Coupled Marine DA at GMAO with a JEDI-based DA workflow

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Abstract

We present the design and initial implementation of a next-generation ocean and sea-ice data assimilation (DA) system being developed at the Global Modeling and Assimilation Office (GMAO) to support both subseasonal-to-seasonal (S2S) prediction and coupled reanalysis. The system performs a weakly-coupled ocean and sea-ice assimilation DA in the context of a coupled atmosphere–ocean–sea-ice model. The effort represents transitioning to a new framework built on MOM6/CICE6 and the Joint Effort for Data assimilation Integration (JEDI), leveraging the SOCA marine component. We are evaluating candidate DA architectures, including a hybrid 3DEnVar for the deterministic analysis with an LETKF for flow-dependent ensemble covariances and an ensemble of DA (EDA), and conducting experiments to determine the most appropriate configurations for the distinct requirements of S2S prediction and reanalysis. These experiments also address ensemble generation, perturbation scaling, and spread maintenance. The goal is to assimilate nadir altimeter- and SWOT KaRIn-derived ADT, in-situ T/S profiles, SST, SSS, and sea-ice concentration, with attention to interface-sensitive observations. This work focuses on the preliminary challenges we face: software-infrastructure considerations, running Earth system components within a weakly-coupled DA framework, determining the right strategy for ensemble perturbations and analysis, and providing recommendations for adequate implementation(s) of the ocean-atmosphere coupling in the context of S2S and/or reanalysis.