ΓΕΩΔΑΙΣΙΑ.— **The Gravity Field of Northern Greece. I. Eastern Macedonia and Western Thrace,** *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 $\varphi = 40°$ (approximately), which was not covered during the first phase,

---

* Λ. Ν. ΜΑΥΡΙΔΟΥ - Δ. ΑΡΑΜΠΕΛΟΥ - Ι ΚΑΡΡΙΝΤΗ, **Τὸ πεδίον τῆς γηίνης βαρύτητος εἰς τὴν Βόρειον Ἑλλάδα. Ι. Ἀνατολικὴ Μακεδονία καὶ Δυτικὴ Θράκη.**

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

iii) the Ionian islands and the island of Euboea.

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 $\lambda = 24°30'$ (including the island of Thasos),

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

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

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 Eastern Macedonia and Western Thrace. The data obtained for the remaining area covered during the third phase of the survey will be discussed in a forthcoming paper.

2. SOME TECHNICAL DETAILS

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

One LaCoste and Romberg Gravity Meter, Type G (No. 265).

Three 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

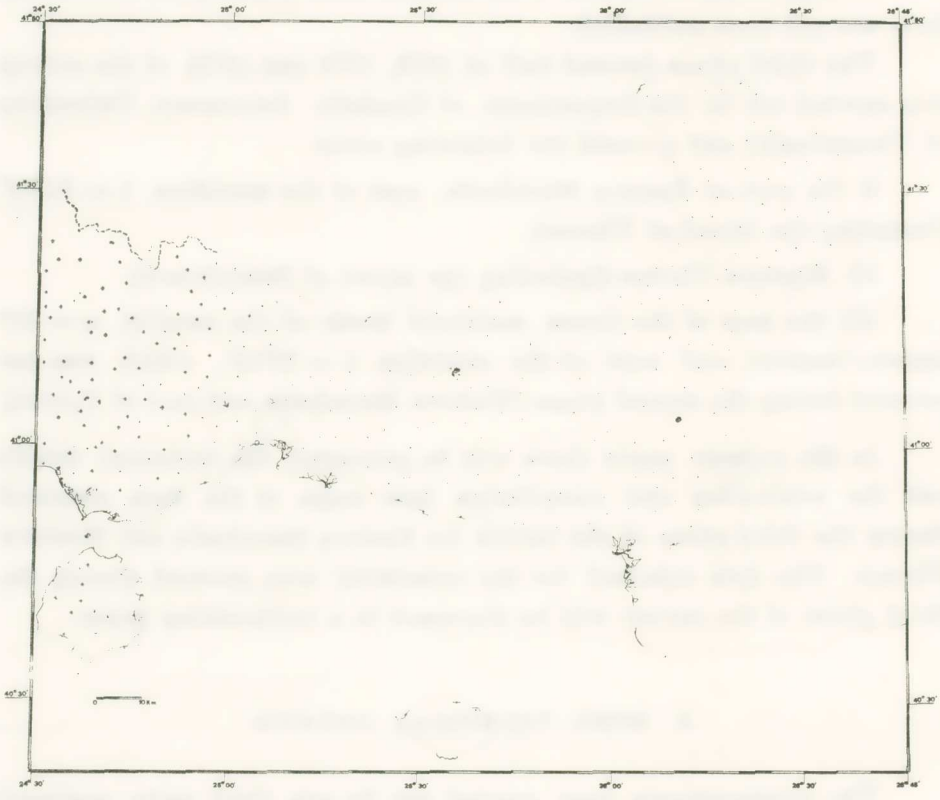

Fig. 1. Surface distribution of the gravity stations.

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).

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 $\pm$ 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 three Thommen Altimeters (Type 3B4).

