GGP Newsletter #7 - 25 May 1999

Contents

Prepared by David Crossley and Jacques Hinderer, May 21 1999

The Second GGP Workshop - Minutes

Introduction

The Workshop entitled ``High Precision Gravity Measurements with Application to Geodynamics and Second GGP Workshop'' was held 24-26 March 1999 at Munsbach Castle in the Grand Duchy of Luxembourg. The first 2 days were devoted to the GGP and the last day concentrated on the application of gravity measurements to various tectonic problems.

This Newsletter covers in detail only events of the first 2 days. The Proceedings of the entire workshop will be published in Conseil de L'Europe - Cahiers du Centre Europeen de Geodynamique et se Seismologie - probably in late 1999.

GGP is indebted to the efforts of the Workshop organizers, in particular Bernard Ducarme of the Royal Observatory in Brussels, for ensuring the success of the meeting.

The session first started on Wednesday, 24 March 1999 with a Welcome from the Organizing Committee. An overview of the workshop content was presented and the scientific program started. Following the List of Participants, we give hereafter the topics covered by GGP and a short summary of each paper (the speaker is underlined).

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Topic 1: Detailed reports from each GGP station - all groups

D. Crossley - Status of GGP stations

The Chairman's status report focussed on the goals, problems and achievements of GGP in the first 18 months of operation. There are two main goals

(1) To record global signals - possible inner/outer core modes, atmospheric pressure effects in gravity, polar motion, long term gravity variations - and to use stacking techniques to separate regional effects from worldwide effects, and

(2) To establish a high quality, global gravity data set - that will provide a benchmark for recording, processing and distributing high precision gravity data for current and future scientific studies.

Difficulties and Successes

Crossley outlined some of the frustrations in getting the project fully underway. These include issues such as problems of getting the instruments calibrated, the lack of use of the pilot phase to check out the data recording and archiving systems, and the lack of stations reporting data and recording of environmental data. He noted that only recently has ICET finally set up the Data Base but GGP stations still had access to only their own data. On the positive side, stations were getting better at sending in their data on time and the GGP EOS article was published recently to promote the project to a wider audience.

Data Availability

Crossley reported on the good availability of data from some of the GGP stations and the lack of data from others. This situation was based on indirect reports from ROB. Later in the Workshop, O. Francis indicated that the majority of stations had now reported data, although some of it is still missing from the archive. The current situation, as of 25 May 99, is given in the following table which is extracted from the ICET Data Base (http://oma.be).

Table 1. Minute Data by Year - Months Available Through ICET
[This table was updated 12 September 1999]

Station	Location	1997	1997	1998	1998	1999	2000	2001	2002	2003
BA	Bandung									
BE	Belgium		8-12	1-8	9-12	1,2,5,6				
BO	Boulder	1-6	7-12	1-7						
BR	Brasimone		7-12	1-3						
CA	Cantley		7-12	1-8						
CB	Canberra		7-12	1-8	9					
ES	Esashi		7-12	1-8	9					
KY	Kyoto		7-12	1-8	9					
MA	Matsushiro		7-12	1-6						
MB	Membach		7-12	1-8	9-12	1-2				
ME	Metsahovi		7-12	1-2						
MO	Moxa									
PO	Potsdam	1-6	8-12	1-8						

ST	Strasbourg		7-12	1-4						
SY	Syowa									
VI	Vienna		7-12	1-8	9-10					
WE	Wettzell		7-12	1-7	9					
WU	Wuhan									

NOTES:

- The availability of data is governed by the Data Authorization (see later in this Newsletter)
- The 2 vertical double lines bracket the start of GGP and the current date for which data is due
- Station Moxa did not start recording until 1999
- Station Potsdam has data in the ICET data base from 1992; it stopped operation in September 1998
- Station Wettzell stopped operation in September 1998

Station Hydrology Data and Log Files

Crossley noted that few groups had yet sent any hydrogeological data. The only stations informally reporting to have sent data were BE, BO, CA, and ST. At the presentation, other groups also stated they had sent data (ES, ME, PO, and VI). However **none of this data has yet made its way into the ICET Data Base**.

