NEWSLETTER #20

8 December 2010

Prepared by Jacques Hinderer and David Crossley.

Note two attachments are included with this Newsletter:

1. A Powerpoint Presentation (GGP Business Meeting_egu_2010.pdf) for some of the items in the EUG Business Meeting (J. Hinderer).

2. A Powerpoint Presentation (Wilmes_World_AG_Network.pdf) on the Absolute Gravity Network (AGrav) from the St. Petersburg Meeting (H. Wilmes).

IMPORTANT NOTE: The Business Meeting Minutes are not amended to reflect information that later became available. A final section Updates includes the latest news.

1. Minutes of the GGP business meeting, EGU Vienna, May 6th, 2010

In Attendance (15): C. Kroner, PTB Munchen, J. Hinderer, EOST Strasbourg France, B. Meurers U. Of Vienna, Austria, Germany, C. Försch, GFZ Potsdam, Germany, T. Klügel, BKG Germany, B. Richter, BKG Germany, H. Virtanen, FGI Finland, V. Palinkas, VUGTK, K. Shibuya, NIPR, Japan, Y. Fukuda, Kyoto U. Japan, Tzu-Yi Lien, Hsinchu, Taiwan, B. Ritschel, GFZ Potsdam Germany, X. Lei, Institute of Geodesy & Geophysics, CAS, Wuhan, China, J.-P. Boy, NASA GSFC USA & EOST Strasbourg France, R. Warburton, GWR Instruments, San Diego, USA.

The file GGP Business Meeting_egu_2010.pdf contains slides for some of the items below, including photos, graphics and tables. These are noted [..] beside the item**.**

1.1 Station review

Asia

- Second Chinese instrument installed, in Lhasa, belongs to the seismological service [slide]
- Hsinchu: two SGs there, parallel observations with AG once per month, one instrument has problems with coldhead, one instrument will be move but not in 2010
- Kyoto stopped
- MunGyung stopped
- Lhasa new station installation December 2009 [slide]
- Cibinong: new station in Indonesia, replacement for Bandung, started in Nov. 2008, since Sept. 2009 stop of recording, restart probably July 2010, impression of good data quality [slide]
- Esashi stopped, instrument moved to Mizusawa downtown near VLBI site
- Syowa: data quality not good, instrument running

Americas

- New station at Apache Point at LLR site [slide]
- Boulder restarted [slide]
- Concepcion: earthquake Feb. 2010 led to tilting of SG, AG dropped to the ground, recording of SG continues after sensor recentering (done May 2010), AG reference measurements at Concepcion station in April/May 2010, change in gravity (based on AG measurements) of about 10 µGal due to earthquake [2 slides]

Africa

- SG installation at Djougou/Benin in the near future
- Sutherland. Left: new single sphere SG-052, since August 2008. Second SG – dual sensor SG-037, running at Sutherland since Nov. 2009, AG measurements in fall

2010. One instrument will be moved in the future, which one, and when, is not clear. [2 slides]

Europe

- New stations: BFO, Onsala, Yebes/Spain (mid of May 2010) [Yebes slide]
- Vienna: regular AG measurements at Conrad Observatory, **changed calibration factor for the old station, GFZ will take care to exchange the value in the data header of the old files**
- Metsähovi: okay, investigations into local hydrology
- Pecny: okay, regular AG measurements, investigations into local hydrology
- Bad Homburg:
    - SG 044 installed in Feb. 2007, parallel operation with SG 030 for determination of the drift function. SG 044 restarted in 2008 after upgrade to new dewar and cooling system, problems in Feb. 2010 (noisy data) → replacement of electronic card. Since June 2007 SF 044 is the reference gravimeter for station Bad Homburg and will continue registration.
    - In June 2007 SG 030 was removed for upgrade to new dewar and cooling system. Re-installation in Bad Homburg in Feb. 2008. Instrument was used for several instrumental tests and experiments. Data can be provided on request.
- Wettzell:
    - New gravimeter hut, necessary because of establishment of new VLBI site next to the old station.
    - In June 2010 SG 030 was moved (from Bad Homburg) to Wettzell and installed in a second (new) gravity building at the premises of the Wettzell observatory.
    - SG 029 continued operation at the old gravity building of the station. Parallel record of SG 029 (old site) and SG 030 (new site) for one year, investigations on local hydrology in cooperation with GFZ
- Medicina: okay
- Status of BKG stations, comparison of WE, BH, MC [2 slides]
- Strasbourg: problems with the old electronics → were replace with another old set, plans for a new SG

