10.1 REAL-TIME STEERING OF MESOSCALE FORECAST MODELS USING OBJECTIVE TECHNIQUES

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1. INTRODUCTION

Real-time steering of mesoscale forecast models using objective techniques allows data assimilation and computational resources to focus on Regions of Interest (ROI) where active weather will likely occur. In developments inspired by a presentation of Linked Environments for Atmospheric Discovery (LEAD) at the 2005 AMS Annual Meeting which described the need for automated, continuous and dynamically adaptive forecast models (Droegemeier, 2005), mechanisms for using existing real-time data systems and analysis tools to steer a local forecast model to a region where "interesting" weather would occur during the forecast period have been employed which enable the model domain to evolve over successive forecast runs while providing research and education users with products and data based on the forecast domain.

The system implemented within a week following the San Diego AMS meeting uses operational forecast model fields and an objective weighting method to select the region of interest. GEMPAK's Gaussian Weighted Filter using normal distribution of weights is used to create a 24 hour predictive field where the model domain is centered over selected CONUS located maximas. The method currently uses the 24 hour accumulated precipitation field produced from forecast hours 6 through 30 of NCEP's 12km NAM (currently NCEP's ETA) model, which is distributed operationally via NOAAPORT, as the predictor for the ROI function. Once the model domain is determined, Workstation ETA and WRF models are run, and generation of high resolution products (ie radar mosaics, satellite imagery, mesoscale analyses) for the selected region is initiated for the period over which model output will be generated. As an initial result, the system successfully tracked the major ice storm (Jan 26-30, 2005) that moved across the Southeast US and effectively shutdown Atlanta and other cities in the area, while providing a readily accessible case study for researchers, complete with model runs, imagery, and analyses (see URL: http://www.unidata.ucar.edu/projects/THREDDS/DataPublications/EarlyLEAD/EarlyLEAD.htm).

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2. APPLICATIONS

The use of a 24 hour precipitation window, along with the Gaussian Weight function allows the model domain to track major systems for several days, while providing the flexibility to change focus to a new region as systems evolve (Fig. 1). Model runs are initiated at 6 hour intervals producing output through 30 hours, while continuous product generation for the 5 most recent domains allows for concurrent analysis and model comparison over multiple regions.

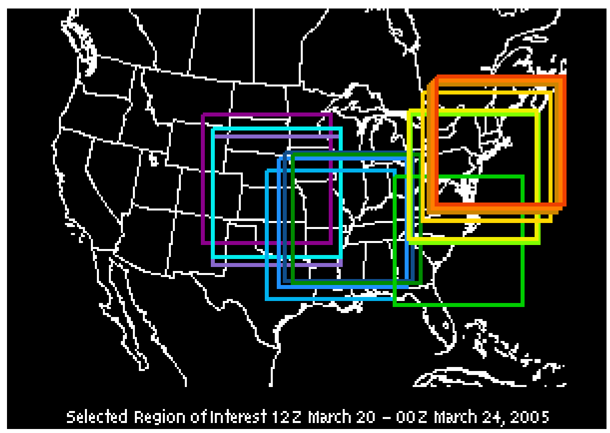

Figure 1. Objectively determined regions of interest for 6 hourly intervals from 12Z March 20 – 00Z March 24, 2005. Model domains tracked system moving from Nebraska through Tennessee, and then shifted focus 12Z March 22 to evolving system off the Carolina coast line, moving north along the eastern US coast as a new storm center formed. For more details see URL: http://www.unidata.ucar.edu/staff/chiz/ams2006/.

Real-time operation of the steering algorithm, model output, and selected products are available at http://www.unidata.ucar.edu/software/gempak/rtmodel/. Distribution of the model output and data products is accomplished automatically by the Unidata LDM software (http://www.unidata.ucar.edu/software/ldm/) for wide distribution to the research and education community. The 2005 Atlantic Hurricane season proved to be well suited to the precipitation based

ROI criteria used. Since outer rain bands were depicted by the operational models well in advance of actual landfall events, the selected model and derived product domain located the landfall region very early in the model cycle, ranging from 30 hours prior to Hurricane Katrina's landfall of the Louisiana coast to nearly 4 days prior to Hurricane Wilma's crossing of the Florida Peninsula (Fig 2). As a result, the products available on the web server were quite popular.

3. CONCLUSIONS

Automated steering of mesoscale models provides interesting opportunities for research and education. The ability to focus data collection and archival based on objective methods facilitates additional model investigation and inter-comparison both locally, and within the user community. By distributing focused data and products widely and in real-time, greater interaction and diversity in the user community is fostered.