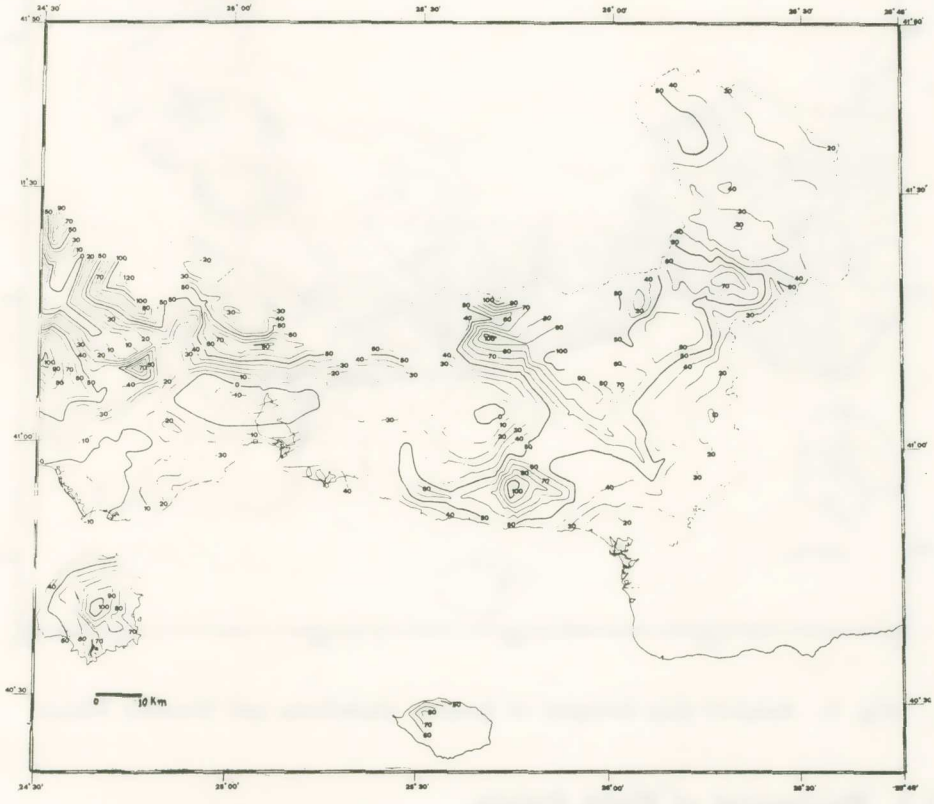

Fig 2. Free-air map of Eastern Macedonia and Western Thrace.

In this way an accuracy of the order $\pm$ 1 - 2 meters was achieved for 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 the altimetrically obtained heights, which were evaluated according to the formula of Jordan, as modified by Möller (1962).

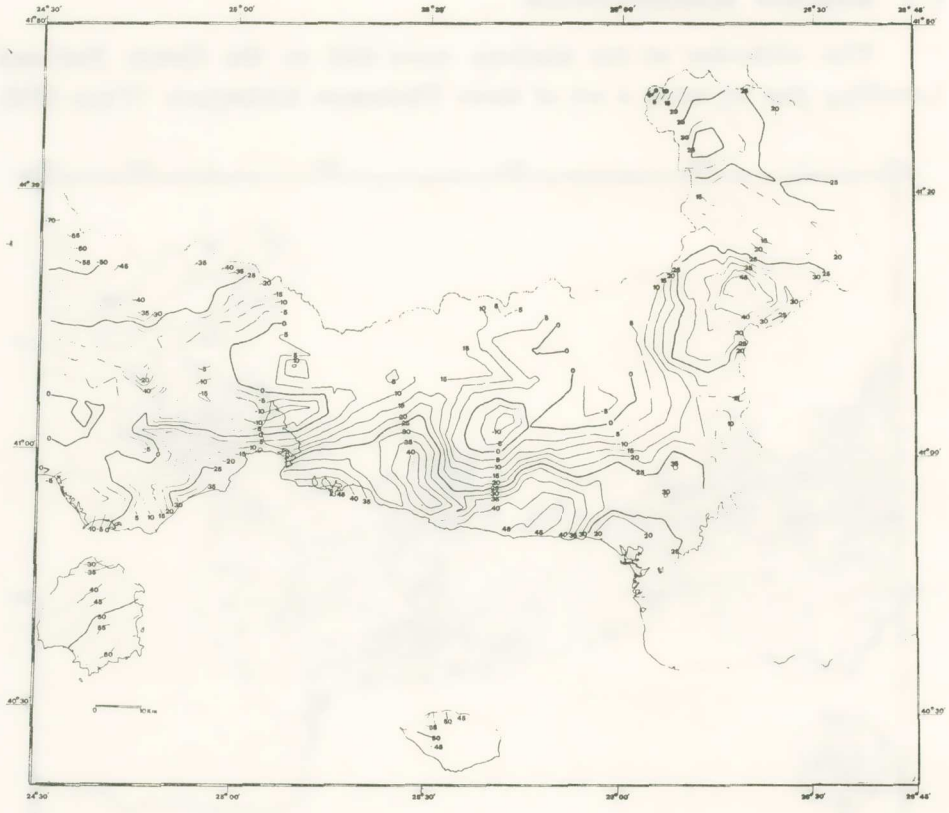

Fig. 3. Bouguer map (simple) of Eastern Macedonia and Western Thrace.