1.2 Status of ICET data

[slide, table]

- Vienna: data from Conrad Observatory will be sent in the near future
- Syowa data will be available, recently sent to GFZ
- More recent data from Japanese stations will also become available in the near future
- Cibinong: data will be sent

1.3 Chile earthquake data (Crossley)

- Data from 12 stations were sent, **records from more sites would be welcome**

- **Data from April 2010 should also be sent because of $_0S_0$**

1.4 ICET data base (Ducarme, Barriot)

- No news regarding ICET
- Expected discussion at Taiwan meeting in June 2010

1.5 Data support from GFZ (Ritschel)

- Two ways to access data:
  1. old GGP data base
  2. via ISDC-portal at GFZ, encouragement to use the mew portal, registering once beforehand necessary, upload via ftp-server possible with the new system
- contact at GFZ: Bernd Ritschel

1.6 New proposal for data treatment (Palinkas)

- Proposal: provision of automatic data quality assessment in terms of gaps, spikes etc. on a daily basis and data processing → would require to send 1 s data in a timely fashion
- Partly overlap with ICET tasks, partly task of the station operators
- But a regular documentation of the station performance would be helpful, provision of a 'processed product' to outsiders would be good but it is then mandatory to outline explicitly for which purposes the processed data sets can be used and for which not
- Discussion to be continued at the Taiwan meeting

1.7 Improving data distribution models (Hinderer)

- Discipline to send data low at several stations, proposed idea (Hinderer): those stations that send their data on time get immediate access to data from other stations without a six months time delay
- Proposal: to encourage station operators to make their data as soon as possible available to the public, allowed maximum delay: 3 months
- **E-Mail to station operators to ask for their agreement on changed data policy, <u>no</u> answer means agreement!**
- From participants in the business meeting no concerns indicated

1.8 Other issues

1) GGP as IAG service

(a) Clarification of relation between ICET and a future 'GGP-Service'

(b) framework/regulations necessary for becoming a service already existing

(c) **E-Mail to station operators to ask which of the stations will participate in such a service** → participation means adhering to defined regulations and standards and sending data in a timely manner, then getting in touch with the IAG executive committee

2) **AGRAV data base [2 slides]**
   (a) Two 'views' to data: meta data – free access, complete data: restricted to contributing groups
   (b) More than 400 stations (April 2010)
   (c) More than 1300 observations (April 2010)
   (d) Access: http://bgi.dtp.obs-mip.fr or http://agrav.bkg.bund.de
   (e) Capacities for storage of AG observations for calibrations purposes of SGs available

3) **Instrument calibration (scale) factors and history**
   (a) Proposal (Meurers) to add for each instrument a separate calibration file with information on calibration factor and the time span for which it is valid which can be easily updated if necessary, reason: from time to time it happens that the calibration factor changes for the past observation periods, this way information would be more easily available
   (b) More discussion necessary, unclear what to do about the line on the scale factor in the data header: keep the line and the factor given at the time of file submission and have an additional calibration file, remove the line and have only the calibration file or update the factor in the data header and have no separate calibration file?

1.9 Small issues

(a) New maps are available on the GGP website
http://www.eas.slu.edu/GGP/ggpmaps.html
(b) Decimation Filters. Double precision version of filters from 1s to 1 min etc. now on GGP website:
http://www.eas.slu.edu/GGP/ggpfilters.html
(c) BIM back issues. Thanks to Michel Van Ruymbek, All BIM past issues have been scanned to .pdf files:
http://www.eas.slu.edu/GGP/BIM_Past Issues/readme.html
(d) Provision of meta data to GGOS portal (http://observing-system-portal.bkg.bund.de/GGOS-Portal/EN/Home/homepage.html), request will come
(e) Atmospheric reductions to be provided by BKG resp. GGFC for GGP stations, mass attraction computations based on 3D atmospheric models (spatial resolution: 7 km, temporal resolution: 6 h) for European stations (exception: Ny Ålesund), in computation of attraction effect in station vicinity local station air pressure in computation included, from 2008 onwards global atmospheric models available spatial resolution: 40 km); loading part to be provided by GGFC, details will be given in the near future

