



Status report of the BKG Gravity Group

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- TIGO/Concepcion (Chile): gravity observations and the Maule Earthquake from 27.02.2010
- Future of ICAG
- New Gravity Lab at Wettzell and 1st RICAG there
- Hydrological studies at Wettzell
- A10 field campaign in Greenland
- Status of the AGrav database



TIGO/Concepcion (Chile): Superconducting Gravimeter GWR SG038



May 2006

- coldhead lifetime exceeded:
>5 years without service!
- no spare coldhead available
by manufacturer
- frequent icing problems

Upgrade

June 2008 – Dec 2009:

- new dewar (OSG)
- new cooling system

delay due to complicated
customs procedure



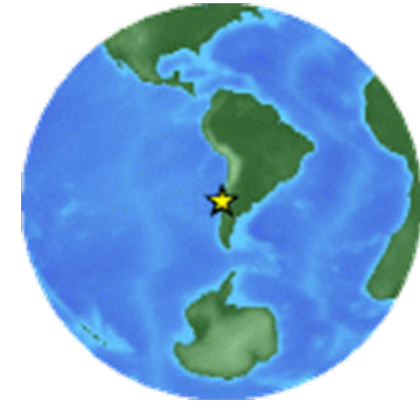
May 2010



EQ: Magnitude 8.8 OFFSHORE MAULE, CHILE

Saturday, February 27, 2010 at 06:34:14 UTC

Chile earthquake



- Epicenter only 80 km away from station
- TIGO crew and their families safe after this devastating earthquake!



TIGO FG5-227 after Earthquake





TIGO

Comparison of FG5-227

**Superconducting
gravimeter SG038**

**Absolute gravimeters of BKG
FG5-227 FG5-101**





TIGO: Comparison results FG5-227 – FG5-101 – SG038

Results of Combination of AG and SG observations

Absolute gravimeters:

- Difference FG5-227 – FG5-101:

$$2.3 \pm 1.7 \mu\text{Gal}$$

Agreement within manufacturer uncertainty of 2 μGal ;
confirms reliability of measurements with FG5-227 after the Earthquake!

- Difference pier 403 – 402:

$$-5.0 \pm 0.2 \mu\text{Gal}$$

Superconducting gravimeter:

- Estimation of initial drift after setup (exponential function)
- Scale-factor SG038 confirmed after upgrade and reinstallation in 12/2009:

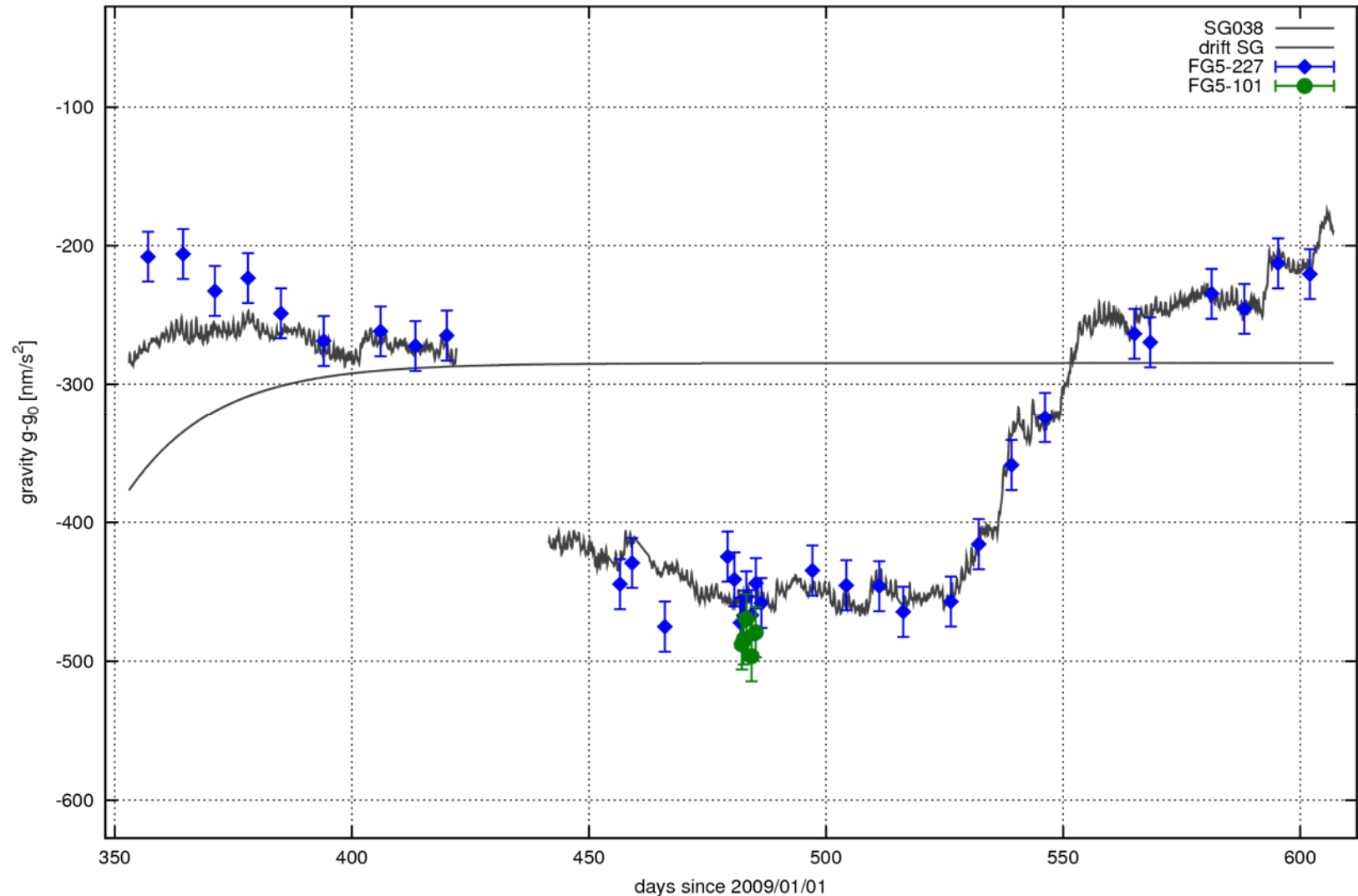
$$736.5 \pm 0.2 \text{ nm/s}^2/\text{Volt}$$



TIGO: combination AG-SG

24.12.2009 – 26.08.2010

Concepcion/TIGO 2009/12-2010/08 FG5-227 - SG038 (24-Dec-2009 00:28:05 - 26-Aug-2010 01:28:03):
mean observations, proj means, offsets, weights

