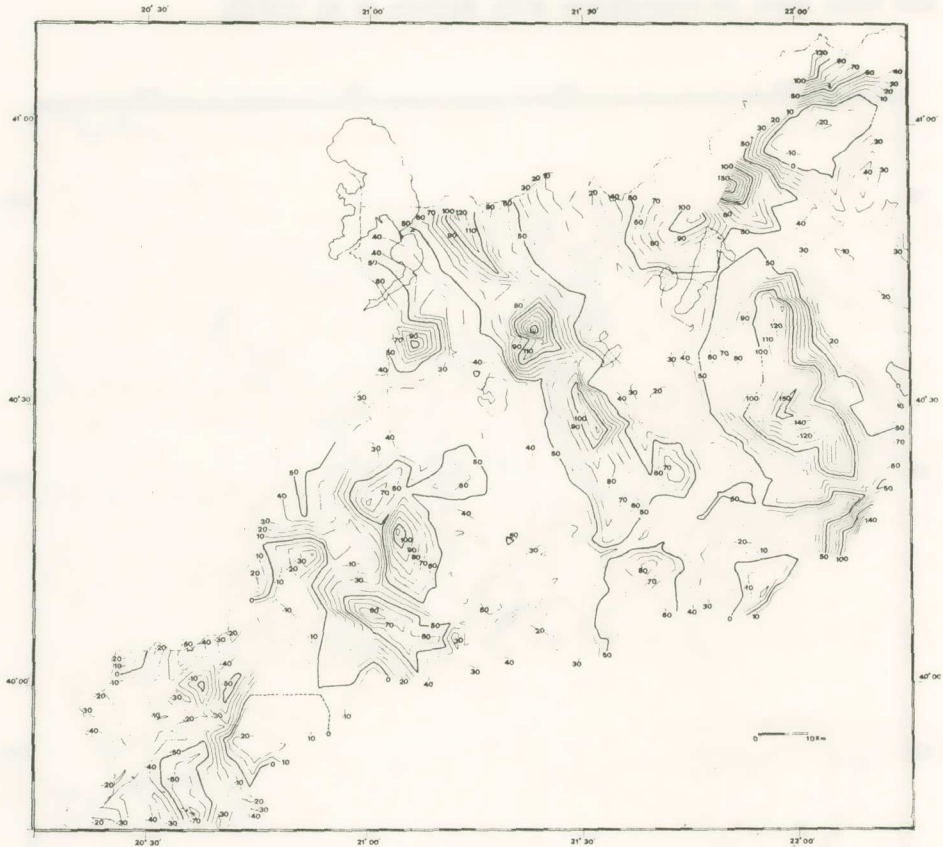


Fig. 2. Free-air map of Western Macedonia.

most of the stations. In a few cases, particularly in remote stations of the mountains, the accuracy might be between 2 - 5 meters. Such stations, however, constitute a small percentage of the survey.

Temperature measurements of the dry and moisture-saturated air were used to correct altimetrically obtained heights, which were evaluated according to the formula of Jordan, as modified by Möller (1962).

2. 3. Horizontal of Field Points.

Topographic maps of 1:50.000 scale were used for locating the field points. The geographic coordinates of the stations were estimated with an accuracy of ± 10 meters. The field points were transferred into maps of 1:200.000 scale for the final compilation of the data (Fig. 1).



Fig. 3. Bouguer map (simple) of Western Macedonia.

3. EVALUATION OF THE GRAVITY DATA

The gravity data were evaluated and reduced to free-air and simple Bouguer anomalies. Maps of 10 mgal isolines for the free-air anomalies (Fig. 2) and 5 mgal isolines for the simple Bouguer anomalies (Fig. 3) were compiled.

For the sake of homogeneity an effort has been made to perform the reduction of the data in the same general way as in the paper by Makris et al. (1973).

