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Evaluation of Satellite Derived Information as an Analysis Tool and to Improve Predictability Over Conventional Data Sparse Regions

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LONG-TERM GOALS

The long term goal of this project is to develop a method to assimilate satellite observations into a mesoscale model to improve prediction in data sparse areas.

OBJECTIVES

The objectives of this research are to assimilate satellite cloud drift winds, satellite soundings and irradiances into a mesoscale model using multiquadric interpolation. The system will be tested using data obtained during FASTEX and validation tests done to demonstrate its capability.

APPROACH

The approach is to adapt the existing three dimensional multiquadric interpolation based data assimilation technique developed at NPS to ingest satellite derived products. The satellite irradiances will be assimilated by applying a radiance model as a weak constraint in the assimilation method. This will be done for several cases during FASTEX and a series of numerical experiments will be done to test the impact of these data on the mesoscale forecasts.

WORK COMPLETED

The work completed in 1998 has focused on the implementation of the three dimensional multiquadric interpolation assimilation with the MM5 model and satellite derived winds supplied by Chris Veldon of the University of Wisconsin. The MM5 model has been run on one of the cases from FASTEX both with and without the satellite derived winds. The model was run using a 108 and 36 km grid resolution from a cold start using NOGAPS analyses as the first guess in the data assimilation. The multiquadric data assimilation has been modified to accept the satellite derived winds and tests to optimize the use of this set of observations is being done. The model forecasts with the various sets of observational data are being compared and examined to determine the impact of these observations on the mesoscale structure.

RESULTS

The primary results come from the preliminary analysis of the FASTEX case run using MM5 and the various observational data sets. The initial impact of the satellite cloud tracked winds on the cyclone of 16 February 1997 during FASTEX has been rather unimpressive. The differences between the model forecasts on the 36 km grid with and without satellite data were very small with central pressure differences less than 2-3 mb and rather similar cyclone tracks. These small differences in the synoptic scale forecasts suggest that the satellite data provided only limited new information for this case. The basic structure was reasonably well depicted in the NOGAPS initial fields. The mesoscale structures, such as the frontal strength and structure, are being examined to determine whether the satellite winds had a favorable impact or these structures. Additional cases are being examined as well to provide a more definitive test of the impact of the satellite winds and are reported in Nuss and Miller (1999).

IMPACTS

There is considerable potential impact of this work on the methods by which these satellite observations get used in operational systems at FNMOC. Results are too preliminary to produce any impact yet.

TRANSITIONS

None

REFERENCES:

Nuss, W.A. and D.K. Miller, 1999: Cloud-track wind use in coastal mesoscale numerical forecasts. *Preprints of the 3rd Symposium on Integrated Observing Systems*, Dallas, Jan. 1999.