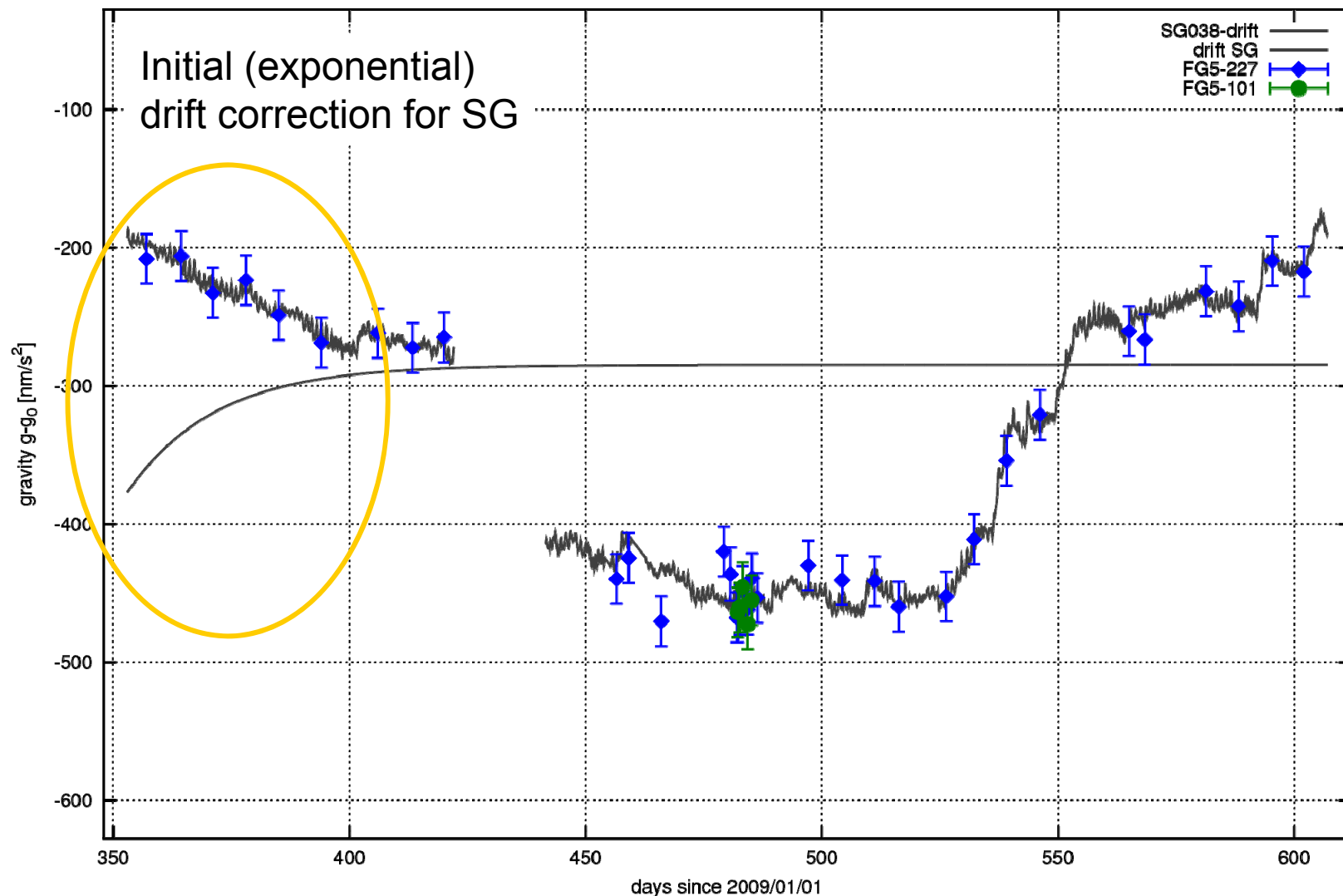




TIGO: combination AG-SG

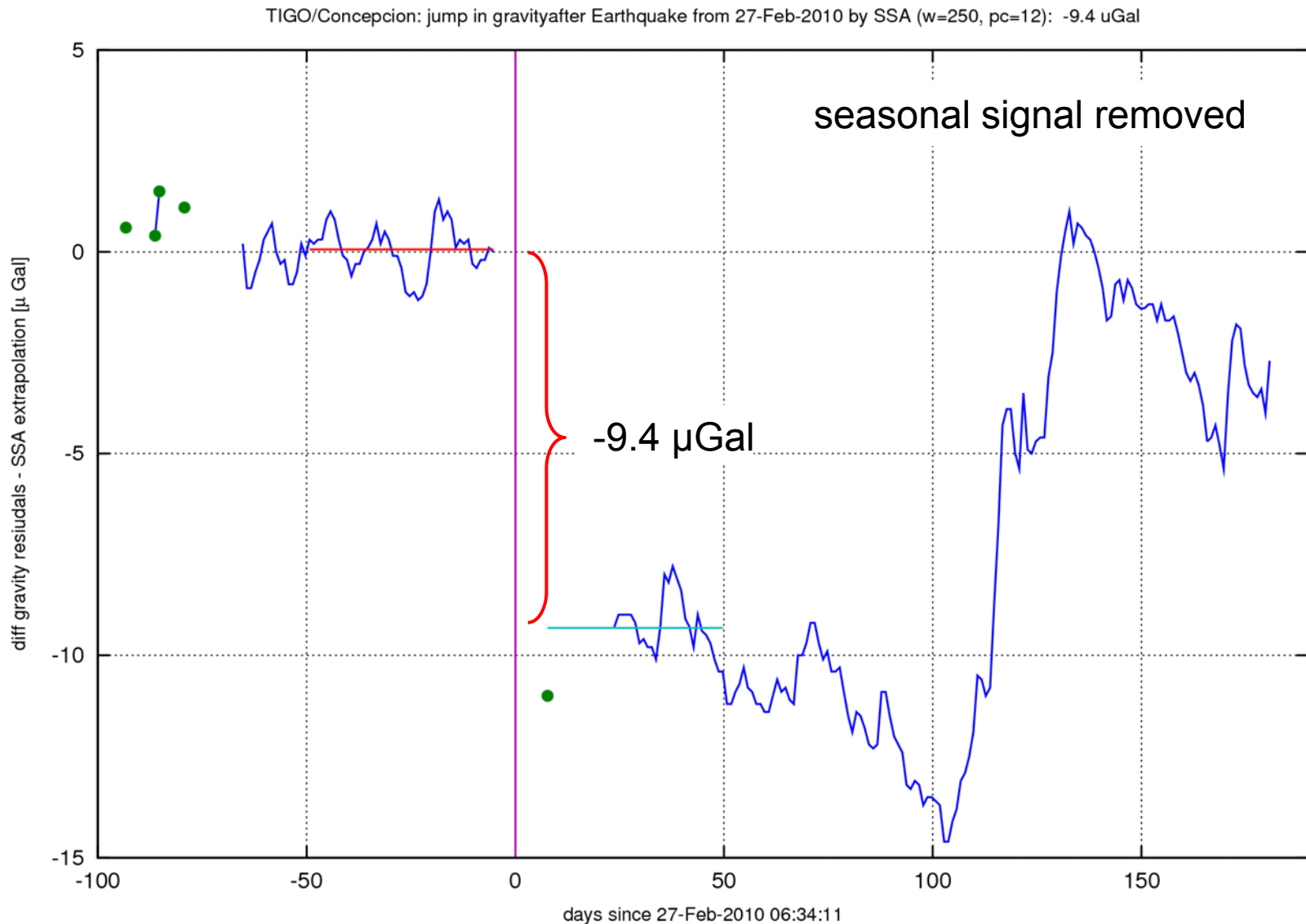
24.12.2009 – 26.08.2010

Concepcion/TIGO 2009/12-2010/08 FG5-227 - SG038 (24-Dec-2009 00:28:05 - 26-Aug-2010 01:28:03):
adjusted observations, proj means, offsets, weights





