



## **EIGEN-6 - A new combined global gravity field model including GOCE data from the collaboration of GFZ Potsdam and GRGS Toulouse**

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High-resolution global gravity field models 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. We report on the latest combined EIGEN-model (EIGEN = European Improved Gravity model of the Earth by New techniques), which is complete to degree and order 1440 and was jointly elaborated by GFZ Potsdam and CNES/GRGS Toulouse. It is the first EIGEN model inferred from a combination of GRACE and GOCE data, enhanced with the DTU10 surface gravity data.

The combination of GRACE and GOCE data allows the construction of an accurate satellite-only model to degree and order 240, the gradiometer data of the latter contributing only to 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. Analyses of gradiometer residuals calculated with ITG-Grace2010s, EIGEN-5C and EGM2008 as background models revealed considerable model errors in current combined gravity field models caused by the inclusion low-quality and/or low resolution surface data in particular over South America, Africa, the Himalayas and New Guinea. Therefore, the combination procedure of satellite and surface data was revisited in order to mitigate this error source. In particular, the surface data normal equations are combined with satellite normal equations at a higher degree than presently applied (for instance at degree 70 in EIGEN-5C).

The comparison of test results (orbit computation, GPS levelling) of this latest EIGEN model with a GOCE-only model, EGM2008 and ITG-Grace2010s demonstrates the gain in accuracy at high degrees, while its performance remains identical compared to a GRACE-only model for the low degrees.