Similarly there are no station Log Files in the Data Base so scientists downloading the data have no idea what the problems are when the data are disturbed, or even whether there are any calibration changes or replacement of filters etc.

Review of Promises at Last GGP Workshop

Crossley reviewed the **Action Promises** that had been made 2 years ago at the First GGP Workshop (Newsletter #5):

1. O. Francis was to provide data validation information to GGP groups (not done)
2. O. Francis was to provide a yearly summary of data on CDROM (to be done this coming August)
3. ICET should produce a yearly report - perhaps published in BIM (or a read-me file on the yearly CDROM) (not yet done)
4. A Station Questionnaire should be sent to all Groups (done)
5. All Groups to send their decimation filters to ICET (not done)
6. GGP recognizes 1999 solar eclipse experiment (takes place this summer)
7. GGP accepts ICET as the GGP Data Centre (done)

H.-T. Hsu and H.P. Sun - Status and calibration of SG in Wuhan (China)

This report concerns the upgraded SG (T004) which has been installed in the new Chinese station, about 15km from Wuhan. The data recording system records only 1 sample every 20s and pressure 1 sample every 1 min (unfortunately this is below the GGP standard of gravity and data which stipulates between 1 and 10s sampling). The instrumental drift is about -13 microgal /year and calibration was performed with the help of the two spring meters ET15 and ET21. It is planned to use the Chinese FG5 AG in the future to check the scale factor.

H.-J. Dittfeld - Final results of the SG registration in Potsdam

The reported drift of SG T018 in Potsdam is of the order of 5 microgal/year (linear). The analysis of long period gravity variations shows the pole motion signature with a delta factor close to 1.12 but there are also additional phenomena which superimpose onto this effect. Dittfeld noted that ETERNA V3.3 has a problem with long period waves compared to ETERNA 2.0 and 2.2. Addmittances for temperature and groundwater is very variable and did not improve the modeling.

M. Harnisch, G. Harnisch, H. Jurczyk, and H. Wilmes - 889 days of registration with the superconducting gravimeter SG103 at Wettzell (Germany)

This report was on the final recording for the SG103 in Wettzell - the only remaining instrument with a 0.5in sphere. The main story is the large drift of -0.02 microgal/hr while the instrument has been at Wettzell, compared to a much smaller (positive) drift when the instrument was in Bad Homberg. The residuals are somewhat disturbed, but polar motion was successfully fitted and so was rainfall with 2 exponentials. A calibration was done between SG103 and AGs.

M. Harnisch**, G. Harnisch,** I. Nowak, B. Richter, and P. Wolf - The dual sphere superconducting gravimeter C029 at Frankfurt and Wettzell- First results and calibration

This report gives the first results from the new SG C029 which is equipped with two levitating spheres. The drift rates of the two sensors are different and quite large (30-40 microgal/year). This instrument has been moved to Wettzell in a cold stage and the drift behavior changed a lot after the move. It is evident from compared records that the detection of spurious steps in gravity is facilitated by a dual system. A correlation was pointed out between the cooling system and gravity residuals. Inferences of hydrology (rainfall and snow) also appear in gravity. R. Warburton commented some of the results and suggested that it is better to move such an instrument after warming up and then fully re-install it at the new site.

H. Virtanen - Status report on Metsahovi station (Finland)

The results of SG T020 are reported. The drift seems to be linear and somewhat large (5 microgal / yr), but the polar motion signature leads to a gravimetric factor d = 1.17, close to theory. The introduction of the new gravity card lead to an apparent increase in residual noise and there was some audience discussion on this point. R. Warburton noted that the new card has a much greater bandwidth than the older one. The importance of the log file (a summary of station events and problems) was discussed.

B. Meurers - 1200 days SG-recording in Vienna (Austria)

This record of SG C025 led to interesting new correlations between rainfall, air pressure and gravity in the short period range. A modeling based on air masses exchanges is proposed that leads to a mass effect with no surface pressure signature. Rainfall is associated with the gravity effect.The polar motion is also nicely visible in the registration. It is reported that the change in the transfer functions (new versus old filters) does not lead to changes in the observed tides. The calibration is done with AG parallel measurements but the accuracy is limited by a high noise connected with urban activity. Again comments were mad about the noise of the new gravity card.

