GOCE Satellite and Mission Performance

Rune Floberghagen[1], Michael Fehringer[1], Thomas Gruber[2]

[1] European Space Agency

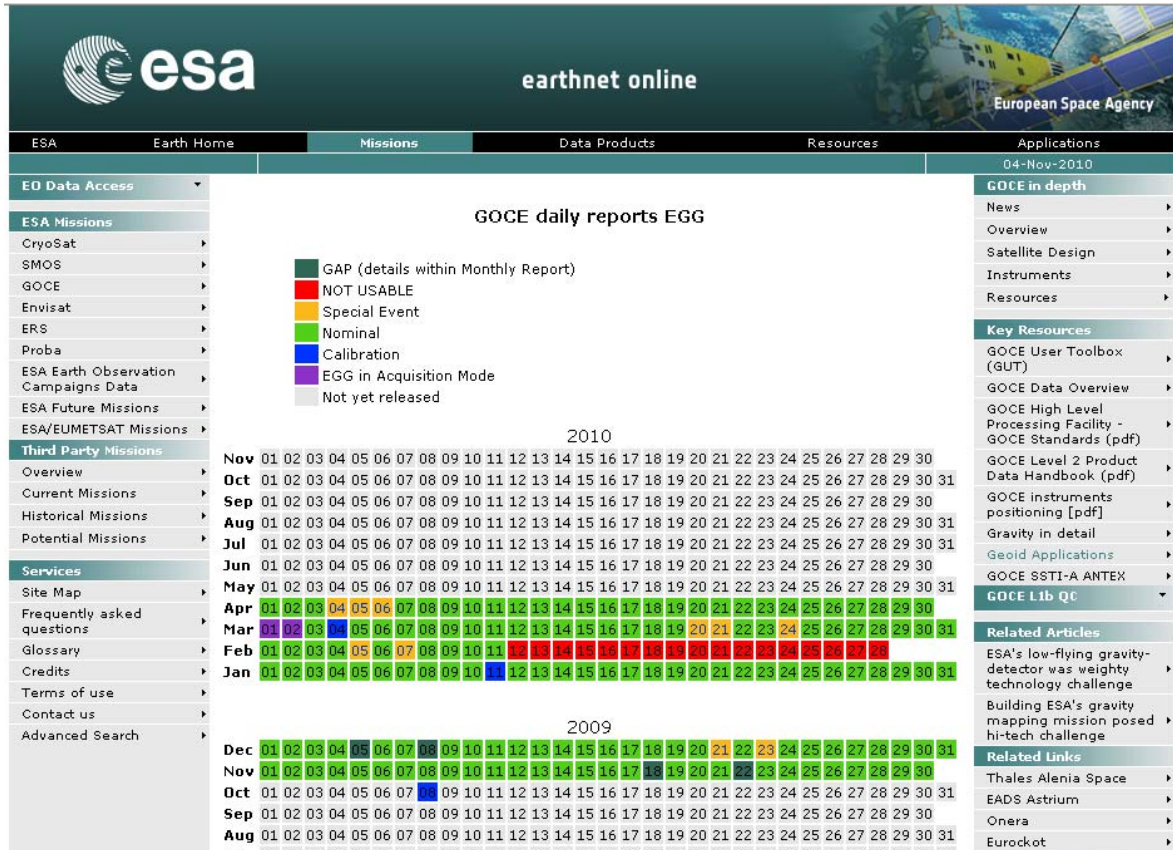
[2] Technical University Munich, Institute of Astronomical and Physical Geodesy

Recent history

- In nominal ops since end September 2009. Commissioning phase long due to need for orbit decay to an altitude where proper drag-free operation was possible (impact of low solar activity).
- Satellite operations proceeding well, with two hiccups.
- Level 1b data (gravity gradients, orbit, attitude, accelerometer and GPS data) available since May 2010.
- Level 2 data, including first generation gravity field models, available since 29 June 2010.
- Now in 5th global mapping cycle (6 needed for nominal mission).
- Data release is progressing, lag w.r.t. sampling is about 6 months.
- Data is accessible through ESA's user services standard catalogue tools as well as on a Virtual Online Archive (in the "cloud"). The latter is the more efficient way of accessing data. Registration is straightfoward.
- Model coefficients also available through ICGEM.

