

ASSOCIATION INTERNATIONALE DE GÉODÉSIE

M. OGIER

2

BUREAU GRAVIMETRIQUE INTERNATIONAL

BULLETIN D'INFORMATION

N° 40

Mai 1977

UNIVERSITÉ PARIS VI
11, Quai Saint-Bernard - Tour 14
75005 PARIS (FRANCE)

BUREAU GRAVIMETRIQUE
INTERNATIONAL

Paris

BULLETIN D'INFORMATION

Mai 1977

N° 40

Publié pour le Conseil International des Unions
Scientifiques avec l'aide financière de l'UNESCO

Subvention UNESCO 1977 DG/2.1/414/44

T A B L E d e s M A T I E R E S

1ère PartieINTERNATIONAL GRAVITY BUREAU - Minutes of the meetings
held in February 1977, Paris.

- Meeting of the Directing Board p.I-2.
Convenor : L.E. WILCOX
- Meeting of the Working Group I :
Data processing and evaluation p.I-6.
Convenor : R.K. McCONNELL
- Meeting of the Working Group II :
World gravity standards p.I-8.
Convenor : U. UOTILA

VARIOUS INFORMATION

- A - Recent publication : "The Geophysics of the Pacific
Ocean Basin and its Margin".
A volume in the honor of G.P. WOOLLARD p.I-14.
- B - Physical interpretation of gravity anomalies -
Status Report on Activities of SSG 5:46
February 1976 to March 1977 p.I-16.
- C - Accuracy estimation for the measurement of
small gravity differences,
by H. DREWES, W. TORGE & H.G. WENZEL p.I-22.

2ème Partie

- Liste des publications reçues au B.G.I.
(Mai à Décembre 1976)
concernant les questions de pesanteur p.II-1.

I N T E R N A T I O N A L G R A V I T Y B U R E A U

MEETING of the DIRECTING BOARD

22 February 1977, Paris

Attendees :

S. CORON, Assistant Director, IGB
J.P. LEPRETRE, Member W.G.I, representing A. GERARD
J.J. LEVALLOIS, Director IGB
K. McCONNELL, representing J. TANNER, Member W.G. I and II
C. MORELLI, President
W. TORGE, Member W.G. II
U. UOTILA, Convenor W.G. II
L. WILCOX, Recorder W.G. II

The Director of the International Gravity Bureau (IGB), J.J. LEVALLOIS, summarized the work of the IGB since the last meeting of the Directing Board in February 1976. With respect to the worldwide homogeneous network of fundamental stations the IGB in conjunction with the EPB (Canada), has been collecting new and updated descriptive information on IGSN 71 station locations. Thanks to the efforts of TANNER and McCONNELL, a good set of station descriptions for IGSN 71 is being compiled for distribution by the IGB.

LEVALLOIS indicated that compilation of $1^{\circ} \times 1^{\circ}$ mean gravity anomaly values has been a major project for the IGB. It is anticipated that the first results of this project will be ready for presentation to the IGC meeting scheduled for the fall of 1978.

The $1^{\circ} \times 1^{\circ}$ mean gravity values are being derived by personnel of the IGB using published gravity anomaly maps. A $1^{\circ} \times 1^{\circ}$ mean elevation data set provided to the IGB by DMAAC is being used to convert $1^{\circ} \times 1^{\circ}$ mean Bouguer anomaly values read from the maps to $1^{\circ} \times 1^{\circ}$ mean free-air anomaly values. The desired accuracy in the final $1^{\circ} \times 1^{\circ}$ mean anomaly data set is ± 5 to ± 10 milligals. Consequently, possible differences in datum between the rather heterogeneous collection of maps being used for this project should not cause any significant problems.

In addition to the new $1^\circ \times 1^\circ$ values read from maps by the IGB, the final $1^\circ \times 1^\circ$ data set will also include $1^\circ \times 1^\circ$ values compiled from a variety of original sources. For example, $1^\circ \times 1^\circ$ values published by TALWANI for portions of the Atlantic and Pacific ocean areas will be included. In this connection, TALWANI has promised to furnish 2,500 new $1^\circ \times 1^\circ$ values in the Atlantic area to the IGB for inclusion in the final $1^\circ \times 1^\circ$ data set.

The $1^\circ \times 1^\circ$ mean anomaly values published by DMAAC will not be included in the IGB data set because the DMAAC values are readily available. However, the IGB compiled $1^\circ \times 1^\circ$ values have been compared to the DMAAC $1^\circ \times 1^\circ$ values. Occasionally, there are differences between the two sets of up to 20 to 25 milligals, even in some well surveyed areas. WILCOX pointed out that the latter, in particular, seems excessive and that both data sets would benefit if a check is made in the $1^\circ \times 1^\circ$ areas where such discrepancies occur. LEVALLOIS agreed to furnish the IGB data set to DMAAC so that the reasons for these discrepancies could be determined and the differences resolved, if possible.

The IGB listings of $1^\circ \times 1^\circ$ mean gravity anomaly data includes, for each $1^\circ \times 1^\circ$ area, the $1^\circ \times 1^\circ$ mean elevation, the $1^\circ \times 1^\circ$ mean Bouguer correction, the $1^\circ \times 1^\circ$ mean Bouguer anomaly, and area of 10° in latitude and 30° in longitude, and contains bibliographical references for sources used.

LEVALLOIS requested that all Bouguer anomaly maps be sent to the IGB as they become available so that they can be used in this project. A scale of 1:1,000,000 is optimum but maps at any scale will be helpful. The Directing Board decided that, for the purposes of $1^\circ \times 1^\circ$ mean anomaly listings, longitudes are to be reckoned from 0° to 360° east and each $1^\circ \times 1^\circ$ area is to be identified by the coordinates at its northwest corner.

In the Africa project, the objective of the IGB has been to adjust a number of fundamental national networks in Africa to the IGSN 71. To date, the network of Algeria has been adjusted and the network of Kenya has been linked to it. Both Tchad and Ghana have been readjusted. Other networks now connected to the IGSN 71 include those of Senegal, Mali, Central African Republic, Ivory Coast, Zaire, and Madagascar. The IGB has applied to UNESCO to obtain financial support for continuing this project.

MORELLI requested LEVALLOIS to prepare a report on the present state of the African project. MORELLI will present this report on behalf of the IGB at the IAG meeting to be held at Lagos on 23-25 March 1977. The report should include a request for data to the various African countries attending the meeting.

McCONNELL presented the report of IGB Working Group I. If the gravity data bank is to function at all, the whole operation must be designed so that it will work within the available human and financial resources of the IGB. Therefore, it seems advisable to adopt a basic and uncomplicated data format at this time. The objective is to establish an operating automated gravity data file as soon as possible. Then, at some later date, a more involved and comprehensive data format might be considered.

The storage and retrieval software developed and tested at BRGM is quite good and of proven reliability. The immediate problem centers on the conversion of existing data to the IGSN 71 datum and its evaluation. These operations ought to be completed before the data is inserted into the IGB data bank.

The acquisition of new data for the data bank is a separate problem. The proposed format, as published in IGB Bulletin d'Information N° 39 is so complex that many potential contributors will decide that it is impractical for them to use the format for coding their data. Therefore, a shorter, more practical format is needed for data input purposes as well as for data storage and retrieval.

The Directing Board approved the idea of a short, uncomplicated data format for the IGB gravity data bank and directed Working Group I to recommend appropriate formats. The Group was also instructed to recommend appropriate formats. The Group was also instructed to recommend which area ought to be first in having its data processed, evaluated, and inserted into the data bank. The simplified formats are to be printed in the next IGB Bulletin d'Information.

MORELLI suggested that the IGB periodically publish an inventory of gravity anomaly data available in the IGB data bank.

LEVALLOIS indicated that about 200 of the stations included in the IGB African project have good descriptions and can be reoccupied. MORELLI requested that a list of these stations be published in the next Bulletin d'Information with instructions that the IGB is to be contacted to obtain the descriptions. These reoccupable stations should be included both in the gravity anomaly and reference station files of the data base.

A. SAKUMA gave a short presentation on new absolute gravity equipment. The Italian apparatus has been used to establish 18 new stations in Europe from Hammerfest on the north to Catania on the south. The indicated accuracy of these measurements is 10 microgals. A second generation apparatus is now under development. This will weigh about 100 kilograms and be transportable by automobile. Each measurement will require about one week of observations, and the expected accuracy is 2 to 3 microgals. A prototype is currently being constructed. Eventually, the instrument will be manufactured for sale.

There was a short discussion on continued use of the milligal as opposed to adoption of S.I. units. It was decided that the problem should be presented to the IGC for decision.

UOTILA presented the report of IGB Working Group II. Good progress is being made in updating the IGSN 71 station descriptions work is proceeding on schedule. A disturbing factor is that about one third of the stations have been lost. The new South American regional adjustment, recently completed by EPB, is an excellent addition to the world base network. The details of the work will be provided to the members of the WG II for review.

The new absolute measurements at 17 stations in Europe will improve the IGSN in a new adjustment. As a result of SAKUMA's report, the Working Group must now consider the possibility of a future IGSN which includes only absolute measurements. However, the Working Group still plans to begin work on a more conventional IGSN to replace the present IGSN 71. McCONNELL and UOTILA have been appointed to prepare a plan to establish a new IGSN containing 500 to 600 well distributed stations. This plan will be submitted to the entire WG II membership for review. After Working Group agreement is reached, the plan will be presented to the International Gravity Commission for approval, and international cooperation will be requested in order to carry out the required ties. Although more studies need to be done on the mathematical model to be used for the next adjustment, dial readings will probably be used as observations. The problem of which tidal correction model to be used must also be solved. It is expected that the next IGSN will be completed in 1982 with results to be available in 1983.

MORELLI noted that the IGSN 71 description update could not have been accomplished without the excellent support which has been provided by the Canadian EPB. He then read a letter from the Director General of the Canadian National Committee recommending that EPB continue to provide the scientific and technical services for maintenance to the IGSN 71, and endorsing the participation of TANNER and McCONNELL in this effort. There was a round of applause and a general expression of thanks to TANNER and McCONNELL from all members of the Directing Board. McCONNELL was requested to extend the gratitude of the Directing Board to TANNER.

LEVALLOIS discussed the financial problems of the IGB. The Bureau has operated with a modest deficit for the past two years. However, if supporting funds can be obtained from FAGS and UNESCO, the IGB will be in pretty good shape this year.

There was a short discussion of establishing standards for the data to be included in the IGB gravity data bank. LEVALLOIS preferred putting all material into the data bank whether it has been adjusted and evaluated or not. The unevaluated data is the raw material to be used for future adjustments. McCONNELL disagreed, stating that the reputation of the IGB data bank would hinge on its ability to provide data of known quality and therefore any data released should contain quality estimation parameters. The Directing Board decided that raw data, coded to show that it is unevaluated, should be included in the data bank. The problem was referred to Working Group I to define the details.

UOTILA proposed that B. SZABO be invited to become a member of IGB Working Group II and McCONNELL proposed to appoint J.P. LEPRETRE as a member of IGB Working Group I. The Directing Board approved this action.

Luman E. WILCOX, Recorder

INTERNATIONAL GRAVITY BUREAU

MEETING of the WORKING GROUP I

DATA PROCESSING and EVALUATION

21-24 February 1977

ParisPresent :

Acting Chairman : R.K. McCONNELL
Director IGB : J.J. LEVALLOIS
Members : L. WILCOX
 : A. GERARD
 : J.P. LEPRETRE

Observers : U. UOTILA
 : S. CORON
 : B. SZABO

1. Mr. J.P. LEPRETRE of the Bureau de Recherches Géologiques et Minières was appointed as a member of Working Group N° 1 since he has been responsible for the software development for the IGB gravity data base.

2. A report on the present status of the data base was presented by Mr. LEPRETRE and both he and Mr. GERARD responded to a number of technical questions concerning format, structure and organization as well as the updating and retrieval capability of the data base. About 126,000 of a possible 450,000 stations have now been transferred from IGB files to the data base although no data have yet been transferred to IGSN 71 datum and scale and no evaluation of this data has been done. The bulk of the information in the data base pertains to Europe and Africa.

3. It is evident that the IGB has not sufficient manpower or funding to carry out the complex data analysis and adjustment procedures necessary to transform all existing data, let alone new data, to a uniform reference system. The working group therefore proposed to the representative of DMA (Dr. WILCOX) that he approach his agency to investigate the possibility of having the homogenization of IGB data performed at DMAAC, St-Louis, with subsequent return of the data to IGB for general distribution.

4. The Director of the IGB was requested to prepare a detailed index of all present holdings whether in the data base, on punched cards or magnetic tape or in manuscript form (listings, maps, etc.). This task is expected to be completed within one or two months and forwarded to DMAAC. The inventory would also be available to the public on request.

5. After consideration of the proposal to request DMAAC to provide assistance to the IGB, the Director of the IGB suggested that any relationship between the two agencies should include consideration of the following points :

- a) Details on the nature of the data evaluation process performed by DMAAC.
- b) Logistics for transmitting data between DMAAC and the IGB.
- c) No release restriction should be placed on any data processed by DMAAC for the IGB.
- d) IGB should be supplied with processing history for each data set evaluated by DMAAC.
- e) The Chairman of W.G. 1 should visit DMAAC as required to discuss priorities and provide co-ordination where deemed necessary by IGB or DMAAC.
- f) All servicing of requests should be performed by the IGB.
- g) An official of DMAAC should be appointed to liaise with the Director of IGB and the Chairman of W.G. 1.
- h) Any relationship between IGB and DMAAC should be in written form and would have to be ratified by the International Gravity Commission, the International Association of Geodesy and IAGS.

With regard to (a), WILCOX pointed out that DMAAC has already agreed (W.G. 1 meeting of February, 1976) to supply IGB with a report on the DMAAC data evaluation process.

6. A greatly simplified format for use by contributors of data to the IGB was developed. The formal description of this format for both anomaly and reference stations will be prepared by LEPRETRE and GERARD and forwarded to the IGB, through the Chairman of W.G. 1, for publication in the IGB Bulletin. This format will replace the one published in IGB Bulletin N° 39.

R.K. McCONNELL
Acting Chairman

IGB Working Group N° 1

I N T E R N A T I O N A L G R A V I T Y B U R E A U

MEETINGS of the WORKING GROUP II

WORLD GRAVITY STANDARDS

21-25 February 1977

Paris

Attendees :

S. CORON, Ex Officio Member
J.P. LEPRETRE, Guest
J.J. LEVALLOIS, Ex Officio Member
K. McCONNELL, Member
C. MORELLI, Ex Officio Member
B. SZABO, Member
W. TORGE, Member
U. UOTILA, Convenor
L. WILCOX, Member

McCONNELL reviewed progress in updating the IGSN 71 descriptions. Responses to the questionnaire requesting information on the condition of IGSN 71 stations and additional descriptive information have been received by EPB during the past year from 43 of the 108 countries which have IGSN 71 stations. EPB has begun compilation of the new descriptions, and 700 of these have been completed to date. Most of the completed descriptions are for IGSN 71 stations in South America, Australia, Germany and Canada. The file containing the digital data for IGSN 71 stations has been updated from the 43 replies received. A tape of this updated material is to be shipped to IGB during the week of 28 March 1977.

A number of problems occurred in handling the material supplied in some of the responses. Some agencies have made new measurements and some respondees requested inclusion of new stations in the IGSN 71 catalog. This cannot be done until such time as IGSN 71 is completely readjusted. In the meantime, contributors will be encouraged to submit descriptive information and measurements for potential inclusion in the next adjustment of IGSN.

There is a very high attrition rate among the IGSN 71 stations - about 1/3 have been destroyed. The attrition rate at airports is even higher. In some cases, the markers have disappeared although the sites appear to be intact. The attrition rate for stations located at churches is very low and such sites appear to be good, permanent places to locate IGSN stations.

Many of the countries which did not respond to the IGSN 71 questionnaire have no known agency which is responsible for gravity survey or gravity standardization work. UOTILA requested McCONNELL and CORON to review these cases and recommend which ones require follow-up action. Particular emphasis should be given to identifying specific individuals in each non-responding country who may be contacted individually. Members of the working group will be asked to contact these individuals to try and obtain the needed IGSN 71 updates. In addition, MORELLI will speak to a number of people representing African countries during an IAG meeting at Lagos to be held 23 - 25 March 1977.

McCONNELL explained that the digital data base for IGSN 71 contains two types of data. In addition to the digital data describing each station the data base contains the observational data set. The original dial readings, gravity differences, and time are recorded for all measurements done with LaCoste-Romberg instruments. Thus, adjustments can be based on first principles. Only gravity differences are recorded for the earlier measurements made with Worden gravimeters or pendulums.

McCONNELL recommended that destroyed stations be maintained in the digital data base if the ties to these stations might be useful in future adjustments.

On behalf of the IGC, MORELLI expressed the thanks and gratitude of the international scientific community to their Canadian colleagues, TANNER and McCONNELL, for the valuable and significant work they are accomplishing with respect to the IGSN 71.

Required gravity adjustments have been made recently in several areas of the world. LEVALLOIS reported that the IGC has established a second order gravity net in West Africa, Ghana, Zaire and Kenya. This net has been adjusted to the IGSN 71 and includes about 400 stations. The Japan Gravity Standardization Net of 1975 has been published in the Bulletin of the Geodetic Society of Japan.

McCONNELL reported on the regional adjustment of South America done at EPB. The project has been underway for the past three years and is being done in cooperation with the Inter-American Geodetic Survey. The national nets of Central America, South America and some Caribbean islands are included. LaCoste-Romberg instruments were used throughout with the exceptions of some excenter ties which were made with older instruments. There are 1,000 stations in the South American adjustments of which 240 are IGSN 71 stations. There are 6,800 measurements in the system, most of which were obtained between 1966 and 1972.

For the most part, the national nets in Latin America were established through co-operative programs between IAGS and national agencies. Most stations were established at bench marks, and they are all well documented. There are photographs for 85 % of the sites.

The South American regional adjustment is consistent in datum and scale with the IGSN 71. This was accomplished by weighting the IGSN 71 stations inversely proportional to their error estimates. Therefore, values computed for the South American net differ slightly from adopted IGSN 71 values at common stations.

EPB has recently received National network data covering the eastern portion of Brazil which will be incorporated into the final South American adjustment. An agreement has been reached between the University of Parana and the National Observatory in Rio de Janeiro to reobserve and extend the Brazilian network. McCONNELL is participating in the design of this net which will be observed with LaCoste-Romberg instruments.

The results of the South American adjustment will be presented to a PAIGH meeting to be held at Quito next August, and will probably be published in *Geophysica Panamerica*. MORELLI indicated that these results should be published with IAG endorsement. UOTILA directed that the work should be reviewed by members of IGB Working Group II, and appropriate recommendations made by them to the IAG.

There was an extended discussion about the merits of constraining regional gravity network adjustments such that IGSN 71 values are held fixed as opposed to a free adjustment where IGSN 71 values are used to establish datum and scale but are not held fixed. The first option would insure uniformity - there should only be one value for IGSN 71 stations. The second solution would provide for better internal accuracy as resulting from a freer regional adjustment. After considering a number of options the group decided to recommend the second option. The complete text of the recommendation, as adopted by the working group, is attached.

Other regional networks being revised include those in Canada (3,500 stations), Germany, The Netherlands, and Denmark. New measurements have been completed in the latter three countries and the adjustments are now in progress. TORGE has established the new first order net of 25 stations in Germany using LaCoste instruments. A precision of 0.01 mGal without outside constraints is anticipated. Japan has published a new national net (JGSN).

The group discussed the potential value of IGSN 71 to secular variation studies. It was decided that IGSN 71 cannot be used in such studies because the ties incorporated in the IGSN 71 adjustment were made over a period of many years. A future IGSN, if it is properly designed and based on measurements made over a very short time base, might be more useful. For secular variation studies, it would be more useful to analyze well located individual absolute measurements which are repeated at the same site over a period of many years.

It was decided that the IAG Special Study Group in charge of secular variation studies be contacted in order to establish a discourse with respect to the value of a future IGSN for secular variation studies. Provisions should be made for incorporation of absolute measurements made for secular variation purposes in a future IGSN adjustment. The president of the IGC was asked to make contact with the secular variation Special Study Group during its meeting scheduled for Trieste in June 1977.

McCONNELL was requested to design forms on which base stations information and new observations can be recorded by observers. These forms will be distributed by the IGB for use by gravity surveyors who are acquiring data potentially useful for future adjustments of IGSN.

On the subject of new absolute measurements, MORELLI reported that the portable Italian absolute apparatus has completed new absolute measurements at 17 sites in Europe from Hammerfest on the north to Catania on the South. The absolute accuracy of the measurements is expected to be on the order of 0.02 mGal. Results should be available in about two months.

MORELLI indicated plans for moving the Italian apparatus to Africa and requested assistance from the working group in selecting sites in Africa which should be occupied. Using a variance-covariance matrix based on existing ties, UOTILA has developed a priority list of sites. The list indicates the relative importance of new absolute measurements at various sites for improving gravity standardization within Africa. The list considers only the need for new absolute measurements in the existing IGSN 71 network in Africa. In consideration of UOTILA's computations, and recommendations by J. RECHENMANN as to suitability of sites for absolute measurements, the working group decided that the following sites are suitable for occupation by the Italian absolute apparatus :

<u>West Coast</u>	:	Casablanca
		M'bour-Dakar
		Kinshasa
		Kano (possible)
		Douala (possible)
<u>East Coast</u>	:	Cairo
		Khartoum
		Nairobi
		Lusaka
		Johannesburg
		Beaufort
		Kimberly
		Eulawayo

MORELLI pointed out that the financial arrangements have not been completed for the absolute measurements in Africa.

On the subject of new absolute measurements, UOTILA is making a study to determine sites where new absolute measurements will make the greatest contribution to improvements of IGSN 71. The results of this study can serve as a guideline for future absolute measurements.

McCONNELL and SZABO were asked to consider the establishment of a program for new absolute measurements in the Americas.

The Working Group requested McCONNELL and UOTILA to make a detailed plan for the next IGSN adjustment. The plan will be circulated to members of the working group and discussed in detail at the next meeting of the group. The plan should be ready for presentation to and approval by the IGC in September 1978. Following IGC approval, national agencies will be asked to support the plan. Target date for completion of the next IGSN adjustment in 1983. It is anticipated that the IGSN 83 will be superseded eventually by a system consisting of all absolute measurements.

There was some discussion of the mathematical model to be used for the next IGSN adjustment. UOTILA recommended inclusion of the second order gravimetric calibration term. This would require an adjustment of dial readings rather than gravity differences. TORGE will publish the mathematical model used in the German regional adjustment. McCONNELL and UOTILA were asked to include recommendations for a mathematical model in the plan for the next IGSN.

The next meeting of Working Group II was tentatively scheduled for 20 - 24 February 1978 in Paris.

Addendum : Mr. B. SZABO reported on the progress of the AFGL absolute gravity experiments as follows :

"The objective of the AFGL "second generation" instrument was primarily to reduce the size and weight of the Faller-Hammond apparatus. Its expected accuracy is 0.03 to 0.05 mGal. The improvement of this accuracy to the level of several microgals is the objective of the follow-on "third generation" instrument.

AFGL's plans call for laboratory testing of Dr. Hammond's new apparatus in Bedford and in Boulder, Colorado. These are in progress now. If successfully completed, the apparatus will be field tested at several formerly observed sites in the U.S. After we are convinced that the instrument is performing satisfactorily, we are considering a trip to Europe to compare our instrument with others for the detection of possible systematic errors. Sèvres, Teddington, Hammerfest, Torino and Catania are the stations under consideration. If everything progresses on schedule, the European measurements may be accomplished this fall or early spring of 1978.

If the measurements are successful, AFGL is ready to work out an observational plan for the use of all qualified instruments to observe absolute gravity at strategically located stations of the IGSN.

The most urgent first task would be the comparison of the qualified instruments at the earliest possible date.

Urho A. UOTILA

GUIDELINES FOR THE ADJUSTMENT OF NATIONAL AND
CONTINENTAL GRAVITY BASE NETWORKS WITHIN THE FRAMEWORK OF THE
INTERNATIONAL GRAVITY STANDARDIZATION NET 1971 (IGSN 71)

In 1971 an international gravity reference system known as the International Gravity Standardization Net (IGSN 71) was adopted by the IUGG.

Since that time several national and continental gravity networks have been observed or are in the planning stage. In order to ensure consistency of these networks with IGSN 71, Working Group N° 2 (World Gravity Standards) of the IGB, proposes the following procedures.

1. For the purpose of controlling the gravity level and scale it is recommended that a minimum of three IGSN stations spanning the gravity range of the network be included in the adjustment although two would be theoretically sufficient.
2. The gravity values of the IGSN 71 stations used should be introduced into the adjustment as observations with the appropriate elements from the variance-covariance matrix of the IGSN 71 adjustment. Agencies planning to carry out national network adjustments may request through the IGB that portion of the variance-covariance matrix corresponding to the IGSN 71 stations (identified by IGSN number) which they will include to their adjustment. Such requests will be transmitted to IGB Working Group N° 2 which will provide the necessary information directly.

Care should be taken that the national network observations are correctly weighted with respect to IGSN 71 stations.