The gravity measurements were corrected for tidal effects. Each loop was corrected for drift, using the corresponding linear drift

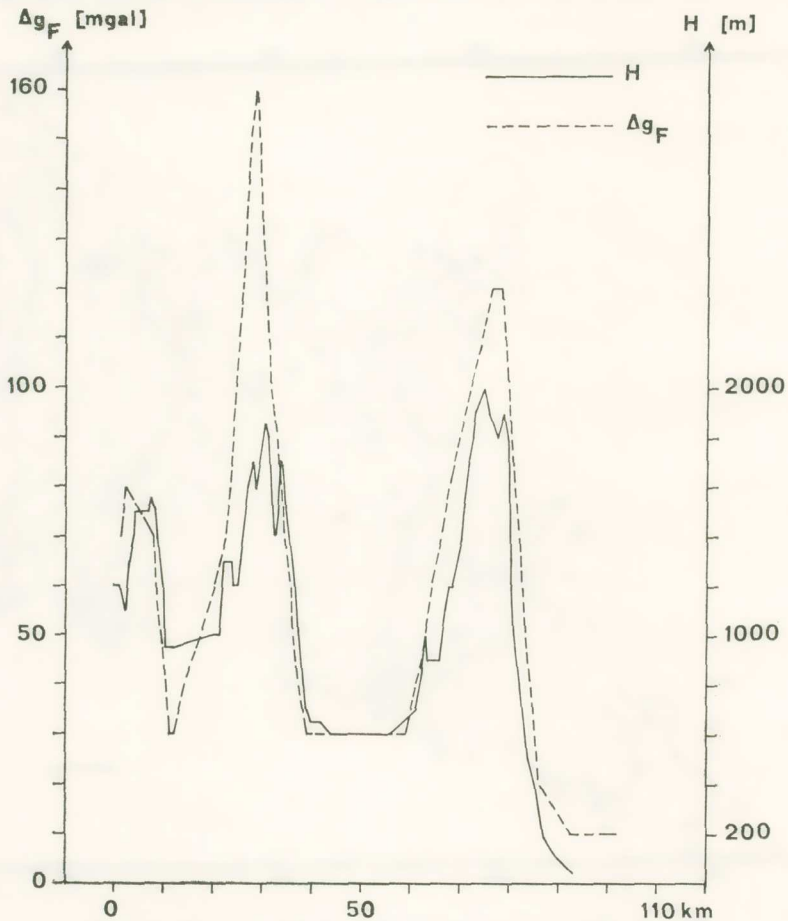


Fig. 4. Cross-section along the parallel $\varphi = 40^{\circ} 38'$.

H = elevation, Δg_F = Free-air anomaly. East is on the right.

coefficient. The values were reduced to free-air and simple Bouguer anomalies according to the formulae :

$$\Delta g_F = g - \gamma_0 + \delta g_F,$$

$$\Delta g_B = g - \gamma_0 + \delta g_F + \delta g_B,$$

where :

g = the measured gravity adjusted to the gravity net, which has been connected with the Athens, Hellenikon, East Air Terminal, Station A : $g = 980058.28 \pm 0.08$ mgal,

γ_0 = theoretical gravity according to the International Formula 1930,

δg_F = free-air reduction = $0.3086 (h_s - h_0)$ mgal, with

h_s = altitude of the gravity station,

h_0 = reduction level = 0 m,

δg_B = Bouguer plate reduction = $-0.1108 (h_s - h_0)$ mgal, corresponding to an infinitely extended horizontal plate with uniform density of 2.67 g/cm^3 .

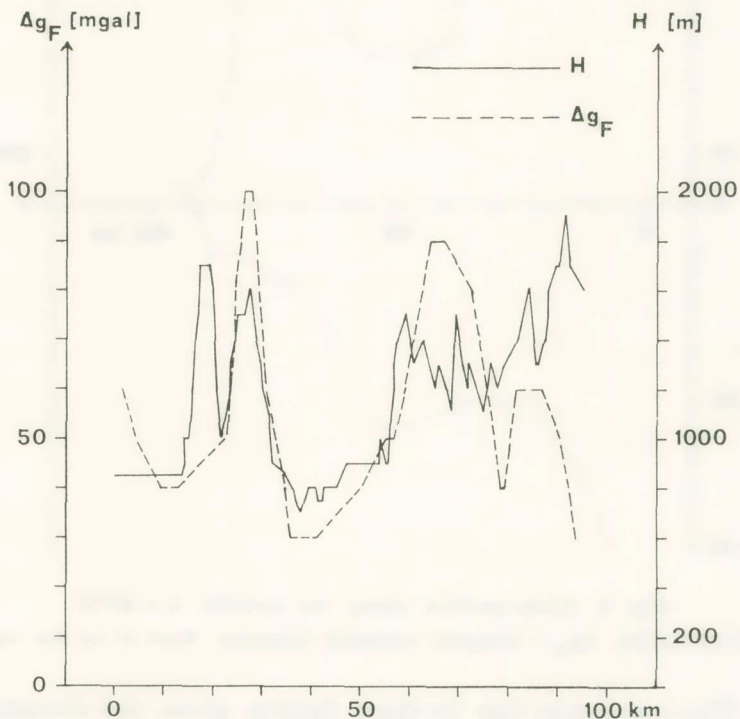


Fig. 5. Cross-section along the meridian $\lambda = 21^\circ 6'$.
H = elevation, Δg_F = Free-air anomaly. South is on the right.