Coseismic gravity change





Meeting on the Future of International Comparisons of Absolute Gravimeters

- BIPM closed support for ICAG in Sevres (Paris)
- Discussion on the continuation of International Comparisons of AG at BKG: 28 February to 1 March, 2011, Frankfurt a.M., Germany
- Preparation of a proposal for the meeting of CCM-WGG (10.05.2011) and CCM
- Balance of geodetical and metrological aspects/requirements of AG comparisons

Participants:

- L. Vitushkin, chair of the Working Group on Gravimetry of the Consultative Committee on Mass and Related Quantities (CCM-WGG)
- V. Palinkas, chair of IAG Study Group 2.1.1 on Comparison of Absolute Gravimeters and member of CCM-WGG
- H. Wilmes, chair of IAG IC-Working Group 2.1 on Absolute Gravimetry (IAG-WGAG)
- Lennart Robertsson, BIPM (Department Time)
- Alessandro Germak (INRiM), Member of CCM WGG
- Mirjam Bilker-Koivula (FGI), Member of CCM WGG
- Sergiy Svitlov (MPI), Member of IAG SGCAG
- Reinhard Falk, Hartmut Wziontek, Jan Müller (BKG), Members of IAG WGAG



Meeting on the Future of International Comparisons of Absolute Gravimeters

The meeting supported

- the continuation of CCM Key Comparisons (KC) of Absolute Gravimeters
- the official proposals to host the CIPM KC on Absolute Gravimetry from
 - 2013: Walferdange (ECGS) (Luxembourg)
 - 2017: All-Russian D.I.Mendeleyev Research Institute for Metrology (Russian Federation)
 - 2021: National Institute of Metrology (China)
- the continuation of regional comparisons of absolute gravimeters on two-years time scale with enlarging them to all Regional Metrology Organizations,

The meeting will propose to the meeting of CCM-WGG

- the inclusion of the gravity sites for CCM KC and Regional KC of AG in the International Gravity Reference System.
- superconducting gravimeters as necessary equipment of comparison sites
- that participants in CIPM KC will be
 - National Metrology Institutions (NMI),
 - Designated Institutions (DI) and
 - *all other laboratories having the highest technical competence and experience.*



New gravity station at the Geodetic Observatory Wettzell

New Twin VLBI telescope
very close to gravity station!

New gravity laboratory
to avoid disturbances in SG
registration



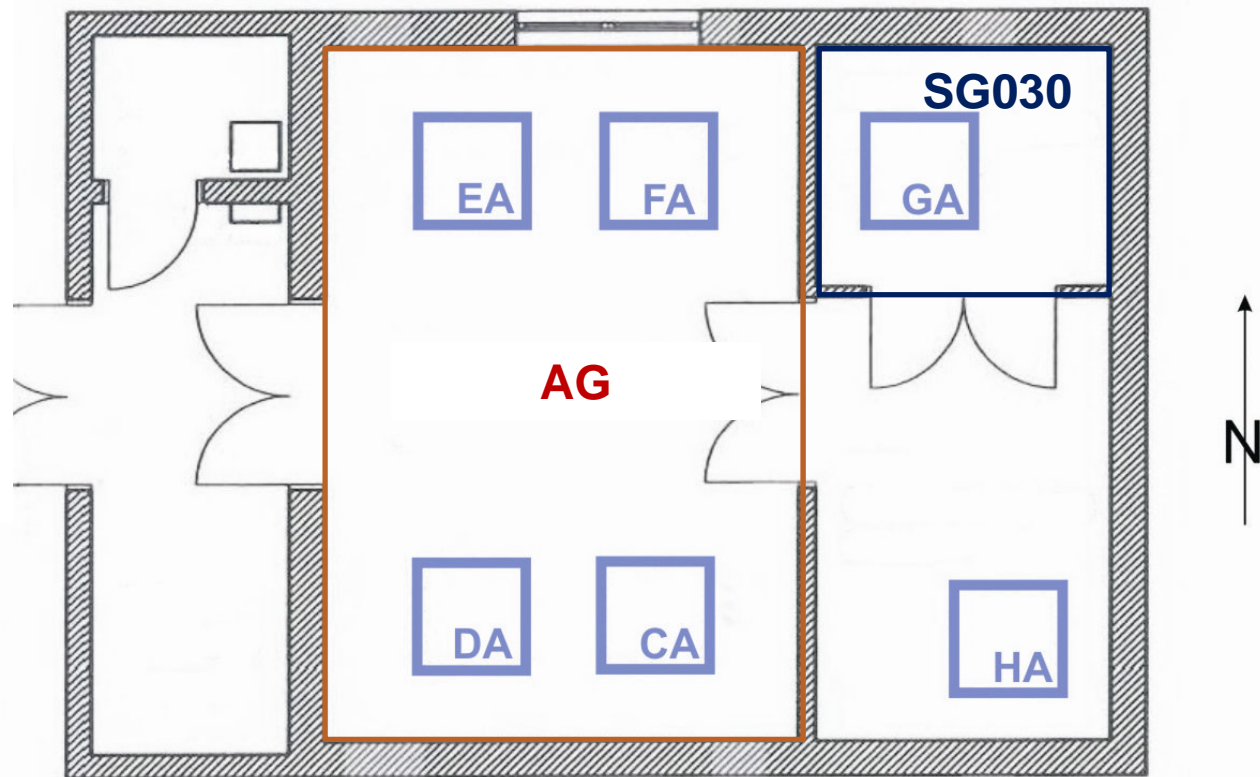
New gravity station at the Geodetic Observatory Wettzell

Offers:

- 4 pillars for AG,
- 2 pillars for SG,
- air condition system

Installation of dual
sphere
superconducting
gravimeter SG030
after upgrade.

Most suitable for regional
comparisons of AG





1st Regional International Comparison of Absolute Gravimeters in 2010 Wettzell

November 15 – 20, 2010

Participants

	Operator	institution	country
FG5-215	Vojtech Palinkas, Jakub Kostecky	Research Institute of Geodesy, Topography and Cartography (VÚGTK)	Czech Republic
FG5-233	Andreas Engfeldt	Lantmäteriet (LM)	Sweden
FG5-220	Ludger Timmen	Leibniz Universität Hannover (LUH IfE)	Germany
FG5-101 FG5-301	Andreas Reinhold, Reinhard Falk , Herbert Wilmes , Hartmut Wziontek	Federal Agency for Cartography and Geodesy (BKG)	Germany