3. Since the national network is not forced to fit IGSN 71 exactly, the adjusted national network values at the IGSN 71 stations will probably differ slightly from the IGSN 71 values. If these differences exceed four times the published standard deviation of the IGSN 71 gravity value a careful analysis should be made to determine the reason for the discrepancy.
 4. When publishing results of national network adjustment, both the IGSN 71 value and the adjusted value from the national net should be shown for the IGSN 71 stations used. National network gravity values should be designated as such as "gravity values in the IGSN 71 system". The term "IGSN 71 gravity value" is reserved for stations in the IGSN 71 catalog.
 5. The original observations and the variance-covariance matrix from the national network adjustment should be saved for possible use in future adjustments of IGSN.
 6. Published results of adjustments should be transmitted to the IGB.
 7. Agencies wishing assistance in planning or adjustment of a national gravity network may contact the IGB who will forward the requests to IGB Working Group N° 2 for consideration. Apparent discrepancies in IGSN 71 gravity values should be reported through the same Channels.
 8. It is strongly recommended that planning of new absolute measurements be coordinated with IGB Working Group N° 2.
-

- A -

RECENT PUBLICATION

"The Geophysics of the Pacific Ocean Basin and its Margin".

A volume in honor of George P. WOOLLARD.

American Geophysical Union, Geophys. Monograph 19, 480 p,
Washington D.C., 1976.

"The papers included in this volume were originally presented at the
International WOOLLARD Symposium held in Honolulu, Hawai'i (December 1974)".

They concerned different branches of Geophysics.

We are indicating hereunder, some titles of these papers.

I - GRAVITY AND GEODESY

1. Gravity Investigations of the Subduction Zone. J.L. WORZEL
2. Gravity Field of the Northwest Pacific Ocean Basin and its Margin.
A.B. WATTS, M. TALWANI & J.R. COCHRAN
3. Gravity Measurements near Japan and Study of the Upper Mantle beneath
the Oceanic Trench Marginal Sea Transition Zones. J. SEGAWA & Y. TOMODA.
4. Airy-Woollard Isostasy. L.E. WILCOX
5. A Simulation Study for Sub-Meter Geodesy in the Pacific Basin. P. MORGAN.
6. Regional Gravity of Peru. (abstract). L. OCOLA & H. ALEMAN.

II - SEISMOLOGY

7. Seismological Studies of the Pacific Area. Introduction to Session 2.
J.I. EWING & J.E. OLIVER.
8. Crustal Structure of the Peru-Chile Trench : 8° - 12°S Latitude.
D.M. HUSSONG, P.B. EDWARDS, S.H. JOHNSON ...
9. Geometry of the Nazca Plate and its Geodynamic Implications. R. RODRIGUEZ,
E. RAMON CABRE, S.J. & AUGUSTO MERCADO.
10. Project Narino III : Refraction Observation Across a Leading Edge, Malpelo
Island to the Colombian Cordillera Occidental. R.P. MEYER, W.D. MOONEY,
A.L. HALES ...
11. Attenuation of Rayleigh Waves along the East Pacific Ridge. (abstract).
E. KAUSEL & F. SCHWAB.
12. Observation of Earthquakes and Explosions at the Bottom of the Western
Pacific: Structure of Oceanic Lithosphere Revealed by Longshot Experiment.
T. ASADA & H. SHIMAMURA.
13. Ocean-Bottom Seismograph Study of the Western Margin of the Pacific.
S. NAGUMO & J. KASAHARA.
14. Seismic Activity on the Island of Hawai'i, 1970 to 1973. R.Y. KOYANAGI,
E.T. ENDO & P.I. WARD.

III - MAGNETISM

...

IV - MARINE GEOLOGY AND TECTONICS

...

V - VOLCANOLOGY AND PETROLOGY

...

VI - TECTONOPHYSICS

33. Transformations in Descending Plates : Implications for Mantle Dynamics and Differentiation. A.E. RINGWOOD.
34. Mineralogic Distribution of Iron in the Upper Half of the Transition Zone in the Earth's Mantle. S.I. AKIMOTO, M. AKAOGI, K. KAWADA ...
35. Elastic Properties of Selected Ophiolitic Rocks from Papua New Guinea : Nature and Composition of Oceanic Lower Crust and Upper Mantle. L.W. KROENKE, M.H. MANGHNANI, C.S. RAI ...
36. Thickening of the Oceanic Lithosphere. T. YOSHII, Y. KONO & K. ITO.
37. Lithospheric Flexure, Analysis of Gravity Anomalies, and the Propagation of Seamount Chains. R.I. WALCOTT

Epilogue.

References.

Subject index.

- B -

PHYSICAL INTERPRETATION OF GRAVITY ANOMALIES

Status Report on Activities of SSG 5:46

February, 1976 to March 1977

In May, 1976, a letter was circulated to the study group members. In the letter the following activities were suggested :

"In a recent report to the President of Section V I have suggested the following activities to be undertaken :

- 1) Prediction of gravity in unsurveyed areas.
- 2) The study of the relationship between gravity and geology/geophysics/topography.
- 3) Other problems to be studied are seismic velocity, crustal age, heat flow, gravity, crustal spreading rate, hot spots, temperature, and pressure.
- 4) The organization in Aarhus of a symposium/conference/meeting/workshop in either fall 1977 or spring 1978 dealing primarily with the role of density.

In this respect I have asked Dr. Luman WILCOX, DMA, St-Louis, to take care of point 1. I suppose that most members have an interest in points 2 and 3, and I would appreciate your comments and contributions to these two items. Concerning point 4 I would like to ask for your opinion whether a symposium of this kind should take place. In case you are in favour of the symposium, please, indicate if fall (October) 1977 or spring (April/May 1978) should be preferred. Please also indicate name and address of persons who should be approached.

I would appreciate to receive your answer before July 1st, 1977".

Re 1)

Dr. L. WILCOX has agreed to set up a special subcommittee on gravity prediction, and the proposed program and study areas for SSG 5:46 subcommittee on gravity prediction are :

Development and improvement of gravity prediction methods (conventional, statistical, and geophysical) for application in surveyed or unsurveyed areas, both continental and oceanic.

- 2) Development of more rigorous formulations to enable expression of the accuracy of completed gravity predictions.
- 3) Applications of gravity prediction methods to produce gravity anomaly values, deflection of the vertical, etc.
- 4) Development of combined statistical - geophysical approaches to the gravity prediction problem.
- 5) Development of global surface gravity models using surface measurements and prediction methods.

The members of the subcommittee on gravity prediction are :

Dr. Kenneth I. DAUGHERTY
Defense Mapping Agency
ATTN : PPS
U.S. Naval Observatory, Bldg. 56
WASHINGTON, DC. 20305
(U.S.A.)

Prof. Dr. E. GROTEN
Technische Hochschule Darmstadt
Astronomische Geodäsie und Satellitengeodäsie
61 DARMSTADT, Petersenstrasse 13
(Federal Republic of Germany)

Dr. Gérard LACHAPELLE
Physical Geodesy, Geodetic Survey
Surveying and Mapping Energy
Mines and Resources Canada
615 Booth Street
OTTAWA, Ontario K1A 0E9
(Canada)

Prof. Richard H. RAPP
The Ohio State University
Department of Geodetic Science
1958 Neil Avenue
COLUMBUS, Ohio 43210
(U.S.A.)

Mr. William E. STRANGE
Chief, Gravity, Astronomy and Satellite Branch
National Oceanic and Atmospheric Administration
National Ocean Survey
ROCKVILLE, Maryland 20852
(U.S.A.)

Dr. C.C. TSCHERNING
Geodaetisk Institut, Geodaetisk Afdeling 1
Gamlehave Alle 22
DK-2920 CHARLOTTENLUND, COPENHAGEN
(Denmark)

Dr. Luman E. WILCOX
Defense Mapping Agency Aerospace Center
ATTN : GDG
St-LOUIS AFS, Missouri 63118
(U.S.A.)

Professor George P. WOOLLARD
University of Hawaii at Manoa
Hawaii Institute of Geophysics
2525 Correa Road
HONOLULU, Hawaii 96822
(U.S.A.)

Re 2) and 3)

Dr. R.T. HAWORTH has informed me that the Atlantic Geoscience Centre has three activities with relevance to the topics :

- Inversion of gravity data to produce crustal models of continental margins.
- Relationship between marine gravity and seismic refraction data.
- Relationship between gravity and geology in the Appalachians.

Dr. SIIKARLA reports that series of age determinations and heat flow measurements have been carried out. Attempts have been made to interpret regional Bouguer anomalies on the basis of density values from surface rocks, or if the explanation of the gravity anomalies is to be found in rocks at greater depth.

Dr. GIBB has informed me that much work is going on in Ottawa, e.g. a study of gravity anomalies associated with structural province boundaries in the Canadian Shield, gravity anomalies over anorthosites at Morin and Kiglapait in the Shield, a comparison of global gravity and magnetic anomalies and plate motions, studies of subsidence in the Sverdrup Basin (Arctic) and other basins, gravity studies of impact craters, studies of the relationships between gravity anomalies and topography in Canada. Our seismic and heat flow and geomagnetic groups are also active in many of these areas.

Dr. WILCOX has published a paper on "Gravitational Modeling", which is a review of the direct problem of gravitational interpretation.

From Dr. KAHLE I have received the information that he and Dr. WERNER are interested in the relationship between temperature and density.

Professor TORGE has a special interest in investigations about regional gravimetric geoid calculations and about time variations of gravity.

Professor WOOLLARD suggests that besides the topics mentioned in my circular letter also the state of knowledge on secular changes in gravity as related to tectonic provinces is looked upon.

Professor GROTEN has informed me that he is continuing the general regression study by supplementary detailed investigation in the southwestern part of Germany.

In Aarhus we have been engaged in the determination of heat conductivity, temperature gradients and density. Density values from the eastern Oslo Graben together with gravity values have been used in tectonic studies.

Re 4) Answers from the members gave the following results

2 in favour of fall 1977
3 in favour of spring 1978
2 in favour of either fall 1977 or spring 1978.

Under these circumstances I have been very hesitant to summon a meeting here in Aarhus. However, in the recent months I have had the opportunity at various meetings to discuss this problem with colleagues, and they have persuaded me that the meeting should be arranged. I, therefore, suggest that the meeting (symposium) should take place in Aarhus on May 9-11, 1978 or May 9-12, 1978, if Dr. WILCOX would like to have at least a whole day for his gravity prediction.

The preliminary programme could then be composed as follows :

- One day with density in relation to other geophysical properties
- One day with gravity in relation to crustal studies
- One day with secular variations in gravity related to geology
- and possibly one day with gravity prediction.

A letter of invitation will be worked out in the very near future.

The present membership list is as follows :

Dr. A.A. CERRATO
Instituto de Geodesia
Facultad de Ingenieria
Universidad de Buenos Aires
Paseo Colón 850
BUENOS-AIRES
(Argentina)

Dr. R.T. HAWORTH
Atlantic Geoscience Centre
Geological Survey of Canada
Bedford Institute of
Oceanography, Box 1006
DARTMOUTH, Nova Scotia
(Canada)

Professor Dr. T. SIIKARLA
Geological Survey of Finland
SF-02150 OTANIEMI
(Finland)

Professor Dr. W. TORGE
Lehrstuhl und Institut für
Theoretische Geodäsie
3 HANNOVER
Nienburger Strasse 6
(West Germany)

Professor Dr. G.P. WOOLLARD
Hawaii Institute of Geophysics
2525 Correa Road
HONOLULU 14, Hawaii 96822
(U.S.A.)

Professor Dr. E. GROTEN
Astronomische Geodäsie und
Satellitengeodäsie
Technische Hochschule Darmstadt
61 DARMSTADT
Petersenstrasse 13
(West Germany)

Dr. C. GANTAR
Osservatorio Geofisico Sperimentale
Viale R. Gessi, 4
I-34123 TRIESTE
(Italy)

Professor Dr. N.A. KHAN
Computer Sciences Corp.
System Sciences Div.
8728 Colesville Road
SILVER SPRING, 20910 Maryland
(U.S.A.)

Dr. R.A. GIBB
Gravity and Geodynamics Division
Earth Physics Branch
1, Observatory Crescent
OTTAWA, Ont. K1A 0Y3
(Canada)

Dr. L.E. WILCOX
Gravity Correlation Branch
Defense Mapping Agency
Aerospace Center
St-LOUIS AFS, Mis. 63118
(U.S.A.)

Dr. H.G. KAHLE
Institut für Geophysik
Postfach 266
ETH-Hönggerberg
CH-8049 ZURICH
(Switzerland)

Non-participating members to be kept informed of SSG's activities :

Dr. S. CORON
Bureau Gravimétrique International
4, Place Jussieu, tour 14
75230 PARIS Cedex 05
(France)

Professor Dr. E. TENGSTROM
Geodetiska Institutionen
Uppsala Universitet
Hällby
S-755 90 UPPSALA
(Sweden)

Dr. W.F. REILLY
Geophysics Division
Dept. Sci. & Ind. Res. N.Z.
Salamanca Road
Kelburn, Box 8005
WELLINGTON
(New-Zealand)

May, 1977

Svend SAXOV
Professor

ACCURACY ESTIMATION FOR THE MEASUREMENT OF SMALL GRAVITY DIFFERENCES

by Hermann Drewes, Wolfgang Torge and Hans-Georg Wenzel *)

Summary

A gravity network consisting of 17 points with gravity differences less than 2.2 mGal has been established in Hannover and its surroundings (Federal Republic of Germany). Gravity measurements have been carried out during 1976 with three LaCoste-Romberg model G gravity meters and one LaCoste-Romberg model D instrument. The root mean square errors of observed gravity differences do not differ significantly from other networks with large gravity differences.

1. Introduction

The influence of errors in calibration of gravity meters is reduced at small gravity differences. Therefore some authors propose to use only small gravity differences for the study of gravity variations (GERSTENECKER 1973, KIVINIEMI 1974). The purpose of this investigation was to estimate the accuracy of LaCoste-Romberg gravity meters at the measurement of small gravity differences and to compare the results with the well known accuracy of the measurements in large networks. During 1976 we have established a network of 17 gravity stations in Hannover and its surroundings. Fifteen stations are located at the outside of churches on stable stone plates, two points are located in cellar rooms of the Technical University of Hannover. The maximum distance between the points is 20 kilometers, the maximum gravity difference is 2.24 mGal. The points should be stable in height and in gravity, the influence of ground water variation should not exceed some microgal.

2. Evaluation of gravity observations

Gravity observations have been carried out during 1976 with LaCoste-Romberg gravity meters

- model D No. 14 (capacitive readout)
- model G No. 79 (optical readout)
- model G No. 85 (optical readout)
- model G No. 298 (capacitive readout)

by seven different observers. The number of observed gravity differences

*) Institut für Theoretische Geodäsie, Technische Universität Hannover

was 235, the network scheme is given in fig. 1. The mean of the readings at each point has been converted to mGal values by manufacturers calibration tables and transformed to IGSN 71 scale by linear calibration functions (Table 1). Tidal corrections have been computed using CARTWRIGHT and EDDEN (1973) tidal potential development and tidal parameters from earth tide observations at Hannover (TORGE and WENZEL 1975), the estimated accuracy of tidal corrections is $\pm 1 \mu\text{Gal}$. Gravity differences have been computed and introduced into least squares adjustment, no rejection of data has been made. The observed gravity differences have been introduced with equal weights for the same gravity meter, the gravity meter weights have been computed from the residuals after least squares adjustment. The network has been adjusted with two different solutions: solution 1 with fixed point No. 1 and solution 2 as free network (MITTERMAYER 1971). The adjusted gravity values and their root mean square errors are given in Table 2. The root mean square errors of adjusted gravity values of solution 1 are in the order of $\pm 2 \dots \pm 4 \mu\text{Gal}$, the average r.m.s.e. is $\pm 4 \mu\text{Gal}$. For solution 2 (free network adjustment) the root mean square errors of adjusted gravity values are in the order of $\pm 2 \dots \pm 3 \mu\text{Gal}$, the average r.m.s.e. is $\pm 3 \mu\text{Gal}$. The root mean square errors of weight unit (single measurement of a gravity difference) for the different gravimeters are given in Table 3; they vary from $\pm 11 \dots \pm 16 \mu\text{Gal}$. The comparison of the root mean square errors of weight unit with the results, obtained with the same gravimeters in networks with larger ($\leq 400 \text{ mGal}$) gravity differences (Table 3) shows no significant improvement at the Hannover net.

3. Conclusions

The accuracy of gravity observations does not improve significantly by observing small gravity differences. With carefully calibrated instruments, the same order of observation accuracy can be obtained for gravity differences in the range of $0 \dots 400 \text{ mGal}$.

The stability and accuracy of the observed gravity network Hannover is a good basis for future instrumental tests and for the estimation of observation accuracies. The influence of calibration errors and of short periodic spindulum errors should be reduced to the level of some microgals due to the use of four different gravity meters. The use of this gravity network is open to everyone interested in testing gravity meters at small gravity differences.

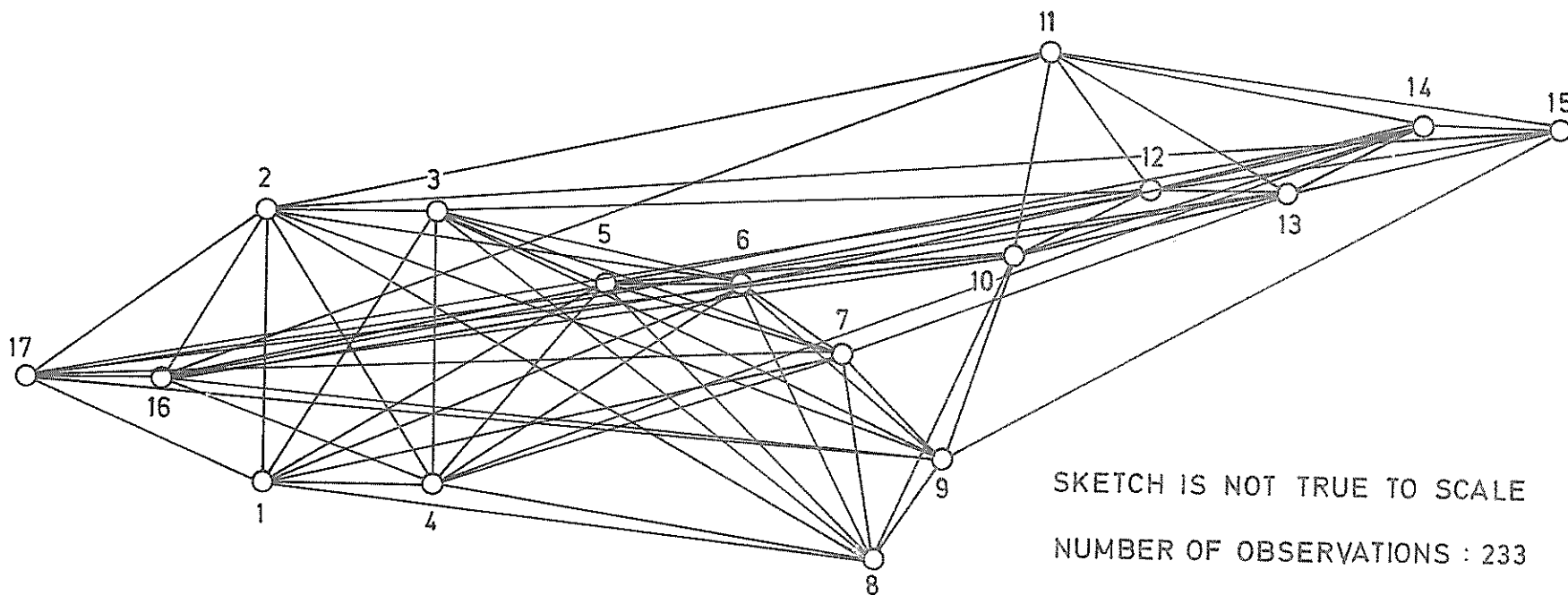


Fig.1 : structure of gravity network Hannover 1976

Table 1: Linear calibration function of the gravity meters, derived from IGSN 71 stations Paris, Bruxelles, Amsterdam, Hannover, Hamburg, Copenhagen

Gravity meter	Calibration function
LCR D No. 14	1.000769 ± 0.000117
LCR G No. 79	1.000560 ± 0.000031
LCR G No. 85	0.999916 ± 0.000035
LCR G No. 298	1.000722 ± 0.000034

Table 2: Results of least squares adjustments

Point No.	Solution 1 (fixed point No. 1)		Solution 2 (free network)	
	g_i [μGal]	mg_i [μGal]	g_i [μGal]	mg_i [μGal]
1	0	-	0	± 2.2
2	822	± 1.7	822	± 2.2
3	142	± 3.5	142	± 3.0
4	229	± 3.4	230	± 3.0
5	309	± 3.9	310	± 3.2
6	1724	± 3.6	1724	± 3.2
7	1644	± 3.9	1644	± 3.2
8	1569	± 3.6	1569	± 3.1
9	2117	± 3.7	2117	± 2.9
10	2240	± 4.0	2240	± 2.9
11	486	± 4.1	486	± 3.0
12	1000	± 4.1	1001	± 3.0
13	1312	± 4.1	1313	± 3.0
14	557	± 4.0	558	± 2.9
15	1104	± 4.0	1105	± 3.0
16	1193	± 3.8	1193	± 2.9
17	920	± 3.7	920	± 2.9
average r.m.s.e.:		$\pm 3.7 \mu\text{Gal}$		$\pm 2.9 \mu\text{Gal}$

Number of observed gravity differences: 233

Table 3: Accuracy of observed gravity differences

Instrument	LCR D 14 m_0 n [μGal]	LCR G 79 m_0 n [μGal]	LCR G 85 m_0 n [μGal]	LCR G 298 m_0 n [μGal]	Average m_0 [μGal]
VERNEY 1972 (TORSE et al 1976a) $\Delta g = 0 \dots 100 \text{ mGal}$	- -	12 144	26 146	- -	20
GREECE 1974 (TORSE et al 1976a) $\Delta g = 0 \dots 270 \text{ mGal}$	- -	15 41	20 40	- -	18
IRELAND 1975 (TORSE and DREHES 1977) $\Delta g = 0 \dots 180 \text{ mGal}$	20 286	10 298	25 298	- -	19
NORTH WEST EUROPE 1976 (unpublished) $\Delta g = 0 \dots 400 \text{ mGal}$	18 114	14 131	13 113	15 130	15
HANNOVER 1976 $\Delta g = 0 \dots 2 \text{ mGal}$	15 98	16 55	11 44	15 36	14

References

- CARTWRIGHT, D.E., EDDEN, A.C. 1973: Corrected tables of tidal harmonics, The Geophysical Journal Vol. 33 No. 3, Oxford 1973
- GERSTENECKER, C. 1973: Die genaue Messung von kleinen Schwereunterschieden, Deutsche Geodätische Kommission Reihe C Nr. 191, München 1973
- KIVINIEMI, A. 1974: High precision measurements for studying the secular variation in gravity in Finland, Publication of the Finnish Geocetic Institute No. 78, Helsinki 1974
- MITTERMAYER, E. 1971: Eine Verallgemeinerung der Methode der kleinsten Quadrate zur Ausgleichung freier Netze, Zeitschrift für Vermessungswesen 96, 401-410, Stuttgart 1971
- TORGE, W. and WENZEL, A.-G. 1975: Comparison of earth tide observations with seven different gravimeters at Hannover, presented to the XVI. General Assembly of the IUGG (IAG), Grenoble 1975
- TORGE, W., BOEDECKER, G. and DOERGÉ, W. 1976a: Eichung von LaCoste-Romberg-Gravimetern auf der europäischen Gravimetereichlinie zwischen München und Bodø, Deutsche Geodätische Kommission Reihe B Nr. 219, München 1976
- TORGE, W., MAVRIDIS, L.N., DREWES, H. and ARABELOS, D. 1976b: Anlage eines Schwerenetzes hoher Präzision im Bereich der Ägäischen Platte, Zeitschrift für Vermessungswesen 101, 213-220, Stuttgart 1976
- TORGE, W. and DREWES, H. 1977: Gravity Variations with Time in Northern Iceland 1965-1975 (in press).

LISTE des PUBLICATIONS
reçues au
BUREAU GRAVIMETRIQUE INTERNATIONAL
(Mai à Décembre 1976)
CONCERNANT LES QUESTIONS DE PESANTEUR

LISTE des PUBLICATIONS

- * 66 - Bulletin de l'Etude en Commun de la Méditerranée
CIM - IOC/UNESCO - ICSEM - GFCM/FAO
Special issue N° 7, Monaco, 1975

MORELLI C. - "Geophysics of the Mediterranean".
p.29-111.

Paper presented to the VIII session of the IOC/UNESCO Assembly in Paris, 5-11 Nov. 1973.