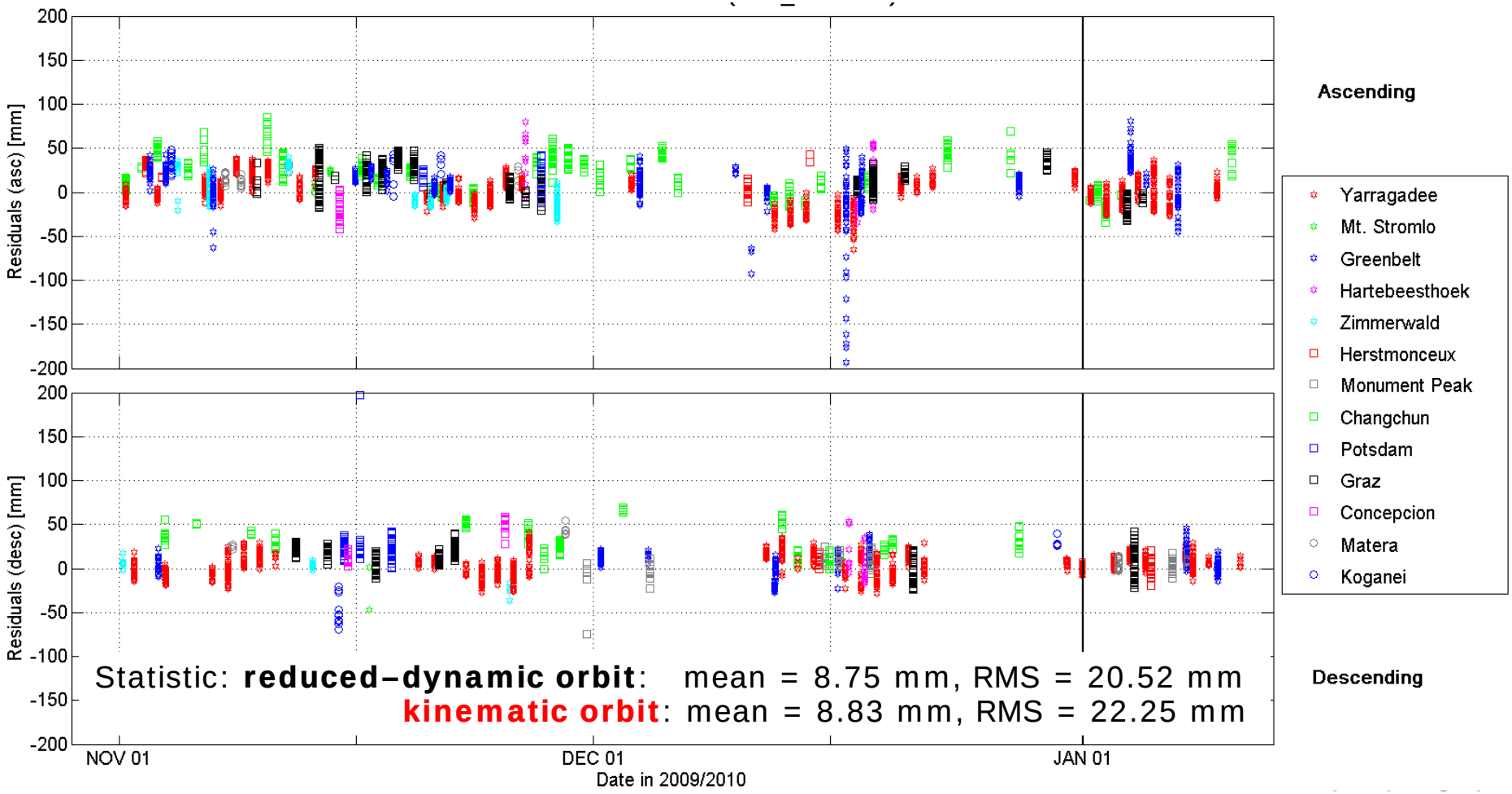
Data availability (as of today)

- Level 1b: November 2009 – April 2010 + commissioning phase data
- Level 2: Gravity field solution based on 2 months of data, time series products for November 2009 – April 2010 + precise orbits for commissioning phase
- Time lag: about 6 months (needed for proper validation, small corrections, etc.)
- Quality reports available at http://earth.esa.int/goce
- All data freely available!