1.10 Next GGP meetings

(a) Taipei: Second Asia workshop on Superconducting Gravimetry, June 20th -22nd, http://space.cv.nctu.edu.tw/SG2/second_asia_workshop.html
(b) St. Petersburg: IAG Symposium on Terrestrial Gravimetry, June 22nd – 25th, http://www.elektropribor.spb.ru/cnf/tg-smm2010/eindex.php

(c) Fairbanks: 2nd International Symposium of the International Gravity Field Service, Sept. 20th- 22nd, deadline for abstracts: June 1st, http://www.gps.alaska.edu/IGFS2/

2. Minutes of the GGP business meeting, 2nd Asia SG Workshop, Taipei, Taiwan, June 22nd, 2010

Attendance: a list of names was not recorded, but conference participation can be found on the website below. Perhaps about 20 people participated in the Business Meeting. The following is an informal outline of the proceedings that was devoted to various aspects of SG instruments and data processing. Many of the presentations given at the Workshop can be found online at http://space.cv.nctu.edu.tw/SG2/programs.html . Of special interest were presentations from some of the new Asian installations (e.g. Gujarat - India, Ghuttu - India, Mizusawa - Japan, Hsinchu - Taiwan, and Mungyung - S. Korea) and reports from other stations (e.g. Ny-Alesund, Norway).

2.1 GGP Business Report (Crossley)

The previous report from the EGU (above) was presented to connect news between the meetings in Europe and Taiwan. The following additional points were discussed:

(1) **Treatment of Missing Data**
Sometimes data is missing entirely due to instrument failure or similar problems. In all cases, the values 9999.99 for gravity and pressure should be used to fill places where there is a missing data value, in either the gravity and pressure, or in the auxiliary file.

(2) All Files Should be Sent
There are times when you may be tempted to not send a file because it contains no useful information. For example, log files may have nothing to report for several months, or an auxiliary file may contain no useful data. Even in these cases we recommend ALL FILES BE SENT FOR ALL MONTHS. There are two reasons for this:

(a) The presence of the file tells ICET that the file has been sent for that month for that station, so you will not be unpleasantly reminded to send the data, and
(b) Any program that is written to read a sequence of files from a station may not like to have files missing. So, even if they contain nothing, or contain only '999 ...', the presence of the file will ensure continuity of the time sequence.

(3) Auxiliary Data
For GGP purposes, auxiliary data was originally intended for ***rainfall, groundwater level***, and more recently ***soil moisture*** measurements. But assuming you may collecting other environmental data (such as ***relative humidity and temperature***), it is appropriate, and useful for detailed local modeling, to include all this hydrology-related data as Auxiliary Data.

However, ***it is not necessary to send data that refers to the health of the instrument*** (such as tilts, heater power, and helium consumption).

(4) Log Files
The log file should be completed for each month. From your station logs, extract all significant events, such as start of recording, change of instrument or repair, helium refills, cold head maintenance, power interruptions, etc. Also, look at the raw 1 minute GGP data for gravity, pressure and auxiliary data. If there are visible disturbances, and these correspond to events you have noted, then make sure they appear in the log file. If there are unknown disturbances, just note 'unknown reason' or something equivalent.

(5) Filename Repair Codes. This is a reminder that these were explained in Newsletters 19, and #19a. Code 00 means no processing except for very short gaps before decimation.

(6) Discussion of Hydrology. We had a lively discussion of the known hydrology effects on gravity. This is parallel to many other similar discussions in the past. One of the simplest approaches to hydrology for gravity is the 'leaky bucket' class of models, that are also favored by hydrologists. By adding sufficient elements, many sources and sinks can be combined empirically without resorting to finite element or other numerically intensive modeling. The hydrology at several stations such as the two new sites in India was discussed.

(7) Reminder about Processing. Some examples were shown from the paper by Hinderer et al (2002) to remind the newer members of the audience about the different possibilities for correcting (or not correcting) various types of data disturbances (such as due to helium refilling). This again is an old subject that has been thoroughly documented in the literature and in previous GGP Newsletters.

Hinderer, J., Rosat, S., Crossley, D., Amalvict, M., Boy, J.-P., and Gegout, P., 2002. Influence of different processing methods on the retrieval of gravity signals from GGP data, *Bull. Inf. Mar. Terr.*, **123**, 9278-9301.

2.2 Training Workshops

Richard Warburton headed a discussion of the need to engage in training people with less previous experience in gravity data, i.e. the newer groups. Possible topics are tidal analysis, ocean tide loading, pressure corrections, etc. Though there was some interest in this idea, the difficulty of putting these ideas into practice was not resolved. Unfortunately GGP and GWR have few opportunities (time and money) to support the community except informally at conferences and individually as the need arises.