Presented together with the most relevant previous results, geophysical data surveyed in the Mediterranean sea under CIM's Program are assembled also if in a preliminary form, presented and discussed. Since 1969, six major events improved drastically the geological and geophysical knowledges in the Mediterranean sea :

- a. The completion of the Gravity and Magnetic Survey.
- b. The Deep Continuous Seismic Profiling, with digital techniques, low energy sources, stacking, computer processing and high penetration.
- c. The Wide Angle Reflections, mainly with the same techniques.
- d. The Deep Seismic Refraction Profiling, both on deep sea and the marginal areas.
- e. The Deep Sea Drilling Project Leg XIII.
- f. The Marine Geology Surveys, until now concentrated mainly in the Central Mediterranean.

- 69 - Bulletin of the Geological Society of Greece,
v.X, n°1, 219 p.

Selection of papers on the Eastern Mediterranean region presented at the 23rd congress of CIESM in Athens, November 1972, Athens, 1973.

- a) MAKRIS J. - "Gravity and magnetic measurements in Greece".
p.131-132.

- b) MAKRIS J. - "Some geophysical aspects of the evolution of the Hellenides".
p.206-213.

From 1971 to 1973 Greek and German institutions jointly studied the physical parameters and the tectonic state of the Hellenides. The cooperation included a gravimetric and a magnetic survey of the Greek mainland and the Peloponnese. One gravity and one magnetic station, (vertical component), were established for every 25 sq. km area. Maps have been partly published or will be presented for publication in 1974.

Seismic refraction lines were observed along the Ionian Sea the Peloponnese, from north Evia to Miconos, and along Crete in an E-W direction. This program will be completed in 1974 with one more profile in the Cretan Sea and the extension of the Miconos - Evia line over central Greece to the northern border. Furthermore, a special two year study of seismic travel - time anomalies recorded in Greece and an investigation of the seismicity of the Peloponnese were completed. The measurements are still in the process of evaluation. Some first remarks however, based mainly on the gravity, the magnetic and the explosion - seismic data can be given.

The Hellenides is a deep rooted mountain chain with crustal thickness of approximately 44 km below the central Peloponnese and 48 km below the Pindos Chains of central Greece. The crust is strongly attenuated towards the eastern Ionian Sea to approximately 22 - 24 km. The north Aegean region and the greatest part of eastern Greece have a crust of approximately 30 km thickness which becomes strongly attenuated toward the Cretan Sea where the thickness is only 26 km. At the Rhodopi Mountains near the Greek Bulgarian border the crust rapidly increases in thickness to nearly 44 km, and it seems very possible that to the east the Taurides in Turkey have a similar behavior. The Aegean area, located between the Hellenides, the Taurides, and the Rhodopi Mountains, builds a large dome.

The tectonic processes have been mainly caused by compressional forces, acting on the Hellenides from WSW to ENE as a consequence of the opening of the Atlantic. This forced the down-buckling of the Hellenic Mountains and the updoming of the Aegean region. Crete is thus forced to move SSW and as a result the crust of the Cretan Sea collapses. This mechanism explains the compressional process observed so far only at the western border of Greece and the extensional tectonism of the Aegean region.

70 - Association Internationale de Géodésie - Bulletin Géodésique
N° 118, p.310-448, 1er Déc. 1975.

- a) XVIème Assemblée Générale de l'AIG, Grenoble, 18 Août - 6 Sept. 1975.
 - Allocutions et Rapports
 - Voeux
 - Annexe A : Structure de l'AIG pour 1975 - 1979
 - " B : Officiels de l'UGGI
 - " C : Liste des pays membres de l'UGGI
 - " D : H. MORITZ - Report of Special Study Group N° 5.39 :
Fundamental geodetic constants, p.398-408.
 - Liste des délégués et invités.

See also N° 111, p. II-12.

b) Additif au Bulletin Géodésique N° 117, 1er Sept. 1975

RAPP R.H. - "Comparison of the potential coefficients models of the Standard Earth (II and III) and the GEM5 and GEM6".
(Voir Bull. Inf. N° 39, II-26, n° 57 b).

71 - SCHLICH R. - "Sea floor spreading history and deep sea drilling results in the Madagascar and Mascarene Basins, Western Indian Ocean".
from : Initial reports of the deep sea drilling project, Washington, v. XXV, p.663-678, 1974.

Bathymetric and magnetic data collected over 6 years in the Madagascar and Mascarene basins by GALLIENI and MARION DUFRESNE are used in this paper. Several well-established transform faults, nearly parallel to the general northeast-southwest topographic trend of the Southwest Indian Ridge, are traced throughout the Madagascar and Mascarene basins between the Mascarene Plateau and the Madagascar Ridge. Late Cretaceous, Paleocene, and early Eocene magnetic anomalies (33 to 19) related to spreading from the Central Indian Ridge are clearly identified in these basins. Changes in spreading rates and directions are recorded between anomalies 31 and 30 (71 m.y. B.P.), near anomaly 27 (67.5 m.y. B.P.), and just before anomaly 22 (57 m.y. B.P.).

The spreading (half) rates are respectively in these intervals : 40 cm/yr (33 to 31), 12.2 cm/yr (30 to 28), 7.1 cm/yr (27 to 23), and about 40 cm/yr (after anomaly 23). The magnetic ages, derived from the identified magnetic anomalies are compared to the biostratigraphic age established by drilling at Site 245 in the Madagascar Basin and Site 239 in the Mascarene Basin. These data show that the present time scale of geomagnetic field reversals remains valid for Late Cretaceous time, but the present scale may be approximately 7 % too old for Paleogene time. However, it is still necessary to obtain complementary drilling data on identified magnetic anomalies before deriving a new time scale for magnetic reversals.

- 72 - SCHLICH R. - "Appendix I - Bathymetric, magnetic and seismic reflection data, deep sea drilling project, leg 25".
from : Initial Reports of the deep sea drilling project, Washington, v. XXV, p.763-829, 1974.

- 73 - KEAREY P. - "Gravity and seismic reflection investigations into the crustal structure of the Aves Ridge, Eastern Caribbean".
from : Geophys. J., R. Astr. Soc., v.32, p.435-448, 1974.
Dept. Geol. Sci., Pub. n°501, Sci. Lab., The Univ. Durham, 1974.

The results of bathymetric, gravimetric and seismic reflection surveys over the Aves Ridge and Grenada Trough (eastern Caribbean) are presented. The Aves Ridge is a submerged linear prominence typically formed of two flanking ridges enclosing a sediment filled trough in which occur seismic reflectors similar to those found in the Venezuela Basin and Grenada Trough. The short wavelength gravity anomalies of the Aves Ridge may be adequately explained in terms of structures in the sediment/basement interface. The Aves Ridge is underlain by a mass deficiency which may be interpreted in terms of a thickened crust with consequent depression of the Moho and lowest crustal layer. The positive Bouguer anomalies of the Grenada Trough are probably due to a relatively shallow Moho. The Aves Ridges and Grenada Trough typically exhibit negative isostatic anomalies and the Lesser Antilles define a linear belt of positive isostatic anomalies.

These new results support the suggestion that the Aves Ridge is an ancient island arc.

Free-air and Bouguer anomalies maps are included, 13° to 16°N 61°45' to 64°45'W.G.

- 74 - SEGOUFIN J. - "Structure du plateau continental armoricain".
from : Phil. Trans. R. Soc. London, A.279, p.109-121, 1975.

Between 1965 and 1970 there has been conducted, in collaboration with the hydrographic service of the French navy, a magnetic survey of the Armorican continental plateau. The zone, covered with 48000 km of profiles, stretches between the parallels of 46°10'N and 49°30'N and between the meridians 4°W and 7°15'W. Position fixing was carried out by means of Toran, with an average accuracy of 50 m.

Two major zones of anomaly can be identified : a northern one, bounded to the south by the 48°N parallel, with strong relief, where the magnetic anomalies are numerous and include major ones at the entrance to the Channel ; a southern zone, with considerably less relief, but where the anomalies present several major directions ...

Finally, it emerges from this study that the magnetic anomalies are, for the most part, related to the major structural and tectonic lines of the metamorphic basement visible at ground level. Several areas of high positive anomaly may be associated with basic intrusions emplaced along the lines of major faults in the basement rocks of the Armorican platform.

- 75 - CENTRE NATIONAL d'ETUDES SPATIALES, Groupe de Recherches de Géodésie Spatiale - Bulletin N° 14, 92 p, Décembre 1974.

- 76 - PLAUMANN S. - "On the gravimetric determination of the density of seamounts with application to the Small and Great Meteor Seamount". from : Geol. Jb. E 2, S.99-110, 8 Abb., Hannover, 1974.

In 1967 seamounts have been one of the objects of RV METEOR cruises. The Small and Great Meteor Seamount have been gravimetrically surveyed, which leads to results about the mean density of the seamount-forming rocks.

A simple method is derived, by which in the case of areal gravity measurements in a similar manner as in the case of profiles a comparison of "measured" and "calculated" curves allows to test, whether the seamount is of uniform density and which in case the mean density is. For the Small Meteor Seamount a mean density of 2.65 g.cm^{-3} was found. The main of the Great Meteor Seamount has a density of 2.72 Model reflections give hints that the central or upper part of Great Meteor Seamount is of even higher density.

- 77 - PLAUMANN S. - "Gegenwärtige Möglichkeiten geophysikalischer Lagerstättenprospektion in Meeresgebieten". from : Bd 23, H.1, S.15-19, Hannover, 1970.

- 78 - SNOEK M. - "The crust-mantle system between the Liparic Islands in the Tyrrhenian Sea and the Albanian coast in the Strait of Otranto". Hamburger Geophysikalische Einzelschriften, H.28, 76 S, Hamburg, 1975.

The results of marine refraction measurements undertaken in 1972 in the Tyrrhenian Sea, the Gulf of Tarrent and the Strait of Otranto are presented. Using geological and geophysical data (seismic, seismicity, gravity and heat-flow) a 2-D model of the crust-mantle system was developed between Albania and Sicily striking NE-SW. Since the seismic profiles at sea revealed only the structure of the upper part of the crust, the lower boundary was obtained by gravity computations (TALWANI method).

The main results are :

- The SE-Tyrrhenian Sea has an intermediate crust of approximately 23 km of thickness,
- The Upper Mantle in the Tyrrhenian Sea is laterally inhomogeneous, partly consisting of low velocity and low density material. Heat-flow values support the 2-D density distribution.
- The great accumulation of sediments ($\sim 10 \text{ km}$) and the gravity minimum at the SW-part of the Gulf of Tarrent and E-Calabria mark the downbuckling zone of the crust due to the subduction of the Ionian bloc lithosphere below Calabria.

- Considerations based on the mass distribution below Apulia clearly show that this area is not isostatically compensated and that vertical movements are due to occur in order to balance the crust-mantle system.
 - Geodesic and seismic data indicate that the Tyrrhenian plate is obducted over the Ionian bloc.
- 79 - HIRSCHLIEBER B. - "Synthese der seismischen Krustenuntersuchungen in Jütland und den angrenzenden Gebieten".
Hamburger Geophysikalische Einzelschriften, H. 29, 110 S, Hamburg, 1975.
- 81 - BOLLO R., A. GERARD & C. WEBER - "La carte gravimétrique de la France à l'échelle de 1/1.000.000".
BRGM, 8 p, 2 feuilles : France Sud et Nord, Orléans, 1975.
- 82 - INDONESIAN INSTITUTE of SCIENCES - Symposium on recent crustal movements and associated seismic and volcanic activity, Bandung, 10 - 18 Nov. 1973.
23 p, Jakarta, 1974.
- 83 - MEHCHERSKY I.N. & T.P. KOROKINA - "Some evidence of recent vertical movements of the Earth's surface in the USSR".
The Central Research Institute of Geodesy, Air Survey and Cartography, 11 p, presented to the XVth General Assembly of IAG, IUGG, Grenoble, Aug. 1975, Moscow, 1975.
- 84 - PELLINEN L.P. - "Studies in geodynamics area".
Central Res. Inst. Geod., Air Survey & Cartog., 50 p,
Presented to the XVth General Assembly of IAG, IUGG, Grenoble, Aug. 1975,
Section V - Physical Interpretation, Grenoble, 1975.
- 85 - MATHER R. - "Quasi-stationary sea surface topography and variations of mean sea level with time, an interim compendium (1973)".
from : UNISURV. G-21, p.18-72,
School of Surveying, Univ. New South Wales, Kensington, 1973.
- 86 - BONATZ M. - "Beiträge zur Erdgezeitenforschung des Arbeitskreises Geodäsie / Geophysik der Bundesrepublik Deutschland".
DGK, Reihe B : Angew. Geod. H. n°211, 116 S, München, 1975.
- a) WENZEL H.G. - "Interpolation von Eichwerten für die Erdgezeitenregistrierung mittels Prädiktionsfilterung".
S. 15-23.
- It is well known, that astatized gravimeters as LaCoste-Romberg and Geodynamics (modified North-Americans) change their sensitivity with tilting. If those gravimeters are used for Earth tide recording without a feedback system, the variation of sensitivity has to be measured by often repeated calibrations, and the calibration values have to be interpolated for the calibration of the Earth tide record. The method of prediction-filtering has been proved to give better representation of the calibration function than least squares polynoms or linear interpolation method.

As an overall test, a five months record from LaCoste-Romberg model G n° 298 has been calibrated by prediction-filtering method ; the accuracy of analysis results could be checked by splitting the record into monthly parts and computing least squares harmonic analysis for each month. The absolute accuracy of amplitude factor for wavegroup M2 from only one month's observation was ± 0.002 .

- b) RICHTER B. - "Untersuchungen zum Gangverhalten dreier Askania-Gravimeter der BN-Serie".
S. 53-60.

The characteristics of the drifts of three Askania gravimeters (BN-Serie), parallelly recording during 60 days, were investigated with regard to their correlative coherences. It is shown, that the gravimeters react differently with time, according to perturbations due to outer influences. This can be explained by the varying behaviour of the mechanical systems of the instruments.

- 87 - DEUTSCHE GEODATISCHE KOMMISSION - "Beiträge aus der Bundesrepublik Deutschland zur Vorlage bei der XVI Generalversammlung der Internationalen Union für Geodäsie und Geophysik, Grenoble 1975".
Reihe B : Angew. Geod., H. n°213, 109 S, München, 1975.

- a) BOEDECKER G. - "Astrogravimetric Levelling with direct regard to topography".
S. 3-12.

The theory of astrogravimetric levelling is generalized for an arbitrary number of stations. The gravitational potential and its derivatives generated by topography are directly taken into account, for which procedure very simple approximations are used. Numerical computations in the testnet Western Harz ($\phi \approx 51^\circ 25' \dots 52^\circ 05'$, $\lambda \approx 9^\circ 50' \dots 10^\circ 40'$, $H \approx 100 \text{ m} \dots 900 \text{ m}$) with 17 stations show an accuracy of a few centimetres when using a radius for the inner zone of $r(\odot) = 50 \text{ km}$.

- b) EITSCHBERGER B.H. - "A biaxial world geodetic datum WD3".
S. 13-22.

The Monge forms of the (quasi-) geoid and of the ellipsoid of revolution are presented in terms of harmonic coefficients. By minimizing the global distance $||\rho - \rho_e||^2 = \min$, where ρ/ρ_e are distances of a (quasi-) geoidal point / a point on the surface of the ellipsoid of revolution, translational, rotational and axial ellipsoidal parameters are estimated. Extending results from : B. EITSCHBERGER/E. GRAFAREND (1974) for WD1 and WD2, a world datum WD3 based on collocated harmonic coefficients (terrestrial and satellite data) of R.H. RAPP (1973), including variances of the coefficients, is given. The significance of the optimal parameter set WD3 is discussed in detail.

- 88 - Verzeichnis der in München Erschienenen, noch Lieferbaren Veröffentlichungen der Deutschen Geodätischen Kommission und der Bayerischen Kommission für die Internationale Erdmessung.
45 S, München, Sept. 1974.

- 89 - Nationalkomitee für Geodäsie und Geophysik bei der Akademie der Wissenschaften der Deutschen Demokratischen Republik".
XIVth General Assembly of the European Seismological Commission,
Trieste, 16-22 September 1974.
469 p, Berlin, 1975.

73 reports or papers presented to the Commission.

- 90 - McKENZIE D.P. - "Some remarks on heat flow and gravity anomalies".
from : J. Geophys. Res., v.72, n°24, p.6261-6273, 1967.

Heat flow anomalies on the oceanic ridges and the large free-air gravity anomalies observed from the Earth's surface and from satellites are often believed to be surface expressions of high temperatures and flow within the mantle. A simple model for the temperature within a spreading sea floor can, however, reproduce the shape and magnitude of the observed anomalies. Thus, it is not necessary for the upper mantle to be hotter beneath ridges than it is elsewhere. A similar model may be used to relate the free-air gravity anomaly to the stress in the lithosphere. The results show that long-wavelength harmonics of the external gravity field cannot be supported by the strength of the lithosphere. Most free-air anomalies observed on the surface can be maintained in this way, except possibly the largest of those over the trenches.

- 91 - KHEIFETS M.Je, N.A. GUSEV & V.V. LOKHOV - "Some results of international pendulum ties worked out by the Central Scientific Research Institute of Geodesy, aerial Survey, and Cartography (TsNIIGAIK, USSR)".
Presented to the XVIth General Assembly of IAG IUGG, Grenoble, France Aug. 1975. 7 p, Moscow, 1975.

- 92 - STRANGE W.E. - "Reobservations over the U.S. National Gravity Base Network".
Presented to the IUGG, IAG, XVI General Assembly, Grenoble, Aug. 1975,
U.S. Dept. of Commerce, NOAA, Nat. Ocean Survey, Preprint, 10 p,
Rockville, 1975.

- 93 - HOLDAHL S.R. - "Models and strategies for computing vertical crustal movements in the United States".
Presented to the Int. Symposium on Recent Crustal Movements,
Grenoble Aug. - Sept. 1975.
U.S. Dept. of Commerce, NOAA, Nat. Ocean Survey, Preprint 13 p,
Rockville, 1975.

Five different adjustment strategies are now being used in North America to obtain vertical crustal movements from repeated levelings. The five methods are described in this paper. Methods 4 and 5 are preferred. The adjustment model corresponding to Method 4 uses a polynomial to describe the height variation of each junction bench mark with time. Method 5 uses a velocity surface polynomial. The basic observation in both models is an observed difference of elevation rather than a velocity difference. Both of the preferred models yield a set of adjusted heights corresponding to a selected reference time,

as well as velocities ; and allow the use of some single levelings and all multiple relevelings without resorting to a complex weighting scheme. Method 5 is suitable for study areas which have scattered relevelings.

- 94 - NAKAGAWA I. - "On characteristics of LaCoste & Romberg gravimeters (Model G)".

Presented to the XVI General Assembly IUGG, Grenoble, Aug. 1975
Geophys. Inst. Kyoto Univ., S p, 1975.

...

The results obtained show that an accuracy of ± 0.01 mGal is attainable through a careful measurement by using the LaCoste & Romberg gravimeters, so that a detection of gravity change with an accuracy of $\pm 0.01 \sim 0.02$ mGal can be possible. For this purpose, it is recommended that three or more sets of the gravimeters should be used for a repetition gravity measurement so as to check a misreading due to sudden drift and also to enhance the measuring accuracy.

- 95 - NAKAGAWA I., M. SATOMURA, M. OZEKI & H. TSUKAMOTO - "Tidal change of gravity by means of an Askania Gravimeter at Kyoto, Japan".

Presented at the XVI General Assembly IUGG, Grenoble, 1975.
from : J. Geod. Soc. Japan, v.21, n°1, p.6-15, Kyoto, 1975.

Continuous observations of the Earth tides are being carried out with an Askania gravimeter Gs-15 (n° 217), under an excellent condition, at Kyoto since June 1972. Data obtained for the first two years (June 1972 - May 1974) were analyzed by LECOLAZET's, VENEDIKOV's and FOURIER transform methods. These three different methods of analysis gave almost the same results so far as the main constituents of tides, and K_1 constituent showed a remarkably seasonal variation in both tidal factor of gravity and phase lag.

The data were also analyzed by the maximum entropy method, which was recently introduced by J.P. BURG in the field of geophysical studies and showed a highly resolving power, in order to get a fine spectral structure of the Earth tides in the vicinity of terdiurnal and quarter-diurnal tides. The M_3 , S_3 and MK constituents were clearly detected by the present analysis.

- 96 - HENRIKSEN S.W. - "Relation between fundamental astronomical constants and the major geodetic constants".

Presented to the IUGG, IAG, XVI General Assembly, Grenoble, Aug. 1975
U.S. Dept. Commerce, NOAA, Nat. Ocean Survey, 12 p, Rockville, 1975.

An analysis of the definitions and methods of measurement of the fundamental astronomical constants shows that

1. the astronomical unit has not been defined in such a way as to allow its expression in physical (S.I.) units, and
2. the constants adopted by the IUGG in 1967 should perhaps be either supplemented by additional constants or redefined.

...

- 97 - HONKASALO T. - "75:76, Finnish Observations and research on Earth tides in 1971 - 1974".

Presented to the IUGG, XVI General Assembly, Grenoble, 1975,
Rep. Finnish Geod. Inst., ISBN 951-711-020-0, Helsinki, 1975.

- 98 - Proceedings of the INSTITUTE of GEODESY & CARTOGRAPHY
t. XXII, PL ISSN 0032-6224, Z.2(51) ; 126 p, Warszawa, 1975.

- 99 - MORELLI C., M. PISANI & C. GANTAR - "Geophysical studies in the Aegean Sea and in the Eastern Mediterranean".
Boll. Geof. teor. appl., v.XVIII, n°66, p.127-167 + plates,
Osser. Geof. Sper., Trieste, 1975.

The results of the bathymetric, gravimetric and magnetic profiles in the Aegean sea and in the area South to Crete are presented and discussed together with those of all geophysical data available for the same Aegean sea and the Eastern Mediterranean. The Aegean sea presents the characteristics of a back-arc marginal sea. For the area South to Crete only the band of the trenches presents compressional characters due to lithospheric absorption ; all the rest (of the Eastern Mediterranean) is the continuation of the african sedimentary series at least from the Upper Cretaceous, with also very thick sedimentary layers in which the evaporities of the Upper Miocene are almost everywhere present, sometime with great thickness.

Plates - 1/750.000° - By O.G.S., Trieste.

- X Bathymetry, Aegean Sea
 - XI Bathymetry, South of Crete
 - XII Free Air gravity anomalies, Aegean sea
 - XIII Free Air gravity anomalies, South of Crete
 - XIV Bouguer anomalies, Aegean sea
 - XV Bouguer gravity anomalies, South of Crete
 - XXV, XXVI, Bathymetry, Levantine sea, by Dept. Geophys., Univ. Cambridge.
- 100 - LACHAPELLE G. - "Determination of the geoid using heterogeneous data".
Mitt. Geod. Inst. Tech. Univ. Graz, F.19, 122 S, (thesis), Graz, 1975.

The object of this work was to develop a method for determining the geoid over large territories using the following types of geodetic data : astrogeodetic deviations of the vertical, gravity anomalies, dynamic data in the form of geopotential coefficients and topographic-isostatic deviations of the vertical.

In Part 1, the application of least squares collocation to Molodenskii's astrogravimetric levelling is considered. Instead of solving the fundamental equation of astrogravimetric levelling by classical methods, which involves much work for extensive applications, it was solved by least squares collocation. The least squares collocation solution offers important advantages in both practical and theoretical aspects. Practically, the solution presented here requires much less data preparation than previously because the observed deviations of the vertical and gravity anomalies can be used as such, regardless of their distribution ; the interpolation is made automatically as it is contained implicitly in the fundamental equation of astrogravimetric levelling in least squares collocation. Theoretically, the contribution of the deviations of the vertical together with the gravity anomalies can be studied according to their distribution and accuracy ; this is because least squares collocation can be directly applied to heterogeneous data. In this respect, important results are presented in Chapter IV. The use of geopotential coefficients is considered in Chapter III and the accuracy of the current geopotential coefficients solutions is studied. The improvement of accuracy attainable when removing low geopotential coefficients is also studied. The covariances, which play a basic role in the application of least squares collocation,

are dealt with in Chapter II; several covariance functions for use in areas of flat and rugged topography are presented. Comparisons are made between the accuracy estimates obtained when using these covariance functions and those obtained when using Bomford's empirical formulae for astrogeodetic levelling ; results are in good agreement ; two Canadian astrogeodetic profiles were used for this purpose.

In Part 2, a method for estimating deviations of the vertical from a combination of topographic-isostatic deviations of the vertical with geopotential coefficients is presented. This method is especially well suited for large areas, either continental or oceanic, where no other geodetic measurements are available. It is ideally applicable in mountainous areas and along coastlines where the deviations depend much on the topography. Numerical results using topographic-isostatic deviations calculated in Canada, Switzerland and West-Germany are presented. The results of a geoid determination in Eastern Canada using these predicted deviations with the results obtained when using the corresponding observed deviations are also presented. Further possible improvements are proposed. A spherical harmonics expansion of the isostatic reduction potential, which is needed in connection with the method mentioned above, is presented ; this method is rigorous within the usual spherical approximations made in physical geodesy.

CENTRE NATIONAL pour l'EXPLOITATION des OCEANS - Bulletin d'Information

- 101 - N° 84, 21 p, Déc. 1975.
- 102 - N° 85, 14 p, Janv. 1976.
- 103 - N° 86, 19 p, Fév. 1976.
- 104 - N° 87, 27 p, Mars 1976.
- 105 - N° 88, 19 p, Avril 1976.

