

Analyzing the ocean with the latest ECCO Ocean State Estimate

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Interannual to decadal variations of the ocean are described using the latest estimate from the “Estimating the Circulation and Climate of the Ocean” (ECCO) project. The estimate combines a state-of-the-art ocean general circulation model (MITgcm) with nearly all extant observations of the ocean from 1992 to 2015, including sea level from satellites (e.g., Jason-2), and in situ hydrographic profiles from ships (e.g., WOCE) and floats (e.g., Argo). The model is of moderate spatial resolution (40-100km) but with a domain that is truly global including the Arctic Ocean. The estimate’s enhancements from earlier analyses include its longer period (4 additional years), use of new observations (e.g., GRACE ocean bottom pressure and Aquarius sea surface salinity), model improvements (e.g., geothermal heating, sea ice model), and accounting of correlated uncertainties (e.g., forcing bias).

The new analysis has improved agreements with observations than before, allowing a more accurate accounting of processes contributing to their variation. In particular, the ECCO analysis is characterized by its physical consistency in the sense of the estimate’s temporal evolution being accounted for explicitly in terms of physical processes resolved by the model. The estimation’s infrastructure (e.g., model adjoint) allows analyses that cannot be easily performed from observations or models alone.

The new estimate and its infrastructure will be presented with a focus on sea level variations and associated changes in ocean heat and mass. Regional and vertical distribution of the variable heat and mass fields will be explored and the nature of their evolution will be examined in relation to the ocean circulation.

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