J. Hinderer and **J.P. Boy** - A two-year record of SG C026 in Strasbourg (France): first results and comparison with the 3000 day record of SG T005 at the same station

This report is devoted to a comparison in different frequency ranges between the old SG T005 operated in Strasbourg from 1987 to 1996 and the new compact C026 installed in summer 1996. It is suggested that, thanks to the new data acquisition system and to the new instrument, the gravity noise spectrum is decreased in all frequency bands. As a consequence of the new very low drift rate (a few microgal/year), the polar motion signature is very clear on the two-year record and nicely superimposes onto the AG measurements performed once a month at the same station. The FCN is much better determined than for the old T005.

J. Neumeyer - The new SG site Sutherland (South Africa)

Different aspects of the new installation of the GFZ SG in South Africa are presented including the site selection criteria. It is also mentioned that the location is very useful for investigating global ocean loading. The GGP community acknowledges the German group for this move which will help in having a better geographical coverage of SG stations.

S. Takemoto, Y. Fukuda, T. Higahi, T. Sato and S. Dwipa - SG observations in Bandung, Indonesia

One of the two SG operating in parallel in Kyoto, Japan, was installed in Bandung on Java island (Indonesia). From the first data analysis, information on drift, tides and ocean loading, noise level, are reported. This new location near the Equator is obviously very important in the GGP network. There have been interruptions due to power problems. Ocean loading models for this region are obviously going to be important.

T. Jahr and **C. Kroner** - The future SG station at the Geodynamic Observatory Moxa (Germany)

This report concerns the new German station in Moxa which will be operated by the Jena group. It will be a dual sphere instrument installed in an observatory where many other types of observations including meteorological parameters are available. The possible noise sources influencing the station are reviewed and discussed, particularly the effect of reservoirs in the region.

Note that the station code for Moxa will be MO, not JE as previously reported.

T. van Dam and **O. Francis** - An update of the SG data of Boulder (Colorado)

The updated report for the Boulder station (SG C024) indicates the quality of the site and several scientific points are addressed including long term residual gravity, resonance in the diurnal band, seasonal effects in barometric admittance. A very complete calibration experiment was presented where 4 AGs measured simultaneously at TMGO (Table Mountain Geodynamics Observatory) and the accuracy reaches 0.1%.

Y. Imanishi - Present Status of SG T011 at Matsushiro, Japan

This site is inside a hill and the room is de-humidified. The calibration is done with an FG5 over a 7 day recording period and accuracy reaches 0.1 %. The drift is 24 microgal / yr. Results from a tidal analysis done with BAYTAP-G software are shown. The polar motion gravimetric factor was found to be d = 1.21. Differences in rainfall effects between Kakioka and Matsushiro are shown.

H.-P. Plag - Present status of and future plans for Earth Tide observations at NMA (Norwegian Mapping Authority)

It was indicated that a new Japanese SG will be installed in the future at Ny Aslund in Norway (80N, Svalbard). At this site there are a number of interesting problems - regional uplift, the presence of glaciers, soil moisture, ocean loading, air pressure were discussed. The GGP members acknowledge the effort to install a new SG in this high latitude station which will obviously help the GGP network coverage.

Topic 2: Treatment of gravity data - processing, filtering, and decimation - tidal processing - calibration

N. Florsch - On various aspects of non-linearities

This paper shows that new non-linear waves are to be expected in gravity spectra mainly due to hydrodynamics in the oceans, especially close to the shore. The amplitude of such waves might easily reach the microgal level when measured close to the sea. More work has to be done on the ocean-solid Earth interactions with the help of tide gauges and gravimeters.

S. Pagiatakis - GWR data treatment and analysis

A general overview of the disturbances existing in SG records is presented and the author proposes a new method of treatment of the problems without using the standard procedure which consists in filling the gaps with a theoretical tide. Examples from noisy and quiet segments in SG data are shown. Such a method would be a way to overcome the disturbances with statistical significance tests rather than being dependent on the person who pre-processes the data.