3. Report from Symposium on Terrestrial Gravimetry, St. Petersburg, 22-25 June, 2010 (AGrav, Wilmes)

There was a Meeting of the Working Group on Absolute Gravimetry, chaired by Herbert Wilmes, with 22 participants from about 12 countries. The following are the points made in an email that Wilmes sent around on July 1 with the minutes (not attached here):

(1) Thanks for participating in the WG meeting during the Symposium on Terrestrial Gravimetry in St. Petersburg, for your contributions and for the active discussion. I thank especially those persons who agreed to contribute to the preparation of a "Call for Participation for a New Global Absolute Gravity System" and to the preparation of "Standards for Absolute Gravity Measurements".

(2) As the establishment of a global absolute gravity reference network foresees a closer connection with stations operating superconducting gravimeters, I also address the representatives of the Global Geodynamics Project to ask for a closer cooperation.
[This point concerns GGP here].

(3) In addition I will address groups with absolute gravimeters which are not yet represented in the AGrav database and ask for their contributions. We would try in this way to fill the gaps in the global distribution of stations.

Attached separately is a PowerPoint presentation (Wilmes_World_AG_Network.pdf) with some interesting information on the current status of Absolute Gravimetry and Reference Networks. Note the distribution of global ownership of AG meters (primarily FG5s and A10s).

4. Updates

4.1 Installation in Djougou

An SG has now been installed in Djougou, Benin, West Africa by J. Hinderer and the Strasbourg group. It will be combined with the AG measurements (FG5 and A10) and microgravity surveys at 3 or 4 sites to monitor the West African Monsoon hydrology. Initial results from the SG instrument are encouraging (J. Hinderer).

4.2 Challenges

GGP face some obvious challenges:

Data. Still there is a lack of timely data. Several stations have not contributed, and many do not keep to the monthly schedule. This makes it difficult to move ahead with better databases etc.

ICET. The anticipated automatic correction of minute data has not been realized, and we have been reliant up until recently on the extra-ordinary contribution of Bernard Ducarme (retired!) and Leslie Vandercoilden in Brussels to provide corrected data (see Appendix A). But this situation cannot be expected to last and a more permanent solution is required.

GFZ Manpower is likewise limited in Potsdam at the main Data Center, and again we are very grateful to Bernd Ritschel for continuing service to GGP under difficult conditions.

4.3 Positive news

On the positive side, many new instruments have been sited in the past few years, and this increases the interest of others in time-variable gravity. New applications are opening up, such as earthquake pre-cursors, the possibility of glacier monitoring and subduction zone slow events.

The list of publications from GGP and related activities is now quite large.

4.4 Next meetings

International Symposium on The 2001 Bhuj Earthquake and Advances in Earthquake Science, 22-27 January 2011, Institute of Seismological Research, Gandhinager-382 009, Gujarat, India. The conference will include a field trip to the SG site in Gujarat.

See the GGP Home page for links to the program and brochure, or contact Dr. Arun Gupta, Institute of Seismological Research (ISR), Department of Science and Technology, Government of Gujarat. akg_mgs@yahoo.com

There will be GGP Business Meetings at the EGU Meeting (Vienna, 2011) and IUGG in Melbourne, Australia (June-July, 2011).

Appendix 1: GGP Data Preprocessing and Analysis Status at ICET (B. Ducarme and J.-P. Barriot)

The last update of the GGP data had been made before the last Earth Tides symposium in 2008. The new revision gave the opportunity to process in most of the stations two years of additional data. We welcome the contribution of Hsinchu (HS) and Pecny (PE), who joined recently GGP. A total of 427 months (n in Table 1) from 14 stations have been processed since the beginning of 2010. These stations are marked in blue. Perhaps additional data have been uploaded since our processing as the data base is permanently in evolution. Stations marked in red are late in uploading their raw data. Four stations operated by the Japanese group (CB, ES, KA, NY) did not upload raw data since 2007. MA and TC stopped sending data after 2008/06. The instruments marked with a star are no more operated.

