Geophysical Research Abstracts
Vol. 17, EGU2015-7334, 2015
EGU General Assembly 2015

Towards a coupled ocean-wave-atmosphere four dimensional data assimilation system

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Individual 4dvar systems have been developed at the Naval Research Laboratory (NRL) for the ocean model (Navy coastal ocean model, NCOM), the wave model (simulating waves in the nearshore, SWAN) and the atmospheric component of the coupled ocean-atmosphere mesoscale prediction system (COAMPS). Although the three models within COAPMS are coupled in the forward integration, the initialization of each model is done separately. The coupled system forecast is hindered, however, by the lack of a fully coupled and dynamically balanced ocean-atmosphere analysis. A recent work by Ngodock and Carrier (2013) has highlighted this shortcoming with the NCOM-4DVAR, showing that while the NCOM-4DVAR is able to adjust the ocean state properly, the resulting ocean forecast degrades quickly due to the fact that the atmospheric state has not also been adjusted relative to the ocean observations. Likewise, . Currently, the coupled model is initialized using separate analyses for the ocean and atmosphere that do not account for observations in the adjacent fluid. The lack of a coupled analysis produces shocks in the coupled model in the form of gravity waves that degrade the information gained through DA and increase the error in the coupled forecast. The goal of this presentation is to describe ongoing developments at NRL in building a fully coupled ocean-wave-atmosphere four-dimensional variational (4dvar) data assimilation system using the Earth System Modeling Framework (ESMF).