

The ECCO Consortium: The ECCO-CLIVAR ocean state estimate for climate applications

Ichiro Fukumori[†]; Patrick Heimbach; Rui Ponte; Tong Lee; Gael Forget; Carl Wunsch

[†] Jet Propulsion Laboratory, USA

Leading author: fukumori@jpl.nasa.gov

The Consortium for Estimating the Circulation and Climate of the Ocean (ECCO) has established an ongoing global multi-decade estimate of the physical state of the ocean. The estimate synthesizes nearly complete global ocean data sets since 1992 with a state-of-the-art ocean general circulation model. The results are characterized by their physical and statistical consistencies and are particularly suited for investigating mechanisms of ocean circulation changes and their causal relationships. The ECCO estimate is being expanded and adapted to support the widest interest in climate research, especially that of CLIVAR. The new estimate, called the ECCO-CLIVAR Central Solution, is being extended in time to present on a regular basis and expanded in scope by incorporating new observations, advancements in ocean modeling, and new methods in estimation. The new observations include updated versions of in situ and satellite measurements, incorporating most recent data and quality controls, and new measurement types such as time-varying satellite ocean mass observations. Model improvements include use of an active sea-ice model and bulk formulae for air-sea fluxes. The Central Solution is obtained by the adjoint method, with the optimization achieved through adjustments to a variety of control variables (e.g., atmospheric state, initial conditions of temperature, salinity, sea level, etc.), and near-real time extensions are produced using an approximate Kalman filter and smoother. Additional improvements to the Central Solution are underway to advance the fidelity and scope of the estimate. In particular, future estimates will employ a truly global grid that includes the Arctic Ocean, use of higher spatial grid resolution, and a mass conserving formulation. Examples of the ongoing estimate and highlights of the present development efforts will be described.