M. van Camp - Transfer function determination of the cryogenic gravimeter C021

This study nicely describes how the phase calibration of SGs has to be performed in order to reach a transfer function determination in agreement with GGP standards. Both sine waves as well as step functions can be used as synthetic input signals and lead to similar results. The data requires only 2-4 minutes of computer time to analyze.

Action

Michel van Camp agreed to put a summary of the Step Response Method on to the GGP Website

J. Makinen, J. Hinderer, N. Florsch and M. Amalvict - Calibrations of SG T005 in Strasbourg 1989-1994 with JILAG-5. Evidence for time changes in calibration factor?

This paper refers to several calibration experiments done in Strasbourg between SG T005 and AG JILAG5. The analysis of all the common data sets suggests that there might be a small evolution in the scale factor of the order of 0.1% per year; the reason for such a change is still unknown but does apparently not originate from changes in the instrumental characteristics of the AG. B. Ducarme suggested to check the reality in this change in calibration by tidal analyses performed on moving time subsets.

Topic 3: The GGP data bank

B. Ritschel and **O. Francis** - The GGP-ISDC at ICET: Design, functions and first experiences

O. Francis first presented the status of data collection at ICET. He insisted on the excellent transfer of data from almost all the groups to the GGP data base. However there are only a few LOG files (report of problems) available, as well as only two auxiliary files with ground water level measurements. The question of high sampling rate data is re-opened and D. Crossley indicated that a test earthquake has been chosen in one of the previous newsletters; J. Hinderer agrees to send a message in the future to all SG groups after major seismic events with magnitude above 8.0. O. Francis asked the groups to do a WEB server test (ftp://ftpserver.oma.be) in order to check that everything is working.

Action

All GGP Groups should check their FTP connection to the ICET server (ftp://ftpserver.oma.be) in order to ensure that everything is working for downloading and uploading files.

Francis also required a copy of all the numerical filters used to decimate from high sampling data to 1 min (GGP files).

Action

All SG groups should send to ICET 3 files:

1. a file containing the numerical filter used to decimate the raw station data to 1 min
2. a file of raw station data and
3. a file of decimated data after processing by the decimation filter

B. Ritschel presented the general form of the GGP data base (http://etggp.oma.be) which was installed very recently at ICET thanks to the knowledge and experience of the GFZ Potsdam group in managing large data bases. He showed several examples on how to send data files, to visualize them and to retrieve them. He also asked for a separation character (:) between the columns in the header of the files which would greatly simplify the treatment in the data base later on.

Action

All GGP Groups should note that the **colon character (:) should be added to each field descriptor for the GGP files**

