



Coupled Ocean-Atmosphere 4D-Var: Formulation and Sensitivity Analysis Results

Hans Ngodock (1), Matthew Carrier (1), Liang Xu (2), Clark Amerault (2), Tim Campbell (1), and Clark Rowley (1)

(1) Naval Research Laboratory, Stennis Space Center, United States (hans.ngodock@nrlssc.navy.mil), (2) Naval Research Laboratory, Monterey, United States

The US Navy is currently developing the first coupled ocean-atmosphere four-dimensional variational (4D-Var) data assimilation system to be used for short-term regional forecasting. This project merges the 4D-Var capabilities of the atmospheric component of the Coupled Ocean/Atmospheric Mesoscale Prediction System (COAMPS[®]) with the Navy Coastal Ocean Model (NCOM) through the Earth System Modeling Framework (ESMF). This will provide the coupled ocean-atmosphere forecast with a fully balanced analysis that accounts for all combined observations in both primary fluids (i.e. ocean and atmosphere). In this present work, the formulation of the system is presented in detail along with a series of adjoint sensitivity analysis results using the coupled ocean-atmosphere adjoint model. The sensitivity of the atmosphere (ocean) to each ocean (atmosphere) model variable is analyzed in detail in order to illustrate the usefulness of this approach in the coupled data assimilation system.