Gravity Reference Stations Maintained by BKG

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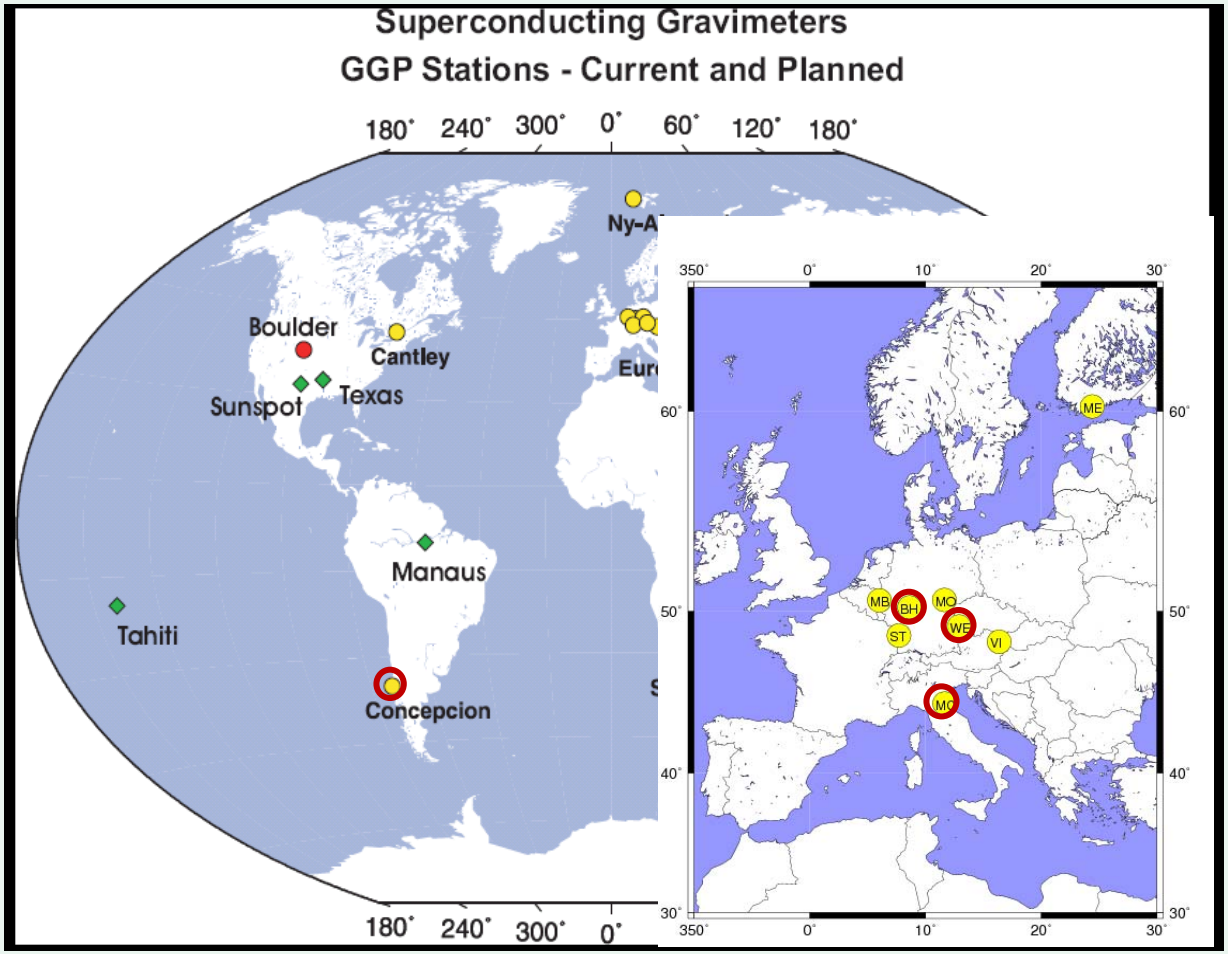
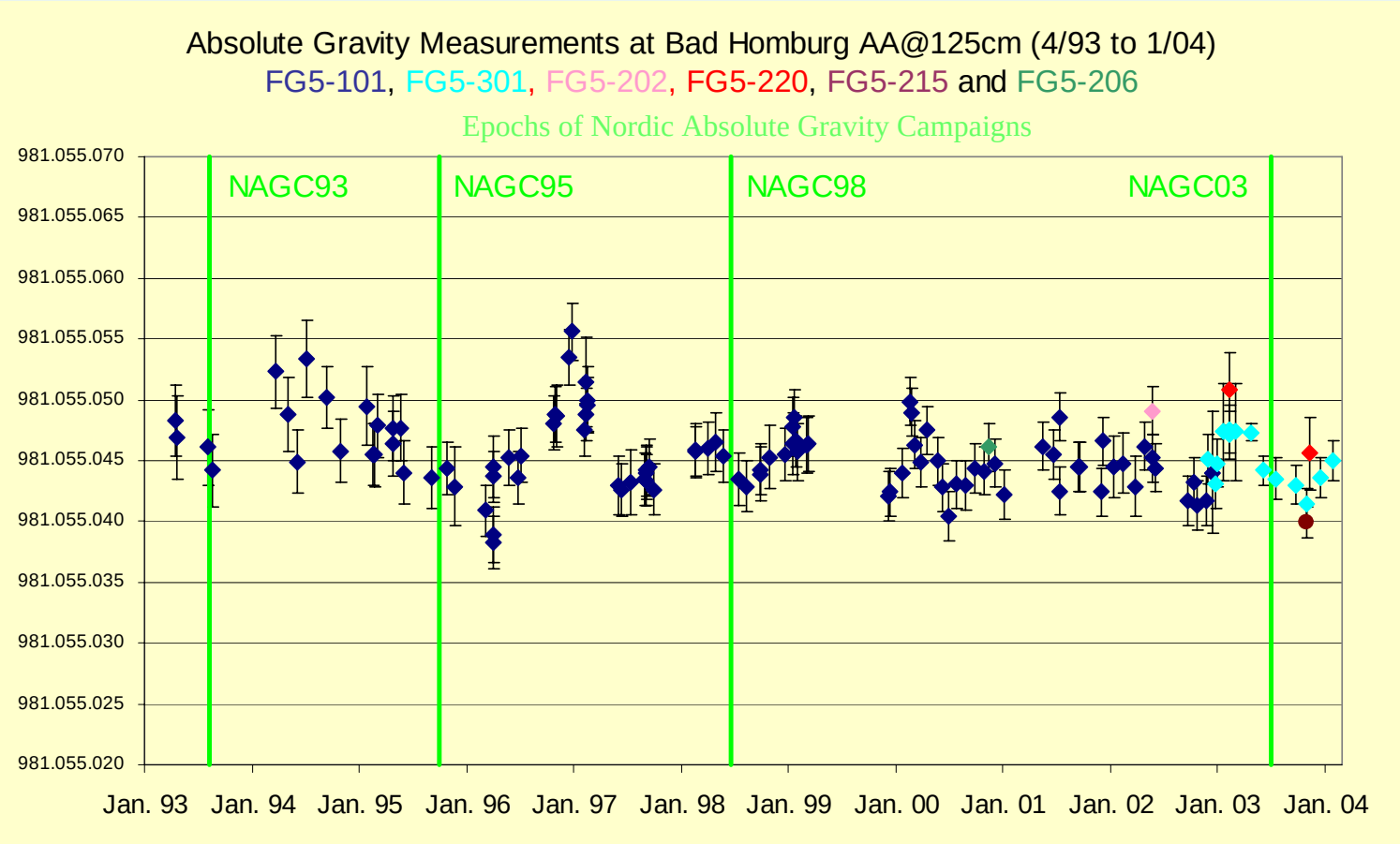
GGP Network