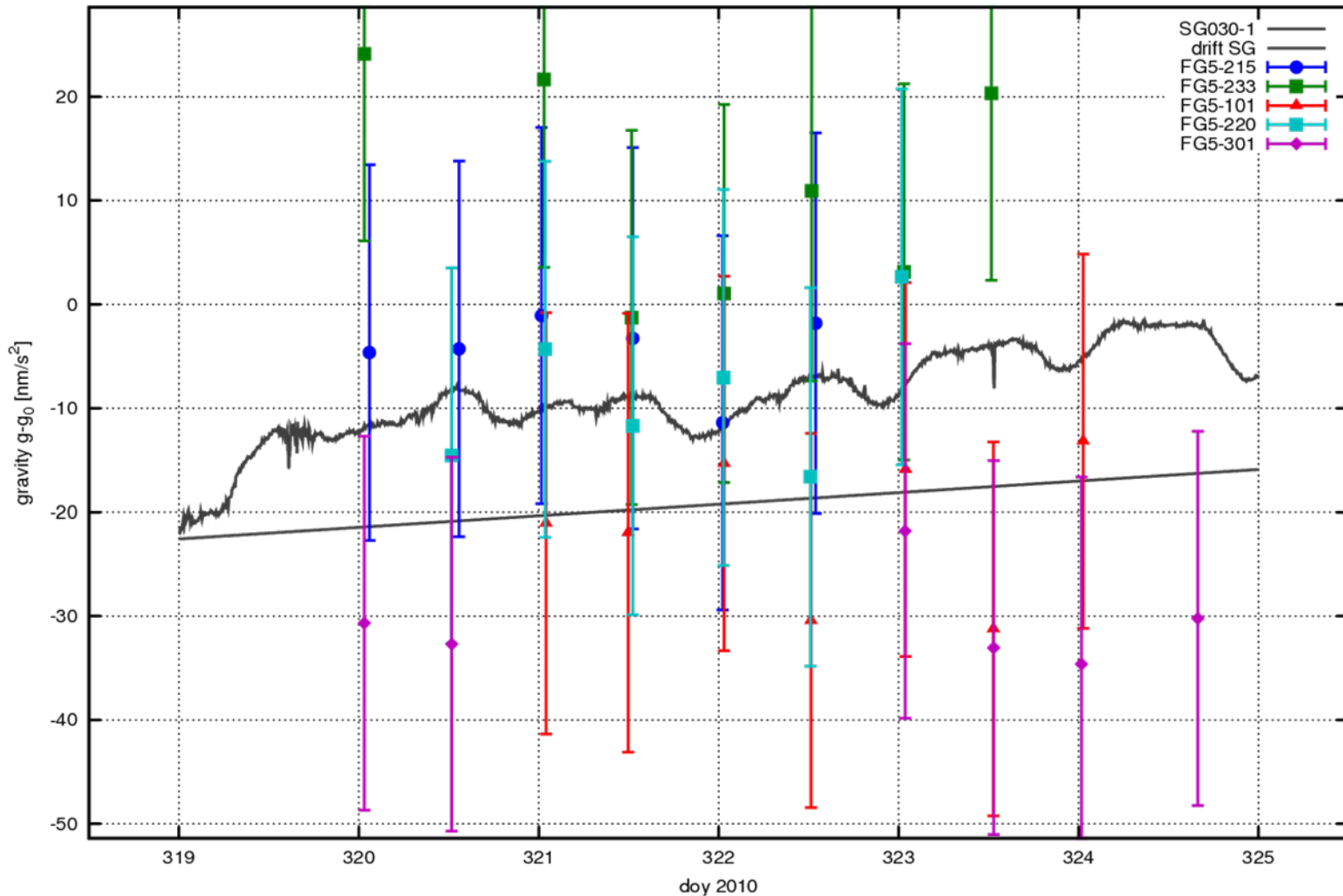
Time Schedule

date/time (UT) \ pillar	CA	DA	EA	FA
15.11.2010 18:00	FG5-301 N		FG5-215 N	FG5-233 N
16.11.2010 09:00	FG5-301 S	FG5-220 N	FG5-215 S	FG5-233 S
16.11.2010 18:00	FG5-220 N	FG5-101a N	FG5-233 N	FG5-215 N
17.11.2010 09:00	FG5-220 S	FG5-101 a/b S	FG5-233 S	FG5-215 S
17.11.2010 18:00	FG5-215 N	FG5-233 N	FG5-101b N	FG5-220 N
18.11.2010 09:00	FG5-215 S	FG5-233 S	FG5-101b S	FG5-220 S
18.11.2010 18:00	FG5-233 N	FG5-301 N	FG5-220 N	FG5-101b N
19.11.2010 09:00	FG5-233 S	FG5-301 S		FG5-101b S
19.11.2010 18:00	FG5-101b N			FG5-301 S
20.11.2010 09:00				FG5-301 N



RICAG 2010 Wettzell Combination AG-SG

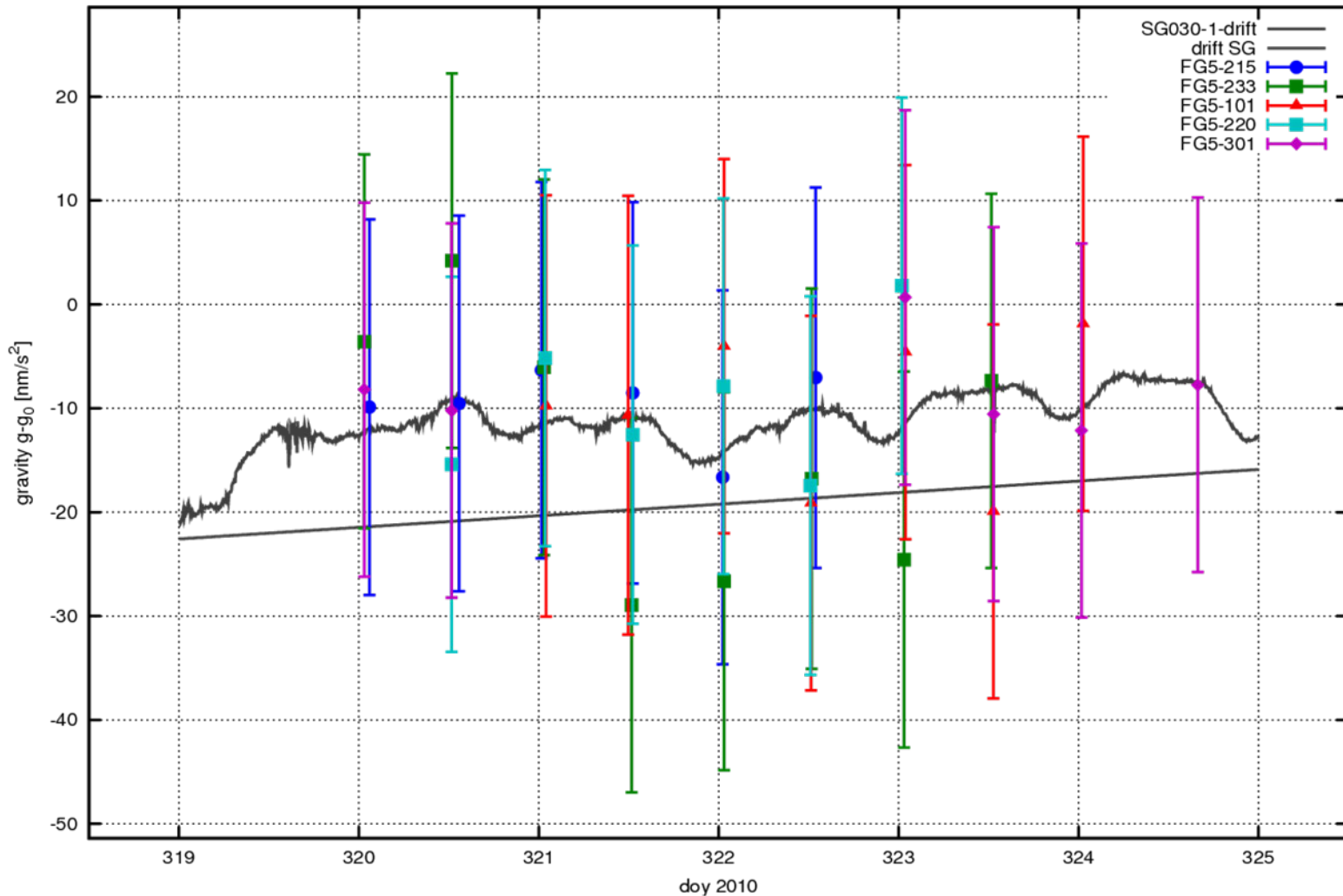
Wettzell AG-Comparison 2010/11/15-21 SG030-1 (15-Nov-2010 17:07:19 - 20-Nov-2010 22:49:58): mean observations
 $g_0 = 9808369539.7 \text{ nm/s}^2$, referred to EA (single drops, offsets, weights)