The new data have been analyzed and the results carefully compared with the previous tidal analysis results when available. The responsible scientists of the 14 reprocessed stations received a report of our investigations. Global tidal analyses have been processed. In some stations the end of the data had to be rejected from the global analysis due to degraded signal to noise ratio (last column of Table 1).The number of days used for the global analysis N and the standard deviation STD computed with ETERNA (ANALYZE) are given in Table 1. As the stability of the sensitivity of the superconducting gravimeters is generally better than 0.1%, the STD is a measure of the signal to noise ratio in the station. For 9 stations among the 14 updated ones the STD is lower than 1nm/s^2.

Status of the processed stations

BH: In Bad Homburg the new SG044 is operational for more than 900 days. The STD of this instrument is one of the lowest among all the GGP stations. The new SG C044 is perfectly fitting the results of the CD030-L. There is a slight calibration difference, close to 0.1%, between CD030-L and CD030-H.The phase differences of the different instruments agree within the associated RMS errors.

CA: Cantley started in 1989. It is the longest series of observations. It suffered from technical problem and the STD was multiplied by a factor of two during several months in 2006/2007. This portion of the data was rejected from the global analysis. The change of electronics on January 22 2008 did not affect the calibration. The amplitude factors agree perfectly. The new time lag of 16.3s applied since that epoch provides phases which seem a bit too large compared to previous results. If a precise determination of the true time lag is obtained it will be possible to normalize the data prior to 2008/01/22 to get homogeneous results.

HS: Hsinchu is a new station which has a large STD. The modelling of the tidal factors using recent ocean tides models is questionable as it provides ratios $\delta_{obs}/\delta_{mod}$ close to 1.01 in the diurnal band and close to 0.995 in the semi-diurnal band. The misfit is thus not related to calibration.

MA: Matsushiro remained a good station and the two last years of data are in perfect agreement with previous data.

MB: Membach continued to run very well as usual. From It is interesting to note a more or less continuous drift of sensitivity of the order of 0.03% to 0.04% between 1998 and 2009. This

variation could probably not be detected by calibration. It confirms that the stability of the superconducting gravimeters is better than 0.1%.

MC : The end of Medicina is a bit noisier than usual. After the change of electronics on 2007/06/12 the calibration factor was modified as well as the time lag. The new time lag of 11.1s is good as the phase lag on M2 is not modified. However a large jump of the amplitude factors of the order of 0.4% is appearing, while the ratio of the new and old calibrations is 1.0043. It is clear that the sensitivity of the voltage output has not been modified. It is the new calibration value which seems questionable as the results obtained with the previous calibration were fitting very well the other GGP stations in Europe as shown in Ducarme et al., 2009.

ME: Metsahovi is also a station which started well before 1997. A comparison of 5 successive analyses covering each 2 years between 2000 and 2009 has shown no shift of sensitivity at the level of 0.05%. The registration prior to the GGP period is in agreement with the GGP data within 0.1%. An adjustment factor of 0.9996 could be introduced for a better fit.

MO: Moxa is an excellent station with very low STD.

PE: Pecny is a new station with exceptionally low STD.. The 900 registration days provide the same tidal factors as the 6 years of excellent rsults with the modified ASK228 but the RMS errors on the tidal factors are already lower.

ST: Strasbourg remains an excellent station even if January and December 2009 are perturbed.

SU: In Sutherland the dual sphere instrument was replaced by SG052 after July 2008. The RMS error on the unit weight of the new SG C052 is better than the RMS error of the CD instrument. There was no difference in the tidal factors between CD037-L and CD037-H.

The provisional calibration of the new SG C052 seems to be very slightly too large compared to both components of CD037, but the series of the new instrument is still too short to draw firm conclusions.

TC: Only 7 additional months have been processed in Tigo and there is no special remark.

WE: The dual sphere instrument of Wettzell is excellent. After the change of electronics on April 17, 2007 new calibration values and new time lags have been determined. The amplitude factors δ and the phase differences α of the L and H sensors are now in perfect agreement. In the previous series there was a difference in the δ values between L and H sensors at the level of 0°05%, while the phase differences were in agreement within the associated RMS errors. It should be noticed that the amplitude factors are now increased by more than 0.1% with respect to the previous values. It confirms the conclusions of Ducarme et al., 2009 based on the previous results. The authors showed that, after tidal loading corrections, the δ_c values for O1 and M2 at Wettzell were 0.1% lower than the mean of 15 European stations. To get homogeneous results it should be necessary to apply a normalisation factor 1.0017 on the previous series of channel L and 1.0012 on channel H.

WU: Wuhan station remains in good shape since its repair at the beginning of 2005. Due to the failure two years of data have been eliminated from the global analysis i.e. 2003-2004. The STD is well below 1nm/s^2.