A few GOCE “goodies” - Orbits

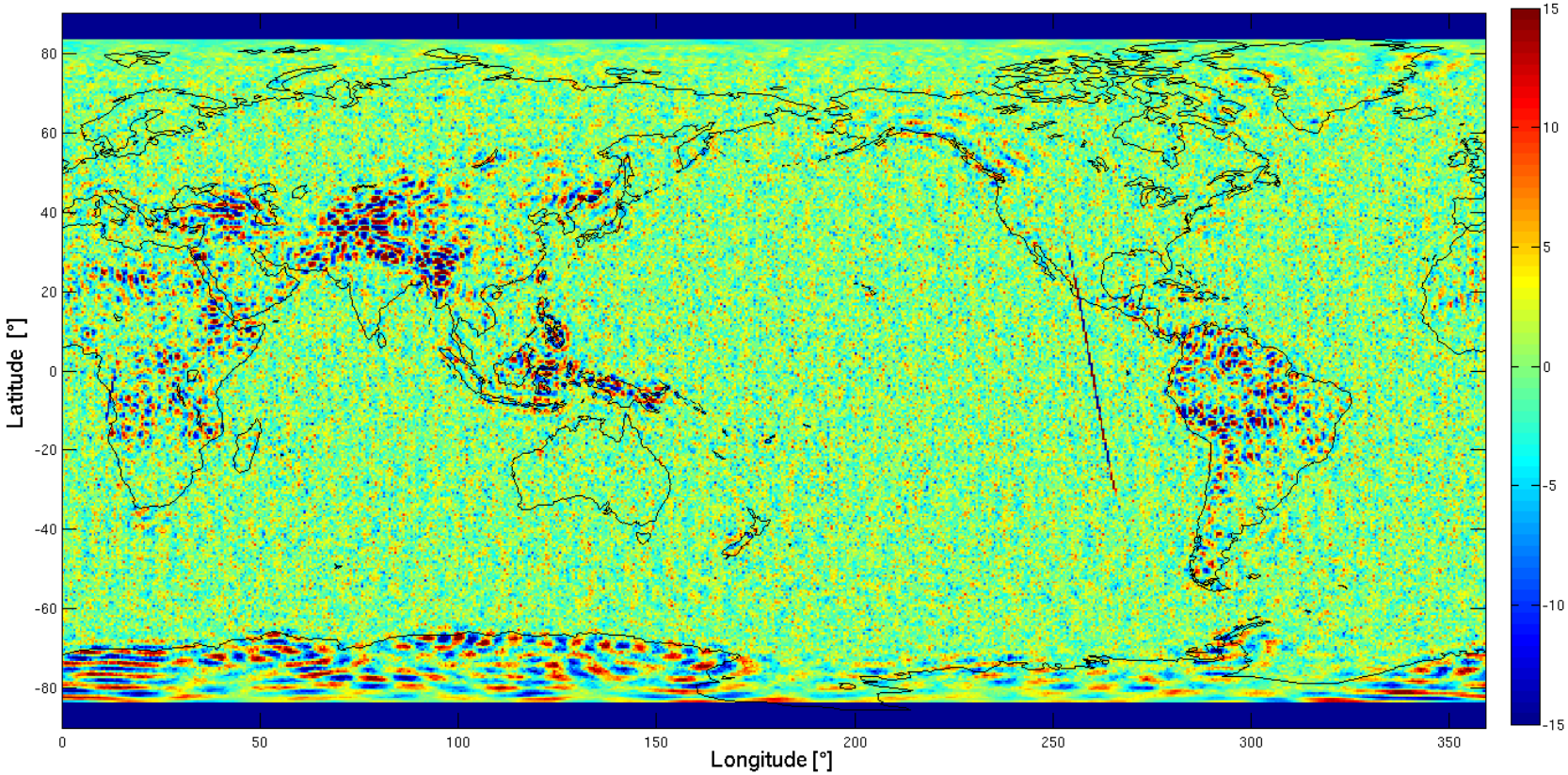
Range residuals between computed range from SLR station to satellite position from **kinematic** orbit and observed range with laser system [mm]