- BKG gravity stations with SG and AG observations



- Bad Homburg:
  - SG30, dual sphere
  - SG44 since Feb 2007
- Wettzell :
  - SG29, dual sphere
  - Hydrological investigations
  - VLBI Twin Telescope in preparation
  - new gravimeter house under construction
  - Plans to move SG44 to Wettzell
- Medicina (Italy):
  - SG23 since 1996
- Concepcion (Chile)
  - SG38 Dec 2002 – June 2008, for upgrade at GWR

Repeated AG Measurements at Bad Homburg



Time series of absolute gravimeter measurements at the station Bad Homburg (1993 – 2003)

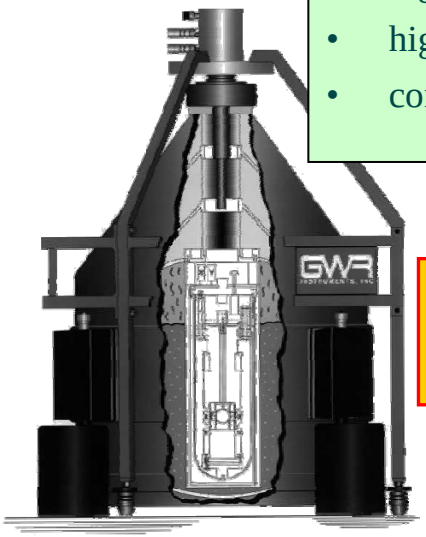
Status 2004 !

Combination of SG and AG time series

Complementary instrumental characteristics

Superconducting Gravimeter (SG)

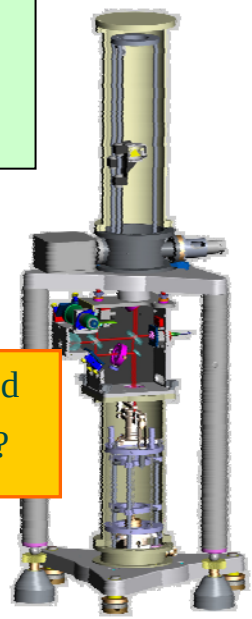
- relative values
- highest accuracy
- high temporal resolution
- continuous registration



- low drift
- calibration needed

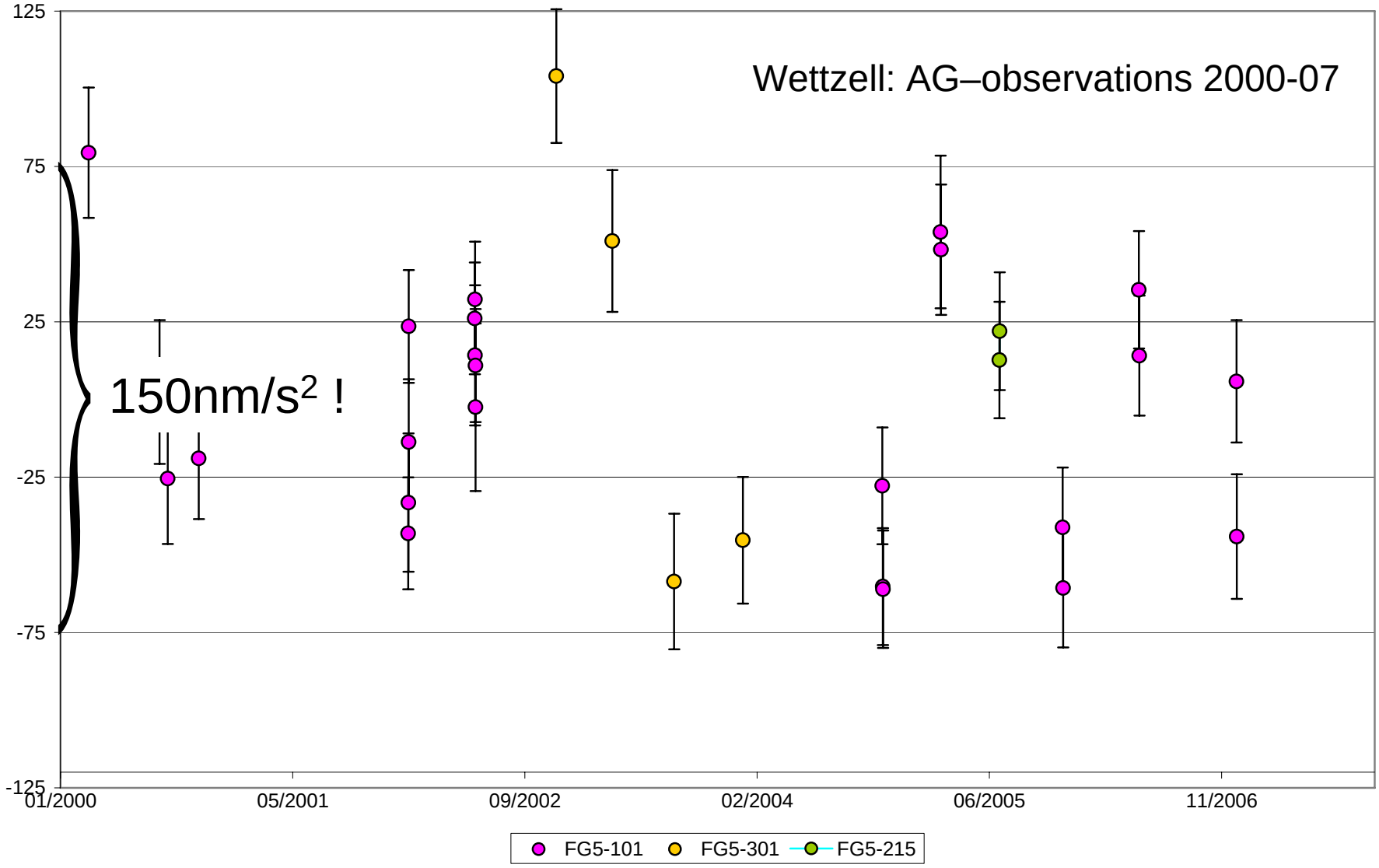
Absolute Gravimeter (AG)

