EWP 2013 operation plan for Variational Local Analysis and Prediction System (LAPS)

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1. Introduction

One of the motivations for our participation in HWT-2013 is to evaluate and further develop Variational Local Analysis and Prediction System. We have been evaluating the performance of variational LAPS in cases of potential severe weather in addition to our real time verification running at GSD.

In EWP-2013 we hope forecasters can provide some assessment, taking advantage of quasi-stationary dry line type boundaries, for example, as well as others that typically develop in the Oklahoma area, as well as smaller outflow boundaries. In addition, we will add a short-term (0-3 h) forecast component that is discussed below, and follows from the idea of WFOs utilizing a high-resolution local analysis to launch a local-scale model at high resolution.

2. Variational LAPS characteristics

Typical setups of Variational LAPS include:

- Horizontal grid resolutions varying from 3 km to 1 km
- Analysis frequency at 15 min
- Full 3-D analysis
- 2-D surface analysis
- Short latency

The maximum latency is 45 min among that 20 min is waiting for observational data to become available.

3. Analysis and short-range forecast products to be tested during EWP-2013

We are setting up several variational LAPS / WRF domains to support EWP-2013. The products are documented on the web at http://laps.noaa.gov/hwt/hwt.html. The website has a table showing the proposed products and links for the various domains, and also allows for customized displays of various fields. These products will be displayed on AWIPS2 workstation in Norman.

1) Sub-regional scale 1 km horizontal grid resolution 3-D analyses run at 15 minute frequency is used to initialize a 1km horizontal grid resolution WRF. The sub-regional scale variational LAPS analysis “hot start” technique is used to generate forecast. The forecast will run every hour, and forecast out to 3 hours. The intent is to try and bridge a gap between longer-range models that may take an hour or more to “spin-up” and current radar and short-term extrapolation techniques. The Thompson microphysics will be used.

2) Regional scale 3 km horizontal grid resolution 3-D analyses run at 15 minute frequency is used to initialize a model run using the variational LAPS “hot start” technique. It is 3 km horizontal grid resolution, model run every 3 hours, and forecast out to 4 hours. Comparison between the 1 km and 3 km analysis and forecast will help answer some resolution issues.

Forecasts Products

- Column maximum reflectivity
- CAPE
- CIN
- Lifted Index
- Updraft Helicity
- Simulated IR Satellite Brightness Temperature
- Cloud Ceiling
- Fractional Cloud Cover

3) CONUS surface analysis from Variational LAPS (aka. STMAS surface analysis) updated every 15-minutes on 2.5 km grid.

Surface analysis Products

- surface temperature,
- dew point temperature,
- horizontal u, and v wind component,
- PMSL,
- surface pressure.

4. Using the AWIPS2 workstation to examine the products during EWP-2013

There are various techniques that will be available on the workstation that can be used to help evaluate the utility of the various products. Some possibilities include the following:

1. Pre-convective environment assessment: Frontal boundaries are often a focus of convective initiation, and we are particularly interested in the utility of the analyses to help forecasters better determine the potential for convective development along a boundary. To this end overlays such as Column maximum radar reflectivity, which can often identify

fine lines, can be paired with surface observations from both conventional (METARs) and non-conventional (various mesonets) sources.

2. Storm environment assessment: Radar reflectivity and velocity can be overlaid with the analyses to determine the environment surrounding a given storm.

3. Short-range forecast assessment: All of the fields that can be examined using the analyses will also be available from the short-range Variational LAPS forecasts. Of obvious interest to the warning forecaster is the behavior and development of convective storms. Model generated radar reflectivity can be displayed, and can be compared to observed reflectivity.

5. Evaluation of the variational LAPS products during EWP-2013

There are key areas where we hope to have forecaster's evaluation. The daily feedback and survey is a good mechanism of doing the evaluation.

The general areas of interest and questions include in the following:

1. In pre-convective environment, do fields such as CAPE, CIN, Updraft Helicity appear reasonable? Is the temporal frequency (15 min) sufficient?

2. Are the short-range forecasts able to resolve boundaries? Specifically, larger scale boundaries (a front or larger-scale convergence line such as a dry line) versus smaller-scale outflow boundaries, and how do these fields compare in the 1 km vs. 3 km resolutions?

3. Are the short-term forecasts useful for convective storm evolution? Are there differences among storm types (supercell vs. multi-cellular convection)? Is the model able to develop storms that actually do form? Are there under/over forecast issues? Is product latency an issue in using the forecasts effectively?

At ESRL, we also have a near real time radar reflectivity verification website that would provide useful corroboration: http://laps.noaa.gov/verification/radar/ (look for the 'conus' run)

6. Summary

The participation in EWP-2013 provides us the opportunity for a real-time test of cutting-edge analyses at very high temporal and spatial resolutions. These analyses have not yet been assessed by forecasters in an operational setting, and there are many issues that can be addressed in the EWP exercises.

The short-term modeling component addresses a new realm of determining how useful very short-range models initialized with a very high-resolution and inclusive analysis

scheme can aid in the warning process. As with the analyses, the workstations will allow for immediate subjective verification possibilities and assessment of the forecasts that should allow for very useful feedback on the utility of this modeling scheme.