The effect of these two changes can be seen in the example below.

```
Filename: ST970910.GGP
Station: Strasbourg, France
Instrument: GWR C026
Phase Lag (sec): 36.0000 2.4000 nominal
N Latitude (deg): 48.6220 0.0010 estimated
E Longitude (deg): 7.6840 0.0010 estimated
Height (m): 180.0000 1.0000 estimated
Gravity Cal (ugal/v): -792.0000 1.0000 measured
Pressure Cal(mbar/v): 200.0000 1.0000 nominal
Author: (jhinderer@eost.u-strasbg.fr)
yyyymmdd hhmmss gravity(V) pressure(V)
C**************************************
77777777 19970901 000000 0.075913 0.420192
...
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B. Ducarme - First results of the GGP data bank at ICET

GGP members should note that the responsibilities of ICET has been divided into two parts:

ICET (O. Francis / M. Hendrickx) is responsible for all aspects of maintaining the Data Base and the users interaction with it.

ROB (B. Ducarme / Vandercoilden) is responsible for all aspects of ICET processing (i.e. the correcting or fixing of files and the tidal analyses).

This talk deals with the second aspect, the processing of GGP data.

In the pre-processing, the raw GGP files (1 min samples) are corrected for spikes, gaps and offsets using the TSOFT program by P. Vauterin from ROB (Brussels). Corrected hourly samples are then high-passed filtered and a tidal analysis is performed using the ETERNA software by H.G. Wenzel. B. Ducarme presented tables with the tidal results for many GGP stations and commented on the noise level in the tidal bands. He indicated that noise levels may be dependent on the duration of the time series and this point implies that a direct comparison of the noise levels is not trivial.

Topic 4: Review of scientific problems addressed by the GGP network

R. Warburton (Invited Talk) - Remote operation of superconducting gravimeters

The manufacturer indicated that the company is aware of the need to install remote SG stations in the future in order to have a better coverage. He presented the new system developed by GWR Instruments in this respect which has a number of important instrumental improvements that should account for low noise, few offsets (or easy separation of true from instrumental ones, invisible refrigeration, smaller size, remote operation (even re-levitation when needed, tilt check). The drift behavior of recently installed SGs is now of the order of a few microgal per year. He indicated that the SG noise figure is close to 0.5 microgal/ $\sqrt {Hz}$. He also mentioned that some minor offsets seen in SG records after helium transfers could be due to liquid mass changes near the sensor. The major improvement in refrigeration is the possibility existing now to operate in dewars where evaporated helium is re-liquefied thanks to a strong compressor. Operating remotely a SG should allow to increase the world-wide distribution of these instruments as well as to decrease the frequency and length of data gaps. BKG (Frankfurt, Germany) helped in funding the development of the first unit which will be delivered end of 1999. GWR announced that RSG (Remote SG) will be available in year 2000.

T. Sato, Y. Fukuda and Y. Aoyama - On the annual gravity changes induced by SSH variability

This paper focused on consequences of SSH (Sea Surface Height) changes on gravity and their impact on tidal gravimetric factors. Three main results were shown: effect of SST (Sea Surface Temperature) on SSH, effects of SSH on gravity and a comparison between observed and theoretically predicted polar motion. A study of annual and semi-annual components in gravity was proposed and the authors indicated how gravity measurements can help in constraining the study of steric changes in the oceans (in particular the scale factor cm/degree Celsius). The convolution using oceanic Green's functions leads to gravity changes of ± 5 microgal due to SSH variability.

D. Smylie and B. Bengert - A Global Phase Experiment: Stacking Superconducting Gravimeter Records for the Detection of the Translational Modes of the Inner Core

A short history of the Slichter mode was given and the speaker insisted on the importance of the splitting law in the search of the triplet in gravity records. He showed individual spectra from several SGs located in Europe as well as in Canada or Japan. He indicated that a stack of the spectra helps in enhancing the triplet which was found at frequencies close to the ones mentioned in earlier stacks. A very nice stacking method was presented which uses the phase information of the motion.

Synthetic examples could demonstrate the efficiency of this approach. It is planned to apply such a powerful method to the GGP data.

L. Mansinha - The 1999 solar eclipse project

