The 36th International Symposium on Remote Sensing of Environment,
11 – 15 May 2015, Berlin, Germany, ISRSE36-348

GOCE: Earth gravity from space

R. Rummel

Institut für Astronomische und Physikalische Geodäsie, Technische Universität München, 80290 München, Germany – rummel@bv.tum.de

THEME: Special Session "Scientific achievements of ESA's Earth Explorer missions"

KEY WORDS: GOCE, ESA, living planet, gravity, geoid, ocean

ABSTRACT:

GOCE (Gravity and steady-state Ocean Circulation Explorer) was the first mission of ESA's earth observation programme "Living Planet". It was in orbit from March 2009 till November 2013. GOCE's mission objectives are the determination of the geoid (geopotential surface at mean sea level) and gravity variations with maximum spatial resolution and accuracy. For this purpose GOCE was carrying a three axis gravitational gradiometer, the first instrument of this kind, measuring gravity gradients in 3D along the orbit path. In order to enhance sensitivity the spacecraft was orbiting the earth at extremely low altitude. GOCE was a gravitational laboratory comprising a geodetic GPS-receiver, star trackers, magneto-torquers and ion-thrusters that kept the satellite free of non-gravitational effects at its low altitude. The latest official ESA gravity models were recently released.

The core product are global maps of the earth's gravity field and geoid with unprecedented accuracy and spatial resolution. They reveal significant inconsistencies of the best pre-GOCE era gravity models in large regions of the earth with poor terrestrial gravity. Currently activities are underway to unify national height systems based on GOCE results and to bring sea level records in various parts of the world into one common height reference. The GOCE geoid, in combination with more than 20 years of satellite altimetry, results in globally consistent, purely geodetic models of dynamic ocean topography and geostrophic currents. These serve as input to ocean modelling and climate research. In addition, GOCE gravity resulted in an improved understanding of the mechanisms of continental mass compensation and elastic thickness. To our own surprise, GOCE was even able to detect temporal gravity changes such as the effect of mass re-adjustment resulting from the Tohoku-Oki earthquake in Japan in 2011.