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DATA ASSIMILATION AND PHYSICAL PARAMETERIZATION STUDIES

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LONG TERM GOALS:

Investigate methods to advance our understanding of dynamical and physical processes in the atmosphere, particularly in the areas of data assimilation and physical processes. Use this information to enhance our ability to predict the atmosphere using global and mesoscale numerical models.

OBJECTIVES:

Investigate methods for producing the most effective data assimilation system for weather forecasting. Establish common radiation parameterizations in the numerical models at the Naval Research Laboratory (NRL).

APPROACH:

Leverage the university research community to develop and refine basic scientific principles that can be applied to the advanced development of numerical weather prediction systems. Incorporate these principles into NRL's global model, the Navy Operational Global Atmospheric Prediction System (NOGAPS) and NRL's mesoscale model, the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS).

WORK COMPLETED:

Dr. Ron Errico made two extended visits to NRL, primarily to teach and do joint research between NCAR and NRL. His work focussed on building the tangent linear model and its adjoint of the Navy global model, NOGAPS. Work is ongoing to use this model and Dr. Errico's mesoscale model, which includes a tangent linear and adjoint component, to study observation targeting using the FASTEX data set. Dr. Erirco is also helping Gregg Rohaly of NRL to develop better methods to assimilate precipitation rate data, and he continues to improve the methods to include moist physics in tangent linear and adjoint versions of models.

Work is continuing on the development of improved radiation parameterizations. New methods are being examined for the solution of the radiative transfer equation which will allow for more accurate and more efficient calculations as the vertical resolution of models increases. The cloud cover and optical properties, originally designed for the global model, NOGAPS, are being adjusted in the long-wave parameterization for implementation into COAMPS. Work has also been started to include a parameterization for ice clouds in the short-wave radiation. This feature will include the explicit representation of ice crystal size.

RESULTS:

Dr. Errico demonstrated that the use of nudging in data assimilation fails to capture information and carry it forward in time as efficiently as other methods, such as multivariate optimum interpolation or 3-dimensional variational analysis.

IMPACT:

The results from Dr. Errico suggest that there exists potential for significant improvements to both global and mesoscale prediction systems through advanced data assimilation methods and utilizing the knowledge we gain from the applications of adjoint models to study the sensitivity of predicted atmospheric phenomena to initial data. The data sensitivity results have had a profound impact on the way in which field programs now collect data. Measuring platforms (e.g., aircraft, dropsondes, ships) are now deployed to areas that adjoint models indicate are most sensitive for further development.

TRANSITIONS:

Developments from this program will transition to existing 6.2 programs, within program element 0602435N, for applications within NOGAPS and COAMPS (projects BE-35-2-18 and BE-35-2-19).

RELATED PROJECTS:

Related 6.2 projects within PE 0602435N include BE-35-2-18 which focuses on the advanced development of NOGAPS and the atmospheric component of COAMPS, and BE-35-2-19, which focuses on the advanced development of data assimilation for NOGAPS and COAMPS.

REFERENCES:

None.