The author presented the eclipse which will occur on August 11, 1999. He indicated the location of total obscurity path in Central Europe and insisted on the fact that several SGs are right on this path. It is a great opportunity to use this eclipse to study several problems of fundamental physics (gravitational shielding) and atmospheric physics (bow and Lamb waves, static pressure changes). It is agreed that the existing SG groups in Europe will join their efforts to observe in the optimal conditions the gravity and pressure changes associated with this eclipse.

Topic 5: Intercomparison of absolute and relative gravity measurements (papers and discussion)

G. Casula, P. Baldi, J. Hinderer and M. Amalvict - The gravimetric station of Brasimone-Italy

This paper reported on the status of the SG station in Brasimone, Italy. The calibration experiment done with FG5 measurements by the Strasbourg team are presented and compared to the calibration experiment using the mass attraction of a moving ring which is available at this station. Both results for the scale factor of the SG are in agreement, but there is a gain of a factor 3 when using the AG parallel measurements. It is planned to re-do this comparison in the future.

J. Hinderer, M. Amalvict, J.P. Boy and E. Calais - On the use of long records of Superconducting and Absolute Gravity observations

This paper is devoted to the use of long records of AG and SG observations. Two year long results from the Strasbourg station are presented and show that both types of gravimeters are able to observe nicely the polar motion signature, as well as, after correction for this effect, to retrieve very stable gravity values with variations ranging not more than several microgal. A comparison is also presented between AG and GPS vertical measurements at Grasse station in southern France. It appears that these two types of observations converge to the 1 cm precision in vertical height change (after conversion of gravity to height using the standard free air gradient).

O. Francis - Long term comparison between a superconducting gravimeter and a FG5 absolute gravimeter

A common record of continuous SG and intermittent AG is presented from the Membach station in Belgium. It is pointed out that both kinds of measurements are complementary one to the other; several examples of true versus spurious offsets in gravity are commented.

T. Niebauer (Invited Talk) - Recent advances in absolute and differential gravity

This review paper addressed three main topics: absolute gravimetry, absolute gradiometry and absolute differential gravimetry. An example taken from the Churchill post-glacial uplift of about 1.4 microgal/year proves the ability of regular AG measurements to detect such small long-term gravity changes. An new portable AG of smaller size and rapid set-up is presented and applications for surveys on volcanology, tectonics and applied geophysics are foreseen despite the slightly degraded precision (of order 10 microgal) due to the lack of an active superspring. Also presented is a gradiometer using two ballistic systems in the same device and a precision of 1 Eotvos is achieved. Finally, the project of a small scale network of different AG all linked via optical fiber to the same pilot system is shown with obvious applications to volcanology or tectonics.

A. Lothhammer, B. Richter, **W. Schwahn**, P. Wolf , T. Baker, and G. Jeffries - Long-term increase of gravity at the Medicina station confirmed by absolute and superconducting gravimeter time series

This paper was devoted to the analysis of long-term gravity changes observed at the Medecina station in northern Italy which was established by BKG (Germany) in the frame of EC program SELF. It is suggested that, in addition to hydrological effects known to be important in the Po river zone, there is a systematic increase in gravity seen by the SG which is confirmed by AG measurements performed by two different instruments at the same location.

M. Llubes - Ocean loading and crustal deformation in Bretagne (France): first results and future experiments

This paper reviewed the problem of strong ocean loading in the Bretagne region near the Atlantic coast. First results from an experiment done in 1998 involving an FG5 AG, Scintrex spring meters and GPS receivers are discussed. Signals as large as ± 20 microgal in gravity and ± 10 cm in vertical height are observed and the discrepancies with respect to loading prediction are analyzed and lead to speculate that near coastal effects might add to the influence of global ocean models derived from satellite altimetry. A second experiment is planned in fall 1999 in order to further investigate this point.

H. Virtanen (Finish Geodetic Institute) - On the observed environmental effects at the Metsahovi station (Finland)

This paper shows the impact of environmental effects on the SG operated at Metsahovi station. In particular, snow load effects are identified. An experiment involving the removal of 20 tons of snow in a short time interval was performed in order to better try to model this load.