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 $\pm$ 10 meters. The field points were transferred into maps of 1 : 200.000 scale for the final compilation of the data (Fig. 1).

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 safe 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):

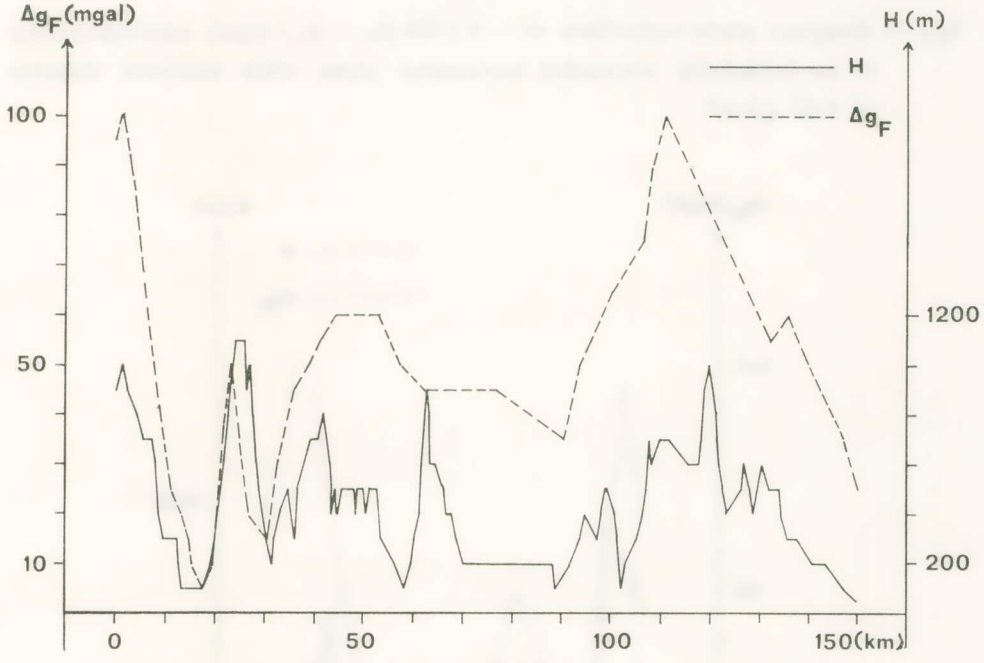

Fig. 4. Cross-section along the parallel $\varphi = 41° 10'$.
H = elevation, Δg_F = Free-air anomaly. East is on the right.

The gravity measurements were corrected for tidal effects. Each loop was corrected for drift, using the corresponding linear drift coefficient. The values were reduced to free-air and simple Bouguer anomalies according to the formulae :

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

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

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_o = theoretical gravity according to the International Formula 1930,