Ducarme B., Rosat S., Vandercoilden L., Xu J.Q., Sun H.P., 2009. European tidal gravity observations: Comparison with Earth Tides models and estimation of the Free Core Nutation (FCN) parameters. *Proceedings of the 2007 IAG General Assembly, Perugia, Italy, July 2 - 13, 2007, Observing our Changing Earth*, M.G. Sideris (ed.), Springer Verlag, International. Association of Geodesy Symposia 133, 523-532*(DOI10.1007/978-3-540-85426-5)*.

[Note: In what follows Table 1 is the original received from B. Ducarme, and Table 2 is a reduced version with only the essential columns.]

Table 1: Status of preprocessed and analyzed GGP data

n: number of preprocessed months since 2008
N: number of days effectively used in the global tidal analysis
STD: standard deviation of the global analysis (ETERNA)

Code	Location	SG Instr.	ICET Code	RAW	Corrected	n (months)	N (days)	STD (nm/s^2)	remarks
BA	Bandung, Indonesia	T008	00084100	030600	030622*		1104	2.938	
BE	Brussels, Belgium	T003	07790200	000900	000901*		6692	1.641	
BH	Bad Homburg, Germany	CD030_L	01300734	070400	070422*		2222	0.783	
		CD030_U	02300734	070400	070422*		2218	0.835	
		SG044	00440734	090800	090822	31	909	0.558	
BO	Boulder, USA	C024	00246085	031000	031022*		1850	1.109	
BR	Brasimone, Italy	T015	00150515	991200	991222*		1428	2.954	
CA	Cantley, Canada	T012	00126824	091100	091122	23	4212	1.221	
							¶5777	1.210	
CB	Canberra, Australia	C031	00314204	070400	070422		3429	1.019	
ES	Esashi, Japan	T007	00072849	070400	070322		2274	1.491	→20040225
HS	Hsinchu, Taiwan	T048	00482695	081200	081222	33	898	2.249	
KA	Kamioka, Japan	T016	00162828	070500	070522		901	1.310	
KY	Kyoto, Japan	T009	00092823	030600	030622*		1533	3.691	→20020731
MA	Matsushiro, Japan	T011	00112834	080600	080622	25	3954	1.008	
MB	Membach, Belgium	C021	00210243	091000	091022	20	4282	0.789	
MC	Medicina,Italy	C023	00230506	100300	100300	34	4458	0.876	
ME	Metsahovi, Finland	T020	00200892	091100	091122	24	4303	1.254	
							¶4829	1.154	
MG	MunGuyng, S. Korea								
MO	Moxa, Germany	CD034_L	01340770	100400	100422	27	3576	0.679	
		CD034_U	02340770	100400	100322	27	3646	0.626	
NY	Ny Alesund, Norway	C039	00390005	070400	070422		2413	2.954	
PE	Pecny,CZ	OSG050	00500930	090900	090922	29	864	0.566	
PO	Potsdam, Germany	T018	00180765	980900	980912*		2250	0.856	
ST	Strasbourg, France	C026	00230306	091200	091222	25	4492	0.744	
SU	Sutherland, South Africa	CD037_L	01373806	080700	080722*	08	2665	1.113	
		CD037_U	02373806	080700	080722*	08	2502	1.038	
		SG052	00523806	090900	090922	13	385	0.713	
SY	Syowa, Antarctic	T016	00169960	030100	030122*		1279	1.387	→20001231
TC	Tigo, Concepcion, Chile	RT038	00387621	080600	080622	07	1805	1.158	
VI	Vienna, Austria	C025	00250698	061200	061222*		3402	0.530	
WA	Walferdange, GDL								
WE	Wettzell, Germany	SG103	01030731	980900	980921*		¶726	2.639	
		CD029_L	01290731	090800	090822	29	3784	0.629	
		CD029_U	02290731	090800	090822	29	3750	0.642	
WU	Wuhan, China	T004	00322647	090500	090522	35	3300	0.924	
					TOTAL	427			

* instrument stopped
¶ with data before 1997/07
→ end of the global analysis

Table 2. ICET REVIEW - Status of preprocessed and analyzed GGP data

(n = number preprocessed months since 2008, N = number of days in the global tidal analysis, STD = standard deviation of the global analysis using ETERNA). Stations in blue are new, in red are behind (omits stations that have not sent any data).

