Rui
Ponte
Atmospheric and Environmental Research/JANUS Research Group
Nishchitha Silva, Atmospheric and Environmental Research/JANUS Research Group
Mengnan Zhao, Atmospheric and Environmental Research/JANUS Research Group
Ou Wang, Jet Propulsion Laboratory/California Institute of Technology
Ichiro Fukumori, Jet Propulsion Laboratory/California Institute of Technology
Oral
Ocean bottom pressure (OBP) is a key variable for monitoring and understanding ocean variability and change, but the coarse resolution of GRACE and GRACE Follow-On data can be a limiting factor when trying, for example, to close coastal sea level budgets or measure changes in deep circulation involving narrow boundary currents. Models can provide dynamical interpolation of the sparse data in both space and time, and state estimation methods allow for the optimal combination of observations and models to address some of the shortcomings of both. Here we examine the effects of assimilating GRACE(-FO) data in global ocean state estimates produced by the project for Estimating the Circulation and Climate of the Ocean (ECCO). The latest ECCO solution assimilates the whole GRACE record, along with many other ocean datasets. In addition to local OBP anomalies, ECCO uses GRACE-based estimates of global ocean mean mass to constrain the net freshwater flux into the oceans and associated changes in barystatic sea level.

Differences between the optimized ECCO solution and its control counterpart, run without any data constraints, reveal the large impact of the optimization on the OBP fields at monthly and longer timescales. Comparisons with the GRACE measurements suggest that a substantial part of the OBP adjustments at regional scale is directly induced by the GRACE constraints. Largest changes are seen in the Mediterranean Sea, the Arctic and the Southern Ocean. In addition, the constraint on the mean ocean mass is essential for mitigating large imbalances in freshwater fluxes derived from atmospheric reanalyses (used as prior forcing fields) and for producing a realistic barystatic sea level curve. Our findings indicate that GRACE data contain information complementary to that available in altimetry and hydrography data, confirming the value of GRACE data for determining OBP fields and their relation to the variable ocean circulation.
Presentation file
ponte-rui.pdf
Meeting homepage

GRACE-FO 2025 Science Team Meeting
Download to PDF