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

h_s = altitude of the gravity station,

h_o = reduction level = 0 m,

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

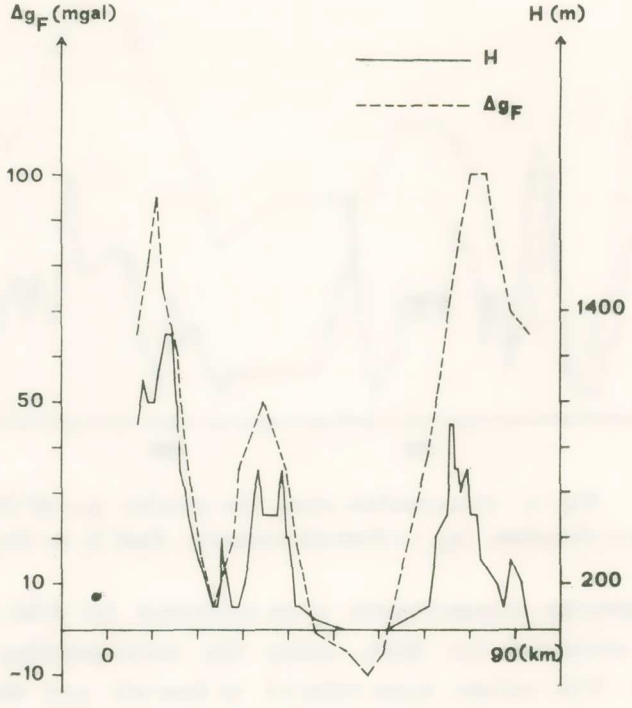

Fig. 5. Cross-section along the meridian $\lambda = 24° 40'$.
H = elevation, Δg_F = Free-air anomaly. South is on the right.

4. SHORT DESCRIPTION OF THE FIELD

Figs. 4 and 5 give the cross-sections of the surveyed area (free-air map) along the parallel $\varphi = 41°10'$ and the meridian $\lambda = 24°40'$ respectively. The continuous line in these figures gives the elevation H (m) and the broken line the free-air anomaly Δg_F (mgal).

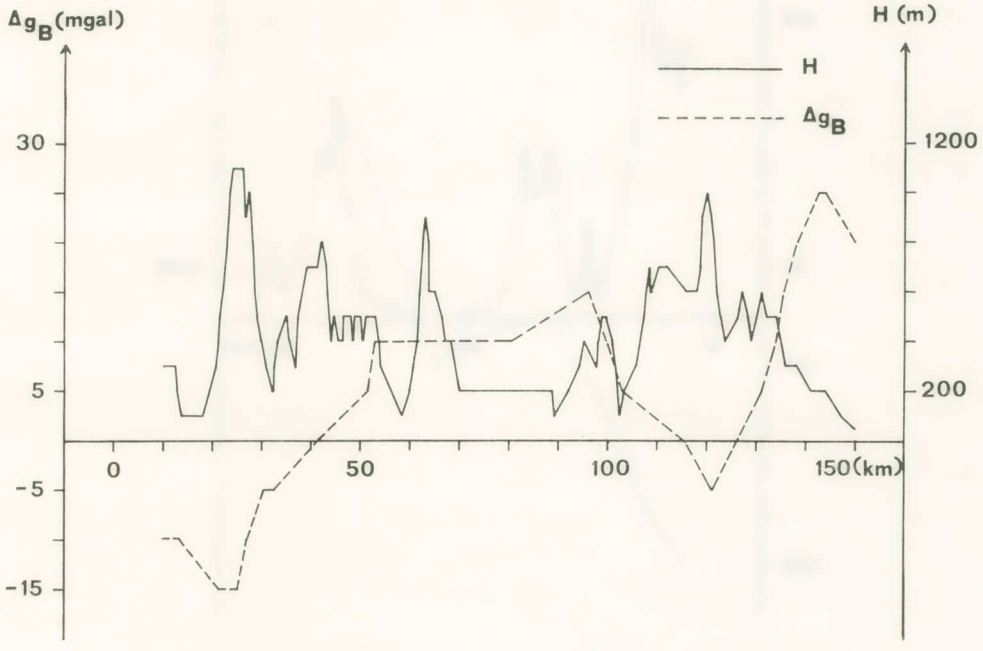

Fig. 6. Cross-section along the parallel $\varphi = 41° 10'$.
H = elevation, Δg_B = Bouguer anomaly (simple). East is on the right.

From these figures we see that the free air anomalies assume in most of the cases positive values, which follow closely the topography.

Also Figs. 6 and 7 give the cross-sections of the surveyed area (simple Bouguer map) along the parallel $\varphi = 41°10'$ and the meridian $\lambda = 24°40'$ respectively. The continuous line in these figures gives the elevation H (m) and the broken line the simple Bouguer anomaly Δg_B (mgal).

From these figures we see that contrary to the free-air anomalies the simple Bouguer anomalies assume both positive and negative values.