4. SHORT DESCRIPTION OF THE FIELD

Figs. 4 and 5 give the cross-sections of the surveyed area (free-air map) along the parallel $\varphi = 40^{\circ} 38'$ and the meridian $\lambda = 21^{\circ} 6'$ respec-

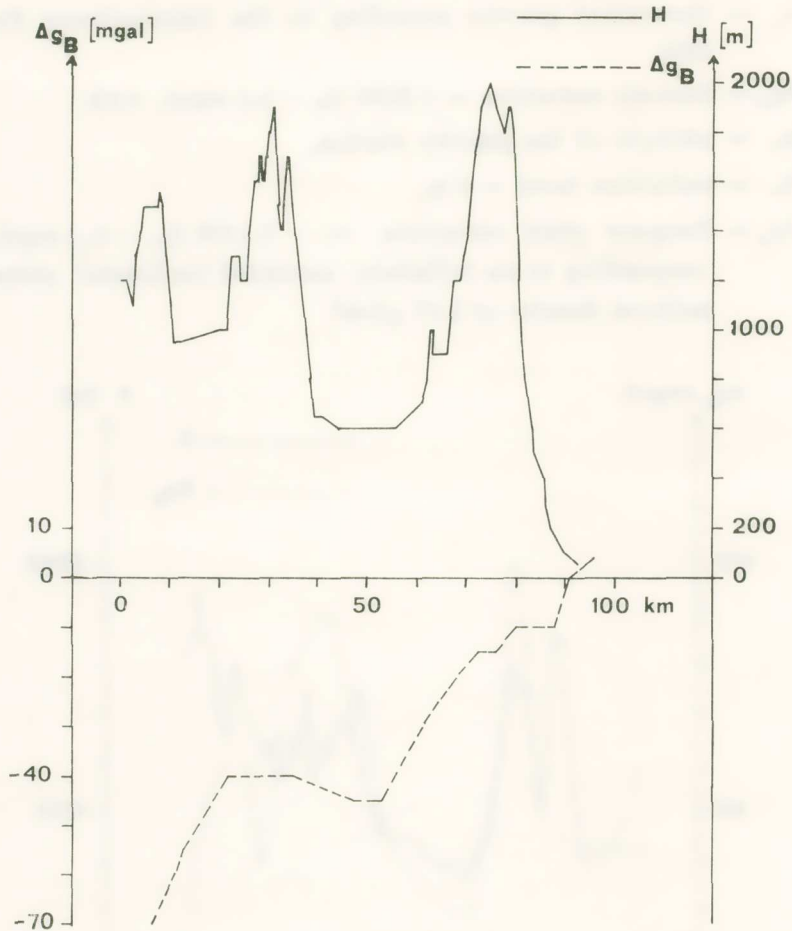


Fig. 6. Cross-section along the parallel $\varphi = 40^{\circ} 38'$.
 H = elevation, Δg_B = Bouguer anomaly (simple) East is on the right.

tively. The continuous line in these figures gives the elevation H (m) and the broken line the free-air anomaly Δg_F (mgal).

From Fig. 2 we see that in the surveyed area the free-air anomalies assume positive values. The only exceptions are the south-western part of the area and a small region in the north-eastern part, where

the free-air anomalies become negative. Furthermore, from Figs. 4 and 5 we see that along the cross-sections considered the free-air anomalies follow rather closely the topography.