RICAG 2010 Wettzell Combination AG-SG

Wettzell AG-Comparison 2010/11/15-21 SG030-1 (15-Nov-2010 17:07:19 - 20-Nov-2010 22:49:58): adjusted observations
 $g_0 = 9808369539.7 \text{ nm/s}^2$, referred to EA (single drops, offsets, weights)





1st Regional International Comparison of Absolute Gravimeters in 2010 Wettzell

Preliminary results [nm/s²]

FG5-215 5.2 ± 0.6

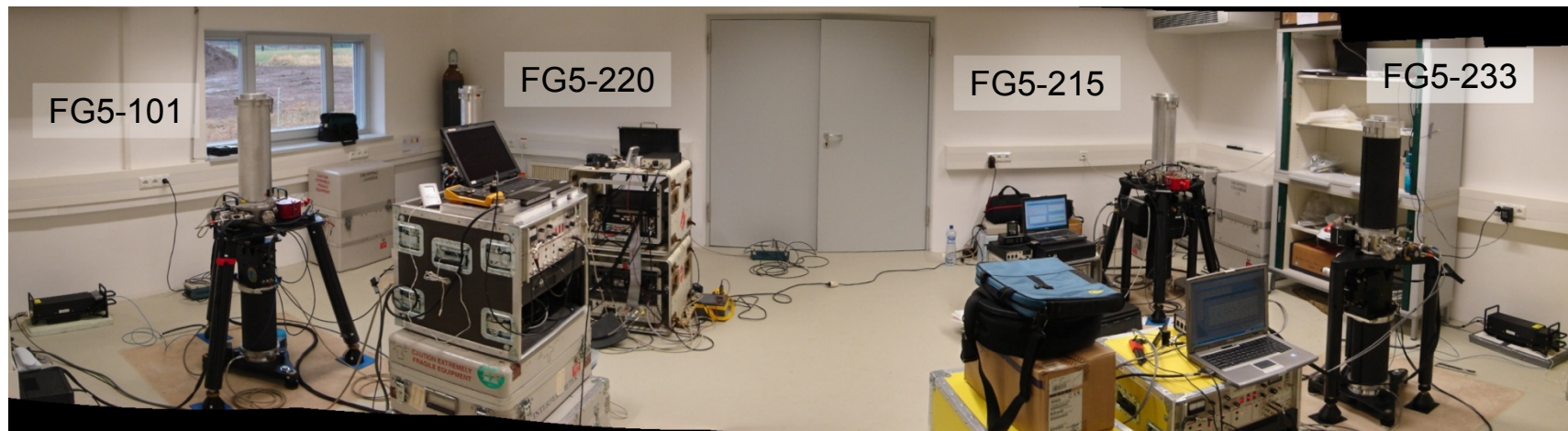
FG5-233 27.7 ± 0.5

FG5-101 -11.3 ± 0.5

FG5-220 0.8 ± 0.9

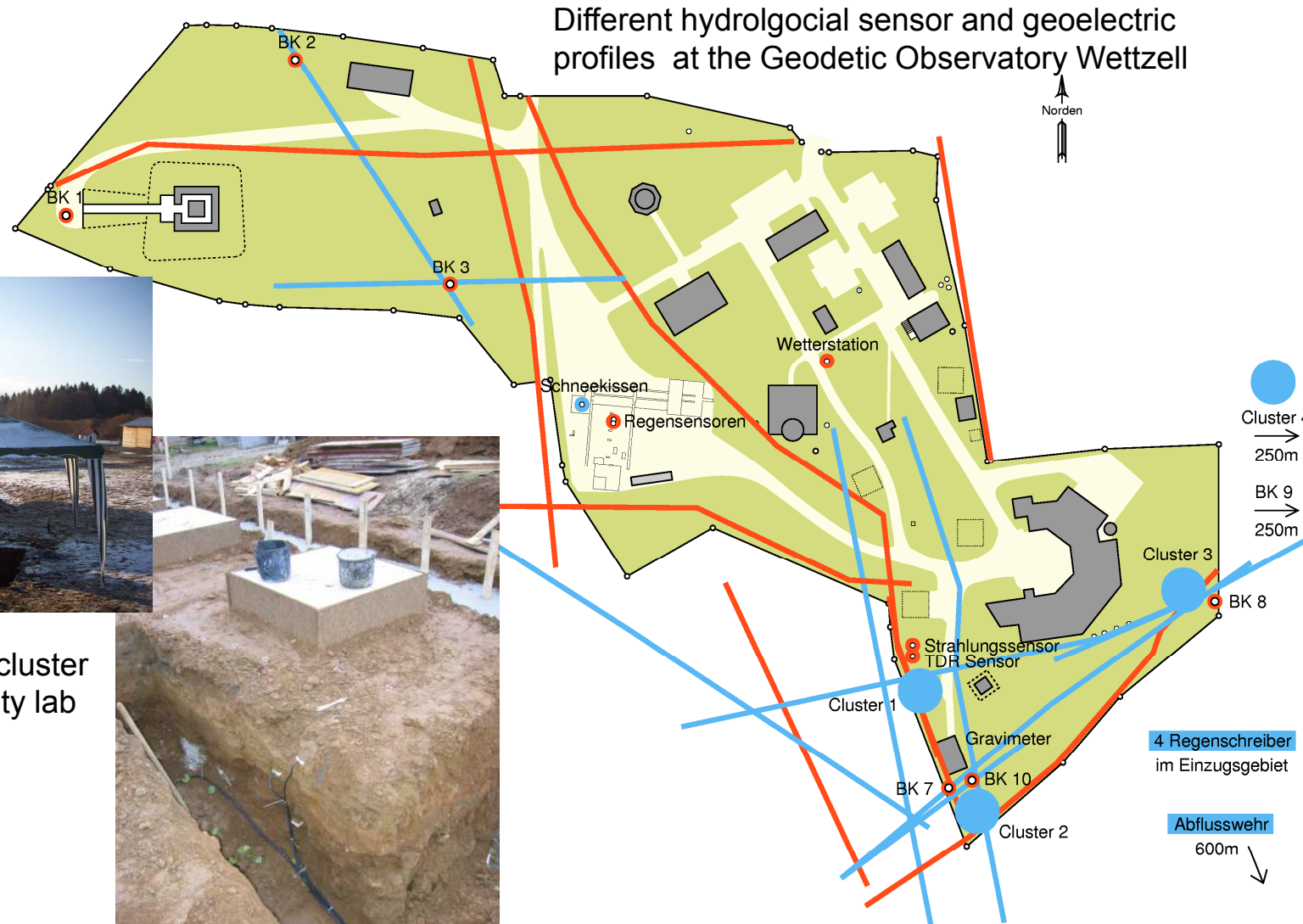
FG5-301 -22.5 ± 0.4

(status 12/2010)