Code	Location	SG Instr.	RAW	Corr.	n (mo)	N (days)	STD (nm/s^2)
BA	Bandung, Indonesia	T008	030600	030622*		1104	2.938
BE	Brussels, Belgium	T003	000900	000901*		6692	1.641
BH	Bad Homburg, Germany	CD030_L	070400	070422*		2222	0.783
		CD030_U	070400	070422*		2218	0.835
		SG044	090800	090822	31	909	0.558
BO	Boulder, USA	C024	031000	031022*		1850	1.109
BR	Brasimone, Italy	T015	991200	991222*		1428	2.954
CA	Cantley, Canada	T012	091100	091122	23	4212	1.221
						¶5777	1.210
CB	Canberra, Australia	C031	100300	070422		3429	1.019
ES	Esashi, Japan	T007	081200	070322*		2274	1.491
HS	Hsinchu, Taiwan	T048	081200	081222	33	898	2.249
KA	Kamioka, Japan	T016	100300	070522		901	1.310
KY	Kyoto, Japan	T009	030600	030622*		1533	3.691
MA	Matsushiro, Japan	T011	080600	080622	25	3954	1.008
MB	Membach, Belgium	C021	091000	091022	20	4282	0.789
MC	Medicina,Italy	C023	100300	070822	34	3520	0.827
ME	Metsahovi, Finland	T020	091100	091122	24	4303	1.254
						¶4829	1.154
MG	MunGuyng, S. Korea						
MO	Moxa, Germany	CD034_L	100400	100422	27	3576	0.679
		CD034_U	100400	100322	27	3646	0.626
NY	Ny Alesund, Norway	C039	100300	070422		2413	2.954
PE	Pecny,CZ	OSG050	090900	090922	29	864	0.566
PO	Potsdam, Germany	T018	980900	980912*		2250	0.856
ST	Strasbourg, France	C026	091200	091222	25	4492	0.744
SU	Sutherland, South Africa	D037_L	080700	080722*	08	2665	1.113
		D037_U	080700	080722*	08	2502	1.038
		SG052	090900	090922	13	385	0.713
SY	Syowa, Antarctic	T016	030100	030122*		1279	1.387
TC	Tigo, Concepcion, Chile	RT038	080600	080622	07	1805	1.158
VI	Vienna, Austria	C025	061200	061222*		3402	0.530
WA	Walferdange, GDL						
WE	Wettzell, Germany	SG103	980900	980921*		¶726	2.639
		CD029_L	090800	090822	29	3784	0.629
		CD029_U	090800	090822	29	3750	0.642
WU	Wuhan, China	T004	090500	090522	35	3300	0.924
				TOTAL	**427**		

* instrument stopped ¶ with data before 1997/07

Appendix 2: Minutes of Meeting, Working Group on Absolute Gravimetry St. Petersburg, 23.06.2010

A2.1 Absolute Gravity Database AGrav

An overview was given by H. Wilmes with reference to his circular letter of May 2010 asking all groups with absolute gravimeters for support and contribution to the International Database for Absolute Gravity Measurements. The database acts as the official database of BGI and is supported by the IGFS. It has reached operational status now. A number of stations and observations are already present (more than 400 sites, about 1400 observations). The database enables cooperation and data exchange between AG groups and it enhances the visibility of absolute gravimetry. It ensures long term availability of the valuable AG measurements. The data policy ensures that data property remains with the institutions and persons which carried out the measurements. The database also provides access to the public. For this (metadata) access the gravity values are cut to μGal resolution.

Contributions to the database:

- J. Mäkinen: Data upload is scheduled for near future.
- J. Krynski: Provision of A10 measurements in Poland.
- M. Barlik: FG5 measurements are already uploaded.
- R. Davis: Measurements of ICAG comparisons and FG5-108 of BIPM will be provided.
- L. Vitushkin: 3 years of AG measurements with FG5 at BIPM are available, with a limitation on the applied corrections (no ocean tidal loading).
- M. Lim: Measurements with FG-L available, instrument took part in ICAG 2009.
- L. Vitushkin: storage of results of ICAG (offsets) in database proposed.
- B. Karaböce: Discussion on reference height: Must always be specified but should be chosen individually depending on instrument, no recommendation of specific height.
- Y. Fukuda: Proposes to introduce recommendations and checkpoints for data compilation and upload to the database.
- D. Ruess: Gravity gradient for processing might differ from gradient for height transfer, which might be non-linear, especially in mountainous regions (like the alps)
- L. Timmen: Discussion on rounding of gravity values for public access. Rounding to mGal-level is too restrictive with respect to applications in sea and air-borne gravimetry. IGSN71 was established for ship-borne gravimetry and for such applications the values from the AGrav database should be “open access”. He suggests that the release of full values or the individual rounding can be defined by each institution.

