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DEVELOPMENT OF AN OCEAN MODEL FOR COAMPS

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LONG TERM GOALS:

Couple a full-physics, mesoscale ocean model to the atmospheric forecast model of COAMPS. Leverage related programs to develop an ocean data assimilation capability for COAMPS. Utilize this fully-coupled data assimilation system for basic and applied research on mesoscale phenomena for which atmosphere-ocean coupling may be important.

OBJECTIVES:

Develop appropriate ocean model to use to couple to COAMPS atmospheric model for forecasting in littoral environments. Study methodology for coupling, such as one-way vs. two-way interaction, frequency of coupling, etc. to determine importance relative importance of air-ocean energy exchanges in the atmosphere and ocean.

APPROACH:

Utilize existing ocean models as the basis for initial investigation of air-ocean interfaces issues for coupled models. Include the Modular Ocean Model (MOM) and the Princeton Ocean Model (POM), which represent state-of-the-art z- and sigma-coordinate ocean models. Design a general interface between the atmosphere and ocean models to allow for testing of other ocean models, in particular, the hybrid sigma-z model being developed at NRL SSC as part of this joint program.

WORK COMPLETED:

The MOM has been coupled to the COAMPS atmospheric model. The coupling allows for each model to use it's own resolution and time step, and allows for an arbitrary coupling interval. Real-data coupled simulations of Atlantic hurricanes has been started. The POM has been modified to include the latest version of turbulence mixing and to allow for coupling within COAMPS and to allow for horizontally nested grids.

RESULTS:

Minor differences (1-2 mb in central pressure) were noted for Hurricane Opal between a COAMPS atmospheric simulation using fixed sea surface temperatures and a fully-coupled atmosphere-ocean (COAMPS/MOM) simulation that used the predicted sea surface temperatures. These sensitivities are no larger than those associated with the uncertainty of the analyzed sea surface temperature.

IMPACT:

Our results indicate that it is unclear as to how significant full atmosphere-ocean coupling is for short-term forecasts of tropical cyclones. The results from Hurricane Opal as well as earlier tests using an idealized tropical cyclone indicate that the response time for changes in the ocean to affect the atmospheric circulation are long enough (at least 6-12 hours) so that they have little or no impact for a tropical cyclone moving at least 1-2 m/s.

TRANSITIONS:

Developments from this program will transition to an existing 6.4 program (PE 0603207N) for applications within COAMPS and for possible transition to Fleet Numerical Meteorology and Oceanography Center (FNMOC) for operational use.

RELATED PROJECTS:

Related 6.2 projects within PE 0602435N include BE-35-2-18 which focuses on the development of the atmospheric component of COAMPS, BE-35-2-19 which focuses on the importance of satellite data on the prediction of tropical cyclones, 035-23 which focuses on the study of the effects and feedbacks that occur between the atmosphere and the ocean. A related 6.4 project within PE 0603207N is X0513-02 which focuses on the transition of COAMPS to FNMOC. Another 6.4 project, within PE 0603785N is 0120-ADV which focuses on the development of a coupled data assimilation system for COAMPS.

REFERENCES:

None.