- absolute values based upon physical standards
- no drift

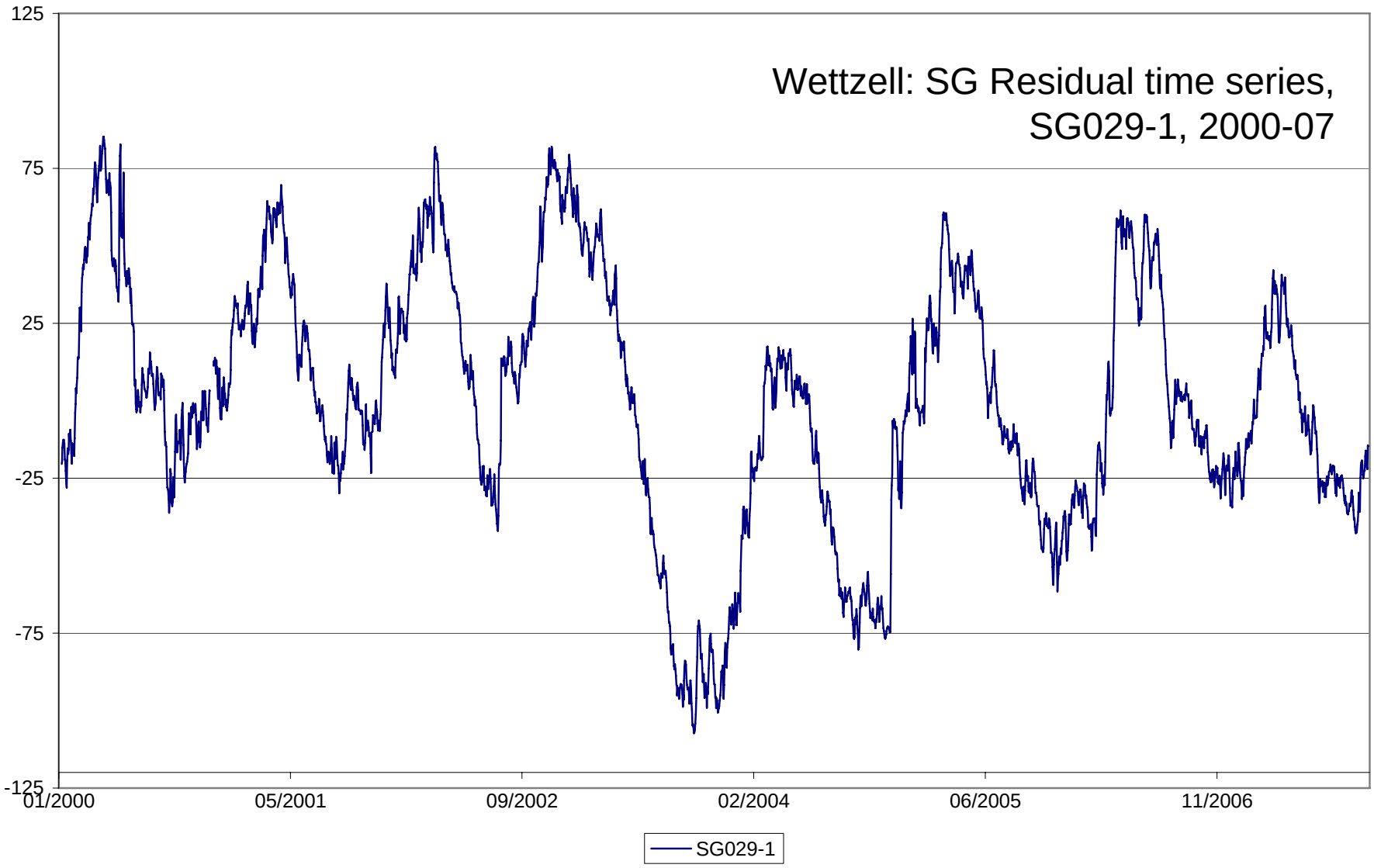


- regular supervision needed
- offsets after maintenance?

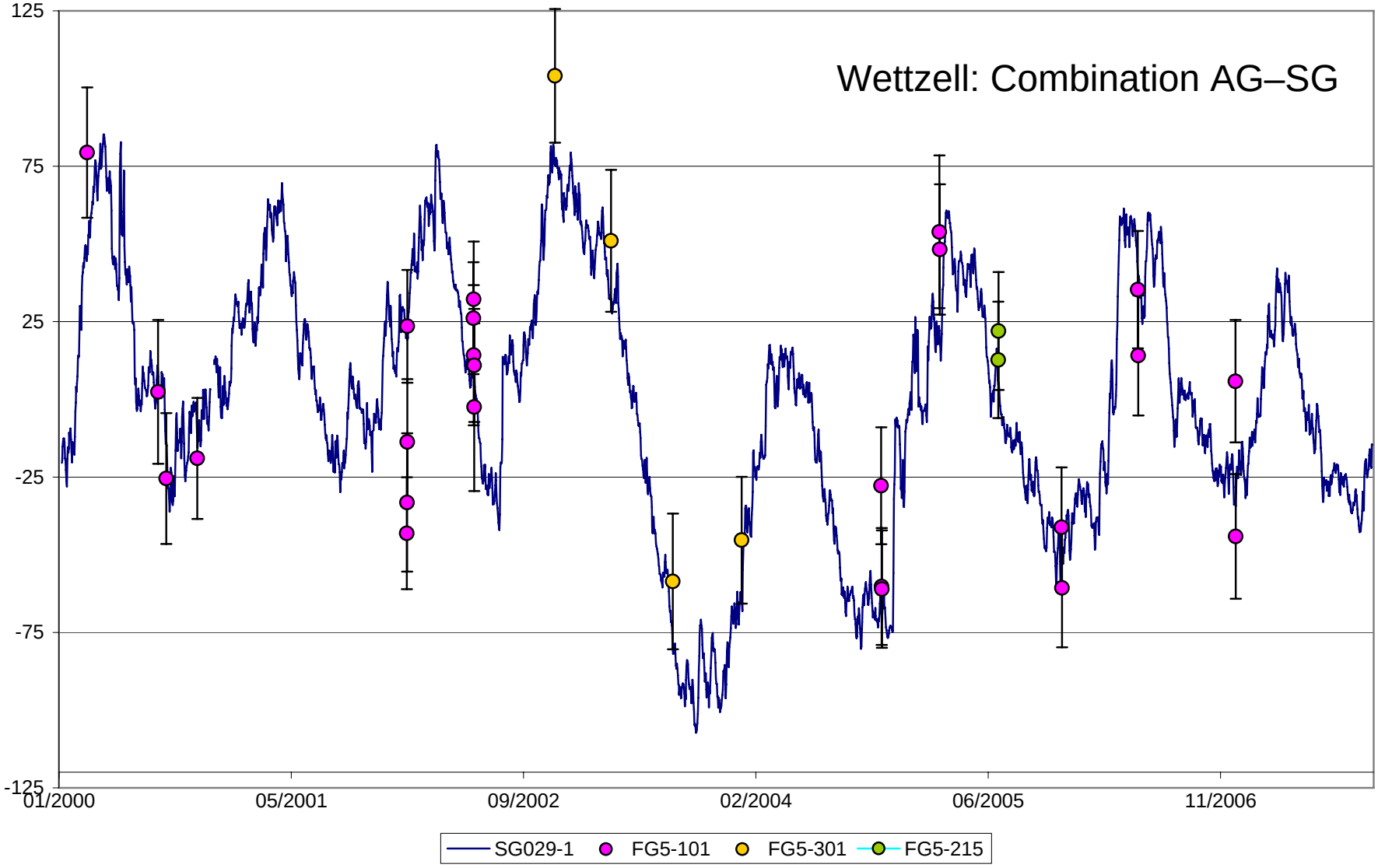
Absolute gravity



Superconducting gravity



Combination of SG and AG



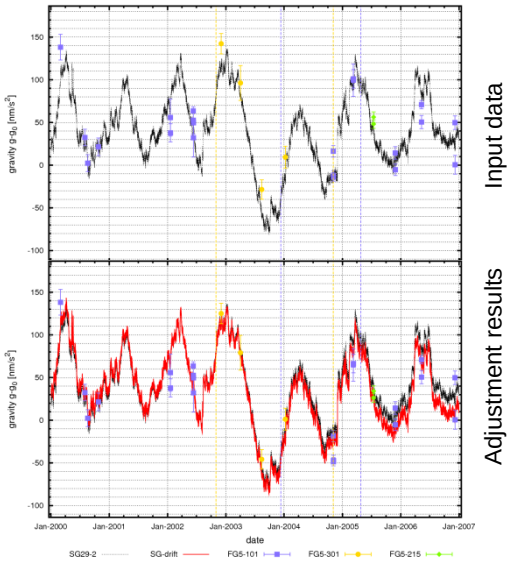
SG and AG observations at selected sites