Figs. 6 and 7 give the cross-sections of the surveyed area (simple Bouguer map) along the parallel $\varphi = 40^{\circ}38'$ and the meridian $\lambda = 21^{\circ}6'$

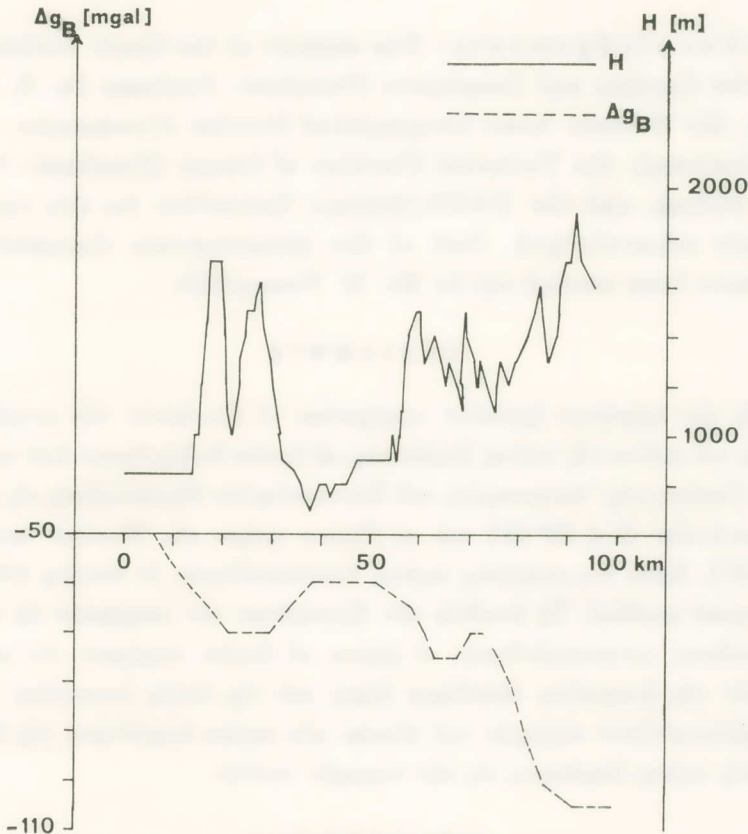


Fig. 7. Cross-section along the meridian $\lambda = 21^{\circ}6'$.

H = elevation, Δg_B = Bouguer anomaly (simple). South is on the right.

respectively. The continuous line in these figures gives the elevation H(m) and the broken line the simple Bouguer anomaly Δg_B (mgal). From Fig. 3 we see that the simple Bouguer anomalies increase continuously from high negative values in the south-western part of the surveyed area to low positive values in the north-eastern part. Furthermore, from Figs. 6 and 7 we see that contrary to the free-air anomalies

the simple Bouguer anomalies vary inversely of the topography along the meridian $\lambda = 21^{\circ} 6'$, while along the parallel $\varphi = 40^{\circ} 38'$ no clear correlation with the topography seems to exist.

A more thorough investigation of the structure of the gravity field in the area under consideration will be made in a forthcoming paper with the help of the refined Bouguer anomalies.

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Π Ε Ρ Ι Λ Η Ψ Ι Σ

Εἰς τὴν παροῦσαν ἐργασίαν παρέχονται τὰ ἐξαγόμενα τῶν μετρήσεων τῆς ἐντάσεως τοῦ πεδίου τῆς γήινης βαρύτητος, αἱ ὁποῖαι διεξήχθησαν ὑπὸ τοῦ Ἐργαστηρίου Γεωδαιτικῆς Ἀστρονομίας τοῦ Πανεπιστημίου Θεσσαλονίκης εἰς τὴν Δυτικὴν Μακεδονίαν ($\lambda < 22^{\circ} 15'$) καὶ τὸ βόρειον τμήμα τῆς Ἡπείρου κατὰ τὰ ἔτη 1974, 1975. Κατὰ τὰς μετρήσεις ταύτας ἐγκατεστάθησαν ἐν συνόλῳ 400 περίπου βαρυστροφικοί σταθμοί. Τῇ βοηθείᾳ τῶν ἐξαγομένων τῶν μετρήσεων εἰς τοὺς σταθμοὺς τούτους κατεσκευάσθησαν οἱ χάρται οἱ ὁποῖοι παρέχουν τὴν κατανομὴν τῶν τιμῶν τῆς ἀνωμαλίας ἐλευθέρου ἀέρος καὶ τῆς ἀπλῆς ἀνωμαλίας Bouguer εἰς τὴν μελετηθεῖσαν περιοχὴν καὶ γίνεται μία πρώτη διερεύνησις τῆς δομῆς τοῦ πεδίου τῆς γήινης βαρύτητος εἰς τὴν περιοχὴν ταύτην.

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