Preliminary results of global gravity recovery from precise science orbits of dedicated satellite gravity missions

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Dedicated satellite gravity missions such as CHAMP and GRACE are highly expected to substantially reduce systematic errors at medium to long wavelengths in resulting global gravity field models, especially in and around Japan which is located in an island and arc region, thanks to its (nearly) homogenous observation over the globe. Because of geological and tectonic setting in the vicinity of Japan, the latest local gravimetric geoid models for that area suffer from such systematic errors inherent to their reference global models.

The latest gravimetric geoid model for Japan, JGEOID2004, was developed in a remove-restore manner by the 1D-FFT method of generalized Stokes integral: EGM96 was employed as the foundational model and a local gravity model was created by combining an altimetric marine gravity model, KMS02 with local data of land and marine gravity. Comparison with GPS/levelling geoidal undulation data of a nationwide net of GPS at benchmarks reveals that JGEOID2004 is precise at short wavelengths, but contains systematic errors at long wavelengths, which can be expressed as a planar trend of 0.3 ppm. Those systematic errors would be attributed to the errors of EGM96 because no local gravity data is available over the Eurasian continent and because there exists no constraints to the marine gravity data in an absolute sense.

We started study on global gravity field modeling from precise science orbits of the dedicated gravity satellite missions. Preliminary results were obtained from six months of CHAMP orbits with no use of accelerometer data or atmospheric-oceanographic de-aliasing pre-process. The resulting gravity/geoid models indicate that appropriate correction for non-conservative forces and mass redistribution effects of the atmosphere and ocean is essential to recover the global gravity field from precise orbits of low-earth-orbiters.