

# **2014 Experimental Warning Program (EWP2014) Operation plan for Variational Local Analysis and Prediction System (vLAPS)**

Hongli Jiang, Yuanfu Xie, Steve Albers, Ligia Bernardet, and Zoltan Toth

Forecast Applications Branch  
Global System Division  
NOAA Earth System Research Laboratory  
25 March 2014

## **1. Introduction**

Our motivation for participation in EWP2014 is to evaluate and further develop Variational Local Analysis and Prediction System (vLAPS). Several improvements were made since the Spring 2013 including:

1. Ingest GPS data,
2. Incorporate sounder data (layer integrated precipitable water between 700 hPa - 300hPa). Data was made available to us by CIMSS (Cooperative Institute for Meteorological Satellite Studies),
3. Increased vertical levels for forecast model. The increased vertical levels resulted in improvement in divergent field.
4. Floating domain

The vLAPS surface analysis is in transition to FAA for operation in 2015. In EWP-2014 we hope forecasters can provide assessment of the vLAPS 2-D surface analysis in detection of quasi-stationary dry line and frontal boundaries that typically develop in the Oklahoma area, as well as smaller outflow boundaries. We will have a short-term (0-3 h) forecast that follows 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:

- 1-km horizontal grid spacing
- Analysis frequency at 15 min
- Full 3-D analysis
- 2-D surface analysis
- Short latency

The maximum latency for analysis 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 EWP2014**

We are setting up several vLAPS / WRF domains to support EWP2014. 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 AWIPS II workstation in Norman.

1) On demand, re-locatable, 800X800 km domain, 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 vLAPS 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.

#### **Analysis Products (all derived and saved in 2-D)**

- Column maximum reflectivity
- CAPE
- CIN
- Updraft Helicity
- Simulated IR Satellite Brightness Temperature
- Cloud ceiling

#### **Forecast Products (all derived and saved in 2-D)**

- Column maximum reflectivity
- CAPE
- CIN
- Storm Relative Helicity
- Updraft Helicity
- Simulated IR Satellite Brightness Temperature
- Cloud ceiling

2) On demand, re-locatable domain of 200x200 km, 1 km horizontal grid resolution 3-D analyses run and moving domain once per hour, and output frequency at 5 - 10 min frequency, analysis and forecast 0-60 min.

#### **Analysis Products (+ 3-D forecast)**

- Wind field
- Vorticity (calculated from the 3-D wind field)

- Reflectivity

3) CONUS surface analysis from vLAPS (aka. STMAS surface analysis, the older acronym) updated every 15-minutes on 2.5 km grid.

### **Surface analysis Products**

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

## **4. Using the AWIPS2 workstation to examine the products during EWP-2014**

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 vLAPS forecasts. Of obvious interest to the warning forecaster is the behavior and development of convective storms. Model generated radar reflectivity can be displayed

## **5. Evaluation of the vLAPS products during EWP-2014**

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.

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/lmr#laps\\_conus](http://laps.noaa.gov/verification/lmr#laps_conus) (look for the 'conus' run)

## **6. Summary**

The participation in EWP-2014 provides us the opportunity for a real-time test of cutting-edge analyses at very high temporal and spatial resolutions. Feedback from forecasters will help identify issues that can be addressed in future improvement. We hope either WRF-OUN or another data assimilation and forecast system will provide similar products list for forecasters to compare and evaluate. This will lead to in depth research and publications.