

## **GOCE: Mission Overview and Early Results**

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### Gravity field and steady-state Ocean Circulation Explorer: GOCE





First Earth Explorer
 Core Mission of ESA's
 Living Planet Program

 First ESA Mission dedicated to the exploration of the Earth Gravity Field

## **GOCE** Mission Objectives



- Determine the Earth's gravity field with an accuracy of 1 mgal (i.e. 1 millionth of the Earth gravity)
- Determine the geoid (i.e. the equipotential surface for a hypothetical ocean at rest ) with a radial accuracy of 1 to 2 cm
- Achieve this at length scales down to 100 km

# The Launch





# GOCE successfully launched from Plesetsk on 17 March

# lift-off at 15:21:13 CET

## **Mission History**



- 17 20 March
- > 30 March 3 April
- ▶ 6 9 April
- > 7 May
- > May June
- > July mid Sept
- > 13 September
- ▶ 14 18 Sept
- > 29 September

launch and LEOP IPA commissioning gradiometer commissioning first time in drag-free mode gradiometer calibration orbit decay to 255 km back to drag-free mode orbit stabilisation

and gradiometer calibration

start of science operations

### **Overall status of satellite**



- Satellite and payloads are in a very good state
- Orbit control strategy is mature and verified
- > The required ground repeat pattern is achieved
- Satellite is indeed very "quiet" allowing operations in eclipse period
- Overall mission objectives are expected to be met within nominal mission duration
- > Big margin in consumables at the end of nominal mission

### Level 1b data products



| EGG_NOM_1b | <ul> <li>Control voltages, linear/angular accelerations, common/<br/>differential accelerations</li> <li>Angular rates and attitude</li> <li>6 gravity gradients (xx,yy,zz,xz,xy,yz)</li> <li>Transformation matrix instrument frame to inertial frame</li> <li>Quality parameters, data gap information</li> <li>Includes all steps/corrections (reversible)</li> </ul> |
|------------|--|
| SST_NOM_1b | <ul> <li>Carrier phases, pseudo-ranges</li> <li>Orbit solution (Earth-fixed)</li> <li>Quality parameters, noise level estimates, data gap information</li> <li>Includes all steps/corrections (reversible)</li> </ul>  |
| SST_RIN_1b | <ul> <li>Sub-set of SST_NOM_1b information</li> <li>Follows RINEX 2.20</li> </ul>  |

### **Level 2 data products**



| EGG_NOM_2 | <ul> <li>Externally calibrated and corrected gravity gradients in GRF</li> <li>Corrections to gradients for temporal gravity variations</li> <li>Flags for outliers and data gaps, fill-ins for gaps</li> <li>Statistical information</li> </ul> |
|-----------|--|
| EGG_TRF_2 | <ul> <li>Externally calibrated gradients in Earth-fixed reference frame</li> <li>Including error estimates for transformed gradients</li> <li>Transformation parameters to Earth-fixed reference frame</li> </ul>                                |
| SST_PSO_2 | <ul><li> Precise science orbit</li><li> Quality report</li></ul>   |
| EGM_GOC_2 | <ul> <li>Final gravity field model in spherical harmonic series</li> <li>Grids of geoid heights, gravity anomalies and geoid slopes</li> <li>(Propagated) error estimates for all quantities</li> <li>Quality report</li> </ul>                  |
| EGM_GVC_2 | <ul> <li>Variance-covariance matrix of final gravity field model</li> </ul>  |

## **GOCE Data Handbook**





GOCE High Level Processing Facility

GOCE Level 2 Product Data Handbook

| Doc. No.: | GO-MA-HPF-GS-0110 |
|-----------|-------------------|
| Issue:    | 4                 |
| Revision: | 1                 |
| Date:     | 30 / 04 / 2009    |



Prepared by: The European GOCE Gravity Consortium EGG-C

- GOCE Mission Overview
- GOCE Data Processing Overview
- Reference Frames and Time

#### Systems

- Mathematical Conventions
  - Quaternions and Interpolation,
  - Spherical Harmonic Series,
  - Error Propagation
- Gravity Field Conventions
  - Approximations for derived quantities
  - Accurate Formulations
- Level 2 Product Definitions
  - Gradients & Orbits
  - Gravity Fields & Covariance

Matrix

European Space Agency

Format Descriptions (XML, other)

### **GOCE Standards**





GOCE High Level Processing Facility

GOCE Standards

| Doc. No.: | GO-TN-HPF-GS-0111 |
|-----------|-------------------|
| Issue:    | 3                 |
| Revision: | 1                 |
| Date:     | 30 / 04 / 2009    |



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Issue 3.1 in April 2009:

- Numerical Standards
- Time Systems
- Reference Systems Definitions
- Transformation between
   Reference
- Systems
- Geometrical Models
- Dynamical Models
- Height, Gravity & Tide Systems
- GOCE Reference & Time Systems

# Future outlook



### **26 December 2009**

Completion of first global mapping of the Earth with uniform longitude spacing at the equator of < 0.4 deg

### Sept 2009 – April 2011

Uninterrupted science measurement phase until end of nominal mission, including eclipse periods.

It is expected that the current altitude of 255 km can be maintained throughout 2010.

### Data release



- Release of first set of Level 1b data planned for Spring 2010 (around EGU)
- First official gravity field and release of first set of Level 2 data at ESA's Living Planet Symposium in Bergen, Norway, 28 June – 02 July 2010
- > Thereafter, regular release through standard ESA user services

http://earth.esa.int/goce