Combined time series from adjustment of SG and AG observations at three European gravity stations

Fundamental station Wettzell (Germany)

- Wettzell: AG twice yearly since 1994

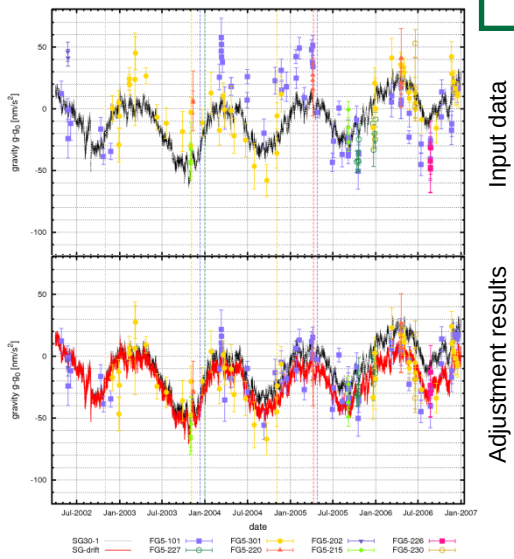
Dataset for period Feb 2000 – Dec 2006



Regional comparison site Bad Homburg (Germany)

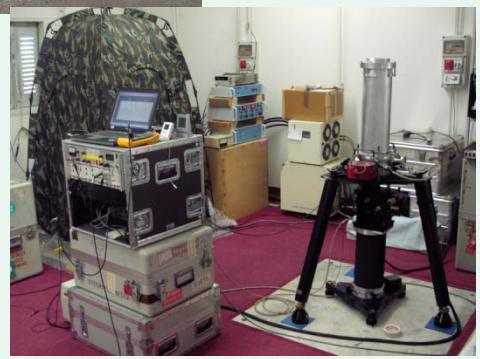
- Bad Homburg: monthly AG measurements (on average) since1993

Dataset for period Apr 2002 – Dec 2006



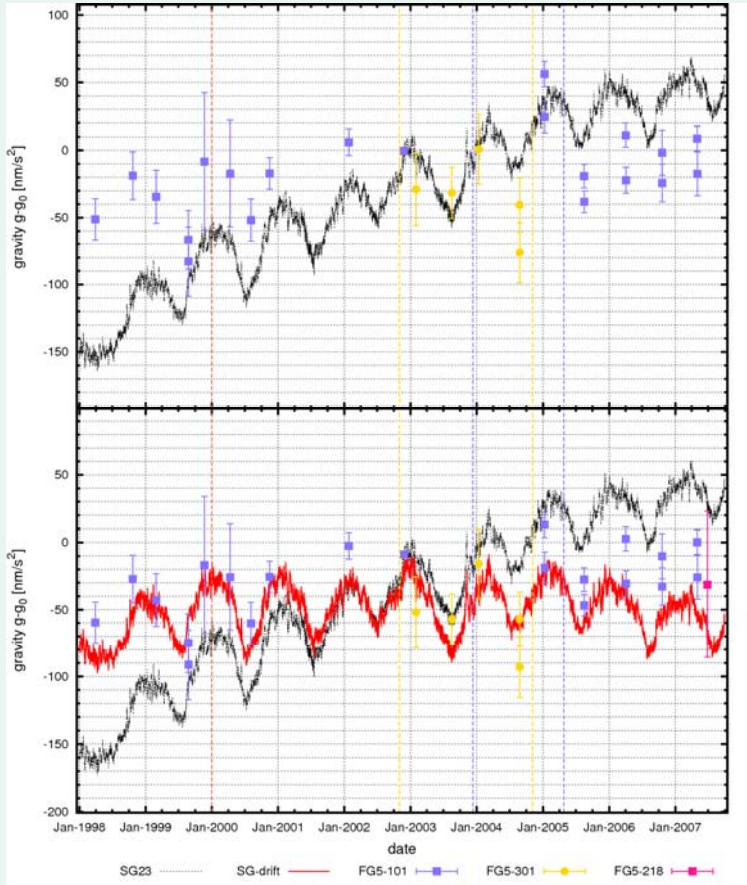
Combination of SG and AG time series

Station Medician (Italy)



