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REVISITING NOTEWORTHY U.S. EAST COAST STORMS AND EXPLOSIVE CYCLONES IN THE WESTERN NORTH ATLANTIC OCEAN FROM 1979-1993: SIMULATIONS USING DATA FROM THE NCEP REGIONAL REANALYSIS PROJECT

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1. INTRODUCTION / OVERVIEW

The purpose of the NCEP Regional Reanalysis (RR, Mesinger et al., 2003) project is to produce a long-term set of consistent climate data produced at a regional scale, using a state-of-the-art data assimilation system. The NCEP RR project will produce a 25 year set of analyses (1979-2003) over North America. To create this data set, a special 32-km version of the NCEP Eta Data Assimilation System (EDAS) has been created. The EDAS consists of successive 3-h analyses and forecasts using the Eta forecast model and the Eta 3-dimensional variational (3DVAR) analysis. The RR EDAS will assimilate most data types now used in the operational EDAS at NCEP, including observed precipitation and satellite radiance data.

Although the NCEP RR effort has been designed primarily as a vehicle for climate studies, this project offers a unique opportunity for researchers to revisit noteworthy weather events which occurred during the past quarter century. Of particular interest are memorable cyclones along the east coast of the United States whose synoptic and mesoscale features have been the subject of exhaustive diagnostic study (e.g., Kocin and Uccellini, 1990), such as the February 1979 Presidents' Day Storm (Bosart, 1981), the February 1983 "Megalopolitan" storm (Bosart and Sanders, 1985) and the "Blizzard of 2000" (24-25 January 2000).

As this volume goes to press, the NCEP RR processing for the period 1 October 1978 – 30 November 2002 has been completed. For updates on RR progress at NCEP and for access to selected output, go to http://wwwt.emc.ncep.noaa.gov/mmb/rreanl.

As part of the routine NCEP RR processing, 72-h Eta forecasts at 32-km resolution were produced every 2.5 days, using a special global model forecast using the NCEP/NCAR Global Reanalysis for lateral boundary conditions. By using predicted lateral boundary conditions, these 72-h Eta forecasts show how a state-of-the-art NWP systems would have performed in "real-time" over the past 25 years.

2. TWO FORECAST EXAMPLES

To briefly illustrate the performance of the RR system, two forecast examples are presented; one in which produced a reasonable forecast, and one in which both the RR forecast and analyses were deficient.

Fig 1 shows a comparison of the 24-h Eta RR forecast and verifying RR analyses of sea level pressure valid at 12Z 4 October 1987. This system produced an early season snowfall over portions of interior eastern New York and western New England. As documented by Bosart and Sanders (1991), the 24-h forecasts from the U.S. operational models (AVN and NGM, their Figs 15b and 15d) predicted weak to moderate cyclogenesis east of New England by 12Z 4 October. Although the Eta RR forecast central pressure was about 8 mb too high, the 24-h forecast of 10-m wind (Fig. 2) shows that it predicted the cyclone to track across southeastern New England, close to the observed track.

Fig. 3 shows the RR verifying analyses and Eta RR 48-h forecasts of mean sea level pressure and 250 mb heights and wind speed valid at 12Z 19 February 1979. This system, the well-documented Presidents' Day storm, produced a then record-breaking snowfall over

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the mid-Atlantic states. At 12Z 19 February, the cyclone's central pressure was observed at approximately 1004 mb (Bosart, 1981; his Fig 4), located just east of the lower Delmarva peninsula, within the exit region of the 250 mb jet streak with maximum winds of 70-80 ms^{-1}. The Eta RR forecast predicted a slower and weaker cyclone, with no evidence of a 250 mb jet streak over the Carolinas. While the RR analysis captures the 250 mb jet structure, the analyzed sea-level pressure is actually higher then the given 48-h Eta forecast, which was about 10 mb too high.

Complete maps of these and other Eta RR forecasts can be found on-line at http://wwwt.emc.ncep.noaa.gov/mmb/mmbpll/, then go to "eta32rr.html".

3. CONCLUSIONS / PLANS

Forecasts using both the 32 km Eta model and an 8-km version of the NCEP non-hydrostatic Meso model (NMM, Janjic et al, 2001) will be shown to illustrate how well current NWP systems can stimulate the observed synoptic and mesoscale structures in these storms, which were often poorly forecast in real-time.

Since several of these storms have been well documented in the meteorological literature, this study hopes to illustrate how much progress in NWP has been made in the last 25 years and to stimulate discussion on what still needs to be improved in mesoscale NWP systems.

