



EIGEN-6C4 – The latest combined global gravity field model including GOCE data up to degree and order 1949 of GFZ Potsdam and GRGS Toulouse

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GFZ Potsdam and GRGS Toulouse have a long-time close cooperation in the field of global gravity field determination. Here we focus on (1) GOCE gravity field determination and (2) computation of high resolution combined gravity field models. Such data products play a fundamental role in geodesy and Earth sciences, ranging from practical purposes, like precise orbit determination, to scientific applications, like investigations of the density structure of the Earth's interior. Here we present our combined gravity field model EIGEN-6C4 which is the fourth release of EIGEN-6C (EIGEN = European Improved Gravity model of the Earth by New techniques).

The first release of EIGEN-6C, published in 2011, was the first global combined gravity field model containing GOCE data. It was computed from a combination of LAGEOS, GRACE and GOCE data, augmented with DTU10 surface gravity data, and it is complete to degree and order 1440 (corresponding to 14 km spatial resolution). The combination of the different data types has been done on the basis of full normal equations up to maximum degree/order 370. The spherical harmonic coefficients of the shorter wavelengths were obtained from a block diagonal normal equation from the terrestrial data only. The subsequent releases EIGEN-6C2 (2012) and EIGEN-6C3stat (2013) were complete to degree and order 1949 (corresponding to approx. 10 km spatial resolution) and comprise extended measurement time spans for the LAGEOS/GRACE as well as for the GOCE data. Now we present the new release EIGEN-6C4. This time variable combined gravity field model is again developed to degree and order 1949 and comprises the new GRACE Release 03 from GRGS and gradiometer data almost of the entire GOCE mission (Sept. 2009-Sept. 2013). Our combination of GRACE and GOCE data allows the construction of an accurate satellite-only contribution to the final combined model up to degree and order 260, where the GOCE gradiometer data contribute only for degrees upwards of 100. This is achieved through filtering of the GOCE observation equations, which is necessary because of the degraded gradiometer performance outside the measurement bandwidth. Consequently, surface data normal equations are combined with the satellite normal equations at a higher degree than formerly applied before the GOCE launch (for instance at degree 70 in EIGEN-5C).

The comparison of test results (orbit computation, GPS leveling, geostrophic current speeds) of this latest EIGEN model with GOCE-only models, EGM2008, GGM03 and GRACE-ITG2010S demonstrates the gain in accuracy at high degrees, while its performance is identical to recent GRACE-only model for the low degrees. Compared to the precursor releases of EIGEN-6 this new release shows a general improvement.

EIGEN-6C4 is available at the ICGEM data base at GFZ Potsdam via

<http://icgem.gfz-potsdam.de>

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