- Medicina (Italy): semiannual AG since 1998

Dataset for period Mar 1998 – May 2007

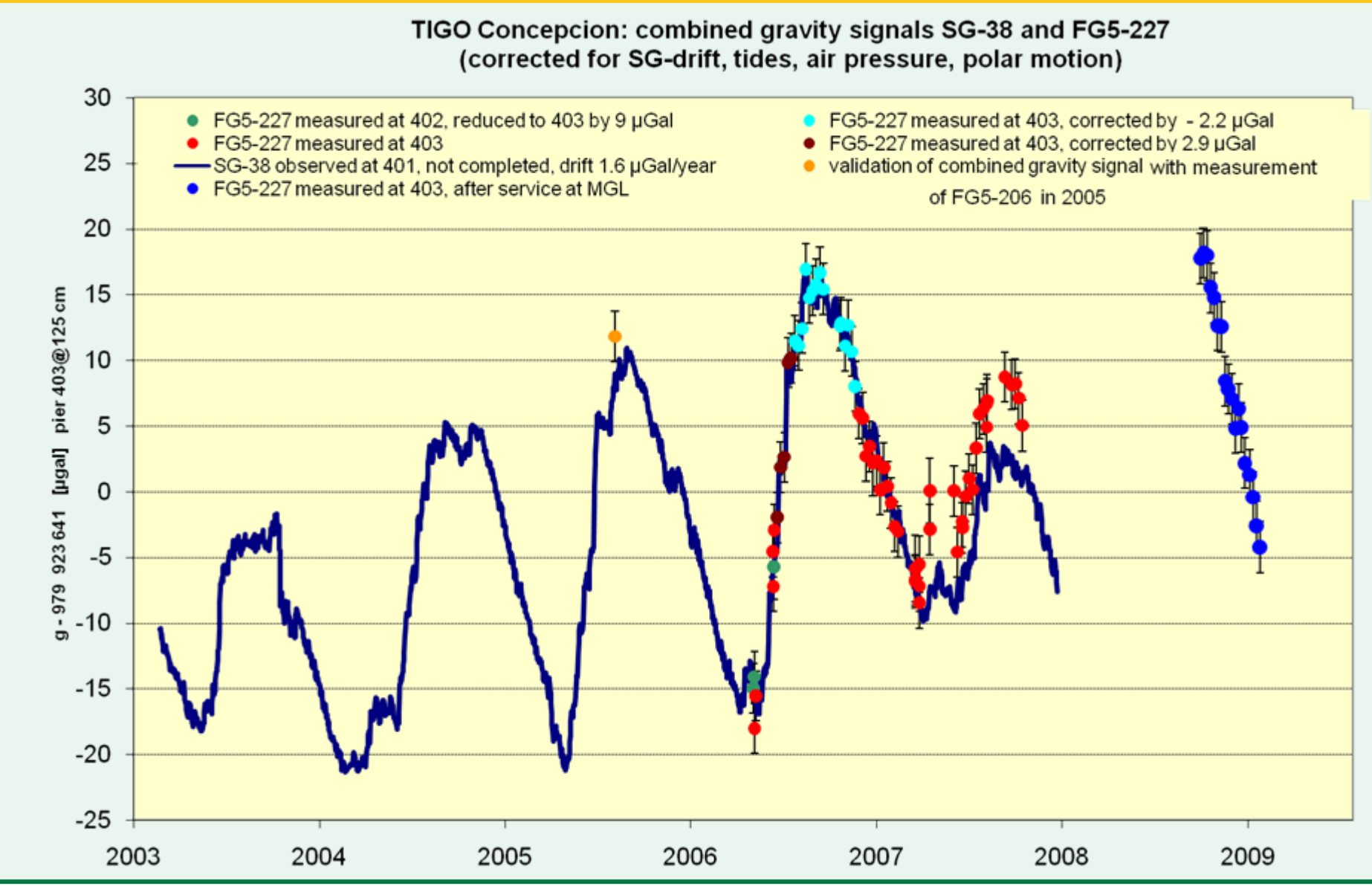


Input data

Adjustment results

Bundesamt für Kartographie und Geodäsie

Combined gravity signal TIGO Concepcion



Geometric Observations

Position information

- GPS permanent: Wettzell, Bad Homburg, Medicina (Italy), Concepcion (Chile)
- VLBI: Wettzell, Medicina (Italy), Concepcion (Chile)
- SLR: Wettzell, Concepcion (Chile)
- SAR: Medicina (Italy)
- Station control network: Wettzell, Concepcion (Chile)
- Precise levelling to reference markers: Bad Homburg, Medicina
- Wettzell, Bad Homburg and Medicina (Italy) are part of “ECGN” integrated geodetic network

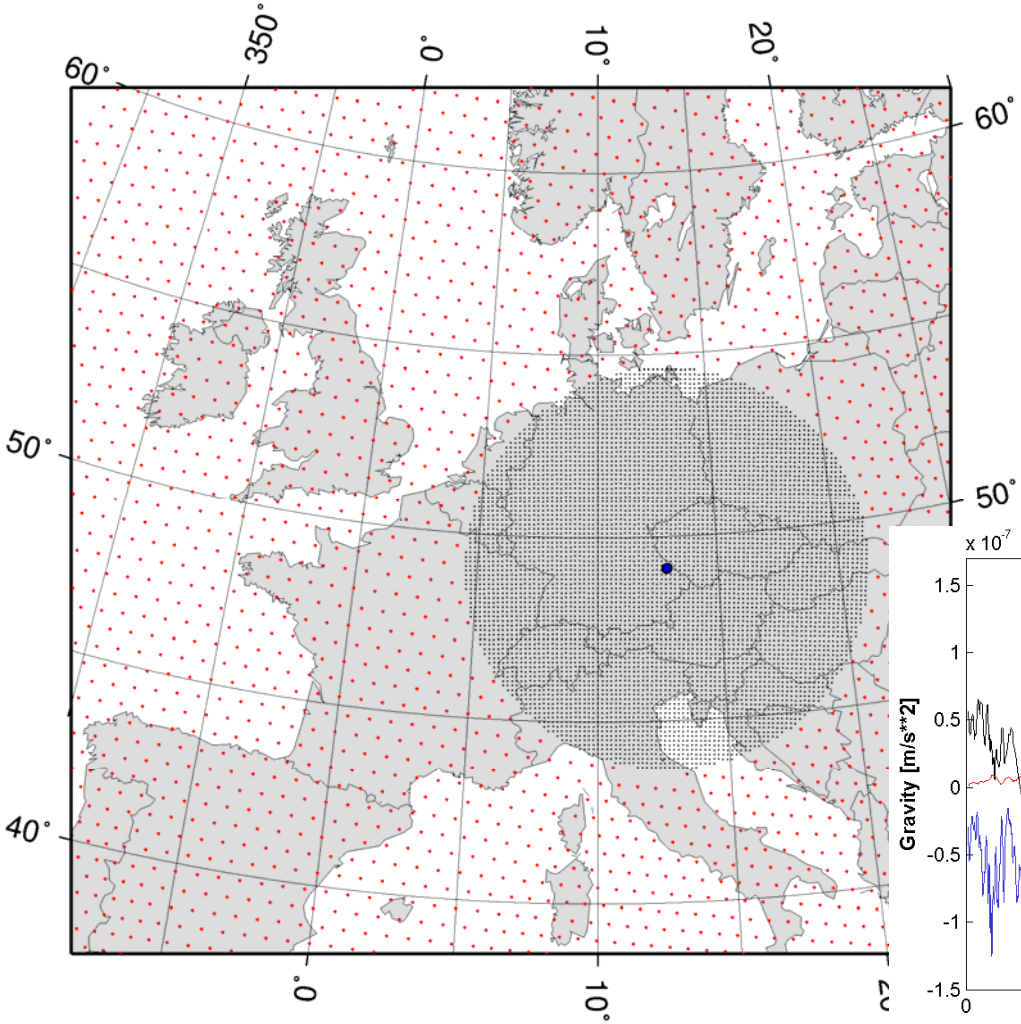
Environmental parameters

Atmosphere

- All BKG stations supplied with “Paroscientific” barometers to ensure stable long-term reference
- Improved 3D atmospheric correction for European stations based upon operational weather models of DWD (German Weather Service) in combination with local air pressure records (Klügel and Wziontek, submitted to J. Geodynamics)

3-D weather model by Klügel and Wziontek

Combination of partial models:



Local model:

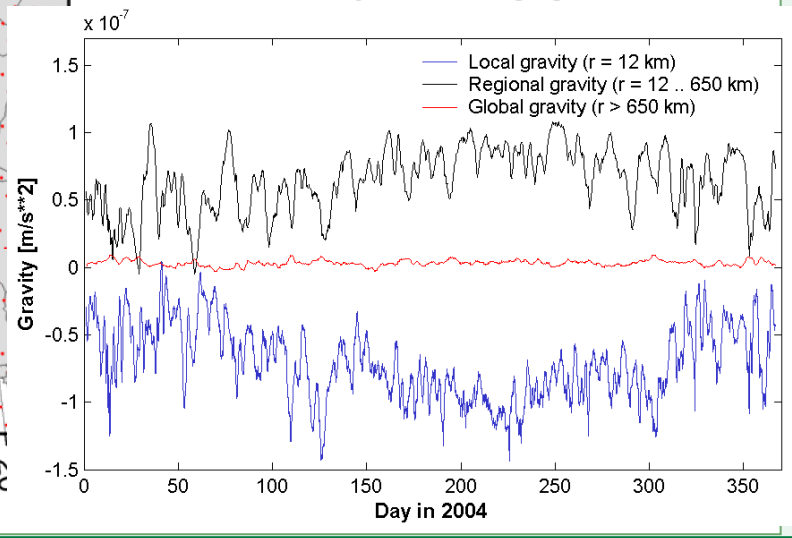
- r = 11.7 km

Regional model:

- Omission of 9 cells near observation point
- max. radius: 5.8° (Wettzell)

Global model:

- Omission of all cells within r = 5.8°



Environmental parameters

Hydrology

- Bad Homburg: 2 groundwater wells, automatic registration
- Wettzell: meteorological station (temperature, air pressure, air humidity, wind speed and direction, precipitation)
  8 groundwater wells in station area, detailed hydrological investigations in cooperation with GFZ Potsdam
- Medicina (Italy): groundwater registration, precipitation
- Concepcion, Chile (TIGO): precipitation record, soil moisture

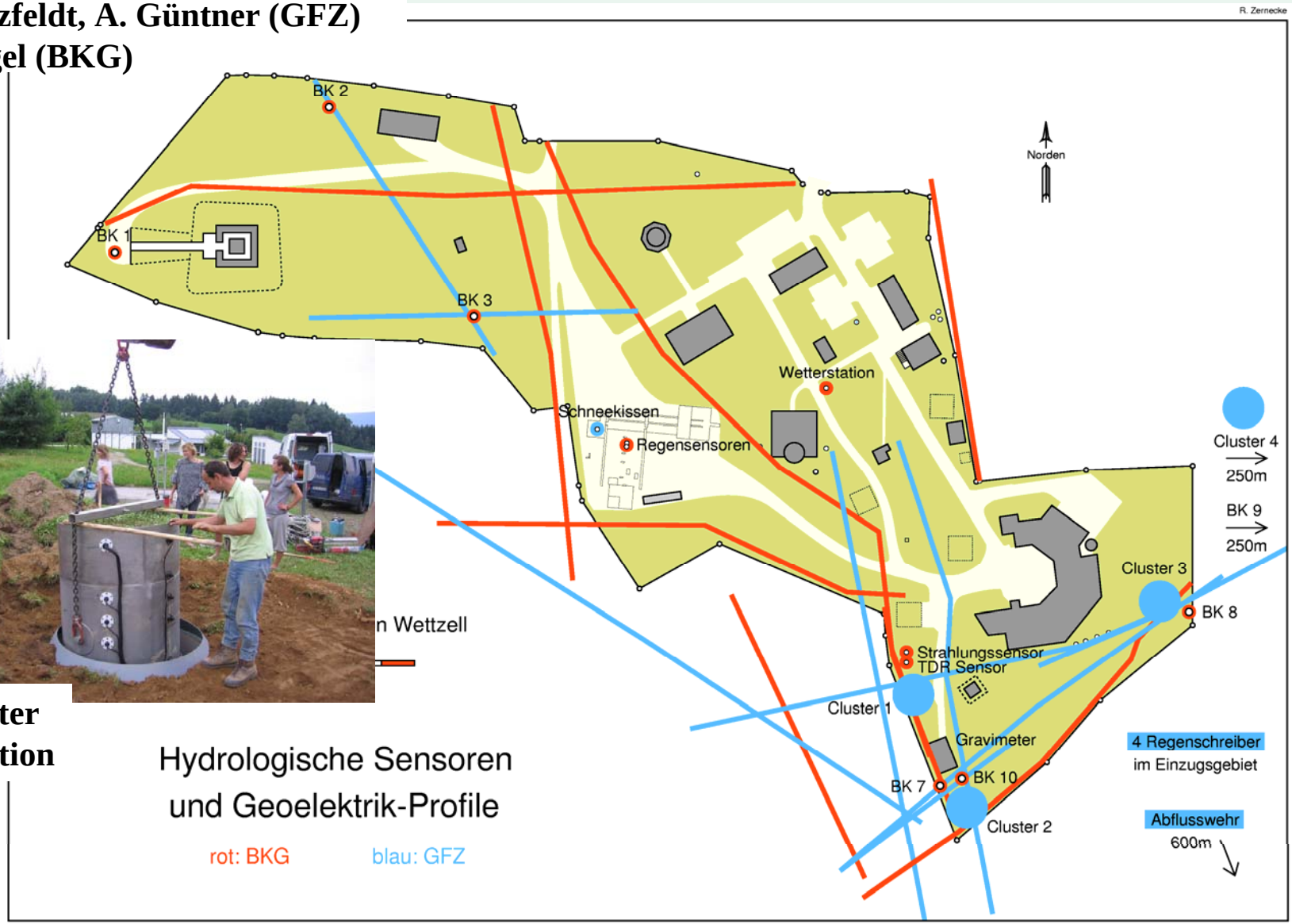
Gravity building at station Wettzell

Wettzell Hydrology Project

Cooperation between GFZ Potsdam and BKG:

B. Creutzfeldt, A. Güntner (GFZ)
Th. Klügel (BKG)

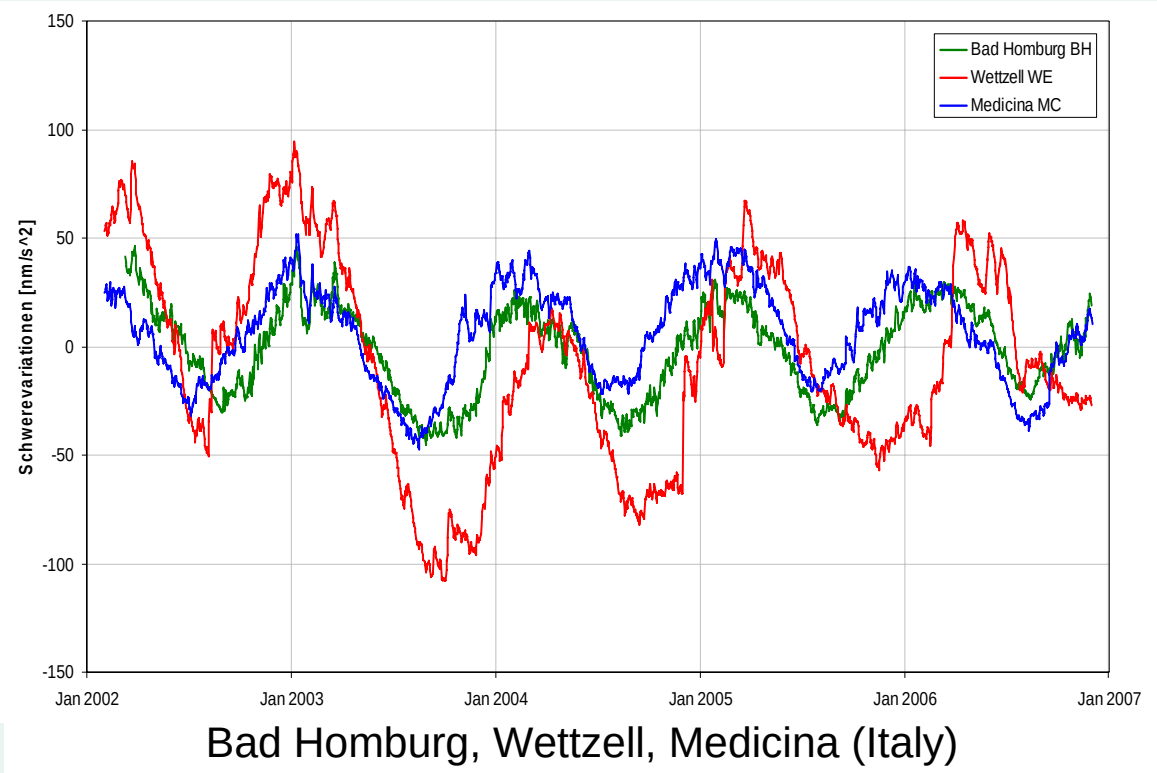
Lysimeter installation



Gravimetric residual functions

After AG and SG combination we get a drift-free residual gravity time series.