Z. Zabek and **A. Pachuta** - Absolute measurements with Polish ballistic gravimeter

This paper presented AG measurements at the Polish station near Warszawa and long-term observed changes are discussed in the frame of UNIGRACE EC project which tries to unify different gravity networks in Europe both from Eastern and Western

countries.

Arnautov, G., Ducarme, B., **Kalish, E.**, Smirnov, M., Y. Stus, and V. Timofeev - Gravity variations at Novosibirsk region and Irkutsk region by GABL measurements

[We apologize, but have no notes concerning this presentation].

Topic 6: Guidelines for the authorship of papers using GGP data and other issues (open discussion)

D. Crossley chaired this topic and proposed different items for discussion:

Data Formats

We refer to Newsletter #6 (and Appendix #6a) for the description of the data formats. At the request of several members of the audience (though with some minor dissention), it was agreed that the header of GGP files should give the phase lag of the anti-aliasing filter in seconds, and not in degree/cycle per day, in order to suppress any confusion in the processing.

Action

All GGP Groups should change the **file header for gravity and pressure file** - the phase lag of the anti-aliasing filter should now be quoted in **seconds** (not degrees / cycle per day)

Reporting of Data for Dual Sphere Instruments

The current station identifications and data formats are inadequate to deal with the newer generation of dual sphere instruments. After some discussion the following were agreed to:

1. Stations with dual sphere instruments (currently the new installations at MO Moxa, SU Sutherland, and WE Wettzell), would continue with their existing two letter station codes.
2. The data from the upper and lower spheres of these instruments are to be treated as two independent data sets. However, the **upper sphere is #1**} and the **lower sphere is #2**; these two numbers must be used **as the second character of the station identification** when constructing the data files. Thus, for example, the 1 minute GGP data from these three stations for the month of May 1999 would be designated:

Station Code	Files from Upper Sphere	Files from Lower Sphere
MO	M1990500.GGP	M2990500.GGP
SU	S1990500.GGP	S2990500.GGP
WE	W1990500.GGP	W2990500.GGP

Earthquake Data

So far GGP has not made much progress in supplying short period (1-10s) seismic data either to ICET or to the scientific community. As a first step it was suggested that SG groups send data from a representative earthquake. This was first suggested a year ago and the request is now repeated:

Action

10 days of raw high sampling data from the March 25, 1998 Balleny Islands earthquake of magnitude 8.1 and depth 29 km should be sent from each station to ICET

For future reference, a method of notifying groups about earthquake data was agreed to at the first GGP Workshop.

Action

J. Hinderer agreed to send a message in the future to inform the GGP members to send earthquake data as soon as there is an earthquake with magnitude exceeding 8

Additional Information for ICET

B. Ducarme requested that all GGP Groups send him the following additional data for their station:

Action

B. Ducarme requested that all GGP Groups send him the following additional

data for their station:

Institution	_____
Instrument	_____
Owner if Different from above	_____
Geological Description of Site	_____
Calibration Method	_____
Installation by	_____
Maintenance by	_____

Authorship of Papers Using GGP data

D. Crossley introduced then the discussion for the guidelines for authorship of papers using GGP data. The following items were agreed to:

1. Only people who had contributed significantly to the writing of the paper should be on the author list - not the entire group of people who provided the data for the paper. All authors should be responsible for the accuracy of the scientific content of the paper.
2. The minimum requirement for all papers using GGP data is to acknowledge the GGP and the institutions providing the data. [*J. Neumeyer suggested that persons in charge of the SGs should be acknowledged rather than general institutions but the general opinion was still to recognize the importance of institutions rather than individuals*]
3. As a courtesy to other groups, GGP authors should contact the other groups whose data they use in order to verify that the data is being used, interpreted and analyzed fairly.

J. Hinderer suggested that people writing a paper should contact the providing groups and check with them the type of required acknowledgment. As indicated above **it is highly recommended to send to each SG group a preprint for information**.

D. Crossley pointed out that preprints cannot be put on the GGP Website because of the policy of the scientific journals prevailing up to now.

Other Remarks