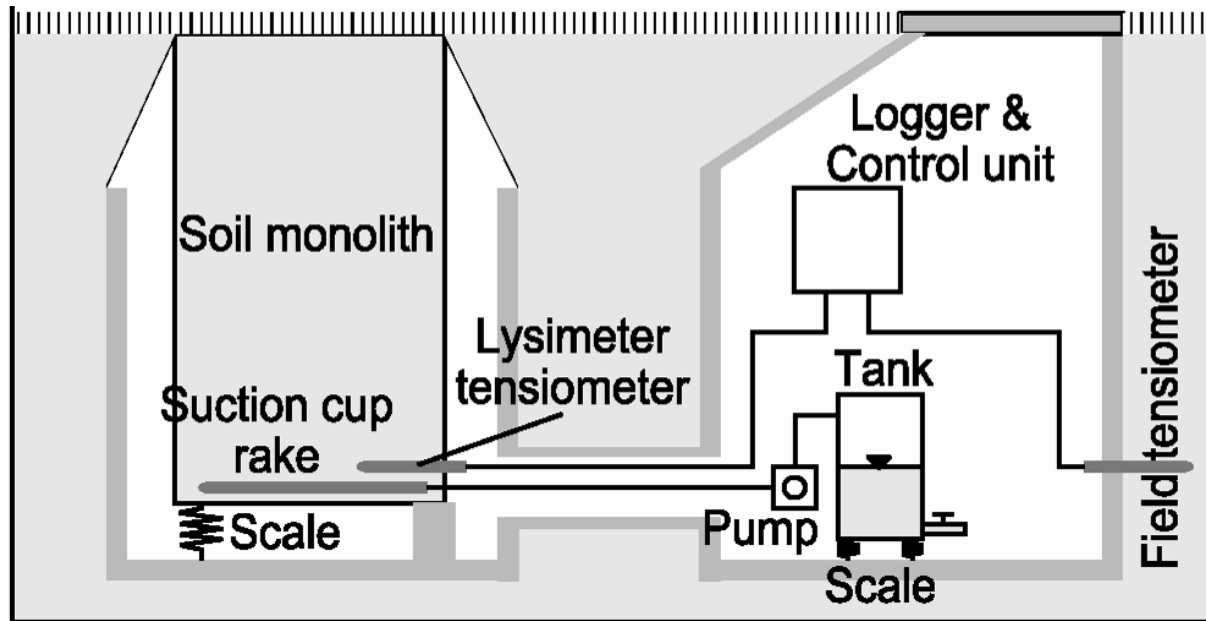


Cooperation with GFZ Potsdam: Assessment and Modeling of local waterstorage changes

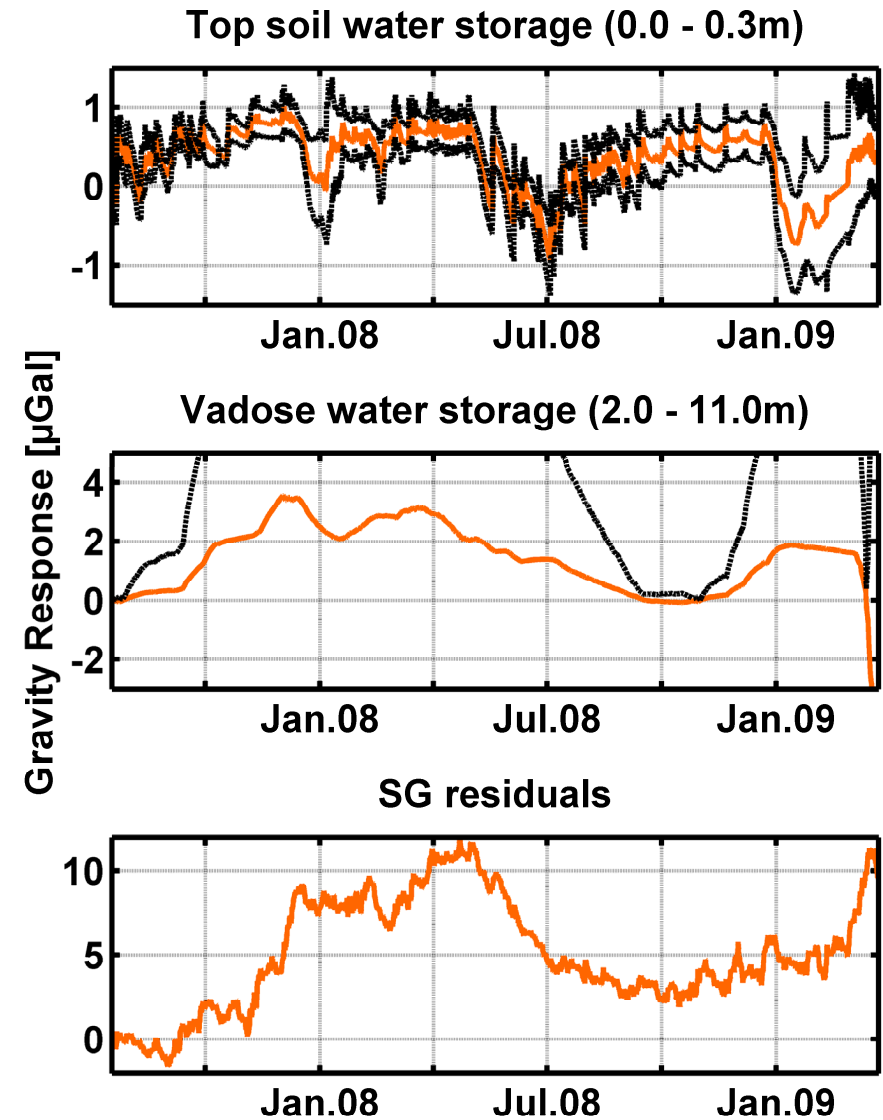
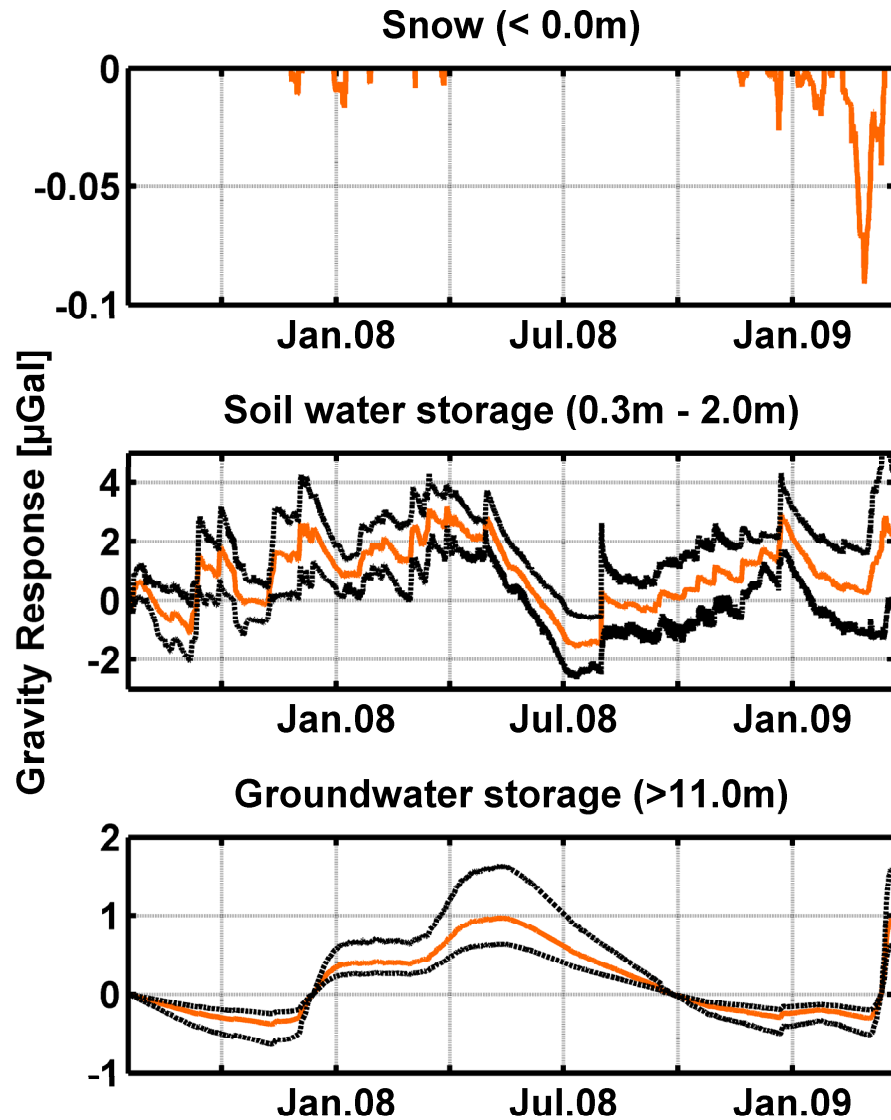


