

# GOCE-GRAND II Project Overview and Status of the GOCE Mission

Th. Gruber, R. Rummel, J. Flury  
 Institute of Astronomical and Physical Geodesy, Technische Universität München, Germany,  
 E-mail: Thomas.Gruber@bv.tu-muenchen.de

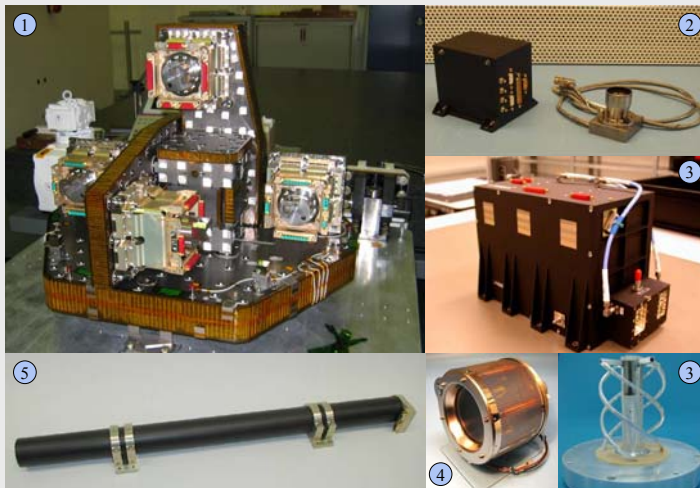
## The GOCE Mission

GOCE is the first core mission selected for the ESA Earth science satellite programme "Living Planet". Its objective is to provide data from space necessary for an improved understanding of the interactions of atmosphere, oceans, ice and solid Earth. GOCE will be launched in summer/early autumn 2007. It aims at the determination of the stationary part of the Earth's gravity field and geoid with maximum spatial resolution and accuracy (1-2 cm geoid height accuracy with spatial resolution of approximately 100 km). The mission is complementary to GRACE, which is primarily designed to measure the temporal variations of gravity and geoid.

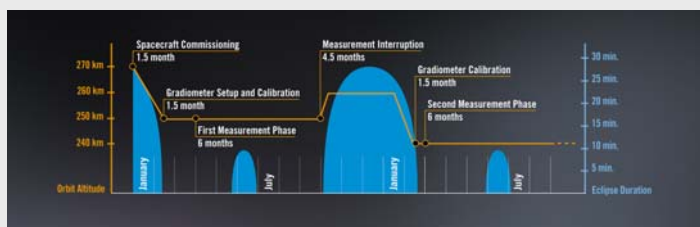


### Elements of the Gravity Sensor System of GOCE

Sensor	Measurements
3-axis gravity gradiometer ①	Gravity gradients $\Gamma_{xx}, \Gamma_{yy}, \Gamma_{zz}$ in instrument system and inside MBW (measurement bandwidth) Angular accelerations (highly accurate around y-axis, less accurate around x, z axes) Common mode accelerations
Star sensors ②	High rate and high precision inertial orientation
GPS receiver ③	Orbit trajectory with cm-precision
Drag control with 2 ion thrusters ④	Based on common mode accelerations from gradiometer data
Angular control with magnetic torquers ⑤	Based on angular rates from star sensors and gradiometer
Orbit altitude maintenance	Based on GPS orbit
Internal calibration of gradiometer (and quadratic factors)	Random shaking with cold gas thrusters (and random pulses)

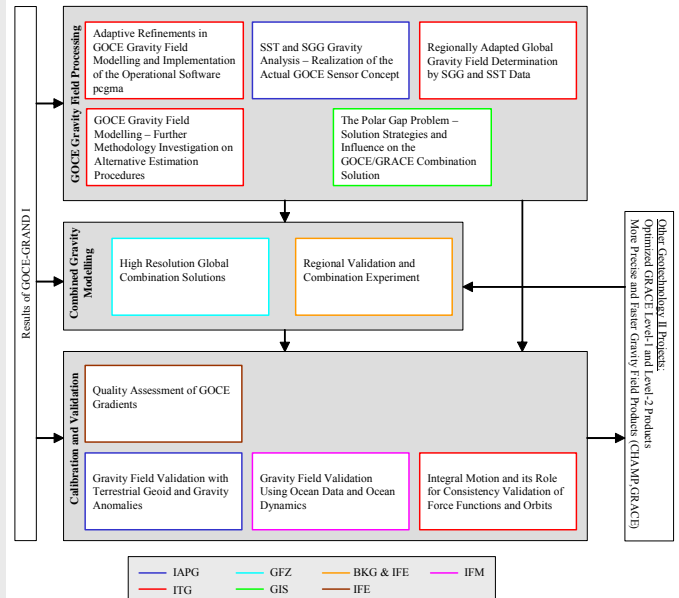


### GOCE Mission Profile



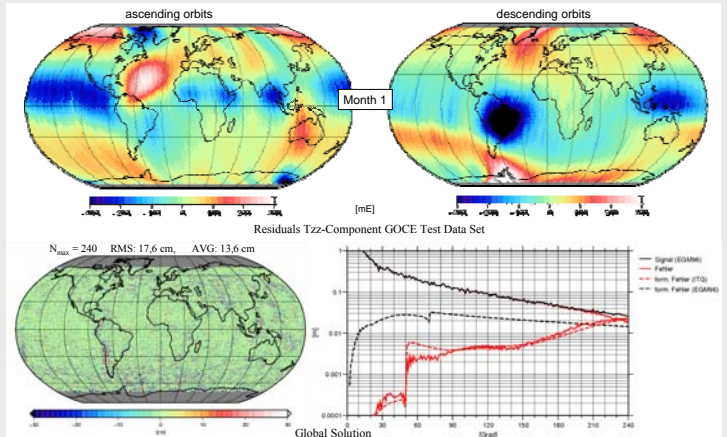
## The GOCE-GRAND II Project

The first phase of the GOCE-GRAND project (2002-2004) was dedicated to the development of a gravity analysis system for GOCE data. It included kinematic orbit computation, the determination of the long wavelength gravity field from these orbits and from common mode accelerometry based on the so-called energy conservation method, several gradiometric gravity analysis methods and development of algorithms for data reduction (temporal effects) and for external calibration and internal validation. GOCE-GRAND II will refine the developed algorithms and adapt them to the final characteristics of sensor system as it will be brought into orbit. This implies that all design changes are taken into account, that realistic stochastic models are developed for all sensor components and that the analysis algorithms are capable to cope with a large number of measurements and unknown parameters. In addition GOCE-GRAND II will address questions concerning the combined GRACE/GOCE data analysis and validation of the GOCE results by means of methods such as GPS-levelling and ocean dynamic topography. In short, GOCE GRAND II yields an important segment of GOCE gravity field analysis, of GRACE-GOCE combination and of in-depth and independent validation of GOCE gravity products.



### GOCE Gravity Field Processing

Regionally adapted global gravity field determination (courtesy ITG Bonn)



### Regional Validation and Combination Experiment

Observations of vertical deflections (courtesy IFE Hannover)