➔for further investigation or comparison

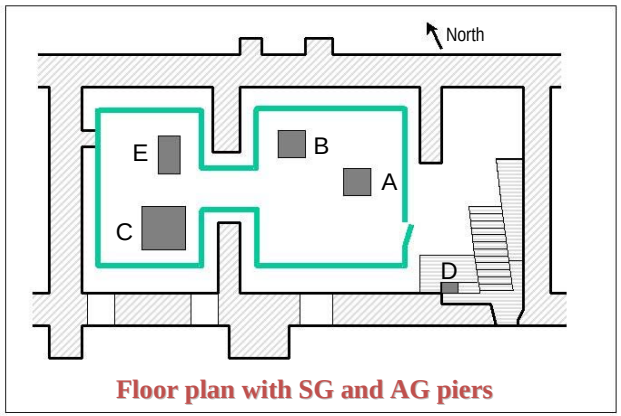


Bad Homburg, Wettzell, Medicina (Italy)

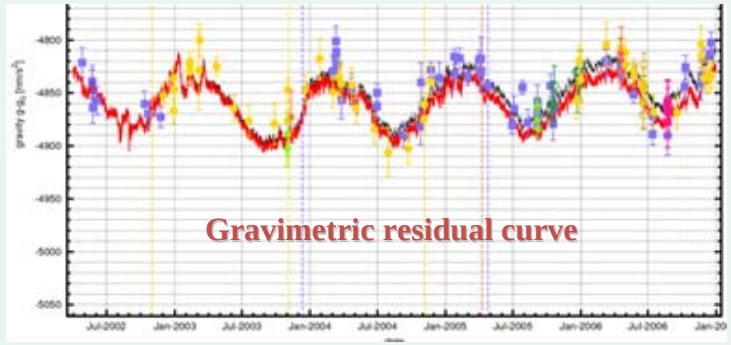
- Comparison with visiting AG
- Stabilisation of A10 mobile AG
- Investigation of environmental influences
- etc.

Gravimetric Reference Station Bad Homburg

A10 and FG5 absolute gravimeters



Floor plan with SG and AG piers



Components for additional checks

- Measurement checks before and after each field campaign at Bad Homburg reference station

- Repeated checks of instrumental standards (Laser- and rubidium-frequencies)

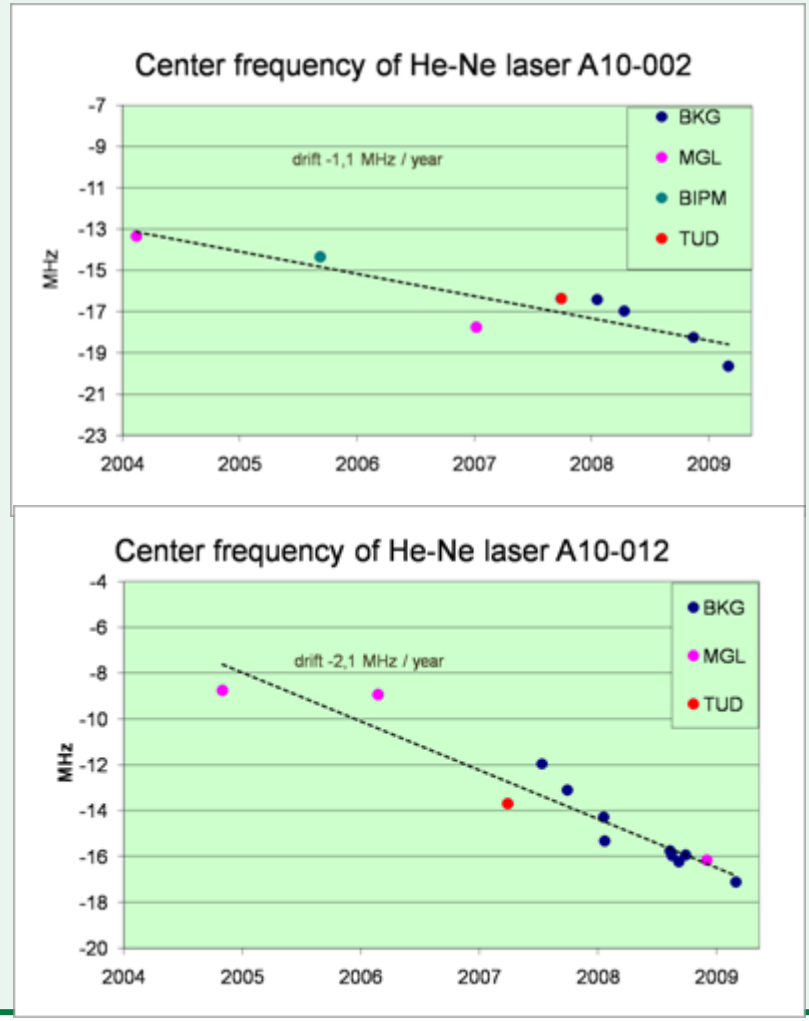
A10 reference measurement at Bad Homburg station