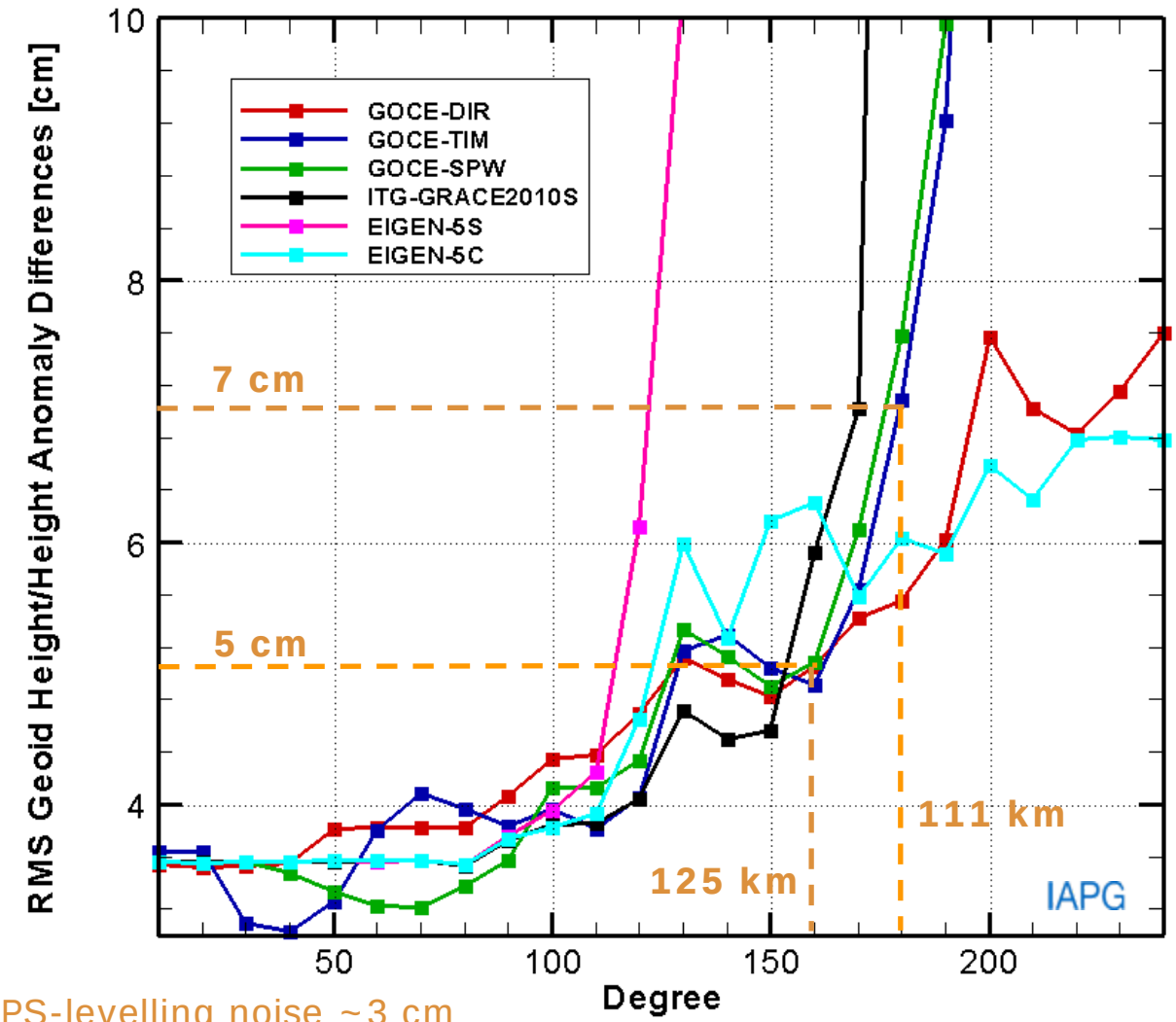
A few GOCE "goodies" – Gravity Gradients

