P2.5 USE OF SMART TOOLS IN GFESUITE TO FORECAST THE NORTH AND CENTRAL GEORGIA ICE STORM OF 28-30 JANUARY 2005

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1. INTRODUCTION

GFESuite continues to be the key component of the National Weather Service's Interactive Forecast Preparation System (IFPS). GFESuite allows forecasters to directly manipulate forecast elements on a grid. However, it also contains a framework for local offices to develop tools, called Smart Tools, that modify grids indirectly based on other elements in the forecast database or from models (LeFebvre, 2001). The use of Smart Tools has increased over the last few years, to the point where forecasters rarely modify grids directly.

Smart Tools developed at the Peachtree City, GA Weather Forecast Office (WFO) were successfully used to modify forecast grids in a highly efficient and consistent manner during the ice storm of 28-30 January, 2005.

2. SYNOPTIC/MESOSCALE ENVIRONMENT

The environment leading up to the ice storm was characterized by a moderately strong short-wave trough located near the lower Mississippi valley at 18UTC on 28 January 2005 (Figure 1).

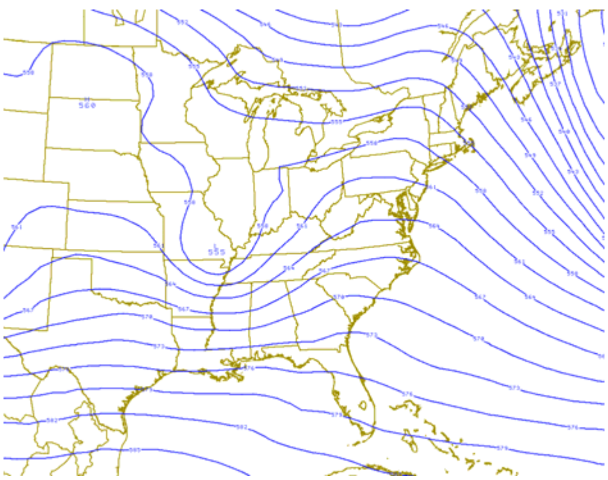

Figure 1. 500mb height at 1800 UTC 28 January 2005.

A cold and extremely dry air mass near the surface was also being forced south along the eastern slope of the southern Appalachian Mountains and westward into Georgia and western Alabama (Figures 2 and 3). This environment is consistent with classic cold air damming events east of the Appalachians (Bell and Bosart, 1988).

Strong upward vertical motion was diagnosed in advance of the short-wave trough. Rawinsonde data at 0000 UTC 29 January (Figure 4) showed that while conditions above the cold air wedge were quite warm and moist, wet-bulb temperatures in the wedge air mass averaged near 24 F (-4 C) (Figure 4) through a deep layer, thus setting up a favorable pattern for freezing precipitation.

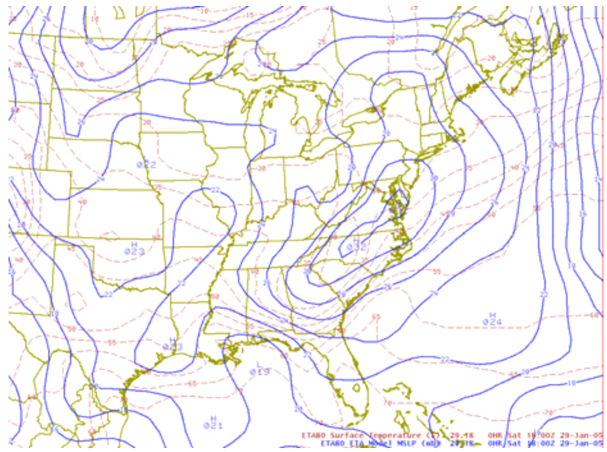

Figure 2. MSL pressure and surface temperature at 1800 UTC 28 January 2005.

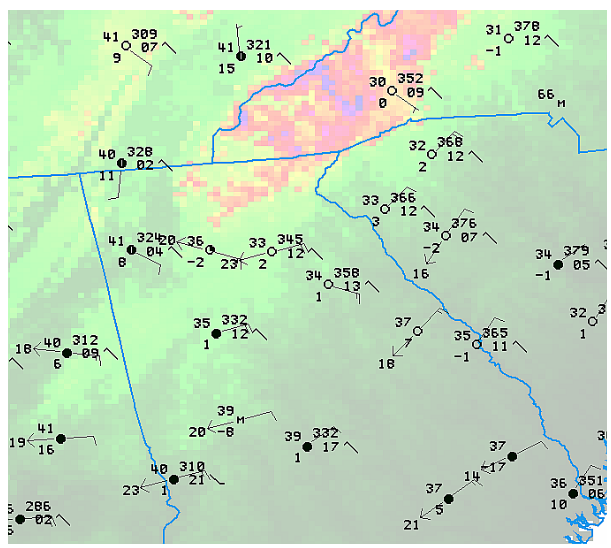

Figure 3. Surface plot at 1800 UTC 28 January 2005. Topography is also indicated in the background image.

