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Separation of earthquake signals from GRACE-based ocean bottom pressure and terrestrial water storage estimates based on a physical model approach

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Since its launch in 2002, the Gravity Recovery and Climate Experiment (GRACE) mission provides as a unique way to monitor the mass changes at the surface of the Earth, including terrestrial water storage (TWS) variations on the continents and ocean bottom pressure (OBP) changes in the oceans. As GRACE detects all mass changes without the ability to discern signals above or below the crust, the contributions from well-known geophysical sources are removed typically by using geophysical a priori models.

Large earthquakes with magnitude larger than 7.5 are also detected by GRACE as the signature can be two times larger than the GRACE errors. Past researches mainly focused on retrieving earthquake signals from the GRACE time variable gravity solutions. In this study, we treat the earthquake signal as a source of error to the TWS and OBP estimates from GRACE and attempt to remove it. Both the co-seismic and post-seismic gravity changes caused by the earthquake are estimated from GRACE and a geophysical model. We take the 2004 Sumatra-Andaman earthquake as an example and demonstrate the effectiveness of our method and evaluate the impact from earthquake signals on the OBP estimate in the nearby regions.