GOCE - EIGEN5C (N=360)
Binned averages V_{ZZ} (EGG_TRF_2)
31 October 2009 - 11 January 2010

Color scale: -15 mE to +15 mE

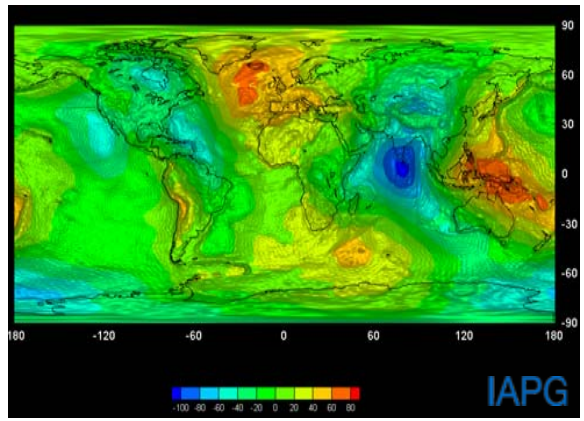


A few GOCE “goodies” – Geoid



GPS-Levelling geoid height differences in Germany:

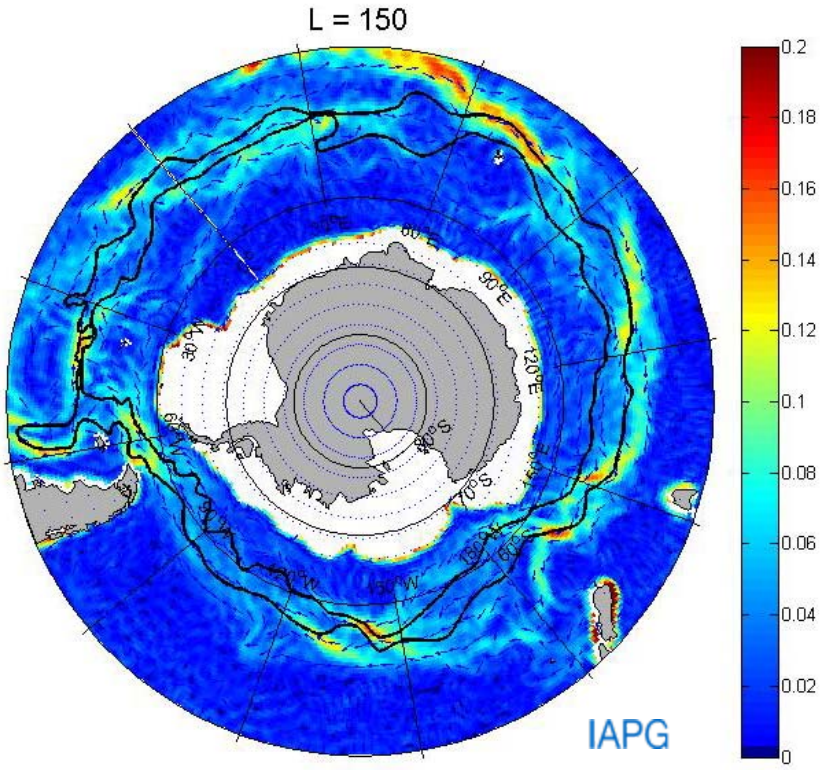
RMS geoid difference versus cut-off degree.