4. REFERENCES

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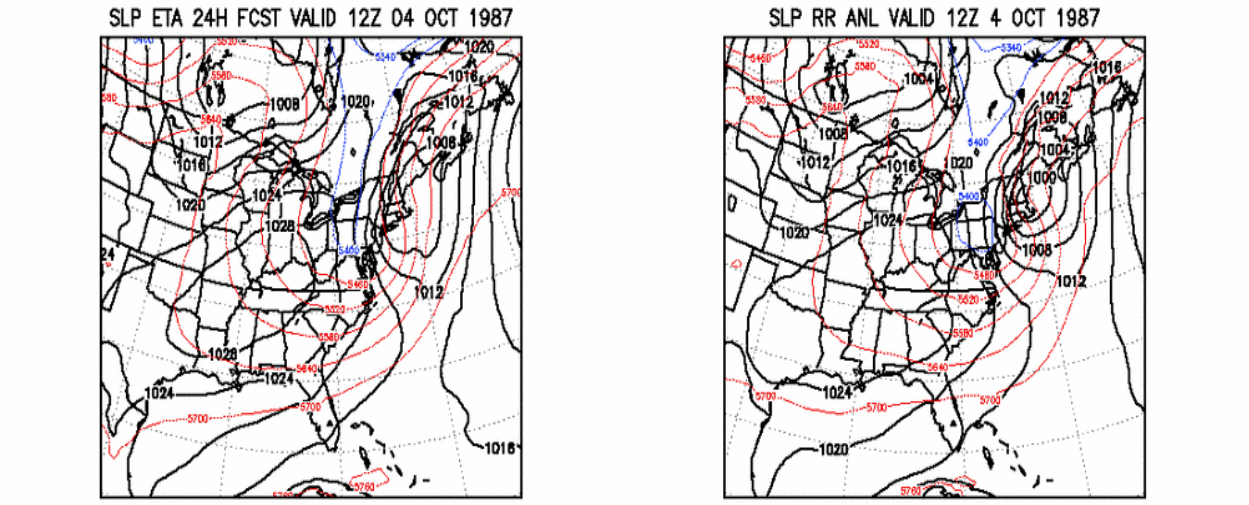

Figure 1: Eta RR 24-h forecast (left) and verifying analysis (right) of mean sea level pressure valid 1200 UTC 4 October 1987.

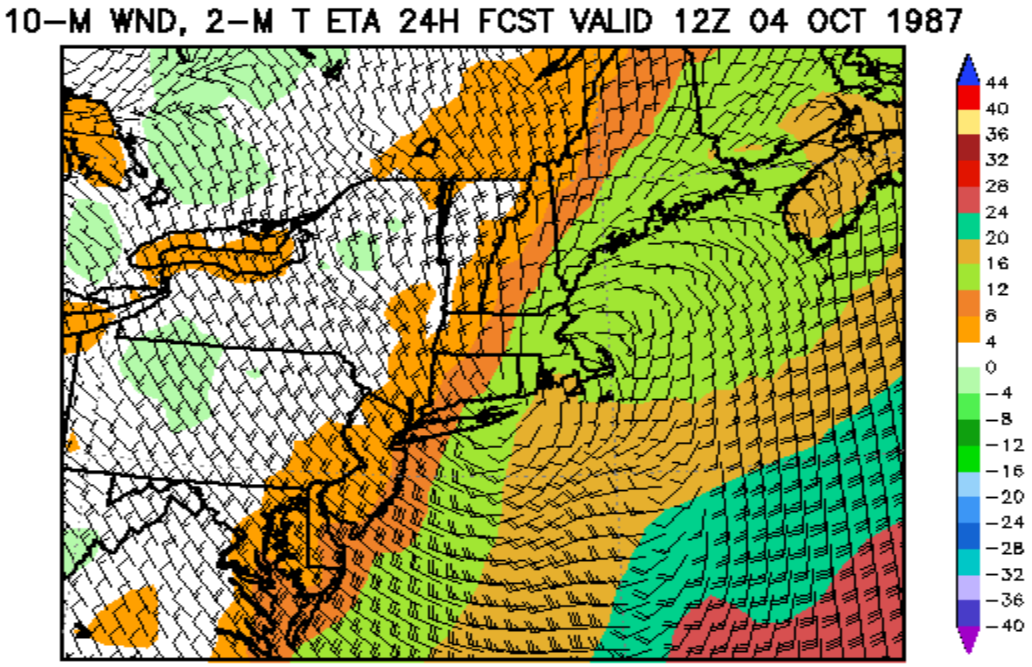

Figure 2: Eta RR 24-h forecast of 2-m temperature (deg C) and 10-m wind (kts) valid 1200 UTC 4 October 1987