DEPARTMENT of DEFENSE, DMAAC - Quarterly accession list,
DoD Gravity Library, St-Louis.

- 106 - 1 Oct. - 31 Dec. 1975, 5 p, 1975.
- 107 - 1 Jan. - 31 March 1976.

- 108 - WELLMAN P. & H.M. McCRACKEN - "Gravity measurements on Papua New Guinea crustal movement survey markers, and along the Australian calibration line, 1975".
B.M.R., Geol. & Geophys., Record 1975/126, 24 p, 1975.

Sets of crustal movement markers have been established straddling two supposed active fault zones in Papua New Guinea. The relative horizontal and vertical positions of these survey markers were first measured in 1973, remeasured in 1975, and are periodically to be resurveyed by the Division of National Mapping. This report gives the gravity differences between the markers at the time of the 1975 National Mapping Survey. Remeasurement of the gravity intervals at the time of a later resurvey should enable the deep mass movements accompanying any surface movement to be estimated.

While in transit to and from the survey area the four LaCoste & Romberg gravimeters were calibrated along part of the Australian Calibration Line, and were used to make measurements extending and strengthening the National Gravity Network and more precisely determining the gravity intervals on calibration ranges.

- 109 - KOCH K.R. - "Vergleich von Kovarianzberechnungen für die Höheninterpolation". Mitt. Inst. Theor. Geod. Univ. Bonn, N° 35, 51 p, Bonn, 1975.

If homogeneous properties for the least-squares prediction of surface heights are assumed in those areas only, where the measuring points used for the prediction of one height are situated, the covariances of the heights have to be estimated from a small number of measuring points. These estimations are compared with covariances obtained empirically by the model of Hirvonen for which the length of the correlation is varied according to the distances from the interpolated point to the measuring points. The estimates of the covariances can be improved by a subdivision into areas for which the covariances have been determined beforehand from several similar areas. However, this procedure might not lead to practical solutions, so that the covariances should be determined empirically.

- 110 - KOCH K.R. - "Wahrscheinlichkeitsverteilung für statistische Beurteilungen von Ausgleichungsergebnissen". Mitt. Inst. Theor. Geod. Univ. Bonn, N° 38, 58 p, Bonn, 1975.

- 111 - MEISSL P., H. MORITZ & K. RINNER - "Contributions of the Graz Group to the XVI General Assembly of IUGG/IAG in Grenoble 1975". Mitt. Geod. Inst. Tech. Univ. Graz, Folge 20, 308 p, Graz, 1975.

- a) MEISSL P. - "Report of Special Study Group N° 4 : 38 of IAG - Computer techniques in Geodesy". p.91-110.

The Study Group was established in February 1972 by a decision of the Executive Committee of IAG. The Study Group is concerned with the following problems and activities :

- 1) Computational aspects of the solution of very large geodetic normal equations.
- 2) Computational aspects of non-traditional adjustment schemes, such as recursive adjustment and inner adjustment.
- 3) Computerized optimization of planning and design of geodetic networks and other projects.
- 4) Numerical and computational aspects of the determination of the Earth's figure and potential from terrestrial and satellite observations.
- 5) Digital models for the mathematical description of geodetically significant functions defined on a reference surface.
- 6) Use of automatic formula manipulation techniques.
- 7) Collecting and cultivating a set of basic geodetic algorithms.
- 8) Documenting and sharing computer programs.

- b) MORITZ H. - "Report of Special Study Group 4 : 31 of IAG - Mathematical techniques in Physical Geodesy". p.111-128.

The IAG Special Study Group N° 31, "Mathematical Techniques in Physical Geodesy" was established at the XIV General Assembly of the IUGG at Lucerne in 1967. Its purpose is the study of advanced mathematical techniques with regard to their application to the solution of theoretical problems of physical geodesy.

The present report covers the period between the XVth and the XVIth General Assembly, that is, August 1971 to August 1975.

- c) MORITZ H. - "Report of Special Study Group 5 : 39 of IAG - Fundamental geodetic constants".
p.129-146 p.

The Special Study Group N° 5.39 "Fundamental Geodetic Constants", was established at the Meeting of the Executive Committee in Paris in February 1974. Its purpose is to follow the development of new numerical values on geodetically important constants such as the velocity of light in vacuum and parameters that characterize the figure of the Earth and its gravitational field the study group is not as such concerned with observational, theoretical, and computational techniques for arriving at such values. SSG 5.39 is to give recommendations concerning values currently considered best, to be submitted at each General Assembly. Particular attention should be paid to the problem of reference Systems used in Geodesy.

- d) SCHWARZ K.P. - "Zonal harmonic coefficients by least squares collocation using satellite and gravimetric data".
p.241-265.

The combination of satellite and gravimetric data to determine the zonal part of the gravity field has been done by the collocation method. The procedure is compared to the adjustment method and it is shown why the two solutions will not be very different. The collocation method has some numerical advantages, however. Aliasing can be avoided, the solution will always be stable even for a very large number of coefficients, and an automatic truncation procedure can be designed which is consistent with the mathematical model.

Results are given for a satellite and for a combination solution. The gravity values computed from the satellite coefficients agree remarkably well with the terrestrial data. A number of recent satellite solutions have been compared. No significant difference can be found when testing them against the available gravity material.

- e) SUNKEL H. - "Reconstruction of functions from discrete mean values using cubic spline functions".
p.267-305.

Integral formulas of physical geodesy frequently contain gravity anomalies and topographic heights available as mean values of standard size blocks. In this way they are more appropriate for purposes of numerical integration. If we wish to reconstruct the original function from these mean values, which may be necessary if the integrand becomes singular or nearly so, we can only expect to obtain a smoothed version of the original function.

The present paper considers this reconstruction using cubic spline-functions which are particularly well-suited for such purposes. Numerical comparisons with spectral analysis and a polynomial method are shown.

- 112 - BOULANGER Yu. D., V.A. TOULIN et al... - "Catalogue des mesures gravimétriques, 6ème croisière du NIS Dimitry MENDELEEV, équipe n° 10, Océan Pacifique, 1971".
Acad. Nauk URSS, Inst. Lénine de Physique de la Terre, O.Y. Schmitt, 148 p, Moscou, 1974.

Schéma de la croisière, résultats de 4163 mesures.

- 113 - BOULANGER Yu.D., V.A. TOULIN et al. ... - "Catalogue des mesures gravimétriques, 9ème croisière du NIS Dimitri MENDELEEV, équipe n° 12, Océan Pacifique, 1973".
Acad. NAUK URSS, Inst. Lénine de Physique de la Terre O.Y. Schmitt
145 p, Moscou, 1974.

Schéma de la croisière et résultats de 4814 mesures.

- 114 - BOULANGER Yu.D., V.A. TOULIN et al. ... - "Catalogue des mesures gravimétriques, 10ème croisière du NIS Dimitri MENDELEEV, équipe n° 12-A, Océan Indien, mers du Sud de la Chine et de la Chine Orientale, 1973".
Acad. NAUK URSS, Inst. Lénine de Physique de la Terre O.Y. Schmitt
155 p, Moscou, 1975.

Schéma de la croisière et résultats de 4330 mesures.

- 115 - GEMAEL C. & A. DOUBEK - "Levantamento gravimétrico do Município de Curitiba".
Bol. Univ. Federal do Paraná, Geod. N° 17, 7 p, Paraná, Brasil, 1975.

Free-air and Bouguer iso-anomaly maps computed from 1000 gravimetric stations are presented (scale 1/60.000). A Worden gravimeter (small dial only) was used and the measured values of gravity are referred to the "old" Potsdam system ; also the "old" International Gravity Formula (1930) was used.

- 116 - TOKUHIRO A. & T. YANAGI - "Preliminary report of the gravity anomaly in the Japan Sea".
Maritime Safety Agency, Pub. N° 691, Data Rep. of Hydrog. Obs.,
Ser. Astr. & Geod., n° 1, p.43-46, Tokyo, April 1966.

- 117 - TOKUHIRO A. & T. YANAGI - "Gravity in the Nippon Kai".
Maritime Safety Agency, Pub. n° 691, Data Rep. of Hydrog. Obs.,
Ser. Astr. & Geod., n° 2, p.29-47, Tokyo, June 1967.

Observed and properly reduced values of surface ship gravimetry are given herewith, that was made for the Nippon Kai (Japan Sea) during early period of 1965 conducted under a set of observations of the UMP by the Hydrographic Office. Preliminary data of this observation was reported in the Data Report of Hydrographic Observations.
Ser. of Astr. & Geod., n° 1, 1966.

Table of 253 stations with coordinates, depth, val. of g, free-air and Bouguer anomalies.

- 118 - TOKUHIRO A. & T. YANAGI - "Gravity in the Nippon Kai".
Maritime Safety Agency, Pub. n° 691, Data Rep. of Hydrog. Obs.,
Ser. Astr. & Geod., n° 3, p.22-32, Tokyo, July 1968.

This is the report of gravity observations to be appended to the paper : "Gravity in the Nippon Kai", 1967.

In the above report, some parts of the observations were not analysed because of difficulty in data processing. Results of these parts are shown here through an improved method of the data processing.

- 119 - TÔKUHIO A., T. YANAGI & Y. GANEKO - "Gravity measurements at sea in 1968".

Maritime Safety Agency, Pub. n° 691, Data Rep. Hydrog. Obs., Ser. Astr. & Geod., n°5, p.33-50, Tokyo, Sept. 1970.

List of 824 gravity points in the Japan Sea made by the Hydrographic Department in 1968.

Track chart of the Meiyo, Aug.- Nov. 1968.

- 120 - YANAGI T. & H. NISIMURA - "Gravity measurements at sea in 1968".

Maritime Safety Agency, Pub. n° 691, Data Rep. Hydrog. Obs., Ser. Astr. & Geod., n°6, p.18-54, Tokyo, Sept. 1971.

This is the report of gravity measurements at sea made by the Hydrographic Department in 1968.

Table of 2014 gravity points in the Japan Sea.

Track chart of the Meiyo (Sept. - Oct. 1968).

- 121 - NISIMURA H. & Y. TOMIOKA - "Gravity measurements at Japan sea in 1970".

Maritime Safety Agency, Pub. n° 691, Data Rep. Hydrog. Obs., Ser. Astr. & Geod., n°7, p.23-80, Tokyo, Sept. 1972.

This is a continuation of the series of the report of gravity measurements made by the Hydrographic Department, and contains the data for off Hokkaido-West Coast in 1970.

List of 3287 gravimetric points.

Track chart of the Meiyo (June - July 1970).

- 122 - YANAGI T. & S. TAKEUTI - "Gravity measurements at Northwest Pacific Ocean in 1970".

Maritime Safety Agency, Data Rep. Hydrog. Obs., Ser. Astr. & Geod., n°8, p.29-55, Tokyo, March 1974.

This is a continuation of the series of gravity measurements made by the Hydrographic Department, and contains the data for the Northwest Pacific Ocean obtained in 1970. (1389 gravimetric points).

Track chart of the Meiyo (Aug. - Sept. 1970).

- 123 - NISIMURA H., Y. TOMIOKA & Y. SUZUKI - "Gravity measurements at Okhotsk sea in 1971 and 1972".

Maritime Safety Agency, Data Rep. Hydrog. Obs., Ser. Astr. & Geod., n°9, p.42-74, Tokyo, March 1975.

This is a continuation of the series of the report of gravity measurements made by the Hydrographic Department, and contains the data for off Hokkaido-East Coast in 1971 and 1972. (About 3500 gravimetric points).

Track chart of the Meiyo (July - Aug. 1971) and of the Shoyo (Sept. - Oct. 1972).

- 124 - NATIONALKOMITEE für GEODASIE & GEOPHYSIK bei der AKADEMIE der WISSENSCHAFTEN der DEUTSCHEN DEMOKRATISCHEN REPUBLIK - Monographie über den Beitrag der DDR zu der von der Unterkommission Osteuropa der CRCM der IAG zusammengestellten Karte der Rezenten vertikalen Erdkrustenbewegungen Osteuropas.
Geod. & Geophys. Veröff. R.III, H.31, 47 S, Berlin, 1973.

ACADEMIE des SCIENCES U.R.S.S. - Références bibliographiques

- 125 - Géophysique, N° 12, 260 p, Moscou, 1975.
- 126 - Sér. 52 - Géodésie et Astronomie, Index des articles 1974.
40 p, Moscou, 1975.
- Sér. 52 - Géodésie et Astronomie
- 127 - N° 1, 36 p, Moscou, 1976.
- 128 - N° 2, 44 p, Moscou, 1976.
- 129 - N° 3, 54 p, Moscou, 1976.
- 130 - N° 4, 54 p, Moscou, 1976.
- 131 - N° 5, 48 p, Moscou, 1976.
- 132 - PLAUMANN S. - "Some results of a detailed gravimetric survey of the Southern Red Sea".
from : Geol. Jb. D. 13, p.155-166, Hannover, 1975.

The new Askania Gss 3 shipboard gravimeter on the R.V. VALDIVIA was used to carry out a gravity survey in the southern Red Sea. The result was highly accurate data along the profiles. Comparison of the gravity data with the bathymetry profiles indicates that the inner graben area has rocks with densities of about 28g/cm^3 exposed at the sea floor. This suggests basaltic material and thereby supports the concept of sea-floor spreading in this area.

- 133 - Bollettino di Geofisica teorica ed applicata, v.XVIII, n°67, Set. 1975.
Osser. Geof. Sper., Trieste.

- a) MORELLI C., P. GIESE, R. CASSINIS, B. COLOMBI, I. GUERRA, G. LUONGO, S. SCARASCIA, K.G. SCHUTTE - "Crustal structure of Southern Italy. A seismic refraction profile between Puglia - Calabria - Sicily".
p.183-210.

In continuation of the investigations of the Earth's Crust in Southern Italy a refraction seismic program was carried through between the southern part of the Adriatic Sea and Sicily. The recording stations were located in Southern Puglia, Calabria, on the Eolian Islands and in the eastern part of Sicily. The shots were fired in the Adriatic Sea, the Gulf of Taranto and in the Tyrrhenian Sea. This research program was carried, in 1972 through in close cooperation of Italian and German Geophysical Institutions.

The platform of Puglia, being the foreland of the Apennines system has a typical continental crust, indicated by a crustal thickness of 28-30 km and a moderate low velocity layer in a depth of about 8 km.

Under the Gulf of Taranto the foredeep of the Orogene, the Crust/Mantle boundary lies at a depth of about 30 km and dips in the direction of the Calabria Massif. Here the total crustal thickness amounts to 40 - 45 km. In the Sila region at a depth of about 20 km, high-velocity material is detected, which is underlain by a strong low velocity layer : an inversed sequence of layering of intermediate and basic rocks, lying over sialic material, seems to be present ; that is, the Calabrian Massif is formed by a crystalline nappe of a thickness of about 20 km.

An abrupt decrease in crustal thickness is detected just W of Cosenza with values of about 30 km. The Crust/Mantle boundary rises in SW direction up to 20 km under the Tyrrhenian shelf edge. A low-velocity layer, which is found in the coastal region, diminishes in SW direction

In the region of the Eolian Islands the crustal thickness reaches no more than 16 to 18 km. Because of the existence of a crustal low velocity layer and a quite normal upper Mantle velocity of 8.0 - 8.2 km/s, this part of the Crust may be classified as a continental one.

A further detailed interpretation of the records on the line Eolian Islands to Sicily will reveal whether there exists a similar structure as under Calabria.

- b) MORELLI C., M. PISANI & C. GANTAR - "Geophysical anomalies and tectonics in the Western Mediterranean".
p.211-249.

Data of the gravimetric and bathymetric surveys performed with the oceanographic ship "Bannock" in the Western Mediterranean sea are presented in the form of 1/750.000 maps and discussed in connection also with the other geophysical results for the same area.

Noteworthy results are that the actual Western Mediterranean has been originated by a rapid and practically continuous sinking by many kms of areas uplifted during the Miocene and practically emerged at the end of the Messinian. This collapse is characterized by a system of sub-vertical faults around all the margins, and by a cristalline basement (followed till great distances from the coasts) plunging towards the center of the basin, where the Bouguer anomalies indicate (in agreement with the seismics) a very thin Crust.

Of the different models discussed the van Bemmelen's one is better in agreement with the facts revealed by Geophysics.

Plates in the fold :

- Bathymetry Alboran
- Bathymetry Lions-Corsica
- Bathymetry Baleares-Sardinia
- Bouguer Alboran
- Bouguer Lions-Corsica
- Bouguer Baleares-Sardinia
- Free-air Alboran
- Free-air Lions-Corsica
- Free-air Balearic-Sardinia.

- 134 - HARRISON P.L., W. ANFILOFF & F.J. MOSS - "Galilee Basin seismic and gravity survey, Queensland 1971".
B.M.R., Geol. & Geophys., Dept. of Minerals & Energy, Report 175,
43 p, Canberra, 1975.

The B.M.R. made a seismic and detailed gravity survey east of the Lake Galilee n°1 well in the Galilee Basin, central Queensland, between August and November 1971. The aim of the survey was to investigate the structure of the eastern part of the Galilee Basin and its relation to the Drummond Basin.

Single-coverage seismic reflection profiling, and some six-fold CDP multiple-coverage profiling were done on a traverse from the well to outcrops of Drummond Basin sediments. A continuous seismic reflection section from the well to the outcrops was constructed by including previous reflection results obtained in the area. Expanded reflection spreads were shot for velocity control, and some refraction work was done to provide supplementary information at the eastern end of the traverse. Gravity was read on the traverse at seismic shotpoints, beyond the eastern end of the traverse over a large gravity high at Mount Donnybrook, and along short cross-traverses.

...

The gravity results in conjunction with the seismic results and geological mapping support the postulate of basement uplift in the western part of the Drummond Basin. Model studies indicate that a 37 mGal gravity high over Mount Donnybrook - the "Donnybrook Gravity High" - may be attributed to a 2-km uplift in basement before deposition of the Drummond Basin sequence. The gravity low west of the Belyando River is considered to be due to a granite pluton at depth. A gentle upward bulge in the two deepest seismic reflection horizons above the position of the postulated granite mass suggests that the mass antedates Drummond Basin deposition and was formed contemporaneously with the basement uplift.

- 135 - MUTTER J.C. - "A structural analysis of the Gulf of Papua and Northwest Coral Sea Region".
B.M.R., Geol. & Geophys., Dept. of Minerals & Energy, Rep. 179,
52 p, Canberra, 1975.

A new interpretation of the structure and tectonic history of the Gulf of Papua and northwest Coral Sea has emerged from a study of 9650 km of seismic, gravity, and magnetic data collected by Compagnie Générale de Géophysique in 1970 for the Bureau of Mineral Resources.

On the basis of gravity evidence, areas of continental, subcontinental, suboceanic and oceanic crustal thickness have been outlined. These correspond with the larger physiographic provinces.

The Eastern Fields Fan consists of a superficial wedge of sediments deposited over a dipping surface, named here the "G" surface. It is underlain by crust of subcontinental thickness. It may be out of isostatic equilibrium and still subsiding towards a compensated state.

Many of the structural features of the Moresby Trough are similar to those characteristic of the Aure Trough. Gravity evidence indicates that it has a thick sediment fill, and folding in the Moresby Trough is very similar to that found in the Aure Trough. It is suggested that the two features are continuous. The crust thins considerably under the Moresby Trough, where the sediment is thickest.

The Pandora Basin has a sediment fill of at least 2,5 km and deposition is continuing. A buried Miocene barrier reef identified by oil company surveys was traced outside oil permit areas and appears to swing east toward Portlock Reef, rather than be continuous with the modern Great Barrier Reef as was previously thought.

Evidence suggests that positive structures on the margin of the continental shelf have controlled the location of reef growth there. No ridge was found beneath the Papuan Plateau, contradicting a supposition by previous workers.

...
(Free-air and Bouguer maps).

- 136 - WILCOX L.E., J.T. VOSS & P.F. PALS - "Regional gravity and elevation maps of Greenland".
DMAAC/TP 75-001, Dept. of Defense, 9 p, St-Louis, 1975.

- 150 - BOEDECKER G. - "An economically working method for computing the gravimetric terrain correction".
Mit. Inst. Theor. Geod. Tech. Univ. Hannover,
from : J. Geophys., n°41, p.513-521, 1976.

The described method for the calculation of the terrain correction (deviation of the actual topography from a Bouguer plate) and the entire topographical reduction combines a station-independent orthogonal grid for the outer zones and a station-centered template for the inner zones as sub-division of the topography. This combination seems to have some practical advantages. Furthermore, the question of the heights to be used with respect to the curvature of the geoid is discussed. The conventional split of the Bouguer-reduction into terrain reduction and plate reduction seems to be no longer advisable.

- 151 - TORGE W. - "Methods and accuracy considerations for positioning and height determination for extensive geophysical investigations".
Proc. International Symposium on the Afar Region and Related Rift Problems, held in Bad Bergzabern, F.R. Germany, April 1-6, 1974, v.1.
from : Afar Depression of Ethiopia, IUGG, Sci. Rep. n°14, p.145-15, 1976.

In extensive geophysical investigations carried out by several German Geophysical Institute in the Afar region of Ethiopia in 1969 - 1972, positions and heights of many stations had to be determined. Although the geodetic problems involved in such determinations are relatively simple, the required work may constitute a considerable effort. It appears to be worthwhile to compare the requirements of geophysics with the efficiency of several geodetic methods. As an example, the methods employed in the German gravimetric and seismic surveys in the Afar region will be discussed with their results.

- 152 - SCHLEUSENER A., W. TORGE & H. DREWES - "The gravity field of Northeastern Iceland".
Mit. Inst. Theor. Geod., Tech. Univ. Hannover,
from : J. Geophys. n°42, p.27-45, 1976.

From 1964 to 1970, about 1000 gravity stations have been established in parts of northeastern Iceland. The survey covered the young volcanic zone and the adjoining tertiary plateau basalts mainly in the region between $65^{\circ}5' - 66^{\circ}N$ and $18^{\circ} - 16^{\circ}W$, with some extensions across the eastern basalt zone. Gravity measurements have been carried out in profiles with LaCoste-Romberg gravity meters (± 0.03 mGal), while heights have been determined by barometric levelling ($+ 2 \dots 3$ m). Density determinations by rock weighing and by Nettleton-profiles gave mean values between 2.0 g/cm^3 (hyaloclastite rocks) and 2.8 g/cm^3 (tertiary basalt lavas). Bouguer anomalies have been calculated with uniform density 2.6 g/cm^3 (tertiary basalt lavas). Bouguer anomalies have been calculated with uniform density 2.6 g/cm^3 and with different density zones ($2.2 - 2.7 \text{ g/cm}^3$). The accuracy of the anomalies varies between ± 0.5 and ± 4 mGal, depending on the height of the gravity station. The gravity field shows the well-known decrease from north to south ($0.4 \dots 0.5 \text{ mGal/km}$) and a relative gravity minimum (5 mGal) in the active rift zone. The more irregular gravity behaviour in the central part of the young zone might be due to surface near mass anomalies.

(Bouguer anomalies map).

- 153 - YOUNG D.G.G. - "A geophysical interpretation of the structural development of the Kingscourt Graben".
Proc. Royal Irish Acad., v.76, Section B, n°3, p.43-52, Dublin, 1976.

Gravity and magnetic data available in the Kingscourt area have been reinterpreted in the context of recent additional measurements intended to define steep local gradients and regional trends. Two major geophysical trends emerge ; a north-south and an approximately northeast to southwest of "caledonoid" direction consistent, though not invariably coincident with the apparent geological structural pattern.

The geophysical results suggest that the early subsidence in the Kingscourt graben during lower Carboniferous time was controlled by major faults of "caledonoid" trend originating in the pre-Palaeozoic basement. Responding to change in the stress pattern in upper Carboniferous time the north-south trending Kingscourt fault became dominant, initially only in the south, migrating northwards to preserve the narrow wedge of Permo-Triassic sediment near Kingscourt.
(Bouguer anomalies map).

- 154 - PLAUMANN S. - "Rock density in the Upper Rhine Valley".
from : The Rhinegraben progress Report 1967, p.114-115, 1967.

- 155 - CLOSS H. & S. PLAUMANN - "Gedanken zur Tektonik der Kruste im Oberrheingraben aufgrund von Schweremessungen".
from : Geol. Jb 85, S. 371-382, Hannover, 1968.

- 156 - SCHRUMPF M.B. - "Mission Océanographique de l'Atlantique Nord, Novembre 1967 - Août 1969".
from : An. Hydrog., t.II, fasc. 1, p.59-81, 1974.

- 157 - GERARD A. - "Apports de la gravimétrie à la connaissance de la tectonique profonde du Bassin de Paris".
from : Bull. BRGM, 2ème Série, n°2, p.75-87, Orléans, 1971.

Une première étude, portant sur les éventuelles corrélations qui pourraient exister entre la géologie superficielle et les traits principaux de la carte gravimétrique à 1/320.000 couvrant la région de Paris, permet de constater qu'à de rares exceptions près il n'est pas possible de trouver des sources superficielles pouvant permettre l'interprétation rationnelle des anomalies de la pesanteur visibles sur la carte.