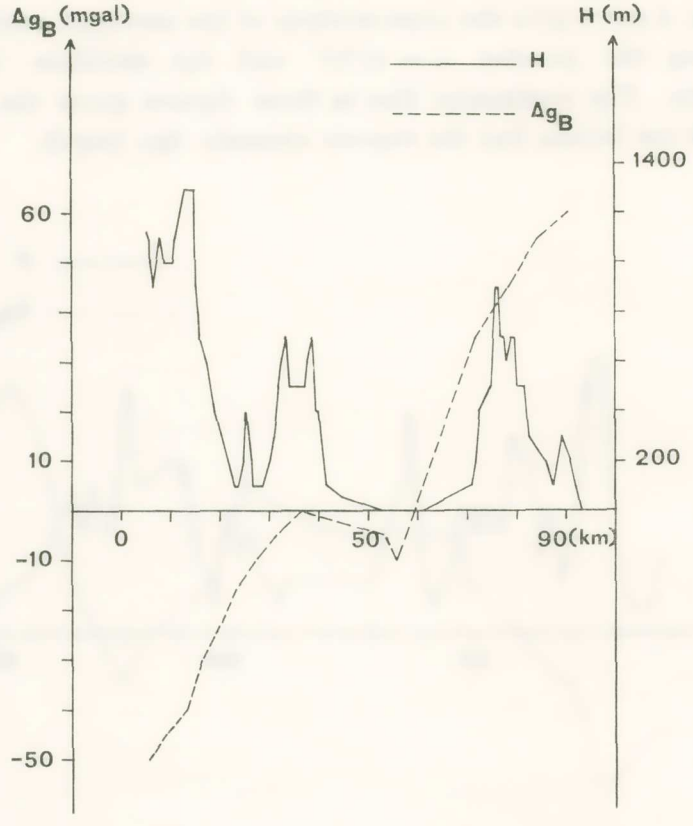

Fig. 7. Cross-section along the meridian $\lambda = 24° 40'$.
H = elevation, Δg_B = Bouguer anomaly (simple). South is on the right.

For the northern part of the area (mainland) these values vary almost inversely of the topography, while in the southern part (island of Thasos) they follow the topography.

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.

Acknowledgements: The support of the Greek National Committee for Geodesy and Geophysics (President: Professor Dr. E. Mariolopoulos), the Hellenic Army Geographical Service (Commander: General A. Contostanos), the Technical Chamber of Greece (President: Professor Dr. A. Sfikas), and the NATO/Science Committee for this research is gratefully acknowledged. Part of the measurements discussed in this paper have been carried out by M. Kessoglidis and P. Atzakis.

ΠΕΡΙΛΗΨΙΣ

Εἰς τὴν παροῦσαν ἐργασίαν παρέχονται τὰ ἐξαγόμενα τῶν μετρήσεων τῆς ἐντάσεως τοῦ πεδίου τῆς γηίνης βαρύτητος αἱ ὁποῖαι διεξήχθησαν ὑπὸ τοῦ Ἐργαστηρίου Γεωδαιτικῆς Ἀστρονομίας τοῦ Πανεπιστημίου Θεσσαλονίκης εἰς τὴν Ἀνατολικὴν Μακεδονίαν ($\lambda > 24°30'$) καὶ τὴν Δυτικὴν Θράκην κατὰ τὸ δεύτερον ἑξάμηνον τοῦ ἔτους 1973. Κατὰ τὰς μετρήσεις ταύτας ἐγκατεστάθησαν ἐν συνόλῳ 400 περίπου βαρυμετρικοὶ 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 ἁπλῆς ἀνωμαλίας Bouguer εἰς τὴν μελετηθεῖσαν περιοχὴν καὶ γίνεται μία πρώτη διερεύνησις τῆς δομῆς τοῦ πεδίου τῆς γηίνης βαρύτητος εἰς τὴν περιοχὴν ταύτην.

REFERENCES

J. Makris - L. N. Mavridis - H. Menzel - A. Stavrou and G. Veis, Zeitschrift für Geophysik **39**, 929, 1973.

D. Möller, Beiträge zur barometrischen Höhenmessung, Veröffentlichung der Deutschen Geodätischen Kommission, Reihe C, Heft 52, 1962.

W. Torge, Grossräumige Schweremessungen mit LaCoste-Romberg-Gravimeter. Veröffentlichung der Deutschen Geodätischen Kommission, Reihe B, Heft 183, 1971.