B. Ducarme announced that he will write up a review paper on tides and ocean loading using the first records of the GGP SG network.

Answering a question on the future of oceanic tidal models derived from satellite altimetry, O. Francis indicated that no major improvement has to be expected in these models and that the oceanographers are now more concerned with non-tidal effects in the oceans.

Publication of the Proceedings of the Workshop

Proceedings of the Workshop have to be sent to B. Ducarme (ORB, Brussels) either in LATEX or WORD formats before **15 JUNE 1999**. These papers with less than 25 pages including figures and tables will be reviewed and most probably published on a CD-ROM or in the Cahiers of ECGS depending on financial aspects.

Action

All presenters to the Workshop should submit their papers by June 15, 1999

Other Issues Discussed at the Workshop

High precision gravity applied to tectonic problems (papers and discussion)

After the regular GGP workshop, topics involving the applications of gravity in tectonic environments was discussed. The presentations were, by title:

M. Diament (Paris, France) - Application of absolute and relative gravity measurements to tectonics and volcanology (45 min)

C. Gerstenecker (Darmstadt, Germany) and I. Suyanto - Gravity mapping on Mount Merapi and Merbabu, Indonesia

B. Snitil (Darmstadt, Germany), C. Gerstenecker, G. Jentzsch, G. Laeufer and A. Weise - Repetition Network on Mount Merapi

C. Keysers (Bonn, Germany) - Observing small gravity changes in the lower Rhine Embayment (Germany) by LCR-gravity meters

A. Elwahabi (Brussels, Belgium), H.J. Dittfeld, and Z. Simon - Meteorological influence on tidal gravimeter drift

C. Lazaro (Vila Nova de Gaia, Portugal) - Precise gravity measurements in the Azores Islands

P. Jousset (Paris, France) - Volcanic activity as revealed by geodetic and microgravity observations at Mount Usu and Mount Komagatake (Hokkaido).

G-Gramophone

Finally, the G-Gramophone session (Topic 8) was an open discussion led by the Chairman of this IAG working group, Bernd Richter. The future of this working group after IUGG in England was discussed and Richter also mentioned that the European SG groups will join in an EC proposal in order to calibrate with ground based measurements the next satellite GRACE mission.

Among the issues discussed were:

1. The necessity of AG measurements at SG sites at least 1-2 times per year
2. The calibration of the SG should be done at times of high tides to improve the error in the scale factor.
3. The use of the theoretical tides (as discussed previously by Merriam and Goodkind) is a good way to check the constancy of the calibration factor of the SG.
4. There is a problem of the permanent offsets with Absolute Gravimeters. The JILAG instruments differ by ± 4 microgal and the FG5s by ± 2 microgal.
5. There is a proposal by NOAA to establish a Fundamental Station at Boulder.
6. There is a great opportunity to use GGP and other gravity sites to check the gravity field obtained from satellites.
7. There is a problem of access to AG data which is not as well organized as the SG data within GGP.

Review of GGP Data Authorization

The following stations have designated their data be made available through the GGP Data Base (ICET) according to the following code. People interested in SG data outside GGP may request it directly from the station managers.

Code	Meaning
U	Unrestricted
R1	Restricted to GGP groups for 1 year following collection
R2	Restricted to GGP groups for 2 years following collection
R	Restricted to GGP groups only
NA	Not available (through ICET)

			Code for Each Data Type		
Station	Location	Data Manager email	GGP	Earthquake	Raw
BA	Bandung	takemoto@kugi.kyoto-u.ac.jp	U	R1	R
BE	Belgium	bernard.ducarme@ksb-orb.oma.be	U	U	U
BO	Boulder	tonie.vandam@ksb-orb.oma.be	U	U	U
CA	Cantley	merriam@geoid.usask.ca	U	U	U
KY	Kyoto	takemoto@kugi.kyoto-u.ac.jp	U	R1	R
BR	Brasimone	casula@ibogfs.df.unibo.it	R1	R1	R
CB	Canberra	tsato@miz.nao.ac.jp	R1	R1	NA
ES	Esashi	tsato@miz.nao.ac.jp	R1	R1	NA
MA	Matsushiro	imanishi@ori.u-tokyo.ac.jp	R1	R1	NA
MB	Membach	olivier.francis@ksb-orb.oma.be	R1	U	U
ME	Metsahovi	hv@fgi.fi	R1	R1	R
MO	Moxa	jentzsch@geo.uni-jena.de			
PO	Potsdam	neum@gfz-potsdam.de	R1	U	U
ST	Strasbourg	jhinderer@eost.u-strasbg.fr	R1	U	U
SY	Syowa	tsato@miz.nao.ac.jp	R2	R2	NA
VI	Vienna	bruno.meurers@univie.ac.at	R1	U	R
WE	Wettzell	richter@ifag.de	R1	U	R
WU	Wuhan	heping@asch.whigg.ac.cn	R1	U	U

NOTES

1. GGP = raw data not corrected for problems but decimated to 1 minute data files, 1 month per file, available through ICET
2. Earthquake = 10 days of raw data including and following a large event
3. Raw = data as it is recorded, no processing or treatment for problems, no decimation, original format used by each group, available through individual station requests.

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