C'est donc au niveau du socle que nous avons été amenés à placer nos interprétations. Ces dernières ont permis de préciser l'extension latérale d'un certain nombre d'hétérogénéités et d'estimer les profondeurs probables de ces dernières.

Des techniques nouvelles ont été utilisées pour mener à bien cette étude.

Dans une première phase la carte du champ de pesanteur a été convertie en un certain nombre d'autres cartes présentant le champ de pesanteur a été convertie en un certain nombre d'autres cartes présentant le champ de pesanteur à la profondeur de - 1500 m dans la région est, ainsi que le gradient vertical de ce dernier aux niveaux suivants :

- 0 sur l'ensemble de la carte,
- 1000 m sur la région centre-est,
- 1500 m sur la région est.

L'étude qualitative des cartes du gradient vertical a pu faciliter l'interprétation géologique des grands traits de la carte gravimétrique initiale. Elle nous a conduit à distinguer trois régions principales :

- une région ouest, où le socle est relativement superficiel, dominée par une tectonique de direction armoricaine,
- une région centrale, caractérisée par de grandes fractures, pouvant être considérée comme une zone de transition,
- une région nord-est où le socle atteint des profondeurs importantes avec une tectonique relativement peu accidentée.

Par ailleurs, un certain nombre de corrélations a pu être dégagé entre les traits principaux du toit de la Craie et le gradient vertical du champ de pesanteur.

Au cours d'une deuxième phase, des renseignements quantitatifs plus précis concernant la profondeur des sources ont été déduits des cartes, soit en utilisant des modèles équivalents, soit par l'étude locale de certaines propriétés du spectre d'énergie du gradient vertical.

- 158 - GERARD A. & P. GRIVEAU - "Interprétation quantitative en gravimétrie ou magnétisme à partir de cartes transformées de gradient vertical". BRGM, Serv. Géol. Nat., Dept. Géophys., 20 p, Orléans, 1971.

A discussion is given of the requirements, the advantages and the methods to be considered in attempting the quantitative interpretation of gravity or magnetic fields from computed maps of the vertically derived field.

The transform which is used here is the first vertical derivative (or vertical gradient) with or without downward continuation, but the computed maps are in fact obtained by a controllable Fourier method in which two kinds of operations can be simultaneously performed, in complete independance : the separation on one hand, by frequency cut-off, of any part of the data - as it may itself demand or permit - and the transformation on the other hand, by vertical derivation and/or continuation, of the part which is retained.

Taking as raw data either actual surveys or a series of artificially constructed maps, it is first shown how separated and transformed maps of this type can be efficiently obtained under quite flexible conditions, using a specially designed computer program. It is further seen that for correctly controlled filterings, the accuracy of the computed maps actually permits to take them as the basis for quantitative interpretation.

To effect this, any one of the conventional methods which make use of equivalent model computations may in the first place be adapted to the gradient's case, with the benefits however, whether in two - or in three dimensional interpretation, of an enhanced lateral separation of the anomalies and of a large attenuation of the regional effects.

Particularly, the delineation of horizontal contours for even fairly complex models can often be made directly in a sufficiently safe way on the anomalies as they show on the vertical gradient maps. This greatly accelerates the process of determining equivalent model bodies.

More special methods of interpretation can also be designed by taking into account first the fact that the vertical derivation of the field amounts to an operation of separation on the field's sources themselves, and then, the availability here of the frequency form of the information as a result of using a Fourier method of transform computation.

Trial utilisations of various such interpretation processes, of either the conventional or the less conventional type, are presented especially in the case of an interpretation study on transformed maps of parts of an offshore aeromagnetic survey (English Channel).

- 159 - GERARD A. & N. DEBEGLIA - "Automatic three-dimensional modeling for the interpretation of gravity or magnetic anomalies".
from : Geophys., v.140, n°6, p.1014-1034, 1975.

Transformation of gravity or magnetic anomaly maps into isodepth maps of a surface separating two homogeneous media may be accomplished by
1) systematically estimating an average depth and density or magnetization contrast for the surface and,
2) using an iterative method to adjust local depths compared to the average depth of the surface. Average depth, density or magnetization contrast, and iterative adjustment of local depths are determined using the Fourier transform of the field to be interpreted and that of the field generated by an equivalent surface.

This leads us to propose a method of estimating the average depth of the sources and a distribution function for the depths and then a complete and very economical algorithm for the calculation of the corresponding equivalent surface.

- 160 - HANKASAL T. - "Final Report of IAG Special Study Group n° 3.37 on Special Techniques of Gravity Measurements".
Presented at the IUGG, IAG XVI General Assembly in Grenoble 1975,
11 p, 1975.

- 162 - LANZA R. - "Profili magnetici e di gravità nelle Alpi Occidentali".
from : Rivista Italiana di Geofisica, v.II, n°2, p.175-183, 1975.

- 164 - ACADEMY of SCIENCES of the USSR, Main Administration of Geodesy and Cartography, under the Council of Ministers of the USSR - "Geological Geophysical Atlas of the Indian Ocean".
151 p, Moscow, 1975.

The International Indian Ocean Expedition (IIOE) was conceived in 1957 and carried out between 1959 and 1965.

For the purpose of the IIOE the Indian Ocean was taken to include the Red Sea, Persian Gulf, and the seas adjacent to the Sunda Arc, and to extend southwards to the Antarctic Continent. The southwest and south-east limits were taken to be the longitudes of the southern points of Africa and Australasia (about 20°E and 147°E, respectively). During the course of the IIOE, 13 countries and at least 46 ships took part, some returning several times to the region. Initially the scientific programmes were co-ordinated, sometimes more and sometimes less, by a working group set up in 1960 by the Special (now Scientific) Committee on Oceanic Research (SCOR).

Numerous publications greatly adding to the body of scientific knowledge on the region have resulted from the expedition.

The Geological-Geophysical Atlas of the Indian Ocean has been under preparation since 1966, under the overall guidance of an International editorial board of scientists from a wide range of disciplines in the Earth sciences.

(8 free-air anomaly maps).

- 165 - MOENS M. & B. DUCARME - "Rattachement gravimétrique des caves géophysiques de Louvain-la-Neuve au réseau Belge et à IGSN 71".
Inst. Astr. & Geophys. G. LEMAITRE, Univ. Catholique de Louvain,
Contr. n°15, 15 p, Louvain, 1976.

- 166 - SAXOV S. - "Gravity measurements in Central Jylland".
Mémoires Inst. Géod. Danemark, 3ème sér., T.42, 138 p, Copenhagen, 1976.

In 1953 the Geodetic Institute purchased a Worden gravimeter, and measurements were commenced in Jylland the same year. The survey was limited to measurements along the lines of precise levelling. In the following years the purpose was altered to a detail gravity survey of all Jylland. Results from the northernmost part (SAXOV 1956), and the southernmost part (SAXOV 1965) have been published, and this paper concluded the survey of Jylland.

The gravity data presented in Tables 9 and 10 all originate from measurements with the Worden gravimeter. The Bouguer anomalies were computed after each field trip, the total number of stations being about 13.000.

The measurements in Jylland was carried out over a long span of years, due to the fact that surveying was undertaken only during a few weeks in spring and in autumn, the summer season being occupied by other work. The surveying went on until 1964, and in the following years only some control measurements were carried out.

The present paper is a presentation of the gravimetric measurements in Central Jylland, a discussion of the behaviour of the gravimeter, and a presentation of 12 Bouguer anomaly maps (scale 1/100.000), however, without any interpretation of the maps.

References : Buddinge pillar 1 : 981.558,00 mGal

Normal Gravity International Formula of 1930

Density 2,0.

Equidistance : 1 mGal.

- 167 - BONATZ M. & B. RICHTER - "Gravimetrische Erdgezeitenstation Réunion (Indischer Ozean)".
Mit. Inst. Theor. Geod. Univ. Bonn, n°32, 20 S, Bonn, 1975

In cooperation with the meteorological service of the isle of Reunion (France) and with support of the Deutsche Forschungsgemeinschaft in March 1974 a gravimetric earthtide station at Reunion was established. The performed measurements, which should continue until the end of 1975, join to the observations at Kerguelen island from January 1973 to January 1974.

It is the object of the measurements to get informations about the tidal variations of gravity for one more point in the southern Indian Ocean (after Kerguelen). Following up the analysis of data, that means after calculation of preliminary amplitudes and phases of the partial tides, investigations will be performed for determination of correlations with some physical parameters as airpressure, airtemperature ... as well as oceanic tides, which have been observed during some years at Le Port. After that it seems to be possible, to calculate approximative values for the vertical movement of the observation point, which may be used for geophysical interpretation.

- 168 - BONATZ M. & B. RICHTER - "Gravimetrisches Gezeitenprofil Bonn - Longyearbyen (Spitzbergen), Hauptpartialtiden für die Stationen Oslo, Bergen und Trondheim".
Mit. Inst. Theor. Geod. Univ. Bonn, n°33, 14 S, Bonn, 1975.

Connected to the reference station Bonn earthtide measurements were performed at Oslo, Bergen and Trondheim in Norway, using the transformed Askania-Gravimeter BN-02. The data were analyzed by CHOJNICKIS method.

...

- 169 - BONATZ M. & H. WILMES - "Zur Frage instrumenteller Phasenfehler bei der Gezeitenregistrierung mit Askania- Gravimetern BN".
Mit. Inst. Theor. Geod. Univ. Bonn, n°34, 9 S, Bonn, 1975.

Due to the mechanical properties of Askania-Gravimeters electronic-filtering of the signal is important when recording earthtides. Disadvantage of filtering is a phase delay of the output signal. Applying a capacitiv transducer system with double activ filter in the Askania-Gravimeter System BN phase errors within the earthtide spectrum are less than $0,1^\circ$.

- 170 - SCHWEIZERISCHEN GEODATISCHEN KOMMISSION - "Arbeiten der Bodenseekonferenz, Basismessung Heerbrugg 1959, Messung der Basislänge".
Dreissigster Band, Teil II, 69 S, 1975.

- 171 - WEBER W. - "Ein kartographisches Datenbanksystem".
D.G.K., Reihe B : Angew. Geod. H. n°208, 102 S, Frankfurt, 1975.

- 172 - RAPP R.H. & R. RUMMEL - "Methods for the computation of detailed geoids and their accuracy".
Rep. Dept. Geod. Sci. Rep. n°233, 36 p, The Ohio State Univ., Columbus, 1975.

Two methods for the computation of geoid undulations using potential coefficients and $1^\circ \times 1^\circ$ terrestrial anomaly data are examined. It was found that both methods give the same final result but that the method suggested by Molodenskii allows a more simplified error analysis than the method used by VINCENT and MARSH.

Specific equations were considered for the effect of the mass of the atmosphere and a cap dependent zero-order undulation term was derived. Although a correction to a gravity anomaly for the effect of the atmosphere is only about - 0.87 mGal, this correction causes a fairly large undulation correction (e.g. 2,3 m with a cap size of 20°) that has not previously been considered.

The accuracy of a geoid undulation computed by these techniques was estimated considering anomaly data errors, potential coefficient errors, and truncation (only a finite set of potential coefficients being used) errors. It was found that an optimum cap size of 20° should be used.

The geoid and its accuracy were computed in the Geos-3 calibration area using the GEM 6 potential coefficients and $1^\circ \times 1^\circ$ terrestrial anomaly data. The accuracy of the computed geoid is on the order of ± 2 m with respect to an unknown set of best earth parameter constants. This geoid was compared to that computed by VINCENT and MARSH where we found a systematic difference of 3.9 m, an undulation difference variance of $(2.6\text{m})^2$, and a maximum difference of 12 meters.

- 173 - MORITZ H. - "Integral formulas and collocation".
Rep. Dept. Geod. Sci. n°234, 63 p, The Ohio State Univ., Columbus, 1975.

The report deals with various theoretical and numerical aspects of the interplay between least-squares collocation and classical integral formulas.

It is proved that geodetic integral formulas may be considered as limiting cases of collocation for homogeneous and regularly and densely distributed data. Collocation methods can be employed for adjusting continuous data and combining them with other measurements, before using them with integral formulas.

With respect to numerical computation, integral formulas and collocation techniques mutually complement each other, so that in many practical cases a judicious combination of the two procedures may be practically convenient.

- 174 - LEIGEMANN D. - "Some problems concerned with the geodetic use of high precision altimeter data".
Rep. Dept Geod. Sci. n°237, 62 p, The Ohio State Univ., Columbus, 1976.

The definition of the geoid in view of different height systems is discussed. A definition is suggested which makes it possible to take the influence of the unknown corrections to the various height systems on the solution of Stokes' problem into account.

A solution of Stokes' problem with an accuracy of 10 cm is derived which allows the inclusion of the results of satellite geodesy in an easy way. In addition, equations are developed that may be used to determine spherical harmonics using altimeter measurements, considering the influence of the ellipticity of the reference surface.

COMMISSION INTERNATIONALE pour l'EXPLORATION SCIENTIFIQUE de la MER MEDITERRANEE, MONACO : Rapports et Procès-Verbaux des Réunions.

- 177 - v.22, Fasc. 2a, 210 p, 1973.
Symposium Géodynamique, Géologie et Géophysique Marines - Projet Géodynamique, Rap. Sci. n°6.

CORON S. - "Grandes zones d'anomalies de la pesanteur dans le Bassin Méditerranéen et ses bordures - Détails pour la région de Gibraltar".
p.31-33, (carte d'anomalies de Bouguer).

- 178 - v.22, Fasc. 2b, 215 p, 1974.
Géologie et Géophysique Marines - Zone Méditerranéenne -
Bibliographie 1969-1972.

- 179 - v.23, Fasc. 4b, 350 p, 1975.
Géologie et Géophysique Marines - Zone Méditerranéenne -
Bibliographie 1973-1974.

- 180 - NATIONAL INSTITUTE of POLAR RESEARCH - "Yamato Meteorites collected in Antarctica in 1969".
Memoirs Nat. Inst. Polar Res., Sp. Issue n°5, 110 p, Tokyo, 1975.

This paper summarizes earlier studies on 9 "Yamato meteorites" which were discovered in December 1969 by an oversnow traverse party of the 10th Japanese Antarctic Research Expedition at the southeastern end of the Yamato Mountains in East Antarctica. The samples consisted of 8 chondrites and 1 achondrite, among which relatively large 4 samples were classified as follows :

a) enstatite chondrite, (b) ca-poor achondrite, (c) carbonaceous chondrite (Type III), and (d) olivine-bronzite chondrite. Since the meteorites were found in the bare ice area of about 5 x 10 km, geomorphological and glaciological features of the sampling site are described in relation to the concentration of the meteorites.

182 - UNISURV G - An Australian Journal of Geodesy, Photogrammetry & Surveying, n°23, 96 p, Univ. New South Wales, Sydney, 1975.

- a) MATHER R.S. - "Secretary's report to section V, International Association of Geodesy, XVI General Assembly, Grenoble, France, August 1975".
p.I-22.

This particular Secretary's Report on some of the activities which fall within the scope of Section V of IAG is complementary to that prepared by the Joint Secretary to Section V, Professor L.P. PELLINEN of the USSR, and is confined to developments in the following areas :

- Fundamental geodetic constants,
- Reference systems,
- Anomalies of the Earth's figure and its gravitational field,
- Mean sea level and departures from a level surface.

Each of these subjects is described in a separate section. The activities in the third topic are dealt with under three sub-sections :

- Data processing
- Determinations,
- Interpretations.

Special Study Groups (SSG's) set up for the quadrennium under review dealing with any of the above subjects, are listed in Section 6, while all relevant international symposia held in this same period are listed in Section 7.

- b) ANDERSON E.G., C. RIZOS & R.S. MATHER - "Atmospheric effects in Physical Geodesy".
p.23-41.

It is well known that the effect of the Earth's atmosphere on the solution of the geodetic boundary value problem would be one of zero degree for a spherical Earth. Thus the presence of the atmosphere has no effect on Stokes' solution of this problem. Atmospheric effects are, however, not insignificant in solution of the geodetic boundary value problem to ± 5 cm. The treatment of the atmosphere using the procedure recommended for Geodetic Reference System 1967 (GRS 67) is reviewed and contrasted with the treatment in MATHER's solution to order e^3 . It is observed that departures of the Earth from the ellipsoidal shell model adopted in GRS 67 are significant at the 50 μ Gal level. The non-zero degree effects of the atmosphere on solutions of the Geodetic boundary value problem have a range of approximately 60 cm in low degree surface harmonic representations. The atmospheric effects cannot therefore be neglected in studies of quasi-stationary sea surface topography.

- c) MATHER R.S. & K. BRETREGER - "An experiment to determine radial deformation of Earth tides in Australia by ocean tides".
p.42-58.

It is planned to deploy four tidal gravimeters loaned by the International Centre for Earth Tides (ICET) at several sites in Australia in 1975-1976. In addition to providing the usual information collected during the ICET program of Trans World Tidal Gravity Profiles, the Australian stations will be sited so that data should also be forthcoming for the study of the radial deformation of Earth tides in the Australian land mass by ocean tides.

It is also proposed to collect some high energy mode satellite altimetry to the ocean surface in the north eastern region of Australia concurrent with this experiment during the GEOS-C mission. The techniques to be used in the analysis of the data are outlined. It is anticipated that the analysis of observations may also provide information on whether a suitable a priori ocean tide model exists for representing long wave tidal effects when pre-processing satellite altimetry data.

- d) LEPPERT K., B.V. HAMON & R.S. MATHER - "A status report on investigations of sea surface slope along the Eastern Coast of Australia".
p.60-67.

Investigations of the sea surface slope along the eastern coast of Australia are proceeding on two fronts. The oceanographic aspects of the discrepancies detected by the Division of National Mapping on comparing geodetic levelling and mean sea level, have been studied and the relationship between mean sea level, current and wind stress is being investigated.

Plans are advanced for the determination of quasi-stationary sea surface slopes off north eastern Australia using the 50 cm altimetry collected in the region during NASA's GEOS-C mission. The technique being experimented with is a solution of the geodetic boundary value problem treating the local stationary sea surface as not coinciding with the geoid. This experiment is being combined with an investigation of ocean tidal loading of Earth tide signals on gravimeters and a tiltmeter sited in the eastern part of Australia, with a view to eventually studying the tidal signal in the altimeter test area.

- e) MATHER R.S. - "Mean sea level and the definition of the geoid".
p.68-79.

The geoid is conventionally defined as the equipotential surface of the Earth's gravity field corresponding to Mean Sea Level (MSL). While adequate for resolution to $\pm 1 - 2$ m, this definition could result in ambiguity when applied at the 10 cm level to the use of mixed data sets (e.g., gravity anomalies and satellite altimetry) for the determination of sea surface topography. The classical concept of being able to relate levelling results directly to the geoid no longer applies. Inconsistencies may occur if this effect were not allowed for in defining Earth space relationships between the physical surface and the reference surface when using mixed data sets in physical geodesy.

An accurate definition of the geoid can be formulated within the framework of the geodetic boundary value problem if certain minimum conventions are adopted by all levelling and gravity authorities. The definition so obtained at the present time is transient in theory but should not change by amounts of practical significance (i.e., 1-2 cm) over one or two decades, as average recorded values of secular changes in MSL are of the order of 1 mm yr⁻¹. Some problems which need to be overcome are summarized and suggestions made for the rationalization of data acquisition procedures to achieve this end.

- f) ANGUS-LEPPAN P.V. - "An investigation of possible systematic errors in levelling along the Eastern Coast of Australia".
p.80-91.

MAVRIDIS L.N., University of Thessaloniki, Dept. of Geodetic Astronomy,

187 - Annual report 1971, 4 p, 1972.

188 - Annual report 1972, 3 p, 1973.

- 189 - MENDES VICTOR L.A. - "Observações gravimétricas no território da Guiné Portuguesa".
Serv. Meteo. Nac., RT 880, GEO 100, 7 p, free-air and Bouguer maps,
Lisboa, 1966.
- 190 - MENDES VICTOR L.A. - "A solução do problema inverso em gravimetria -
Programa em Fortran IV utilizado em computador IBM 360/65".
p.191-204, Bouguer anomaly map, Lisboa
- 191 - INNOUCHI N. & H. SATO - "Vertical crustal deformation accompanied with
the Tonankai Earthquake of 1944".
Bull. Geogr. Survey Inst., v.XXI, Part 1, p.10-18, Tokyo, 1975.
- 192 - GIRDLER R.W. - "The great negative Bouguer gravity anomaly over Africa".
from : EOS, v.56, n°8, p.516-519, 1975.
- 193 - COUTTS D.A. - "Gravity meter ties to New Zealand and Antarctica 1975".
B.M.R., Geol. & Geophys., Record 1975/130, 15 p, Canberra, 1975.
The B.M.R., Geology & Geophysics made gravity ties from Australia
to New Zealand and Antarctica in November and December 1973, using three
LaCoste & Romberg gravimeters. Earlier, in December 1966, the Antarctic
Division (of the Department of External Affairs) made similar ties using
two LaCoste & Romberg gravity meters. Gravity values calculated from the
results of these two surveys are consistent, within experimental error,
with the values of the International Gravity Standardization Net 1971
(IGSN-71) except the IGSN-71 value at Auckland B which appears to be
about 0.1 mGal too high. The gravity intervals measured between McMurdo
and Byrd, and McMurdo and the South Pole have standard deviations of
0.1 to 0.2 mGal.
Diagram Auckland : 45164 D
- 196 - TSCHERNING C.C. - "Implementation of Algol-procedures for covariance
computation on the RC 4000 computer".
The Danish Geodetic Inst., Internal Rep. n°12, 48 p, Copenhagen, 1976.
Algorithms for the computation of analytic covariances of up to
second order derivatives of the anomalous potential of the Earth and of
mass density anomalies fulfilling a simple mathematical property are
programmed in algol for the RC 4000 computer.
Special precautions have been taken to assure a satisfactory numerical
performance when the points of evaluation have a small spherical distance
or lie in a heigh altitude
- 197 - NAKAGAWA I., M. SATOMURA, T. SETO, Y. HASEGAWA ... - "On characteristics
of LaCoste & Romberg Gravimeters (Model G)".
from : J. Geod. Soc. Japan, v.19, n°2, p.100-112, 1973.
(Japanese text).

SERVICE GEOGRAPHIQUE de l'ARMÉE

- 199 - Bull. N°100, 31ème année, 49 p, Athènes, 2ème trimestre 1971.
- 200 - Bull. N°101, 32ème année, 49 p, Athènes, 1er trimestre 1972.
- 201 - Bull. N°102/103/104, 33ème année, 87 p, Athènes, du 2ème trimestre 1972 au 2ème trimestre 1973.
- 202 - Bull. N°105/106, 34ème année, 44 p, Athènes, 1er et 2ème trimestres 1974.
- 203 - HENNION P. - "Calcul de la correction de terrain en gravimétrie : principe de la méthode de calcul par ordinateur, élaboration du programme et application pratique".
Rap. stage D.E.A., Lab. Geophys. Appl., 16 p, Paris, Juin 1970.
- 204 - MASSOT J.P. - "Contribution à l'étude des procédés de calcul automatique de la correction topographique gravimétrique à partir de cartes topographiques digitalisées".
Rap. D.E.A. Geophys. Appl., Lab. Tectonophys., Univ. Paris VI, 36 p, 1974.
- 205 - BARTA Gy - "About the mass-distribution of the Earth on base of the shape of the geoid".
from : Acta Geod., Geophys. & Montanist., Acad. Sci. Hung., t.5, n°3-4, p.355-364, 1970.
Author examines by special application of the zonal spherical functions the dimensions and depth of mass-asymmetries that may cause the anomalies of the geoid (Smithsonian Standard Earth 1966). He arrives at the result that the "pear" shape of the Earth is the result either of a $1,6 \cdot 10^{22}$ g deficiency of mass near the surface in the southern polar region or that of a just as large surplus mass in the northern one. The mass of the acting body increases in function of depth. The Indian and Australian anomalies on the equatorial cut of geoid are the most important ones in respect of both their dimensions and their physical backgrounds. The smaller anomalies antipodal to them are (in greater part) probably results of the superposition of the effects caused by the two chief mass-asymmetries.
- 206 - JACOBY W.R. - "Model experiment of plate movements".
from : Nature Physical Sci., v.242, n°122, p.130-134, 1973.
An attempt to model plate movements is presented in this article and the observed real movements are discussed in the light of the experimental results.
- 208 - LODDO M. & F. MONGELLI - "On the relation of Bouguer anomalies to surface elevation".
from : Geof. e Meteor., Boll. Soc. Italiana Geof. e Meteo., v.XX, n°5/6, p.159-163, Genova, 1971.

- 209 - SENGUPTA S. - "Geological and geophysical studies in Western part of Bengal Basin, India".
from : Bull. American Assoc. Petroleum Geol. v.50, n°5 p.1001-1017, 1966.