A10 check with laser heterodyne and cesium standard

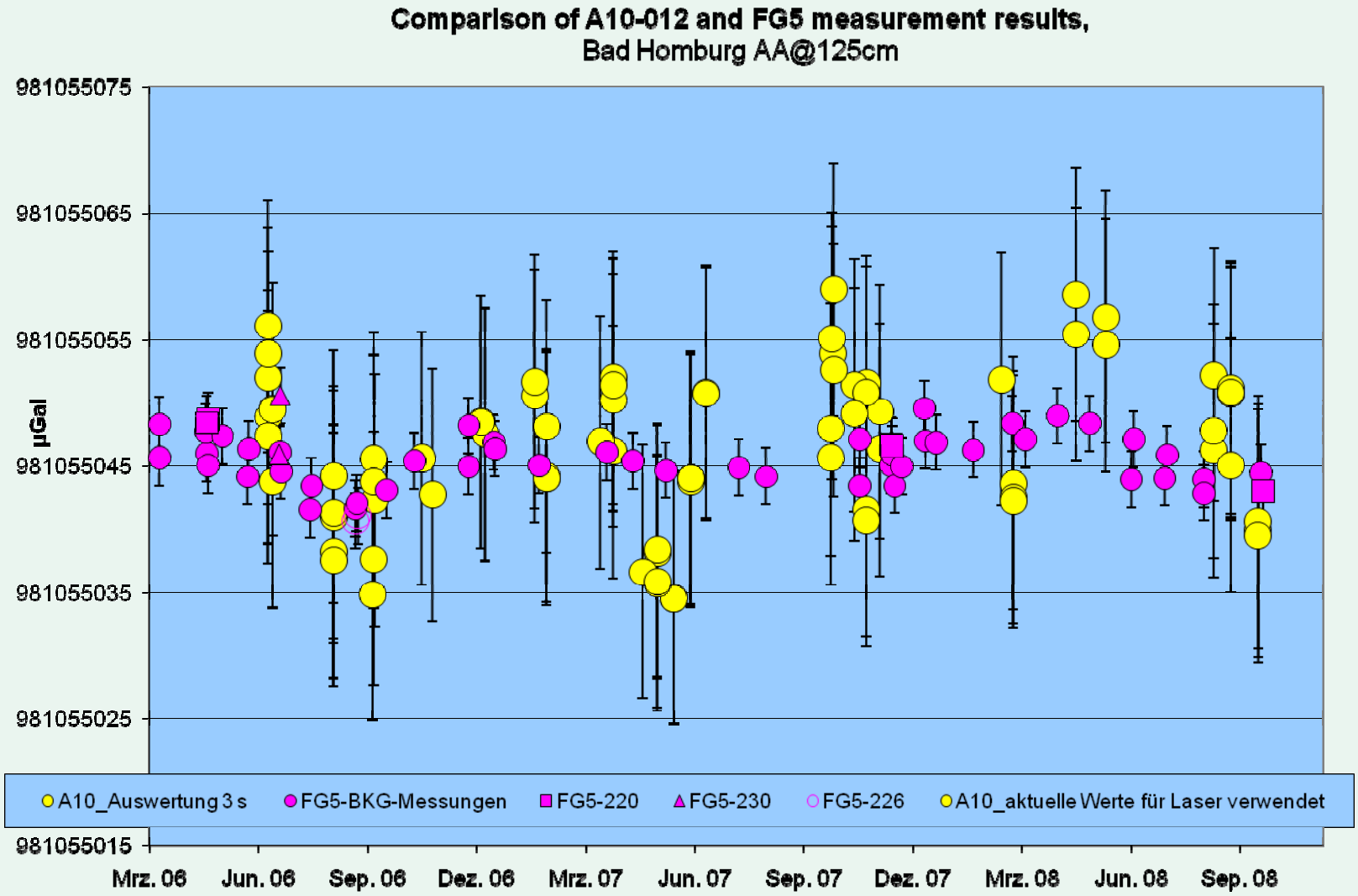
A10 laser calibration with WEO100

1 MHz change of center frequency

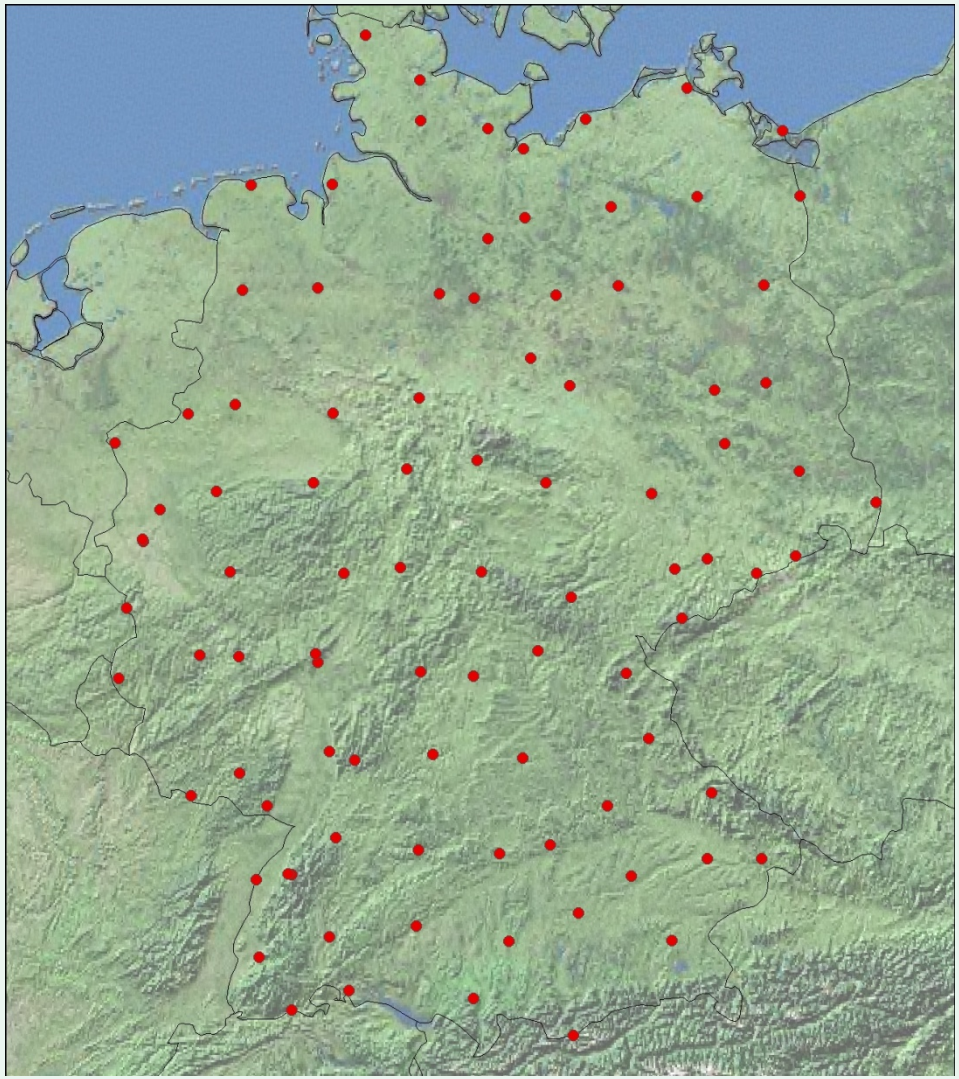
will change the gravity result by 2 µGal



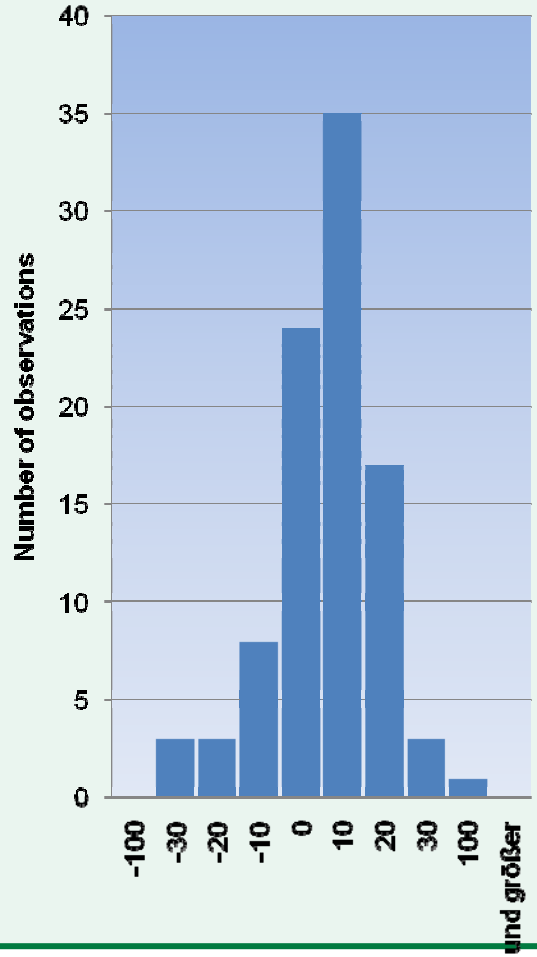
A10 observations in Bad Homburg during GOCE-GRAND II-Project



A10 observations on DHSN96 sites in the framework of GOCE GRAND II



Distribution of offsets:
(A10 minus DHSN96)



Supported by BMBFresearch grant No.03F0422A

Impressions from the A10 observations

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Thank you for your attention!