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# A multi-parameter study of GRACE gravity solutions and their validation with in-situ Ocean Bottom Pressure

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Since 2002, the GRACE satellite mission provides gravity field estimates of the Earth with unprecedented accuracy. Over the oceans, small signal amplitudes, combined with large short-term variability like tides lead to aliasing effects, which still challenge the interpretation of GRACE data. To assess how realistic GRACE data reflect oceanic mass variability, validation with in-situ time series of ocean bottom pressure is critical.
However, the comparison of single-point data from in-situ instruments and spatially smoothed GRACE observations involves differing data processing techniques which possibly induce inherently different results.
Here, all possible combinations of different GRACE products, spatial expansions, and filtering methods, are systematically compared with a comprehensive database of more than 150 in-situ ocean bottom pressure datasets distributed across the world's oceans.
The comparison includes GRACE products provided by the GRACE Science Data System (CSR, GFZ, JPL), and GRGS, ITG amongst others. Both isotropic and anisotropic "de-striping" filters, and ocean-model derived pattern filters are used.
The skill of GRACE 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. To obtain reliable GRACE-derived estimates of oceanic mass variability, a a multi-dimensional "cost function" is introduced, which allows to select the best GRACE gravity fields products and the optimum data processing method. This is critical for the future use of GRACE to remotely determine water mass redistribution in all oceans.