Just beyond the western boundary of West Bengal, the great Indian shield disappears below a blanket of alluvium. The exposed part of the shield bordering the Bengal basin is marked by a row of intracratonic Gondwana basins, a series of thrust zones in Singhbhum, and extensive exposure of basic volcanics in the Rajmahal Hills. Intensive geophysical surveys and deep drilling in the alluvium-covered plains of West Bengal have revealed a thick section of Cretaceous and Tertiary sediments lying on a basement of basalt lava flows, presumably of the same age as the Rajmahal Group volcanics. An extension of the easternmost Gondwana basin farther east, below the Bengal alluvium, also is suggested. A series of buried basement ridges, marking the western margin of the Bengal basin, presumably kept the Gondwana continental basins isolated from the main Bengal basin through most of Tertiary time. Locally, during the late Tertiary, the sea transgressed over these basement ridges and overlapped parts of the Indian shield.

...

- 210 - GUILLAUME A. - "Nouvelles mesures de pesanteur dans les Alpes Centro-Orientales, conséquences géologiques".
from : C.R. Acad. Sci. Paris, t.278, Sér. D, p.2593-2595, 20 Mai 1974.

De nouvelles campagnes gravimétriques aux confins de l'Autriche, de l'Italie et de la Suisse permettent de dresser une carte détaillée des anomalies de Bouguer des Alpes centro-orientales. Cette carte suggère l'existence d'une discontinuité transversale formant la limite ouest des Alpes orientales et correspondant à la ligne judiciaire.

- 212 - MAKRISS J., H. MENZEL, J. ZIMMERMANN & P. GOUIN - "Gravity field and crustal structure of North Ethiopia".
Typewritten paper, 20 p, presented at the "Symposium on the Afar Region of Ethiopia and related rift problems", 1975.

A new Bouguer map of North Ethiopia and the French Territory of the Afars and Issas (TFAI) has been compiled incorporating more than 4.000 gravity data. The map was interpreted using the latest seismic results from the TFAI and the AFAR by means of a 2-D gravity model, a Moho-depth map and two isostatic maps for $T = 20$ km and $T = 25$ km. The results revealed that :

- The crust of AFAR is continental strongly attenuated (14-22 km) and partly oceanised in areas of crustal separation.
- The upper mantle below AFAR has lower density than the normal upper mantle.
- The attenuated areas in AFAR, marked by gravity maxima, indicate the separation zones of the Nubian, Arabian and Somalian plates. These zones are radially arranged building a "triple junction".
- The Western and Southern Plateau are continental blocks of the shield-type and are also partly underlain by low density material. Their thickness varies with elevation and has values between 30 km and 42 km.
- The crust-upper mantle system is, in general, not isostatically balanced at the Moho discontinuity. The AFAR is overcompensated due to the ascent of upper mantle material at low depths. The western part of the Western Plateau is undercompensated due to the low velocity-density material at its basis.
- Considering the amount of the mass per unit area at different depth levels it was shown that isostatic balance occurs at depths below 50 to 60 km.

- 213 - MAKRIJ J., J. ZIMMERMANN, A. BALAN & A. LEBRAS - "Gravity study of the Djibouti area".
from : Tectonophysics, v.27, p.177-185, 1975.

In March and April 1972, 380 gravity stations were established in the TFAI. The data was reduced to Bouguer anomalies of 5 mGal isolines. Qualitative and quantitative interpretation based on the gravity map, on seismic data and the magnetics and physiography of the area revealed that :

The crust of the Gulf of Tadjura and the central part of the TFAI is strongly oceanized and is the direct continuation of the Gheba Ridge.

To the north of the Gulf, at the Dankali Mountains, the crust increases in thickness and most probably contains sialic fragments, indicating the continuation of the Danakil Chains in the TFAI.

To the south the structure is bordered by a continental block the Aysha Horst.

The oceanisation is concentrated only in the area of deep injections, marked by gravity maxima, whereas the rest of the area is to be described as sub-continental. The crust is attenuated from south (Aysha Horst) to north (Red Sea), from 30 to 15 km thickness.

The pattern of the gravity anomalies shows clear lineations only along the coasts of the Gulf of Tadjura and the Straits of Bab el Mandeb. Inland the field breaks up in relative minima and maxima indicating the fragmentation of the crust and the "triple junction" nature of the area.

The tectonic process is that of extension with normal faults having maximum displacements at the northern border of the Gulf of Tadjura.

The Uppermost Mantle has low velocity and density values due to thermal processes in the expanding zone. The state of the Upper Mantle material must be that of partial melting due to high temperatures of the order of 800° to 1.000° C in about 15 km depth.

- 214 - ROESER H.A., S. PLAUMANN & E. FORSTNER-BALLHEIM - "The crustal structure of the Norwegian continental margin and the Norwegian Basin according to magnetic and gravimetric measurements".
from : Meteor. Forsch. Ergebnisse, Reihe C, n°21, Berlin - Stuttgart, 1975.

Marine gravimetric and magnetic measurements indicate that the crust of the western part of the Voring Plateau west of the Voring Plateau fault is probably of continental origin. The magnetic anomalies suggest a cover of plateau basalt which was presumably extruded along the Voring Plateau fault and an additional fault zone on the upper part of the slope between the Voring Plateau and the deep sea. The latter fault on the continental slope is thought to be the original continental margin.

The crust in the area of the continental slope, the Norwegian Basin, and the rise to the Jan Mayen Ridge probably has formed by sea-floor spreading. Subsequently, magmatic rocks intruded into the seamount zone of the Norwegian Basin ; the wide-spread lack of magnetic anomalies in the area could be related to the intrusions. The geophysical data are consistent with an interpretation of the seamount zone as a fracture zone similar to the Jan Mayen fracture zone. It seems unlikely that the Norwegian Basin was ever the site of an active sea-floor spreading axis.

- 215 - SOCIETE HELVETIQUE des SCIENCES NATURELLES - Procès-verbal de la 121ème séance de la Commission Géodésique Suisse tenue à l'Université de Berne le 21 Juin 1975.
65 p, 1976.

- 216 - WENZEL H.G. - "Simultaneous observations with LaCoste-Romberg gravimeters, model G".
Mit. Inst. Theor. Geod., Tech. Univ., Hannover,
Proc. VIIth Intern. Symposium on Earth Tides, p.307-311.

Some years ago the LaCoste-Romberg field gravimeter model G has been built with a capacitance readout. This enables the connection of a recording system for precise earth tide observations. The following paper deals with an instrumental comparison of two different model G gravimeter equipments using simultaneous recordings.

- 217 - HANDSCHUMACHER D.W., S.T. OKAMURA & P.K. WONG - "Magnetic and bathymetric profiles from the Central and Southeastern Pacific : 10°N - 45°S, 70°W-150°W".
HIG-75-18, Data Rep. n°129, 162 p, Univ. of Hawaii, 1975.

Magnetic and bathymetric survey data collected in the central and southeastern Pacific, 10°N - 45°S , 70°W - 150°W, are presented in profile format along tracklines. ...

- 218 - MORITZ H. - "Integral formulas and collocation".
AFCLR-TR-75-0628, The Ohio State Univ., Sci. Rep. n°1, 63 p, 1975.

The report deals with various theoretical and numerical aspects of the interplay between least-squares collocation and classical integral formulas.

It is proved that geodetic integral formulas may be considered as limiting cases of collocation for homogeneous and regularly and densely distributed data. Collocation methods can be employed for adjusting continuous data and combining them with other measurements, before using them with integral formulas.

With respect to numerical computation, integral formulas and collocation techniques mutually complement each other, which is most convenient for the solution of many practical problems.

- 219 - TSCHERNING C.C. - "Covariance expressions for second and lower order derivatives of the anomalous potential".
AFGL-TR-0052, Rep. Dept. Geod. Sci. n°225,
The Ohio State Univ., Sci. Rep. n°2, 62 p, 1976.

Auto-and cross-covariance expressions for the anomalous potential of the Earth and its first and second order derivatives are derived based on three different degree-variance models.

A Fortran IV subroutine is listed and documented that may be used for the computation of auto-and cross-covariance between any of the following quantities :

- 1) the anomalous potential (T),
- 2) the negative gravity disturbance / r,
- 3) the gravity anomaly (Δg),
- 4) the radial component of the gradient of Δg ,
- 5) the second order radial derivative of T,

- (6), (7) the latitude and longitude components of the deflection of the vertical,
- (8), (9) the derivatives in northern and eastern direction of Δg ,
- (10), (11) the derivatives of the gravity disturbance in northern and eastern direction,
- (12)-(14) the second order derivatives of T in northern, in mixed northern and eastern and in eastern direction.

Values of different kinds of covariance of second order derivatives for varying spherical distance and height are tabulated.

- 221 - FAIRHEAD J.D. - "The structure of the lithosphere beneath the Eastern Rift, East Africa, deduced from gravity studies".
 from : Tectonophysics, v.30, p.269-298, 1976.
 Univ. of Leeds, Dept. of Earth Sci., Pub. n°362.

A compilation of all published and unpublished gravity data for the Eastern rift between latitudes 1°N and 5°S is presented. The Bouguer anomaly map reveals that the shape of the negative regional anomaly associated with the rift is approximately two-dimensional, striking east of north, of width 350 ± 50 km and amplitude 500 ± 100 g.u. relative to the background value of -1300 ± 100 g.u. to the west. The regional anomaly is interpreted in terms of an upward thinning of the lithosphere and replacement by low-density asthenosphere. This model is different from previous interpretations in that major lithospheric thinning is restricted to the region of the Eastern rift affected by the domal uplift and does not extend beneath the Lake Victoria region to the west. The gravity and seismic models are compatible if the anomalous upper mantle (asthenospheric part), beneath the rift, is in a state of partial melt. A consequence of the revised regional anomaly is that it reduces previous amplitude estimates of the axial positive residual anomaly within the rift by at least 50 % and generates negative anomalies over the rift shoulders in areas covered by Cenozoic volcanics. These negative anomalies are considered to be caused by the low density of the surface volcanics. Within the rift, elongated negative anomalies of amplitude 100 - 350 g.u. are associated with sedimentary basins and are attributed to low-density sediments up to 3 km thick. The positive residual anomaly along the axis of the rift can be interpreted in terms of either a dyke injection zone less than 15 km wide or by a dense infill body about 2.5 km thick. The positive anomaly is shown to be confined to the volcanic province of the Eastern rift and has its southern termination in the Magadi - Natron area, just north of where the Kenya rift valley changes to block faulting in N. Tanzania. This termination coincides with a change in the spatial distribution of the seismic and geothermal activity

- 222 - PICK M. - "Solution of the inner Stokes problem for a sphere".
 Studia Geophys. & Geod., t.20, n°2, p.193-195,
 Cesk. Akad. Ved, Praha, 1976.

In the present paper the inner Stokes problem is solved.

- 223 - ČERMAK V. - "High heat flow measured in Ostrava - Karvina coal Basin".
Studia Geophys. & Geod., t.20, n°1, p.64-71, Cesk. Akad. Ved, Praha, 1976.

Systematic determinations of the heat flow values in boreholes and mines on the territory of Czechoslovakia started in 1964 and at present more than 80 values are known. During 1970 - 74 several deep holes were drilled in the southern part of the Ostrava - Karvina Coal Basin: (the Czechoslovak part of the Upper Silesian Basin) as a part of a running geological survey. All technical work, i.e. drilling, temperature logging and rock sampling from the core were performed by the Geological Survey, Ostrava - Hrabova; the laboratory determination of the thermal conductivity and the interpretation of the temperature records were carried out in the Geophysical Institute, Czechosl. Acad. Sci., Prague.

- 224 - BARLIK M. - "Problem of gravity reduction for examination of real vertical deflections in mountain areas".
Polish Acad. Sci., Committee Geod., 7 p, Warsaw, 1975.
Presented at the XVth General Assembly of the IAG of IUGG, Grenoble, Aug. 1975.

The problem of choice of a gravity reduction method for determination of real vertical deflection is discussed in the paper. Mountain conditions cause necessity of introducing many corrections to vertical deflections determined from Vening Meinesz's formulas. New author introduces BJERHAMMAR's method of gravity anomaly reduction. It is suggested to complete BJERHAMMAR's reduction with terrain reduction and to divide mountain areas into some parts according to tectonic-stratigraphical and paleogeographic-facial features to determine the gravity reduction. According to the presented modifications there are possibilities of the application of measured higher potential derivatives instead of fully analytical procedure.

- 225 - NAKAGAWA I. & M. SOTOMURA - "On precise gravity measurement at stations of small gravity difference".
Typewritten text, 4 p, presented at the XVth General Assembly of IUGG, Grenoble, Aug. 1975.

- 226 - DITTFELD H.J. - "Digitale Gezeitenregistrierungen am gravimetrischen Observatorium Potsdam".
Sond. : Zeits. Vermessungstechnik, H.7, 23 Jg, 5 S, 1975.

- 227 - DITTFELD H.J. - "Erste Ergebnisse des neuen Gezeitengravimeters im gravimetrischen Observatorium Potsdam".
Mit. Zentralinst. für Physik der Erde n°400, 3 S, Potsdam, 1974.

- 228 - ELSTNER C. & W. ALTMANN - "Ergebnisse gravimetrischer Registrierungen in Potsdam".
Akad. Wissens. der DDR, Zentralinst. für Physik der Erde, 3 S, Potsdam, 1974.

- 229 - NATIONAL KOMITEE für GEODASIE & GEOPHYSIK - "Ergebnisse der Untersuchung rezenter Erdkrustenbewegungen in der Deutschen Demokratischen Republik". Geod. Geoph. Veröff., R.III, H.35, 146 S, Berlin, 1974.
Présentation de 12 articles séparés et bibliographie (de 1962 à 1973) concernant les mouvements récents de la croûte terrestre.
- 230 - GERSTENECKER C. & E. GROTEN - "On long-range gravity measurements with LaCoste-Romberg gravimeters in the International Gravity Net (IGSN 1971)". Osserv. Geof. Sper., Boll. Geof. teor. ed appl., v.XVIII, n°68, p.317-321; Dicembre 1975.
Using LaCoste-Romberg gravimeters during 1970 to 1975 checks of the European part of the IGSN 1971 have been made. Further, time variations of calibration factors and other long range parameters of gravity standardization were investigated. On applying results obtained from several types of adjustment internal consistency as well as accuracy and reliability are discussed.
- 231 - MELCHIOR P. - Marées terrestres.
Bull. Inf. N° 73, p.4186-4257, Obs. Royal de Belgique, Bruxelles, 1er Mars 1976.
- 232 - DJUROVIC D. - "Les termes de marée dans le Temps Universel - Coordonnées du pôle et TUI-TUC pour l'intervalle 1967-1974".
Obs. Royal de Belgique, Bull. d'Obs. Marées Terrestres, v.IV, Fasc. 3, Section Géodynamique, 63 p, Bruxelles, Décembre 1975.
- 233 - ARUR M.G. & I.I. MUELLER - "Does mean sea level slope up or down toward North ?". (Comments on the article of the same title by I. FISCHER 1975).
Bol. da Univ. Federal do Paraná, Geod. N° 18, 12 p, Curitiba, 1975.
- 234 - ASSOCIATION INTERNATIONALE de GEODESIE - Bulletin Géodésique, v.50, n°1, 145 p, Paris, 1976.
- a) ANDERLE R.J. - "Error model for geodetic positions derived from Doppler satellite observations".
p.43-77.
Doppler observations of Navy Navigation Satellites have been used to strengthen and extend many terrestrial geodetic networks. The main sources of errors in positions determined from these observations are random error of observations, random and systematic errors in satellite positions due to uncertainties in the gravity field, and biases in the coordinate system in which the satellite ephemeris is given.
Effects of uncertainties in the gravity field on station coordinates computed with respect to a precise satellite ephemeris are reduced to about 70 cm after 20 satellite passes are observed, but systematic effects prevent assurance that additional observations will improve the accuracy further. A one part per million reduction in scale must be applied to positions computed with the ephemeris to obtain agreement with terrestrial

and other precise determinations of scale. The origin of the system is coincident with the center of mass of the Earth to 1 m accuracy but the polar axis may be tilted 3 to 5 meters at the Earth's surface with respect to coordinate systems upon which star catalogues are based.

- b) FISCHER I. - "Does mean sea level slope up or down toward North ?".
(Response to M. G. ARUR & I. MUELLER's comments, Bull. Géod. N° 117).
p.79-80.
- c) A.I.G. - XVIème Assemblée Générale, Grenoble (France) 18 Août - 6 Sept.
1975, comptes-rendus des séances des sections, Section III - Gravimétrie,
p.91.

- 235 - DUCARME B. - "A fundamental station for trans-world tidal gravity profiles".
Obs. Royal de Belgique, Comm. Sér. A, n°32, Sér. Géophys. n° 126,
from : Physics of the Earth & Planetary Interiors, v.11, p.119-127, 1975.

15 gravimeters, static as well as astaticized, have been compared at the Bruxelles fundamental station during periods not less than three months each.

On the basis of the amplitude and phase of the main tidal waves at Bruxelles a two-parameter rheological model has been constructed for each instrument.

These models are used to analyse the records obtained with the instruments at a great number of stations of the Trans European and Trans Asiatic profiles, and provide uniform results for the amplitude factors and phases which are under publication.

- 236 - FISCHER I. - "Report of the Special Study Group V-29, IAG : Astro-gravimetric and astrogeodetic methods for determining the shape of the geoid".
11 p. Presented to the IAG, Grenoble, France, Aug. 1975.
Proc. Symposium on Earth's gravitational field & secular variations in position, p.3-10, 1973.

The title of Special Study Group V-29 is "Astrogravimetric and Astrogeodetic Methods for Determining the Shape of the Geoid". The statements in this Report on the current activities of the Group have been taken from communications received from the members.

- 237 - DESVIGNES G. - "Contribution à l'étude du champ de pesanteur sur l'Europe et l'Atlantique nord oriental".
Thèse Dr 3ème cycle, Univ. Paris VI, Géodésie Dynamique, 96 p, Paris, 1976.

La zone étudiée : La zone étudiée s'étend, en longitude de 30°W à 30°E, en latitude de 70°N à 30°N. Elle comprend ainsi la presque totalité de l'Europe, l'Afrique du Nord, la Méditerranée et une partie de l'Atlantique Nord-Est. La région ainsi délimitée sera appelée par la suite "zone A".

Les buts de l'étude : Le but de cette étude est double, il s'agit :
- premièrement de calculer et de décrire le champ de pesanteur de la zone A obtenu, d'une part à partir des mesures relatives à la surface terrestre, d'autre part à partir des perturbations des trajectoires des satellites artificiels. Ce champ de pesanteur sera caractérisé soit par les anomalies gravimétriques, soit par les ondulations du géoïde.

- deuxièmement, de comparer et de combiner les deux précédents types d'information ; on essaiera ainsi d'obtenir le "meilleur champ gravimétrique européen" compte tenu des données disponibles.

Après avoir indiqué comment ont été calculées les données de départ, c'est-à-dire, les anomalies moyennes soit "terrestres", soit "provenant des satellites" (chapitre I), on décrira et analysera le champ de pesanteur de la zone A : description qualitative sur des cartes des différents types d'anomalies, analyse harmonique de leurs valeurs moyennes, calcul du géoïde (chapitre 2).

Le troisième chapitre sera consacré à la comparaison des deux types de données, comparaison portant soit sur les anomalies soit sur les ondulations du géoïde.

Dans le quatrième chapitre, on abordera les problèmes de combinaison entre ces deux types d'information théoriquement complémentaires. Dans la conclusion, on tentera une interprétation géologique et géophysique du champ de pesanteur de la zone A, en essayant d'en séparer les différentes composantes.

238 - LACHAPELLE G. - "Research in physical geodesy at geodetic survey of Canada".

Typewritten text, 15 p, Presented at the 69th Annual Meeting of the Canadian Institute of Surveying/Association Canadienne des Sciences Géodésiques, Winnipeg, May 18-21, 1976.

As a part of the requirements for the 1977 Canadian Adjustment of the horizontal control, a Geoid Project was initiated at Geodetic Survey of Canada. This paper summarizes results obtained up to now together with present and future trends which will eventually lead to a geoid undulations and deviations of the vertical solution based on data of heterogeneous type. Among the several solutions available for the first preliminary adjustment taking place, the GEM 8 solution of NASA/Coddard Space Flight Center, which was derived from a combination of satellite dynamic and gravity data, was chosen ; the reasons for this choice are discussed. Preliminary results concerning the determination of deviations of the vertical using gravity data combined with GEM 8 shows that an accuracy close to 1" can be anticipated for the computed deviations in most parts of Canada.

239 - LACHAPELLE G. - "Determination of geoid undulations and deviations of the vertical using a combined integral formulae and collocation approach".

11 p, Presented at the Annual Canadian Geophysical Union Meeting, Québec City, June 14-17, 1976.

A combined integral formulae (Stokes' and Vening Meinesz') and least squares collocation method is presented in order to estimate geoid undulations and deviations of the vertical from measured deviations, gravity anomalies and spherical harmonic coefficients of the Earth's gravitational potential. It makes use of the advantages of both the integral formulae and collocation and avoid the drawbacks proper to each of them. Basically, the method consists of evaluating the inner-zone by collocation and the outer-zone by the integral formulae. In this way, the computer time required is kept relatively low and the method is therefore well suited for application over large areas. Also the method illustrates well the fact that integral formulae and least squares collocation complement each other.

- 240 - RAPP R.H. - "The gravitational potential of the Earth to degree 36 from terrestrial gravity data".
The Ohio State Univ. Dept. Geod. Sci., 12 p, 1975.
The Ohio State Univ., Dept. Geod. Sci., 12 p, 1975.
Presented to the IAG at the XVI General Assembly of the IUGG, Grenoble.

The determination of potential coefficients to describe the Earth's gravitational field can be carried out through the analysis of satellite observations, terrestrial gravity measurements, or a combination of both data types. This paper is concerned with a determination made using only gravity material. Computations described here may be considered to be the updating of the results described in past papers (RAPP, 1969, 1972).

- 241 - WELLMAN P. - "Gravity trends and the growth of Australia : a tentative correlation".
from : J. Geol. Soc. Australia, v.23, Pt.1, p.11-14, 1976.

Gravity anomalies of wavelength 20 to 100 km mainly reflect density variations in the non-sedimentary part of the crust. Elongate highs and lows of this wavelength can be used to divide the Australian continent into areas within each of which the elongate anomalies are subparallel. The relative ages of the gravity trends in adjacent areas can be inferred : those oblique to the boundary between areas are likely to be older, and those parallel, younger than the boundary. The inferred relative ages of gravity-trend areas found using this procedure are consistent with the ages of the first major deformation of cratons inferred from geology and isotopic dating. The Australian continent is thought to have grown by the addition of areas of crust in the order suggested by analysis of the gravity trends. In regions of sedimentary cover the positions of the boundaries of the gravity-trend areas are at present the best estimate of the extent of the geologically defined cratons.

- 242 - HOLDAHL S.R. - "Report of the working group on recent crustal movements in North America".
U.S. Dept of Commerce, NOAA, Nat. Ocean Survey, 12 p, Rockville, 1975.
Presented to the International Symposium on Recent crustal movements, Grenoble, France, Aug. 25 - Sept. 6, 1975.

- 243 - BIRO P. - "Vertical crustal movements and time changes of the gravity field".
Tech. Univ. Budapest, Geod. Inst., Dept. Geod., 8 p, 1975.
Presented to the Symposium on Recent Crustal Movements at the XVIth General Assembly of IUGG, Grenoble, 1975.

Repeated levellings and gravity measurements result the changes of the situation of the Earth's surface and the level surface relative to each other. In the case of any time-change of the gravity field of the Earth, the level surfaces will be displaced, and their displacement will be followed by a certain deformation of the elastic Earth's material. Under the supposition of only elastic deformations the real (absolute)

vertical Earth crust movements can be calculated from the results of measurements, but in general it seems not to be possible. Therefore, it must be known that in a gravity field with time-changes vertical crustal movements determined as usual by repeated levellings are only displacements relative to the level surfaces and can significantly differ from the real vertical movements of the Earth's surface. Relative displacements can be determined not only on the usual way, but also by repeated precise measurements of gravity.

- 244 - KUKKAMAKI T.J. - "Report 1971-1975 of the Fennoscandian Sub-Commission of the Commission of Recent Crustal Movements".
21 p, Presented to the IUGG, IAG, XVI General Assembly in Grenoble, 1975.
- 245 - SETO T. & M. TAZIMA - "Gravity tie between Japan and Europe".
Geogr. Survey Inst., Typewritten text, 3 p, Tokyo, 1975.
- 246 - JOO I., I. DRAGOESCU, M. FURY, P. JAVANOVIC ... - "An investigation on the recent vertical earth-crust movements of the Carpathian-Balkan region".
19 p, Budapest, 1975.
Presented to the IUGG, RCM Symposium n°5, Grenoble, 1975.
- 247 - STRANGE W.E. - "Monitoring of secular changes of gravity in the United States".
U.S. Dept. of Commerce, NOAA, Nat. Ocean Survey, 14 p, Rockville, 1975.
Presented to the IUGG, IAG, XVI General Assembly, Grenoble, France, 1975.
- 248 - COLIC K. - "The terrain-subdivision for the computation of the topographic gravity correction by the method of weigh-factors".
5 p, Zabreb, 1975.
Presented to the IUGG, IAG, XVI General Assembly, Grenoble, France, 1975.
- 249 - TORGE W., L.N. MAVRIDIS, H. DREWES & D. ARABELOS - "Establishment of a high precision gravity network in the Eastern Mediterranean".
10 p. Preliminary paper presented to the XVI General Assembly of the IUGG, IAG, at Grenoble, France, 1975. (English text).
- 249bis - TORGE W., L.N. MAVRIDIS, H. DREWES & D. ARABELOS - "Anlage eines Schwerenetzes hoher Präzision im Bereich der Agaischen Platte".
Sond. : Zeits. Vermess., 101 Jahrgang 1976, H.6, S.213-220, 1976.

