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A global Performance Estimate of GRACE Gravity Solutions validated by in-situ Ocean Bottom Pressure

A. Macrander (1), C. Boening (1), O. Boebel (1), J. Schroeter (1)

(1) Alfred-Wegener-Institut für Polar- und Meeresforschung (Andreas.Macrander@awi.de, fax: +49 471 4831 1797)

The GRACE satellite mission observes the gravity field of the Earth with unprecedented accuracy. Gravity field products provided by the GRACE Science Data System and other processing centres allow assesing both the static geoid, as well as time-varying signals associated with changes of global water mass distribution. For estimating the capability of spaceborne gravity measurements to detect the temporal variability of oceanic mass distribution and currents, the GRACE data is validated against in-situ measurements of ocean bottom pressure (OBP) provided by pressure sensors located at the sea floor. In the framework of a joint BMBF (German Ministry for Education and Research) project, a database has been established that includes all available OBP time series from more than 35 locations in the Southern, Atlantic, Indian and Pacific Oceans. Here, different GRACE solutions from GFZ, CSR, JPL, GRGS and ITG are validated against in-situ OBP on a global scale. The performance of the different GRACE products to capture oceanic mass variability is assessed by a weighed correlation analysis, taking into account the length and data quality of the in-situ time series. The analysis aims (a) to quantify the performance of different GRACE products and to quantify the advances made by recent GRACE gravity field releases with improved data processing, and (b) to identify regions where GRACE performs exceptionally well (e.g. high latitudes), and in which parts of the oceans GRACE fails to detect real OBP variability. Spatial patterns related to the performance of GRACE may help to predict the quality of spaceborne gravity measurements also for those oceanic regions where no in-situ data are available. This is critical for the future use of GRACE to remotely determine water mass redistribution in all oceans.