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The ECCO Consortium: Applications of eddying global ocean and sea ice state estimates

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During the past five years, the Estimating the Circulation and Climate of the Ocean, Phase II (ECCO2) project aimed to add eddies and sea ice to the ECCO ocean state estimates. A first, global, eddying-ocean and sea ice synthesis was obtained for the period 1992-2002 using a Green's Function approach to adjust a small number (~80) of control parameters, including initial temperature and salinity conditions, surface boundary conditions, and several empirical ocean and sea ice model parameters. Data constraints include altimetry, gravity, drifter, hydrography, and observations of sea-ice. A second set of demonstration solutions were obtained during the ARGO-rich period (2004-2005 and 2009-2010) using the adjoint method, which permits the estimation of a much larger number (here ~10^9) of control parameters. Although both of these solutions are preliminary in many ways, they nevertheless are already proving useful for applications ranging from estimates of ocean surface carbon flux to polar oceans and sea ice variability studies. This paper introduces the ECCO2 eddying-ocean and sea-ice solutions and describes a few example climate research applications that make use of these solutions in service to society.