In the eastern Mediterranean, movements of tectonic plates and connected orogenesis probably cause vertical and horizontal displacements of complex structure. For detection of eventual recent gravity variations with time and associated vertical movements, a high precision gravity network has been established in 1974, covering the Greek mainland, the Aegan islands and the island of Crete, in cooperation between the Institute of Theoretical Geodesy, Technical University of Hannover, and the Department of Geodetic Astronomy, University of Thessaloniki.

The evaluation of the measurements, carried out with 4 LaCoste-Romberg gravity meters model G, results in r.m.s. errors between ± 0.014 and ± 0.042 mGal for one observed gravity difference, the accuracy depending on the instrument and the way of the instrument's transportation. From a free net adjustment, the gravity values of 46 stations, referred to the reference station Athens, have been determined with ± 0.01 mGal.

- 250 - LAGRULA J. - "L'isostasie et la forme du géoïde".
C.R. Acad. Sci. Sér. B, 1973.
IPG, Contr. N°34, Paris.

Plusieurs auteurs ont proposé de substituer à l'ellipsoïde de référence un sphéroïde défini, grâce aux satellites, par un développement en série de fonctions sphériques. Il semble indiqué, en géophysique, de limiter cette série à un très petit nombre de termes et, en outre, de doter le sphéroïde de référence de continents isostatiquement compensés.

- 251 - WENZEL H.G. - "Stability of temperature in a transformed Askania gravimeter".
Inst. für Theor. Geod., Tech. Univ., 11 p, Presented to the XVI, IUGG, IAG General Assembly, Grenoble, 1975.

The stability of temperature in a Askania Gs 12 gravimeter with capacitive sensor (transformed by Prof. BONATZ) has been measured with a high sensitive thermistor feeler ; the internal temperature depends on the room temperature by a factor 1:30 due to the bad regulation of the outer thermostat generally only used. Though we cannot avoid variations of the room temperature up to 0.1°C even with regulation of the room temperature, the temperature in the gravimeter is varying up to 0.003°C , which produces errors in the reading of $10 \mu\text{Gal}$. To increase measuring accuracy, the stability of internal temperature has to be improved. This can easily be done by using also the inner thermostat of the gravimeter with some necessary modifications, concerning especially the damping of the resulting short periodic temperature noise.

- 252 - HESS H.H. - "Mid-oceanic ridges and tectonics of the sea-floor".
p.317-333, Princeton Univ.

Continental drift is assumed. The postulated mechanism by which it takes place is related to subcrustal flow, viz, convection in the upper mantle. Mid-oceanic ridges are correlated with rising limbs of the convecting system and it is shown that they are ephemeral in character. Thus the Darwin Rise is recently deceased, the Mid Atlantic Ridge is mature and active, and the East Pacific Rise is just about to be born. The oceanic crust is considered to be serpentized peridotite - hydrated mantle material - and is being continually formed on the crests of ridges, moving laterally away from the crests and finally disappearing downwards under trenches or cordillera flanked coasts. It is a disposable crust inasmuch as dehydration on its downward course regenerates peridotite. The whole ocean-floor may thus be renewed every few hundred million years.

Linear magnetic anomalies of the sea-floor and ophiolites are discussed with respect to mid-oceanic ridges.

- CENTRE NATIONAL pour l'EXPLOITATION des OCEANS - Bulletin d'Information,
 254 - N° 89, 18 p, Paris, Mai 1976.
 255 - N° 90, 23 p, Paris, Juin 1976.

- 256 - GROTEN E. - "On the determination and applications of gravity gradients in geodetic systems".
 from : Boll. Geod. Sci. Aff., Rivista dell'Istituto Geografico Militare Anno XXXIV, n°4, p.357-395, Dec. 1975.

Results obtained from an ensemble of various geodetic measurements in a local geodetic system are discussed in view of application of the components of the MARUSSI (EOTVOS)-Tensor. The observations consist of recent torsion balance measurements, vertical gravity gradients, astrogeodetic and zenith distance observations and a dense gravity net ; first and second derivatives of the well known harmonic functions $r \Delta g$ and T are analyzed. The data lend themselves to a unified approach using collocation procedures but in this context comparison of specific combinations like astrogeodetic and astrogravimetric levellings, boundary value problem solution, integration of gradients etc. is mainly dealt with.

- 257 - BRENECKE J., E. GROTEN, R. RUMMEL & H. SCHAAB - "Variationen zum Geoid in Deutschland".
 D.G.K., Reihe A : Theor. Geod. H. n°83, 43 S, München, 1975.

Results of gravimetric geoid computations in Germany are presented. An earlier described computational method (GROTEN and RUMMEL, 1974) was applied in combining satellite potential coefficients sets with surface gravity data. Coefficients as given by SAO, RAPP and GSFC were used in combination with improved surface material. Numerical effects in evaluating linear MOLODENSKY's corrections were investigated and corresponding discrepancies are shown. In this connection the formulas given by PELLINEN, MORITZ, ARNOLD, MOLODENSKY and an additional correction formula were applied to 6' by 10' blocks. The differences between quasigeoid heights and geoid undulations were considered for the same block size. The effect of atmospheric corrections to surface gravity observations was taken into account ; results are presented for mean values of the above mentioned block size. The effect of isostatic corrections was computed and numerical results are given for neighborhood and distant zones. A very detailed geoid (20 cm-isolines) is given for Northern Germany in order to visualize the smoothness of geoid undulations in that area even in a detailed figure. All geoids are related to the 1967 IUGG normal gravity formula where, however, the N - term as recently discussed by RAPP was taken into account.

In the last part, results of linear autoregression prediction for geoid undulations are given. For comparison, similar results as found by using the global data of the GSFC-geoid are presented.

- 258 - BURSA M. - "The first derivatives of the components of the deflections of the vertical on the territory of the ČSR".
 from : Geofys. Sbor. XXII (1974). Travaux de l'Inst. Geophys., Acad. Tchécosl. Sci. N° 416, p.9-64, Praha, 1976.

A set of homogeneously distributed discrete values of the components of the deflections of the vertical ξ , η with a density of distribution $5' \times 7.5'$ was used to compute their derivatives in the meridian and the prime vertical. Apart from the values of the components ξ and η , as a second alternative, only their parts $\Delta \xi$ and $\Delta \eta$, after removing the topographic masses, are considered.

- 259 - LELGEMANN D. - "On the recovery of gravity anomalies from high precision altimeter data".

Dept. Geod. Sci. Rep. n°239, 52 p, The Ohio State Univ., Columbus, 1976.

A model for the recovery of gravity anomalies from high precision altimeter data is derived which consists of small correction terms to the inverse Stokes' formula. The influence of unknown sea surface topography in the case of meandering currents such as the Gulf stream is discussed. A formula was derived in order to estimate the accuracy of the gravity anomalies from the known accuracy of the altimeter data. It is shown that for the case of known harmonic coefficients of lower order the range of integration in Stokes inverse formula can be reduced very much.

- 260 - BUREAU of MINERAL RESOURCES, GEOLOGY and GEOPHYSICS, Department of Minerals and Energy - Geophysical Branch, Annual summary of activities 1974. Rep. 190, 120 p, Canberra, 1975.

Reports of the different sections :

- Metalliferous and airborne section, G.A. YOUNG (p.4-28),
- Seismic gravity and marine section, H. TURPIE (p.29-77),
- Observatories and regional section, J.C. DOOLEY (p.78-99),
- Geophysical services section, M.G. ALLEN (p.100-113).

- 262 - Bollettino di Geofisica teorica ed applicata,
Osser. Geof. Sper., v.XIX, n°69, Marzo 1976.

- a) FINETTI I. - "Mediterranean ridge : a young submerged chain associated with the Hellenic Arc".
p.31-65.

Mainly based on seismic reflection data, the regional structural and stratigraphic characteristics of the submerged feature known in the literature as the Mediterranean Ridge are reconstructed.

Interpretation of seismic data brings the author to the conclusion that this structure is the result of a marked geodynamical compression which shortened considerably the original crustal space, producing folds, overthrusts and thrust-belts in the Cenozoic with stronger activity during Pliocene-Pleistocene time. Schematically three main thrust-belts associated with the Hellenic arc can be recognized. The outermost one, with remarkable displacement, overthrusts the flat areas of the Ionian and Levantine basins which constitute the foredeep of the arc. The second thrust-belt is the one that has the most limited thrusting displacement and has less evident continuation on the eastern side. The third belt, connected with the Hellenic trench, presents a thrusting displacement of enormous magnitude probably controlled by a subduction of the African Plate under the European one.

The gravitational tectonics (gliding effects), considered by some Authors as the regional generating cause of the Mediterranean Ridge, in the opinion of this author is a marginal aspect of this feature, limited to certain areas and involving only the thin Messinian-Pliocene-Pleistocene layer.

The two most external of the recognized belts may represent the effects of the deformation during the subduction process of the sedimentary sequence sheared from the substratum of the marginal basin of the African Plate.

In accordance with the interpretation carried out, the author proposes to call this feature the more proper name of East-Mediterranean Chain.

- b) PAPAACHOS B.C. - "Evidence of crustal shortening in the northern Aegean region".
p.66-71.

The distribution of foci of intermediate earthquakes ($h \geq 60$ km) which occurred in the northern Aegean region ($38^{\circ}5' N - 41^{\circ} N$, $21^{\circ}5' E - 29^{\circ} E$) between 1962 and 1975 has been investigated.

On the basis of these data tentative isodepths (lines of equal focal depths) of 80 km and 120 km have been drawn have arcuate shapes with their concave sides to the north.

Plot of the distances of the epicenters from the isodepth of 120 km versus the corresponding focal depths reveals the existence of a Benioff zone in the northern Aegean - Marmara region. This zone has approximately an amphitheatrical shape. It dips almost northwards at a mean angle of about 30°

- 263 - ANFILOFF W. - "Automated density profiling over elongate topographic features".
BMR, J. Australian Geol. & Geophys., v.1, n°1, p.57-61, Canberra, 1976.

NETTLETON's concept of density profiling can be utilised to give useful estimates of the bulk density of topographic features. These estimates can be used to infer the composition of such topography, or to assist in the interpretation of local gravity anomalies.

Two methods that facilitate multiple density profiling over elongate topography are presented. One is a simulation reduction method utilising the two-dimensional line integral formula of TALWANI, WORZEL & LANDISMAN (1959). It enables data from any detailed gravity traverse crossing an elongate topographic feature at right angles to be automatically reduced by computer to a set of multiple density Bouguer profiles. From these profiles, the bulk density of the topographic feature can be estimated by visual correlation. The other is a graphical method of converting a set of multiple density Bouguer profiles directly to point density estimates, without the need for visual correlation. Both methods are theoretically exact for the ideal case.

A visual correlation determination of $2.85 \pm 0.05 \text{ g cm}^{-3}$ is demonstrated for a traverse crossing the 300 m high Harts Range, Northern Territory, and three point determinations of 2.97, 2.97, and 2.99 g cm^{-3} , for a traverse crossing the 100 m high Fraser Range, Western Australia.

- 264 - WELLMAN P. & R.J. TINGEY - "Gravity evidence for a major crustal fracture in Eastern Antarctica".
from : BMR, J. Australian Geol. & Geophys., v.1, n°2, p.105-108, Canberra, 1976.

Gravity data are presented for 220 sites covering 180 000 square kilometres in the Prince Charles Mountains area of eastern Antarctica. Bouguer anomalies range from + 60 mGal over the Amery Ice Shelf (near sea level) to - 120 mGal at altitudes above 2000 m on the Antarctic ice cap. Bouguer anomalies correlate with the mass per unit area above sea level in the relation expected for a region in isostatic equilibrium.

Smoothed free-air anomalies range from + 60 to - 60 mGal. North-south trending anomalies over the Lambert Glacier and Amery Ice Shelf are thought to be due to a major fault along the Lambert Glacier, and a rift structure under the Amery Ice Shelf. To the west of these structures the free-air anomalies trend mainly east-west.

- 265 - A.I.G. - Bulletin Géodésique, v.50, n°2, p.109-199, Paris, 1976.

- a) HAGIWARA Y. - "A new formula for evaluating the truncation error coefficient".
p.131-135.

In this paper, a new formula for evaluating the truncation coefficient Q_n is derived from recurrence relations of LEGENDRE polynomials. The present formula has been conveniently processed by an electronic computer, providing the value of Q_n up to a degree $n = 49$ which are exactly equal to those of PAUL (1973).

The geoidal height is obtained by performing an integration of gravity anomaly weighted by STOKES' function over the whole surface of the spherical Earth. When the integration is not extended over the whole surface but restricted to a spherical cap, the effect of neglecting the remote zones on the computation of the geoidal height should be evaluated. The effect is called "truncation error".

- b) RUMMEL R. - "A model comparison in least squares collocation".
p.181-192.

- 266 - INTER-UNION COMMISSION ON GEODYNAMICS - Sci. Rep. n° 14, p.89-108, 1975.
Proc. of an Int. Symposium on the Afar region and related rift problems held in Bad Bergzabern, F.R. Germany April 1 - 6, 1974, v.1.

- a) BERCKHEMER H., B. BAIER, H. BARTELTSEN, A. BEHLE et al. - "Deep seismic soundings in the Afar region and on the highland of Ethiopia".

In March 1972 five deep seismic sounding profiles 120 - 250 km long were run in the Afar lowland and one for reference on the Ethiopian Highland. All profiles with one exception were reversed. Seismogram sections are shown. The data were evaluated by three methods : direct inversion of straight line correlation of first arrivals, calculation of models with gradients and inversions, time term analysis for lateral variations. The following major results were obtained : The crust below the Ethiopian plateau has a typical shield structure, a mean thickness of 38 km and rests on a normal mantle. An anomalous mantle with $V_p = 7.3 - 7.6$ km/s is found on all Afar profiles. The depth to this layer ranges from 26 km in the South to 16 km in North Afar. The thickness of the anomalous mantle layer is estimated 15 - 40 km.

Most of the crust consists of material with $V_p = 6.6 - 6.8$ km/s. There exists on all profiles a thin layer with $V_p = 6.0 - 6.3$ km/s which is considered typical for a highly attenuated sialic upper crust. The results are compared with those of neighbouring rift zones and classified by comparison with other crustal types. An attempt is made to relate the seismic velocities to rock types considering also the P - T conditions. Based on geophysical data a geodynamical model for the evolution of Afar is briefly sketched.

- b) BEHLE A., J. MAKRIS, B. BAIER & N. DELIBASIS - "Salt thickness near Dallol (Ethiopia) from seismic reflection measurements and gravity data".
p.155-167.

During the seismic refraction studies of the Afar region in Northern Ethiopia, conducted by German universities in 1972, a short reflection profile was measured over the salt plain near Dallol to estimate the salt thickness. P - and S - wave reflections were recorded in the time interval between 0.5 and 5.0 sec. The most prominent reflection has a travel-time of 1.1 sec corresponding to a depth of 2.2 km. The P - wave velocity of the salt near Dallol is 4 km/s. A seismic model of the salt configuration is given.

Using seismic constraints and residual Bouguer anomalies, 2-D density models of the salt configuration were computed. The combination of seismic and gravity considerations limit the salt thickness between 2.2 and 3.5 km. The former value is more probable, implied by the quality of the associated reflection.

- c) MAKRIS J. - "Afar and Iceland, a geophysical comparison".
p.379-390.

During the last years various authors (LEPINE et al. 1972, RUEGG et al. 1973, GIRDLER et al. this volume, MOHR this volume, RUEGG this volume) have been comparing Afar with Iceland considering both structures as new crust of the same type. They extrapolate results obtained on Iceland into Afar and vice versa concluding, that in both cases the crust is new "Oceanic" or "pseudo-oceanic" located on a zone of increased sub-lithospheric heat production. The thermal influence of the upper mantle on the crust causes domal uplift, crustal fracture and intense volcanism, as described by GASS (1970b, this volume) effecting a gradual crustal attenuation due to tension.

In the following paper, a comparison of the physical parameters of both structures will be presented, which does not claim finality, since the investigations in both areas have not been completed. Afar is still a "New Land" compared to the more than 40 years of geoscientific history of Iceland and it is expected that new data will supplement the present picture. In spite of the existing uncertainties, I still wish to point out some dissimilarities in the physical parameters of the two structures, which partly permit contradictive conclusions to these expressed by the authors mentioned above. The implication of these contradictions is that the present state of Afar can only be understood, if we accept the existence of a considerable amount of sialic crust in Afar in contrast to that of Iceland, and also a different mechanism for the early stages of crustal fragmentation of the continental blocks than those proposed by the sea-floor spreading processes in oceanic areas.

- 277 - WOOLLARD G.P. & V.M. HANNA - "An analysis of factors controlling gravity and its prediction in the Atlantic Ocean".
HIG-76-4, Final Report, n205 p, Univ. Hawaii, 1976.

An examination of the overall relationships of changes in $1^\circ \times 1^\circ$ averaged free-air anomaly values to changes in $1^\circ \times 1^\circ$ averaged water depth and crustal age values along profiles transverse to the mid-Atlantic Ridge and along crustal age isochrons in the North Atlantic area indicates :

- 1) Depth of water is preferable to crustal age in relating changes in free-air anomaly values to these two independent variables, and,
- 2) That there are at least 6 areas, 3 on each side of the crest of the mid-Atlantic Ridge, and bounded in a North - South direction by transverse fracture zones between 14° and 53° N latitude, which should be considered as independent gravity domains. Each of these gravity domain areas is characterized by significant differences in the relationship of free-air gravity anomaly values to depth of water. A probable seventh domain area, which should also be considered in latitudinal divided segments, is the crustal area of the mid-Atlantic Ridge extending out from the ridge axis to a crustal age of about 25 to 30 MY.

- 278 - MUELLER I.I. - "Basic research and data analysis for the national geodetic satellite program".
Dept. Geod. Sci. Rep. n°241, The Ohio State Univ., Final Rep., 10 p, July 1976.

This report is related to the work performed by the staff of the Department of geodetic science, The Ohio State University sponsored by NASA under the National Geodetic Satellite Program between August 1, 1967-June 30, 1976.

The achievements of this project are reported in the Reports of the Department of Geodetic Science listed on the following pages and in the 18 Semiannual Status Reports submitted to NASA Headquarters. Scientific papers presented at various national and international meetings sponsored under this grant are also listed.

- 279 - DEFENSE MAPPING AGENCY AEROSPACE CENTER - "Holdings, storage and retrieval of DoD Gravity Library Data".
DMAAC/RP-75-003, 33 p, St-Louis, Sept. 1975.

The Department of Defense (DoD) Gravity Library, maintained by the Defense Mapping Agency Aerospace Center, has grown from a small card storage file to a massive data file contained on magnetic tapes. In the growth process, the library has progressed from the use of a various assortment of card processing equipment to the use of a UNIVAC 1108 computer system. The tremendous increase in holdings and user requirements necessitated the establishing of standard formats for all gravity and related data. The receipt of data in various forms and the reduction of this data to a common form made it necessary to develop improved processing techniques for inputting new data. Voluminous retrieval and maintenance of automated data required improved techniques when addressing inquiries to such large files.

This report is intended to explain the holdings, system of storage, maintenance of files and retrieval of data. Included also is a brief descriptions of a variety of our processing techniques and an indication of how these techniques are related to each other in the description of the computer programs most frequently used in accomplishing our assigned mission.

- 280 - DEFENSE MAPPING AGENCY, AEROSPACE CENTER - Quarterly accession list
1 Apr.- 30 June 1976.
DoD Gravity Library, Dept. of Defense, 2 p. St-Louis, 1976.

- 281 - TUEZOV I.K. - "Deep structure models of main structural types in North-Western area of transition belt".
Acad. Sci. USSR, Siberian Branch, Geology & Geophysics,
N° 1 (1973), p.86-90, Novosibirsk, 1976.

On examine les modèles de structures du corps terrestre et du manteau supérieur, également les champs géophysiques de types fondamentaux de structures du secteur Nord Ouest de la zone de passage du Continent Asiatique à l'Océan Pacifique.

Pour chaque type de structure, on analyse la puissance du corps terrestre, de ses couches, densité et les vitesses de propagation des ondes élastiques dans le corps terrestre et le manteau supérieur, la répartition des masses magnétiques des couches conductrices et la séismicité.

- 282 - YUDBOROVSKY I.Kh. - "On reflection from the Moho-surface as applied to anomalies of the gravity field in mountainous regions".
Acad. Sci. USSR, Siberian Branch, Geology & Geophysics, N° 2 (1974),
p.156-160, Novosibirsk, 1976.

Sur la base de travaux géophysiques complexes entrepris le long de profils régionaux dans des régions au-delà du lac Baïkal et en Asie Centrale, on a construit la surface de Mohorovicic d'après des données séismologiques et gravimétriques.

La comparaison des profondeurs obtenues par les méthodes différentes montre une bonne concordance dans la région au-delà du Baïkal et du Tien-Chen et montre des différences substantielles sur le Pamir et dans le Pamar-Ala. L'analyse de la structure isostatique des régions a permis d'établir que la concordance des données séismologiques et gravimétriques s'observe dans les régions isostatiques compensées suivant le schéma d'Airy.

- 283 - ACADEMY of SCIENCES of the USSR, Siberian Branch - Geology & Geophysics,
N° 3 (1975), 160 p, Novosibirsk, 1976.

- 284 - UNIVERSITE d'ETAT LOMONOSSA de MOSCOU - Etudes gravimétriques en mer.
Inst. Nat. Astr. Sternberg, Recueil d'Articles N° 8 (1972-1973), 178 p,
Moscou, 1975.

- a) VESELOV K. Ye. & A.M. LOZINSKAYA - "The state and perspective of sea gravity measurements".
p.15-21.

The state of the elaboration and using of sea bottom and sea surface-gravimeters, air gravimeters and other gravimetrical apparatus for the last 20 years are described.

- b) PANTELEEV V.L. - "The sea gravimeter dynamical synthesis".
p.22-47.

The problem of optimum sea gravimeter synthesis is put and solved. Practically this problem is reduced to the choice of the dynamical system structure (the order, the equivalent order, the astatism and pseudoastatism order) and then to optimizing of its parameters. The range of permitted values of parameters is determined by the smoothing coefficient of the disturbance at the dominant frequency of sea waves and by rms error of the gravity measurement. The other degrees of freedom of parameters are used to provide maximum for quick-operating of system.

- c) KUZIVANOV V.A. & Yu. N. SMIRNOV - "The stability of horizontal and vertical pendulum oscillations on the mobile foundation being acted by periodical accelerations".
p.48-55.

The stability of horizontal and vertical pendulum oscillations on the mobile foundation used for the determination of the angle of foundation inclination with respect to horizon and for the determination of gravity, is analysed. The special attention is paid to studying of resonance phenomena with typical disturbance accelerations inherent to the gravity survey at sea.

The oscillations of pendulums are shown in the linear approximation to be stable under the circumstances. Damping parameters of sensitive system used in modern gravimeters are shown to permit essential reduction.

- d) PANTELEEV V.L. - "On the accuracy of gravimeter drift accounting".
p.56-63.

A new method of the estimation of the accuracy of gravimeter drift accounting is suggested. Two hypothesis are taken :

- 1) gravimeter drift consists of the sum of the linear time function and of the stationary random noise ;
- 2) the drift rate is the stationary random process.

The formulae of the time dependencies of the dispersion of error due to nonlinearity of the drift for the 1st and 11-d hypothesis are given.

- e) KUZIVANOV V.A., B.G. ZELENSKY, S.P. FOMIN & A.V. CHERNISHOV - "On question of the cross-coupling effect compensation in gravity measurements with heavy damping gravimeters".
p.64-71.

Cross-coupling effect and effect of vertical accelerations are shown to be compensated in the time moments when there is the coincidence of evidences of two back-to-back pendulum with damping being forced by harmonic accelerations.

- f) PANTELEEV V.L., V.A. GLADUN & M.N. LOMONOSOV - "On determination of the parameters".
p.72-77.

The new method is proposed for determining the parameters of sea gravimeters described by linear operators. The peculiarity of proposed method is the comparative simplicity of determination of the system's parameters on experimental amplitude-frequency response taken in the narrow frequency band.

- g) KORENFELD V.I. & L.V. PUSCHINA - "The repeated gravity measurements on the same profile at the ocean".
p.78-83.

The estimation of accuracy of repeated measurements with the same gravimeters AMG OMPO on the sister-ships r/v "Academic Kurchatov" (1969) and "Dimitry Mendeleev" (1971) along the 400 km ocean profile, is given. The comparison of results of measurements along the 180 km profile at the Pacific Ocean is carried out. The measurements are fulfilled by Gss 2 ("Vitiaz") and by TSSG-67 ("Hakuko-Maru") simultaneously.

