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Study of temporal gravity variations from GRACE and superconducting gravimeters

A. Weise (1), C. Kroner (2), M. Abe (2), J. Ihde (3), G. Jentzsch (1), M. Naujoks (1), H. Wilmes (3), and H. Wziontek (3)

(1) Institute of Geosciences, Friedrich-Schiller-University Jena, Germany (Adelheid.Weise@uni-jena.de), (2) GFZ Helmholtz Centre Potsdam German Research Centre for Geosciences, Germany, (3) Federal Agency for Cartography and Geodesy (BKG), Frankfurt/M., Germany

Terrestrial gravity observations with superconducting gravimeters (SG) within the network of the 'Global Geodynamics Project' (GGP) offer the unique opportunity to supplement and validate the temporal gravity field variations derived from the GRACE satellite mission. Because of the different spatial and temporal resolution of the gravity data a combination of all data sets, including those from absolute gravimeters (AG), can be considered as the most straight forward approach to retrieve a maximum of information regarding mass transfers on different time and spatial scales. These are esp. related to hydrology which is deployable as constraint for hydrological modelling.

For the consistent combination of the data sets the gap between gravity variations from terrestrial point data of superconducting (SG) and absolute gravimeters (AG) on one side and from satellite data (GRACE) on the other side has to be bridged. A successful combination of SG and AG data could be obtained for several stations.

In principle, reductions for the same geophysical influences applied to the GRACE data have to be taken into account for the SG time series. The separation of local, regional and global hydrological effects in SG observations is crucial but essential for the comparison with satellite-derived gravity data. It can be shown that even for stations with a hydrological challenging situation such as Moxa/Germany local hydrology-induced effects on gravity can be successfully removed.

Initially, the study focuses on Europe where a dense and long-term observation network is available with data sets covering the period of the GRACE mission. From a first comparison a principle good agreement is found for the gravity residuals of some SG stations in distances of a couple of 100 km, thus the gravity variations are representative for a larger region. They are also in good correspondence with the GRACE-derived gravity field changes. Further both data sets are in good agreement with the gravity variations computed on basis of the global hydrological model WGHM.