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EIGEN-6C2 - A new 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 at which the present focus is (1) on GOCE gravity field determination and (2) on 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-6C2 which is the second release of EIGEN-6C (EIGEN = European Improved Gravity model of the Earth by New techniques).

The initial release of EIGEN-6, published in 2011, was the first global combined gravity field model containing GOCE data. It had been computed from a combination of LAGEOS, GRACE and GOCE data, augmented with the DTU10 surface gravity data and 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 new release is now complete to degree and order 1949 (corresponding to approx. 10 km spatial resolution). Furthermore this new model comprises extended measurement time spans for the LAGEOS/GRACE data as well as for the GOCE data. 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 240, 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. The surface data normal equations are combined with satellite normal equations at a higher degree than recently applied (for instance at degree 70 in EIGEN-5C).

The comparison of test results (orbit computation, GPS leveling) of this latest EIGEN model with GOCE-only models, EGM2008, GGM03 and ITG10S demonstrates the gain in accuracy at high degrees, while its performance is identical to a GRACE-only model for the low degrees. Compared to the first release of EIGEN-6 this new release shows a general improvement. Oceanographic validation of the new EIGEN-model in comparison to other global gravity field models is performed through the analysis of differences between mean geostrophic currents derived from the tested gravity field models and inferred from drifter data as a function of resolution (down to 100 km).

EIGEN-6C2 is available at the ICGEM data base at GFZ Potsdam via this link:

http://icgem.gfz-potsdam.de

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