- h) GLADUN V.A., E.G. VOROPAEV, V.L. PANTELEEV & M.N. LOMONOSOV - "Sea automatized gravity meter MAG".
p.84-95.

There was presented the description of new sea automatized gravity meter elaborated in GAJS, VNIIGeofisika, TPI. The fundamentals of device's theory are concerned, the transfer function and AFC are cited. The formula is given for the calculation of the response of the gravity meter. The briefly technical description of the construction is cited.

- i) SMIRNOV L.P. - "Calculation and regulation of quartz torsion system for sea gravimeters".
p.96-106.

The automatic sea gravimeter MAG elaborated together by Geophysical Research Institute and Sternberg State Astronomical Institute is successfully used at present for sea surface gravity measurements. The non-astatic quartz system with horizontal torsion filaments is the basis of that gravimeter. In the paper the methods of calculation and following regulation of quartz system of MAG to provide optimal values of its characteristics (the total temperature compensation at fixed temperature, the scale division of the micro-screw, the time constant, the coefficient of dynamic forcing, etc.).

- j) ZELENSKY B.G., V.A. KUZIVANOV & S.P. FOMIN - "The device for filtering of low power gravity signal from high power noise".
p.107-114.

The device for gravity measurements by the "points of intersections" method is described.

- k) STROEV P.A. - "Gravity investigations at the Pacific Ocean during the 51 st cruise of the r/v "Vitiaz" (1972)".
p.115-120.

In January - May 1972 gravity measurements in the equatorial zone of the West Pacific Ocean were performed. These measurements were made for the space more than 15000 miles. Pendulum measurements were carried out at Brisbane, Lae, Fukuoka, at atoll Tarawa and on the islands Nauru and Ocean. The land binding in Lae and Fukuoka were made. These measurements meet the requirements to the modern sea surface gravity measurements.

- l) GAINANOV A.G., E.D. KORYAKIN & V.L. PANTELEEV - "The results of the gravity survey in the 10th cruise of the r/v "Academic Kurchatov" (1971)".
p.121-135. (maps).

Apparatus and method used for the gravity survey in North Atlantic, between Iceland and Jan-Mayen islands, are described.

The continuous gravity measurements were made on the profiles. At the same time the measurements of the Earth's magnetic field, the thickness of unconsolidated sediments and the submarine relief, were made. The automatic construction of the profiles of relief, magnetic and gravity anomalies, and the thickness of unconsolidated sediments was made by the electronic calculator "Minsk 2".

The gravity maps in free-air and Bouguer reductions are composed. The qualitative and quantitative interpretations of gravity anomalies are made.

Maps - 60° - 75° N ; 15° E.G. - 30° W.G.

- m) STROEV P.A. - "On the distribution of free-air gravity anomalies in the Japanese transition zone".
p.136-144.

Free-air gravity anomaly map for the whole transition zone from the ocean up to the continent in the region of the Japanese island arc is compiled from data of 10 expeditions.

The gravity anomaly field is described, its peculiarities are noted. The scheme of $1^{\circ} \times 1^{\circ}$ mean free gravity anomaly is given.

On the whole the Japan Sea aquatory is characterized by positive anomalies. The anomaly average values is equal ; + 12 mGal (sea), + 55 mGal (island arc), - 75 mGal (Japan trench).

- n) VASHILOV Yu.Ya., V.A. KUCHERINENKO, G.S. MARKOV, I.M. MIRCHINK, E.I. POPOV & V.I. SHEVCHENKO - "The Earth's crust structure on the shelf of the south-west Barents Sea aquatory from gravity data".
p.145-157.

Results of sea gravity survey at West Barents Sea by seasurface gravimeter TGG-1 carried out by Institute of Physics of the Earth of Academy Science of USSR at 1970 are represented. The interpretation of received Bouguer anomalies has made it possible to divide the Earth's crust on blocks, has enable to reveal the magmatic origin one of them composed by basic-ultrabasic rocks, and has enable to prove that thick layers (up to 8 km) of the Barents platform mantle extend more west than most experts believe. In that paper on the concrete example some methodic manners of the anomaly interpretation with simultaneously its division and zero-level choice are considered.

- o) PAVLOV Yu.A. & P.A. STROEV - "Moho discontinuity relief and Earth's crust thickness within the Bering Sea from gravity data".
p.158-168.

Bouguer gravity anomaly map for the Bering Sea aquatory and for the Aleutian arc is compiled. The depths of the Moho discontinuity from mean ($1^{\circ} \times 1^{\circ}$) Bouguer anomalies are calculated. The comparison of these meanings with presenting seismic data reveals divergences no more than 2-3 km.

The morphology of the Moho discontinuity is described, the peculiarities of thickness and of the Earth's crust structure within the Bering Sea are noted. The Earth's crust structure of the Bering, Okhotsk and Japan Seas has common features. Perhaps that bears witness to the same origin and to the similar process of the Far East marginal sea formation.

- p) GAINANOV A.G. & E.D. KORYAKIN - "The regional gravity anomalies on the Atlantic Ocean".
p.169-179.

The schematic maps of the average gravity anomalies on $1^{\circ} \times 1^{\circ}$ squares are composed. The regions of the free-air and Bouguer anomaly gravity fields are described. The schematic sections of the Earth's crust across the Atlantic ocean are constructed using the Bouguer gravity anomalies and seismic data.

- 286 - YOSHIDA M. - "Geology of the region around Botnneset, East Antarctica".
Mem. Nat. Inst. Polar Res., Ser. C, Earth Sci. N°8, 48 p, Tokyo, 1975.

- 287 - BOHME R., T. JOHANNSEN & W. WEBER - "Geographical names - Data capture, information system and Gazetteer".
Inst. Angew. Geod., Nachrichten aus dem Karten und Vermessungswesen, Reihe II : Übersetzungen, H. N°33, p.11-18, Frankfurt, 1976.

While a paper presented to the 6th ICA Conference (Ottawa 1972) outlined all theoretical work including an analysis of a system for the establishment of an integrated system of processing geographic names, this paper is to demonstrate the further development and the procedures of practical work completed so far. The vast amount of data capture has been divided into different steps, which are discussed in detail.

The "Information System for Geographical Names" bases on a general data bank system (DATAS) and offers the possibility, using simple system commands, to store geographical name records in the data bank, to select them in random access according to 22 different descriptors by means of compound selection criteria with AND, OR, NOT, to read them, to erase, and to modify them in batch or dialogue processing. For later extensions the system makes available user interfaces of its programme system established in a modular way.

The "Data Bank System for Geographical Names" is transferable to most of the computer makes as it is completely written in FORTRAN and requires only a small core store ; at present it is implemented on a computer TR 440, but it shall soon also run on a machine PDP 11/45.

The system which is useful for many cartographic purposes is primarily initiated in order to print a concise edition of the volume "Federal Republic of Germany" of the United Nations Gazetteer of the World, as recommended by the 2nd United Nations Conference on the Standardization of Geographical Names, London 1972. Content and structure of this gazetteer are discussed and a sample is presented.

- 288 - BRGM - SERVICE GEOLOGIQUE NATIONAL - Résumé des principaux résultats scientifiques et techniques du Service Géologique National pour 1975.
Bull. BRGM (2), 145 p, Paris, 1976.

- a) PETIT Y - "Un système de gestion d'une banque de données du sous-sol".
p.127-128.

- 289 - McCONNELL R.K., D.B. HEARTY & P.J. WINTER - "An evaluation of the LaCoste-Romberg model D microgravimeter".
Earth Physics Branch, Dept. Energy, Mines & Resources,
Presented to the 7th meeting of the IGC, Paris, Sept. 2-7, 1974, 14 p,
1974.

The recently introduced LaCoste and Romberg model D microgravimeter will permit the determination of relative gravity values to a precision of 1 to 2 μ Gals using standard field procedures. Although most of the tests carried out to date at the Earth Physics Branch have been limited to gravity ranges of 10 mGals or less there are indications that this precision may be achieved over ranges of up to 200 milligals. The possibility of achieving such a precision opens up a wide range of new applications of gravimetry both in the field of engineering and in the study of gravity variations with time. The purpose of this report is to present the results of an evaluation on one model D microgravimeter under laboratory and field conditions.

- 290 - KEAREY P. & D.W. HALLIDAY - "The gravity field of the Central Labrador Trough, Northern Quebec, with map : N° 162 - Lac Nachicapau, Central Labrador Trough".
Earth Physics Branch, Gravity Map Ser. N° 162, 13 p, Ottawa, 1976.

The Labrador Trough is the best preserved and exposed of a series of Archean (lower Proterozoic) fold belts which surround the Archaean Ungava Craton of northern Quebec and mark the junction of the Superior and Churchill Structural Provinces in this region. The results of a detailed gravity survey of the central Labrador Trough are presented.

Regional gravity profiles across the Labrador Trough are characterized by a field which decreases gradually to the east over the Superior Province, reaches a minimum beneath the Trough and thence increases rapidly over the Churchill Province to attain a mean level some 15 mGal higher than observed over the Superior Province. This regional field may be interpreted in terms of a relatively elevated Conrad discontinuity beneath the Churchill Province isostatically compensated by a thickened lower crust. The model is consistent with basement reactivation of the Churchill Province following collision with the Superior Province during the Hudsonian Orogeny.

Subtraction of the regional field from the observed gravity data reveals that positive residual anomalies over the eastern part of the Labrador Trough correlate with outcrops of basic meta-igneous rocks. Their causative bodies probably dip to the east and extend to maximum depths of 9 km in the central part of the area. These interpreted depths are considerably less than previous estimates based on geological analysis. Small positive anomalies correlate with iron formation. A persistent depression in the observed gravity field over the centre of the Labrador Trough in the south coincides with thick deposits of the basal continental sedimentary unit. In the northern part of the area the causative bodies of the negative anomalies are probably elevated areas of granitic basement. These elevated basement features may be related to a ridge that controlled sedimentation during much of the Trough's history.

...

- 291 - KRIVOVY H.L., H.C. EPPERT, Jr. & T.E. PYLE - "Simple Bouguer gravity anomaly map of the Gulf of Mexico and adjacent land areas".
Dept. Interior, U.S. Geol. Survey, Geophys. Investigations Map GP-912, 1976. (Scale : 1/2.500.000°).
- 292 - TORGE W., G. BOEDECKER & W. DOERGE - "Eichung von LaCoste-Romberg-Gravimetern auf der europäischen Gravimetereichlinie zwischen München und Bodø".
D.G.K., Reihe B : Angew. Geod. H. n°219, 83 S, München, 1976.

In April/May 1972 a calibration survey with 9 LaCoste-Romberg model G gravity meters has been carried out along the northern part of the European Calibration Line between Munich and Bodø ($g = 980\ 618 \dots 982\ 373$ mGal). Altogether 64 stations have been occupied, 19 of which are clearly identified IGSN 71 stations. The average gravity difference between adjacent points is about 100 mGal. In the south and in the north, a densification over 370 resp. 220 mGal has been performed, reducing the average gravity difference to 20 resp. 10 mGal. For control, the observations have been adjusted with two different mathematical models.

The adjusted gravity values refer to the level and scale of the connected IGSN 71 stations, the accuracy obtained is $\pm 0,01 \dots 0,02$ mGal. These values may be used for gravimeter calibrations in that region, the densification sections permit a calibration control with higher resolution. Additionally, the gravity values give a base for later investigations of secular gravity variations. The linear scale factors of the gravity meters have been determined with r.m.s.e. $\leq \pm 5 \cdot 10^{-5}$, referring to the IGSN 71 values used. Quadratic calibration factors have been found at most of the instruments, they may result from a non-linearity ($2 \cdot 10^{-4}$) in the IGSN 71 scale in this part of the calibration line. Taking this systematic effect into account, the high accuracy ($\pm 0,01 \dots 0,02$ mGal) of the IGSN 71 values has been confirmed.

- 293 - MORITZ H. - "Covariance functions in least-squares collocation".
AFGL-TR-0165, Rep. Dept. Geod. Sci. n° 240, 79 p,
The Ohio State Univ., Sci. Rep. n°3, June 1976.

The report consists of two parts. Part A deals with the mathematical structure of covariance functions. The properties of isotropy, harmonicity and positive definiteness are discussed, and it is suggested that a covariance function may be characterized by three essential parameters : the variance, the correlation length and a curvature parameter. Finally some spatial covariance models (planar and spherical) are considered.

Part B treats the influence of covariances on the results of collocation. Formulas are developed for the standard error of collocation results when using non-optimal covariance functions, also for the case of stepwise collocation. Finally the behavior of interpolation errors with and without the additional use of horizontal gradients is studied by means of power series expansions for covariance functions and by means of Gaussian covariance functions. It is seen that non-optimal covariance functions have relatively little influence on the interpolated values but a very strong effect on covariances as calculated using the conventional formulas.

- 294 - REES J.E. & R.J. TAYLOR - "Tottenham detailed aeromagnetic survey, New South Wales 1971".
BMR, Geol. & Geophys., Rep. 182, 24 p + 7 magnetic, geol. & geophys. maps, Canberra, 1976.

The data presented in this report were obtained from a detailed aeromagnetic survey in the Tottenham area of New South Wales.

Interpretation of the magnetic data has indicated structural lineations, lithological variations, and basic and/or ultrabasic intrusive associations within the generally homogeneous metasediments of the Ordovician Girilambone Beds. The structural relation of the Girilambone Beds to Silurian-Devonian sediments and volcanics has also been defined.

It is concluded from the geophysical and geological results that the occurrence of particular rock types in specific structural environments is the primary prerequisite for the genesis of economic copper mineralization in the Tottenham district.

- 295 - DREWES H. - "Berechnung regionaler Geoidundulationen durch gravimetrisches Nivellement mit Prädiktion der Schwereanomalien".
Wissens. Arb. der Lehrs. für Geod., Photog. & Kartog. an der Tech. Univ. Hannover, N°63, 110 S, Hannover, 1976.

ACADEMIE des SCIENCES U.R.S.S. - Références bibliographiques : Géodésie et Astronomie, Série 52.

- 299 - N° 6, 55 p, Moscou, 1976.
300 - N° 7, 56 p, Moscou, 1976.
301 - N° 8, 59 p, Moscou, 1976.
302 - N° 9, 56 p, Moscou, 1976.

- 303 - ACADEMIE des SCIENCES U.R.S.S. - Références bibliographiques : Géophysique
Index des Articles 1974.
283 p, Moscou, 1976.

CENTRE NATIONAL pour l'EXPLOITATION des OCEANS

- 304 - Bull. N° 91/92, 29 p, Paris, Juillet/Août 1976.
305 - Bull. N° 93, 28 p, Paris, Septembre 1976.
306 - Bull. N° 94, 19 p, Paris, Octobre 1976.

- 308 - WILLIAMSON M.R. & E.M. GAPOSCHKIN - "The estimation of 550 km x 550 km mean gravity anomalies".
Res. in Space Sci., Smithsonian Astrophys. Obs., Sp. Rep. 363, 22 p, Cambridge, 1975.

The calculation of 550 km x 550 km mean gravity anomalies from 1° x 1° mean free-air gravimetry data is discussed. The block estimate procedure developed by KAULA is used. Estimates for 1452 of the 1654 blocks are obtained.

- 309 - TSCHERNING C.C. - "Models for the auto and cross covariance between mass density anomalies and first and second order derivatives of the anomalous potential of the Earth".
Geod. Inst. Denmark, Paper presented at the 3rd Int. Symposium "Geodesy and Physics of the Earth", Weimar, Oct. 1976, 10 p, 1976.

Using a combination of satellite determined potential coefficients and free-air gravity anomalies a global (isotropic) covariance function for the anomalous potential of the Earth was computed by TSCHERNING and RAPP in 1974.

The variation (as expressed for example through this covariance function) is uniquely determined by mass density anomalies, but the inverse relationship is not unique.

Uniqueness may be imposed by requiring for example the mass density anomaly function to be harmonic (and correspondingly the anomalous potential biharmonic inside the Earth). Under these and slightly different circumstances are cross covariances between density anomalies and derivatives of the anomalous potential derived. Corresponding to a free-air gravity anomaly variation of ± 42 mGal (at the surface of the Earth) the mass density variation becomes ± 0.80 g/cm³ at the surface of the Earth and ± 0.04 g/cm³ in 10 km's depth.

- 310 - MAKRIIS J. - "Crustal structure of the Aegean Sea and the Hellenides obtained from geophysical surveys".
Sond. Arb. Inst. Geophys. Univ. Hamburg,
from : J. Geophys. 41, p.441-443, 1975.

- 311 - BEHLE A. & J. ROHDE - "Ultrasonic modelling of a moving source".
Sond. Arb. Inst. Geophys. Univ. Hamburg,
from : J. Geophys. 42, p.131-136, 1976.

An ultrasonic model experiment simulating a finite moving source in a plate is described.

The source consisted of five identical piezoelectric transducers which were triggered one after another to form a delay-line. The "rupture velocity" was kept constant.

The directivity, as introduced by Ben-Menahem, was computed and a good agreement was found between the observations and theoretical predictions. Some differences result from the fact that a discrete number of single sources have been used instead of a continuous moving source, as required by theory.

- 312 - DUDA S.J. - "Seismicity of South America and the recurrence relation of earthquakes".
Sond. Arb. Inst. Geophys. Univ. Hamburg,
Pan American Inst. Geogr. & Hist.
from : Revista Geof. N° 4, p.155-181, 1976.

- 313 - HEINDL G. & E. REINHART - "Ausgleichung im Sinne minimaler Maximalfehler".
D.G.K., Reihe A : Theor. Geod. H. N°84, 37 S, Munchen, 1975.

A method is proposed of computing a unique best estimate for a set of unknown parameters from observations and known bounds on the observation errors.

Using the Simplex algorithm of the theory of linear programming, the method leads to an estimate minimizing the maximal possible errors of its components.

Several other desirable properties of this best estimate are shown. Problems with weighted quantities and problems in which best estimates for vectors depending on the unknown parameters are searched for, can be handled by slight extensions of the described method.

The paper contains also complete proofs of all assertions made in the authors' former paper with the title "Adjustment by the Principle of Minimal Maximum Error". As an application there is computed the best estimate for a set of coordinates of stations of an E.D.M. - network.

- 315 - SELIGE H. - "Statistische Probleme bei der Ausgleichung direkter, unabhängiger, normalverteilter Beobachtungen mit geschätzten Gewichten". D.G.K., Reihe C : Dissert. H. N° 213, 113 S, München, 1975.

- 316 - SCHAFFRIN B. - "Zur Verzerrtheit von Ausgleichungsergebnissen". Mitt. Inst. Theor. Geod. Univ. Bonn, N° 39, 40 S, Bonn, 1975.

In a generalized Gauss-Markoff-model $y + \varepsilon = Ax = E(y)$ with a possibly singular dispersion matrix $D(y)$, where x is assumed to be not stochastic, best linear estimators are discussed in respect to unbiasedness or minimum bias ; dualities are shown between best estimation and singular least squares adjustment.

- 317 - AYAN T. - "Astrogeodätische Geoidberechnung für das Gebiet der Türkei". Thèse Dr. Ing., Geod. Inst. Univ. Fridericiana, Karlsruhe, 138 S, 1976.

- Geodätische Grundlagen in der Türkei
- Grundlagen einer Geoidbestimmung aufgrund astro-geodätischer Lotabweichungen
- Testausgleichungen berechneter Geoidhöhenunterschiede (erste Berechnung)
- Ausgleichung korrelierter Geoidhöhenunterschiede und beobachteter Lotabweichungskomponenten
- Interpolation von Geoidhöhen
- Zusammenfassung.

- 318 - SCHAFFRIN B. - "Zur Analyse dreidimensionaler Netze : Unverzerrt geschätzte Koordinaten und ihre Invarianzeigenschaft". Mitt. Inst. Theor. Univ. Bonn, N° 40, 23 S, Bonn, 1975.

In three-dimensional networks unbiased estimable coordinates are described ; for this purpose the invariants under certain affine transformations can be chosen.

- 319 - GEOLOGICAL SURVEYS in AUSTRALIA - B.M.R. - "History and role of Government Geological Surveys in Australia". 111 p, 1976.

- 322 - ISHIKAWA T. - "Superimposed folding of the Precambrian metamorphic rocks of the Lützow-Holm Bay Region, East Antarctica".
Mem. Nat. Inst. Polar Res., Ser. C, Earth Sci., N°9, 41 p, Tokyo, 1976.
- 323 - ISHIKAWA T., T. TATSUMI, K. KIZAKI; K. YANAI ... - "Antarctic geological map series, sheet 5 : LANGHOVDE, Antarctica".
Nat. Inst. Polar Res., Explanatory text, 10 p, Tokyo, 1976.
- 324 - YOSHIDA M., Y. YOSHIDA, H. ANDO, T. ISHIKAWA ... - "Antarctic geological map series, sheet 9 : SKALLEN, Antarctica".
Nat. Inst. Polar Res., Explanatory text, 16 p, Tokyo, 1976.
- 325 - SIBUET J.C. - "South Armorican shear zone and continental fit before the opening of the Bay of Biscay".
Earth & Planetary Sci. Letters 18, p.153-157, 1972.
Contr. Centre Océano. Bretagne N° 117.

The relative position of continents prior to the opening of the Bay of Biscay can be correctly deduced from reconstruction of the Ibero-Armorican belt, only if the extent of the Late-Hercynian horizontal displacement along the south Armorican shear zone and perhaps also along the north Pyrenean fault can be determined.

- 326 - ASSOCIATION INTERNATIONALE de GEODESIE - Bulletin Géodésique
v.50, N° 3, p.196-299, Paris, 1976.

- a) A.I.G. - Compte-rendu de la réunion du Comité Exécutif de l'A.I.G.
Paris, 25 et 26 Février 1976.
p.197-249.

Annexe I : Commissions

- Com. III - International Gravity Commission, p.210.
Com. VII - Recent Crustal movements, p.213.
Com. XI - Geodesy in Africa, p.217.

Annexe II : Groupes Spéciaux d'Etudes

- S.S.G. 1.25 - Marine Geodesy, p.223.
S.S.G. 3.37 - Special Techniques of Gravity Measurements, p.230.
S.S.G. 3.40 - Secular variations of gravity, p.231.
S.S.G. 4.45 - Mathematical structure of the gravity field, p.234.
S.S.G. 5.46 - Physical interpretation of gravity anomalies, p.238.

Annexe 3 : Bureaux Internationaux

- International Gravity Bureau, p.243.

...

- b) KRARUP T., B. ZONDEK & W. BARANOV - "La formule de Stokes est-elle correcte ? - Commentaires sur le papier de W. BARANOV.
p.251-253.
- c) COSPAR - XIX Meeting - Report on Open Meetings of Special interest to the I.A.G.
p.269-280.

- d) RUYMBEKE Van M. - "Sur un pendule horizontal équipé d'un capteur de déplacement à capacité variable".
p.281-290.

The Verbaandert-Melchior Horizontal Pendulum, using a capacitive transducer for the tilt measurements, is described. The output sensitivity is about 100 microvolt for 0.001". Damping is produced by the air-drag during the motion of the pendulum arm. Results of tidal analysis for two one month fifty-days recording in the Underground Laboratory of Geodynamics at Walferdange (Grand-Duchy of Luxembourg) are also given.

- e) MARSH J.G. & E.S. CHANG - "Detailed gravimetric geoid confirmation of sea surface topography detected by the SKYLAB S-193 altimeter in the atlantic ocean".
p.291-299.

A detailed gravimetric geoid has been computed for the Northwest Atlantic Ocean and Caribbean Sea area in support of the calibration and evaluation of the GEOS-3 altimeter. This geoid, computed on a 15' x 15' grid was based upon a combination of surface gravity data and the GSFC GEM-8 gravitational field model. This gravimetric geoid has been compared with passes of SKYLAB altimeter data recorded in the Atlantic Ocean, and three typical passes are presented. The relative agreement of the two data types is quite good with differences generally less than 2 meters for these passes. Sea surface manifestations of numerous short wavelength (~ 100 km) oceanographic features indicated in the altimeter data are also confirmed by the gravimetric geoid.

- f) BARANOV W. - "Potential fields and their transformations in applied Geophysics".
Geoexploration Monographs, series 1, n°6, 120 p, Gebrüder Borntraeger; Berlin - Stuttgart, 1975.

Compte-Rendu par H.M. DUFOUR

- 329 - BARLIK M. - "The question of transfer of miligal unit to a gravity network by using quartz gravimeters".
Polska Akad. Nauk, Kom. Geod., Geod. i Kartog. t.XXV, Z.2, p.90-102, Warszawa, 1976.

In the article Author gives a try of determination an accuracy of miligal unit in a gravity network measured by means of quartz gravimeter of type GAK 7T, Sharpe CG-2 and Worden. Taking into account changes of gravimeters equations with passage of time, temperature and depending on a value of gravity, Author has estimated relative errors at $\pm 1.10^{-3}$ for instruments GAK 7T and $\pm 0.2.10^{-3}$ for Sharpe and Worden gravimeters.