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Global Ground Truth Validation of GRACE Gravity Measurements by Ocean Bottom Pressure

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The GRACE satellite mission observes the gravity field of the Earth with unprecedented accuracy. Gravity field products provided by the GRACE Science Data System allow to assess 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 that includes globally available OBP observations is presented here. This database is used to carry out a comprehensive ground-truth validation of GRACE. The capability of GRACE solutions from different analysis centers to capture oceanic mass variability is assessed by comparisons with in-situ OBP data from the Southern Ocean, Atlantic, Indian and Pacific Oceans. It is shown, that GRACE detects real oceanic variability in regions with a high signal-to-noise ratio (e.g. the Antarctic Circumpolar Current), and that reduced noise levels of more recent GRACE solutions may improve GRACE performance in other parts of the Ocean (e.g. the tropical Atlantic). The ground-truth validation against OBP aids the further improvement of GRACE data processing that in the future GRACE may be used to monitor geostrophic transport variability and water mass changes on a global scale.