4. REFERENCES

Droegemeier, K. K., 2005: Linked Environments For Atmospheric Discovery (LEAD): Architecture, Technology Roadmap and Deployment Strategy. 21st International Conference on Interactive Information Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology. **J2.3.**

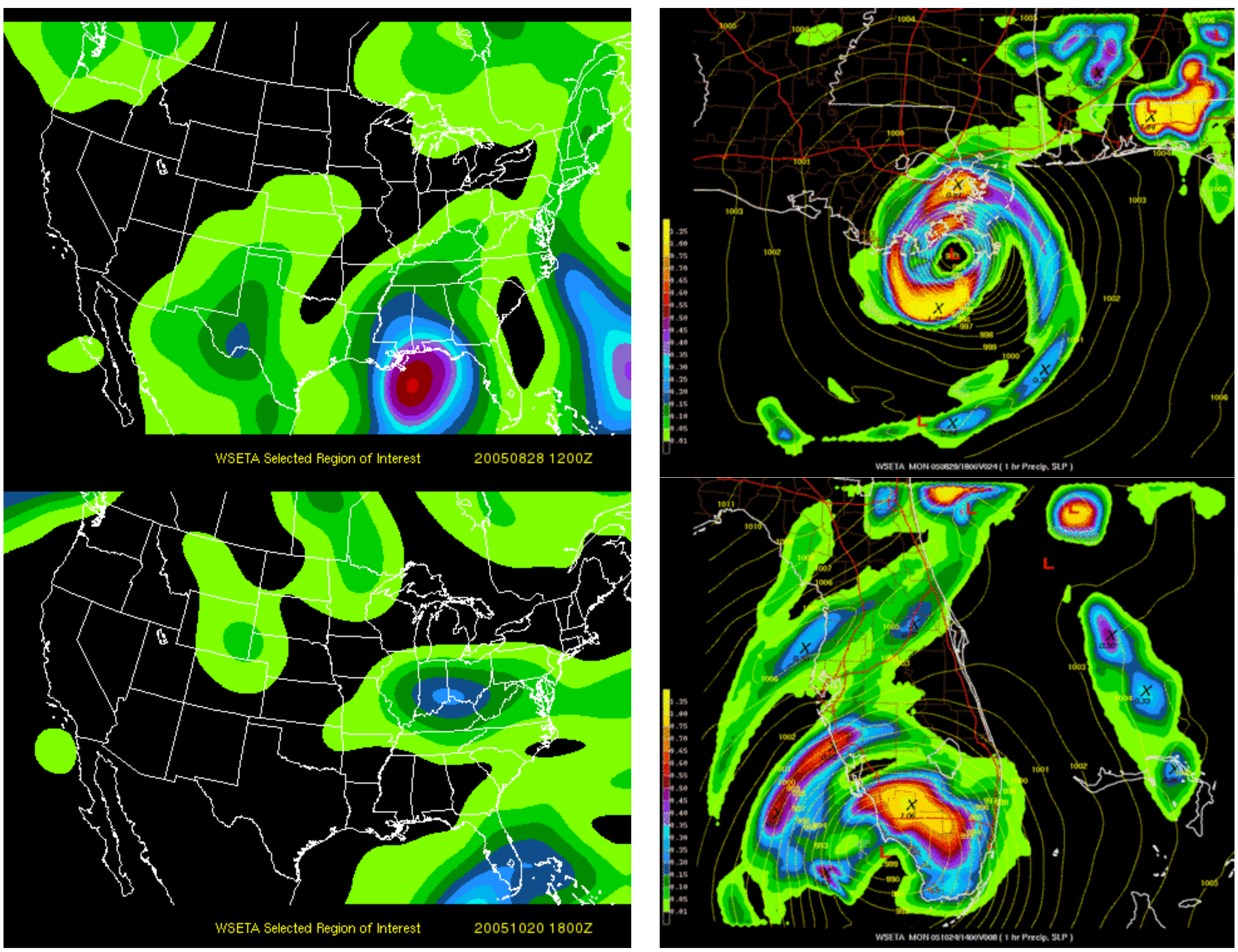

Figure 2. Region of Interest selection for 12Z Aug. 28, 2005 (upper left) and resultant WSETA forecast precipitation valid at 18Z Aug. 29, 2005 (upper right) depicting Hurricane Katrina approaching Louisiana Coast. Region of Interest selection for 18Z Oct. 20, 2005 showing early rain band affects in Florida (lower left) and WSETA forecast precipitation based on subsequent model runs focused on the same region for 14Z Oct 24, 2005 (lower right) as Hurricane Wilma approaches.