Soilmoisture cluster
at new gravity lab



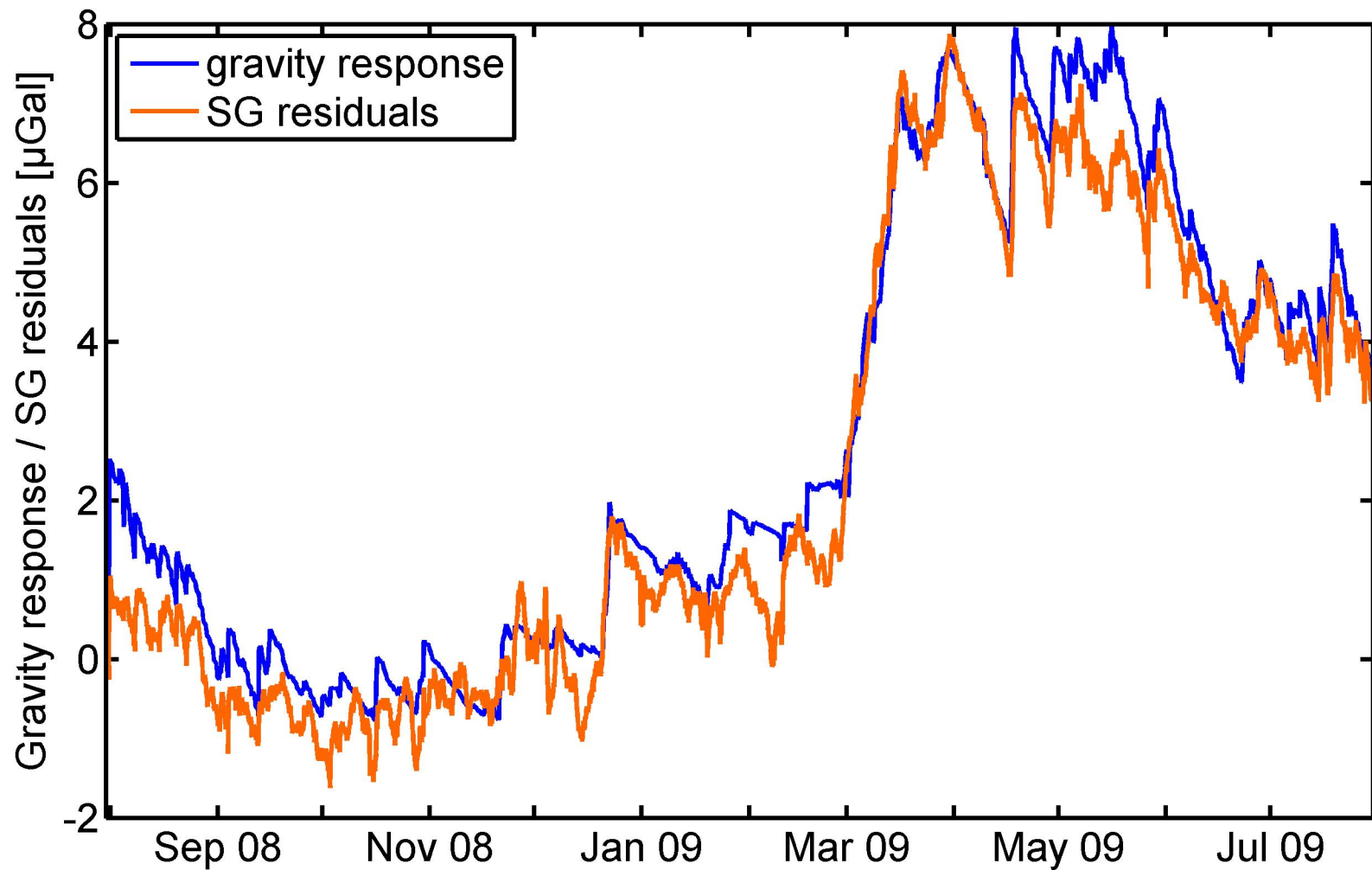


Gravity response of water storages



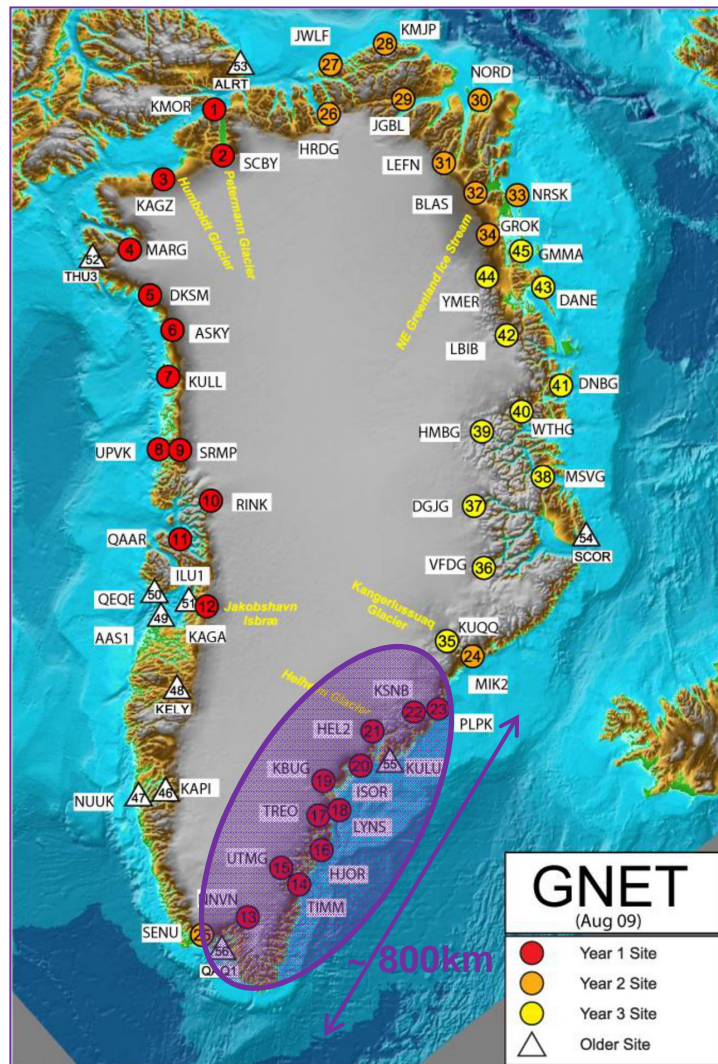
1Gal = 1 cm/s²

SG residuals / hydrolog. gravity response



Creutzfeldt et al., 2010 (GJI)

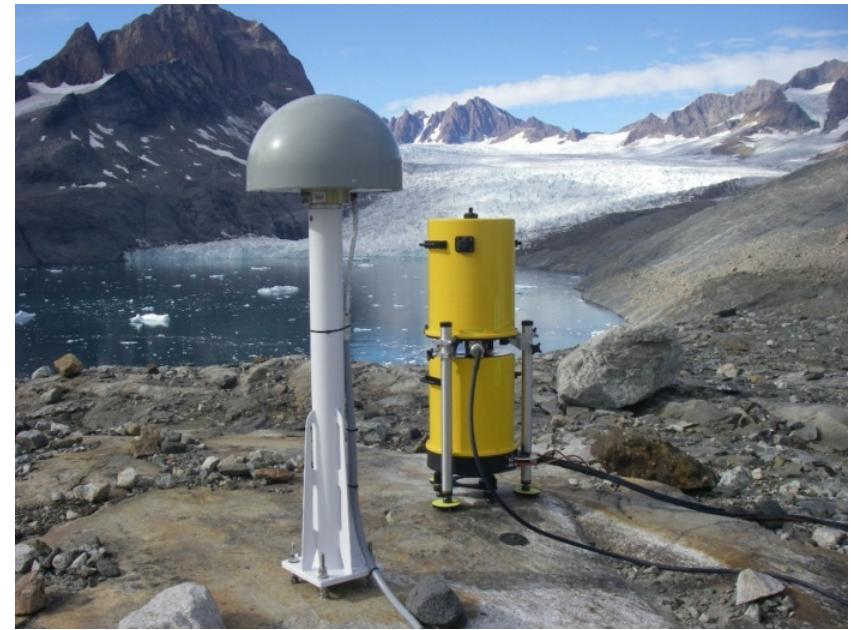
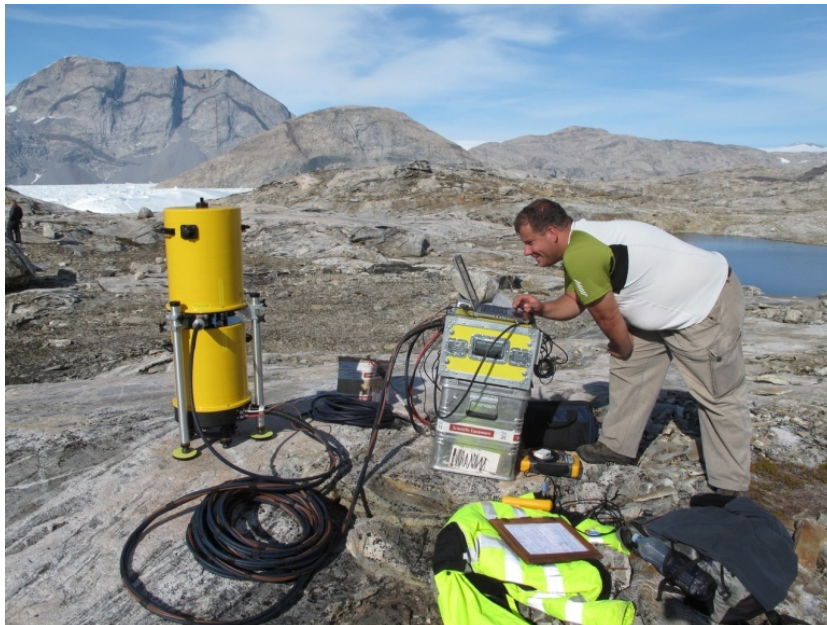
A10 field campaign in Greenland



- Field campaign with A10-002 from 18. - 28. August 2010
 - Ad-hoc cooperation between DTU Space and BKG due to instrumental problems with A10-019
- Absolute gravity measurements at
- 10 G-Net field stations in southeast Greenland;
 - 2 extra points at airports Narsarsuaq and Kulusuk
 - Initial measurements at 7 stations
 - Re-observations at 5 G-Net stations (first measurements: 2009 by DTU Space)
 - Reference measurements before the campaign in Frankfurt and Copenhagen
 - Reference measurement after the campaign in Bad Homburg
 - Comparisons between 2009 (DTU Space) and 2010 (BKG) result still pending

A10 field campaign in Greenland

A10-002 and operator Jan Müller at field point
Trefoldigheden Ø (TREO)



A10-002 and GPS antenna at field point Pilappik (PLPK)



Absolute Gravity Database AGrav

<http://agrav.bkg.bund.de>

<http://bgi.dtp.obs-mip.fr>

- Mirrored servers at BKG (Germany) and BGI (France)
- Map based web-interface to access meta-data and/or processing results
- At present
 - 26 instruments
 - 419 AG stations
 - 1352 AG observations
 - 32 registered users



- Support the realisation of a future global absolute gravity reference network at a “few μGal -level”
- Different data-policy is understood, esp. the importance of long-term gravity time series in studies of PGR.
- It is proposed to submit the station locations and at least one observation result for each site!