• M. Amalvict: Proposal to cut data individually as needed by the data policy of the respective institution

• H. Wziontek: Database will be modified in a way that the data owners can specify to provide full resolution data to the public or select a rounding parameter.

• J. Krynski: Agrees, default value for rounding gravity values should be applied.

• H. Wilmes: There are still large gaps visible in the global station coverage. He proposes to involve further institutions and colleagues. Contributions for Africa, Russia, China, Japan Australia, arctic regions etc. are welcome!

A2.2 Establishment of Global Absolute Gravity Reference System

The discussion under this topic is related to a presentation with the same title during session 2 of the symposium on June 22, 2010. A pdf-copy of the presented viewgraphs is included. H. Wilmes shortly repeats the requested features of stations: repeated absolute gravity measurements which document the variability, connection of gravity (physical) observations with geometrical sensors (permanent GNSS, possibly others), selected sites equipped with a superconducting gravimeter, selected stations with connection to tide gauges. AG comparisons are an important condition of the reference system, standards for models and corrections need to be fixed.

The Global Geodetic Observing System (GGOS) relies on three groups of observables: Earth's shape, Earth's gravity field and Earth's rotation; GGOS requests consistent geometric and gravitational data.

The new gravity reference system shall replace the IGSN71 and improve the uncertainties of the gravity reference by more than an order of magnitude.

• H. Wilmes asks for candidate sites for the reference network, for contributions to the definition of station requirements, and for contributions and support in the preparation of a "Call for Participation".

• L. Vitushkin: A new station near St. Petersburg will be established.

• L. Timmen: Suggests the revival of IAGBN-plans, where 31 stations world-wide were planned. Suggests not planning too many stations, in case of IfE a maximum of three stations might be maintained. Referring to GGOS, connection to other techniques is necessary.

• V. Palinkas: Requirement should be a reference station and the participation in ICAG

• J. Krynski: Suggests not to establish something artificial and not aiming for a too homogeneous station distribution. It should be started with already existing stations since no funding for new stations with special requirements can be expected. An evolution is possible from a regional station distribution to the global scale.

• Y. Fukuda: Questions the need in a new gravity network since the gravity standard is realized by the instruments themselves.

• V. Palinkas: Emphasizes the importance of a network to document time variations in gravity which are mostly impossible to model.

• J. Krynski: Proposes to circulate station requirements and a call to participate.

• Y. Fukuda: GNSS measurements and data or models for hydrology should be included, also tide gauges.

• H. Wilmes: Not all techniques must be available at every station, but repeated AG and permanent GNSS should be considered as a minimum, SG is preferred.

• Krynski: Proposes ECGN stations as starting frame for a network.

• V. Palinkas: Minimum requirement for stations are either AG measurements each two months or the combination of AG and SG, start with a number of SG stations.

• H. Wilmes: For the combination of AG and SG, AG measurements in 6 month interval turned out to be sufficient for the determination of SG instrumental drift.

• The participants were asked for their contribution to the preparation of a Call for Participation for a Global Gravity Reference System.

M. Amalvict, M. Barlik, J. Krynski, V. Palinkas, L. Timmen and H. Wilmes offered to contribute to the preparation of the "Call for Participation".

A2.3 Standards for Absolute Gravity Measurements

• V. Palinkas: Need in global standards illustrated by the still mostly incorrect treatment of the amplitude factor of the 18.6 years tidal wave.

• H. Wilmes: Suggests the circulation of a list of improvements

• J. Mäkinen: Standards should be started and based on IERS conventions, e.g. model choice for Ocean Tide Loading

• The participants were asked for their support with the definitions of standards

M. Eckl, B. Karaböce, J. Mäkinen, V. Palinkas, D. Ruess, H. Wziontek and H. Wilmes offered to contribute to the preparation of "Standards for Gravimetry".

Enclosures:

- Participants list,
- Invitation to contribute to the Absolute Gravity Database AGrav of BGI and BKG,
- "Establishment of a Global Absolute Gravity Network", Presentation during the IAG Symposium on Terrestrial Gravimetry, St. Petersburg 2010