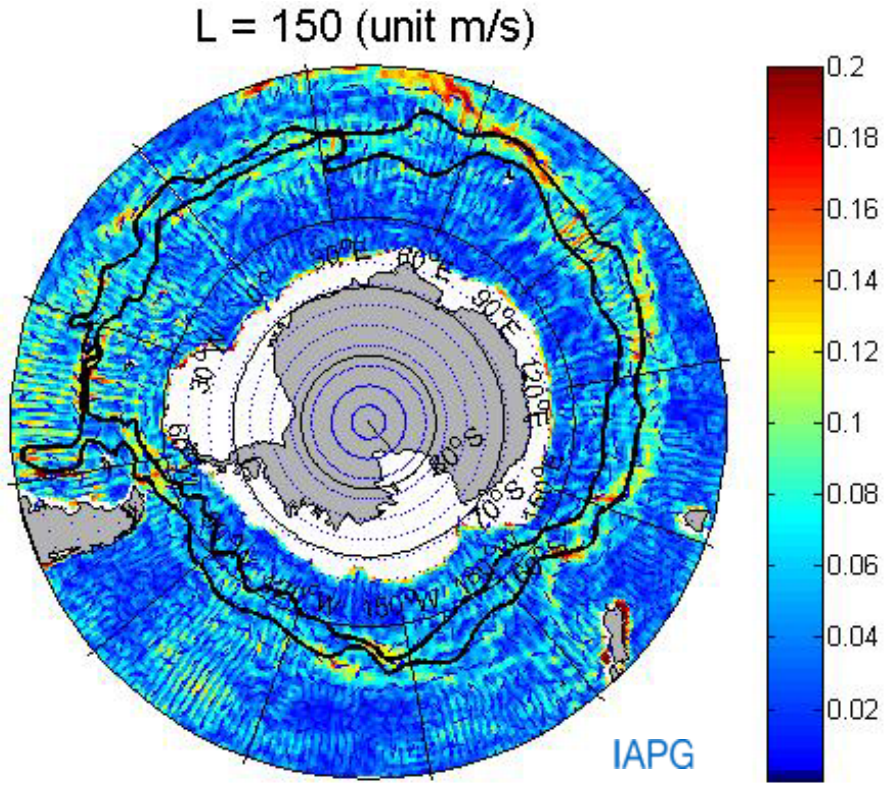


GPS-levelling noise ~3 cm

A few GOCE “goodies” – DOT

Mean geostrophic velocities based on GRACE/GOCE combined model (GOCO01S) and pure GRACE model (ITG-GRACE2010S)





Source: Albertella et al, GEOTOP Project

Two anomalies have impacted operations

- 12 February 2010: Application software crash on main on-board computer due to suspected floating point trap. Automatic reboot on redundant computer worked well, but recovery attempt of A-side on 25 February failed. Running on redundant computer since then.
- 8 July 2010: Temporary loss of software telemetry generated on redundant computer due to oscillation in communication between processor module and telemetry module. Recovery on 30 August, i.e. 7 weeks of operation mostly in “blind”. Root cause has been found in oscillating behaviour of the particular type of receivers used in said communication link. Such oscillations are induced when one branch of the link is connected to a floating potential, such as a powered-off telemetry module.
- Good news: Computer A not “entirely dead”. Procedure in place to revive unit in case of further problems on side B.
- No other hardware problems on the satellite, nor signs of aging.

Recent history and outlook

- 26 Sept: back at nominal orbit altitude of 254.9 km.
- 27 Sep: Resumption of nominal operations.
- Since then no further problems!
- Next set of gravity field solutions expected in February 2011. Preliminary versions will be presented at AGU Fall.

- Current atmospheric drag situation: 3 mN, which represents a slight increase w.r.t. solar minimum. However, this drag level is easily accommodated by the ion thrusters, and ESA will maintain the current altitude until end of nominal mission.

- Extended mission until end 2012 has been proposed (approval expected on 24 November).
- Consumables on-board for ops until end 2013 or longer…

Conclusions

- GOCE is back in operation after a “summer vacation”.
- The data products are of excellent quality.
- ESA is targeting an extension of the mission.

- Next rendez-vous: 4th International GOCE User Workshop, 31 March – 1 April 2011 at Technical University of Munich.