Regional Scale Numerical Simulation of Atmospheric Structure Using VAS Data

George Diak, 1225 W. Dayton, Madison, WI 53706, 608-262-5862
John LeMarshall, 1225 W. Dayton, Madison, WI 53706, 608-264-5325
David Houghton, 1225 W. Dayton, Madison, WI 53706, 608-262-0776

INTRODUCTION

This investigation, which began in July 1983, is targeted at three days in spring 1982, March 6 and April 24, which were AVE/VAS days, and April 26, a day of significant severe weather. To date, experiments have been run on the cases of March 6 and April 26 with the Subsynoptic Scale Model (SSM), with April 24 yet to be investigated in FY 84. A parallel investigation using the Limited Area Mesoscale Prediction System (LAMPS) has been slowed due to a computer change at NCAR from its CDC 7600 to a second CRAY, since LAMPS had been designed to use the 7600 as a front end. The problem was amplified because the Drexel University group (Perkoy, Kreitzberg, and Chang) which had developed the model were not actively maintaining it in FY 84.

Investigations with both SSM and LAMPS are directed at model static initializations using VAS derived temperatures and moistures and also satellite derived winds. The general approach for each day's case study is similar. A 12-hour control forecast (no satellite data) is made 12Z-0Z, using a radiosonde analysis at 12Z as the initial field. For the satellite data experiments, reanalyses are performed at intermediate times, using VAS soundings or VAS soundings in combination with satellite winds. Forecasts are subsequently made from the reanalysis time(s) to the same validation hour (0Z) as the control forecasts. Comparisons are then made between the control forecast and satellite experiments.

ACCOMPLISHMENTS TO DATE IN FY 84

The most interesting and significant results to date have been obtained from the SSM for the April 26 case study. The satellite data for this day is unique in the four VAS sounding data sets which are available (16Z, 17Z, 19Z, 21Z) from which to reinitialize forecasts. Forecasts from each of these times to the 0Z validation hour show good consistency in the primary fields and also derived parameters such as vertical motion, skill scores, and stability indices. Consistency and comparable skill with the control forecast are evident.

A significant feature in this work has been the complementary nature of the VAS soundings and satellite winds in the SSM analysis scheme, a variational approach which uses measured winds as an indicator of height gradients. Often in areas associated with significant weather, clouds are responsible for large areas devoid of satellite soundings which can be analyzed using cloud drift and water vapor winds in the variational analysis approach. Forecasts for April 26 using both satellite soundings and winds have demonstrated the utility of using those two data forms in concert.

FOCUS OF CURRENT RESEARCH ACTIVITIES

A similar approach (i.e., using both satellite winds and VAS soundings) will be applied to the other two days being investigated. We will be re-running March 6, a day where gaps in the VAS soundings made analyses particularly difficult. Initial comparisons of control of a control forecast and forecasts using satellite soundings alone were inconclusive on this day. We expect that including the satellite winds will enhance the analyses and forecasts for this day. Current research activities for the LAMPS include running a control forecast for March 6 and duplicating the SSM forecast sequence for this day and for April 24.

PLANS FOR FY 85 AND RECOMMENDATIONS FOR NEW RESEARCH

The modelling effort for FY 85 will focus on three areas of interest:

1. the importance of mesoscale moisture information in the forecasting of weather events and the suitability of the VAS in providing this data,

2. the importance of satellite-derived winds in combination with conventional and satellite sounding information in representing mesoscale detail of the initial state from which forecasts are made, and

3. the implementation of a data assimilation scheme which preserves the divergent component of the wind to enable meaningful short-term (less than 4 hour) mesoscale forecasts to be achieved with the SSM and LAMPS.

PUBLICATIONS

A publication on the SSM investigation of April 26 is in preparation for Monthly Weather Review.