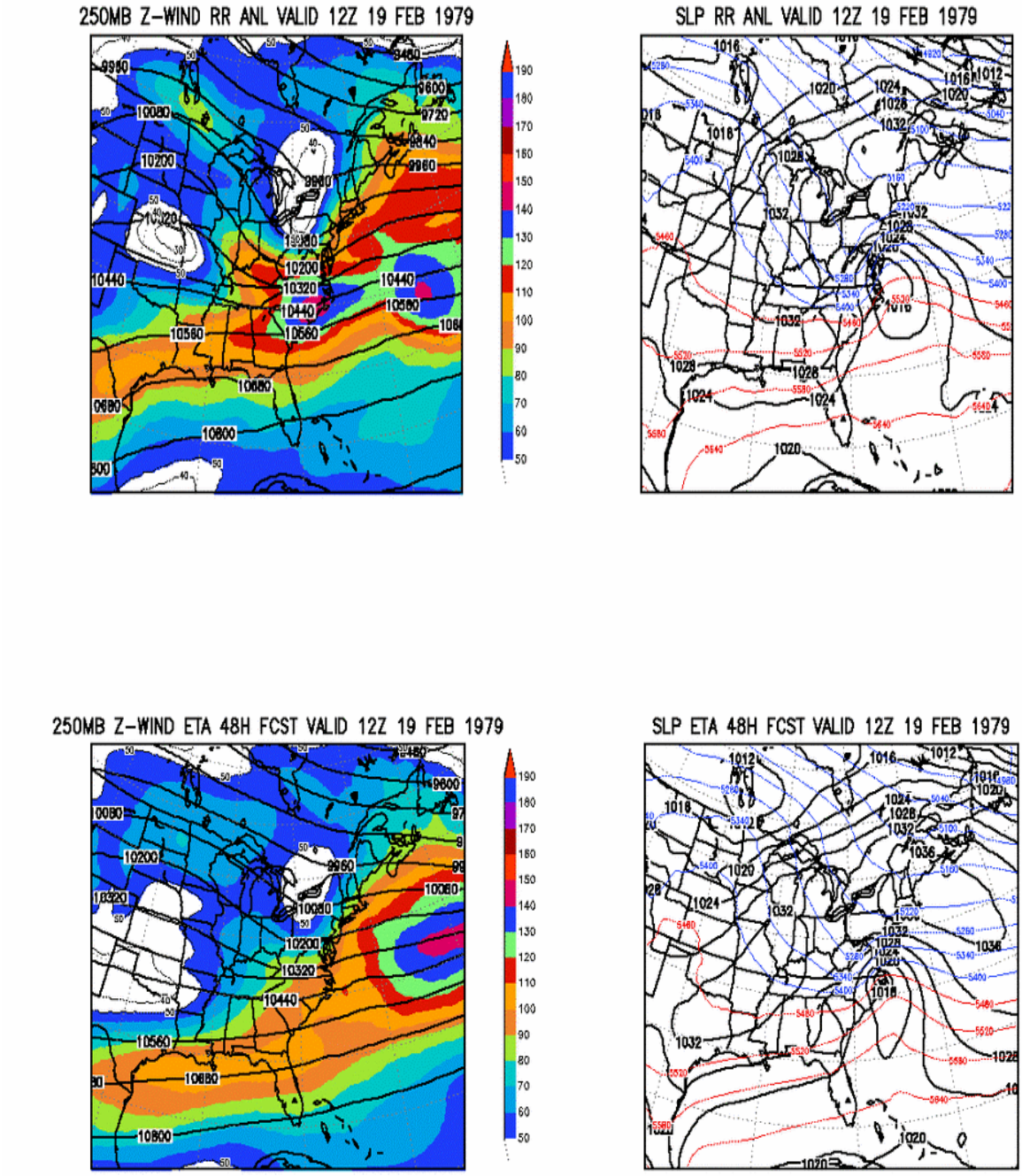

Figure 3: Top left: RR analysis of 250 mb heights (m) and wind speed (kts) valid 12Z 19 February 1979; Top right: RR mean sea level pressure analysis valid at 12Z 19 February 1979; Bottom left: Eta RR 48-h forecast of 250 mb heights and wind speed valid at 12Z 19 February 1979; Bottom right : Eta RR 48-h forecast of mean sea level pressure valid 12Z 19 February 1979.