Precipitation began saturating the cold dry wedge layer after 2100 UTC on 28 January and reached the surface just before 0300 UTC as freezing rain and sleet. Surface temperatures dropped as evaporational cooling occurred and reached saturation at around 27-29 F. The precipitation event occurred over a 24 hour period with moderate freezing rain the

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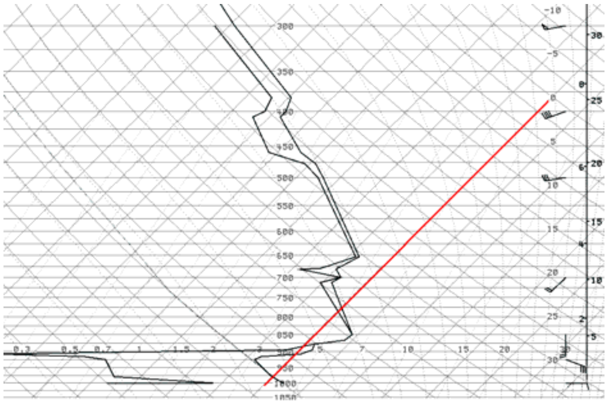

Figure 4. Skew-T diagram of rawinsonde data observed from KFFC, 0000 UTC 29 January 2005. The bold line indicates the 0 C isotherm.

predominate precipitation type. Periods of heavy sleet were also recorded. Quantitative Precipitation Estimate (QPE) data, derived mostly from radar, indicated precipitation during the 30 hour period ending 0600 UTC 30 January averaged 0.50 to 1.00 inches across north and central Georgia. Ice accumulations of 0.25 to 0.50 inches were reported during the event, likely mitigated by evaporation during the onset of precipitation.

3. DESCRIPTION AND USE OF SMART TOOL

One of the most challenging forecast grids to create and modify in GFESuite is the weather grid (Wx). This grid describes weather type, relative probabilities and intensity of each type, obstructions to visibility, and visibility for each hour through 7.5 days. Many smart tools have been created by NWS WFOs to create Wx grids. The tool used at the Peachtree City WFO is simply referred to as the WinterWx smart tool.

The WinterWx tool attempts to determine precipitation type, and the probability and intensity of each type based on the surface temperature and overall probability of precipitation (PoP) in the forecast database. When run, the user interface (Figure 5) allows forecasters to modify the temperature thresholds for liquid, mixed, freezing, and frozen precipitation regimes. Additional toggles also allow the forecaster to select a particular type and intensity of liquid, mixed, freezing and frozen precipitation.

At the onset of the event, a threshold temperature of 42F was used by the forecaster to determine rain vs mixed precipitation, 36F was used to determine mixed vs freezing precipitation, and 24F was used to determine freezing vs frozen precipitation. These values may seem quite atypical, but more accurately reflect the cloud-scale processes occurring in the synoptic and thermodynamic environment of the event. Rawinsonde data indicated a cold and very dry wedge layer that was nearly 3000 feet deep. Liquid precipitation falling into this layer would encounter significant cooling due to evaporation.

As the event progressed, the thresholds were modified to better match the cloud-scale processes and observed precipitation type. By 1200 UTC 29 January, a threshold of 38F was used to determine rain vs mixed precipitation, 33F was used to determine mixed vs freezing precipitation, and 24F was used to determine freezing vs frozen precipitation.

The primary advantage of this approach is better consistency of related forecast elements, such as temperature and precipitation type. Ease of interpretation of output, and flexibility are other advantages.

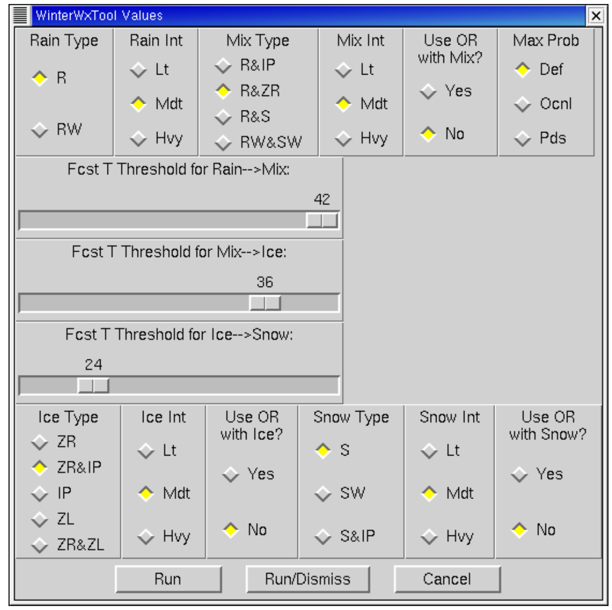

Figure 5. Forecaster interface to the WinterWx smart tool used at the Peachtree City WFO.

An obvious shortcoming of the tool is the lack of control of thresholds and processes above the surface that affect precipitation type. This type of control was intentionally not included due to the added complexity of creating or editing additional gridded fields in GFESuite. Also, if such fields were edited or obtained from model data, they would not necessarily remain in balance with other elements in the forecast database such as surface temperature. Operational models often have difficulty resolving the shallow wedge air masses.

4. SUMMARY

The WinterWx smart tool was used with success during the 28-30 January 2005 ice storm. It has also been helpful forecasting other atypical winter weather events. For instance, light to moderate snow showers often develop on the lee side of the southern Appalachians across northeast Georgia in cases of strong northwest flow aloft and low static stability in the surface to 2km layer. Surface temperatures are often well above freezing, yet snow showers are often reported at the surface in these cases.

Future plans for the tool may include adding thresholds of critical thickness value in the tool interface as opposed to surface temperature to assist precipitation type determination.

5. REFERENCES

Bell, G.D., and L.F. Bosart, 1988: Appalachian cold-air damming. *Mon. Wea. Rev.*, **116**, 137-161.

LeFebvre, T.J., M. Mathewson, T. Hansen, and M. Romberg, 2001: Injecting meteorology into the GFE Suite. Preprints, *17th Intl. Conf. on Interactive Information and Processing Systems for Meteorology, Oceanography and Hydrology*, Albuquerque, NM, Amer. Meteor. Soc., 38-41.