6.5 A Sub-Gridscale Precipitation Classification System

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Abstract

Recent advances in receiving and distributing high resolution NEXRAD and commercial weather radar data at 1-km resolution nationally have enabled fine-scale estimates of precipitation to be produced for commercial customers. However the ability to classify the form of the precipitation at the earth's surface has not been available at the same resolution since these classifications rely upon detailed knowledge of the temperature structure of the atmosphere (typically obtained from much coarser grid meteorological models). This knowledge is simply not available at the time and spatial resolution necessary. Moreover, the aggregation processes used to construct the land surface representation for meteorological models themselves introduce systematic errors in the forecast of precipitation phase.

The form of the precipitation is critical in many situations. In particular, the accumulated amounts, location, and extent of freezing rain are vital information for decisions in the transportation and power industries. This paper describes a system for combining high-resolution radar data with information from the MM5 meteorological model. A parameterization of sub-gridscale hydrometeorological processes is applied to the MM5 data to yield classification of precipitation form at a resolution comparable to the radar data.

Results

Terrain height, vegetation, and land use type are factors that vary at scales finer than the grid scale of the meteorology model, but which affect local near-surface values of atmospheric state variables such as temperature and humidity: We have developed an algorithm that takes MM5 state variables, corrects them for sub-grid scale effects, and then determines the predicted phase for precipitation. The resulting maps are then used for a variety of purposes, including radar-image precipitation phase analysis. In the current Baron meteorology system, these maps are produced at five-minute temporal resolution and 1 km spatial resolution by a co-processor program coupled to the MM5 meteorological model. They are used by the radar precipitation-analysis system to determine the phase (frozen, mixed, or liquid) of the precipitation observed by the Baron weather radars. Clearly, they have potential application beyond this, particularly in the transportation and emergency management arenas.

In the **Figures**, we show samples of these maps for Nov. 3, 2003. The first map displays the Sacramento CA area, overlaid with the road network for that region. The second is n enlargement showing the Cameron Park suburb. The area for which precipitation phase would be liquid is shown in green; the mixed-phase area in pink, and the ice-phase area in light blue. The scale of the precipitation mask grid is 1 kilometer; showing much detail at scales finer than the 45 kilometer grid scale of the original meteorology model data used to drive the sub-grid effects co-processor.

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References

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Figure 1: Precipitation-Phase Forecast Grid for Sacramento Area

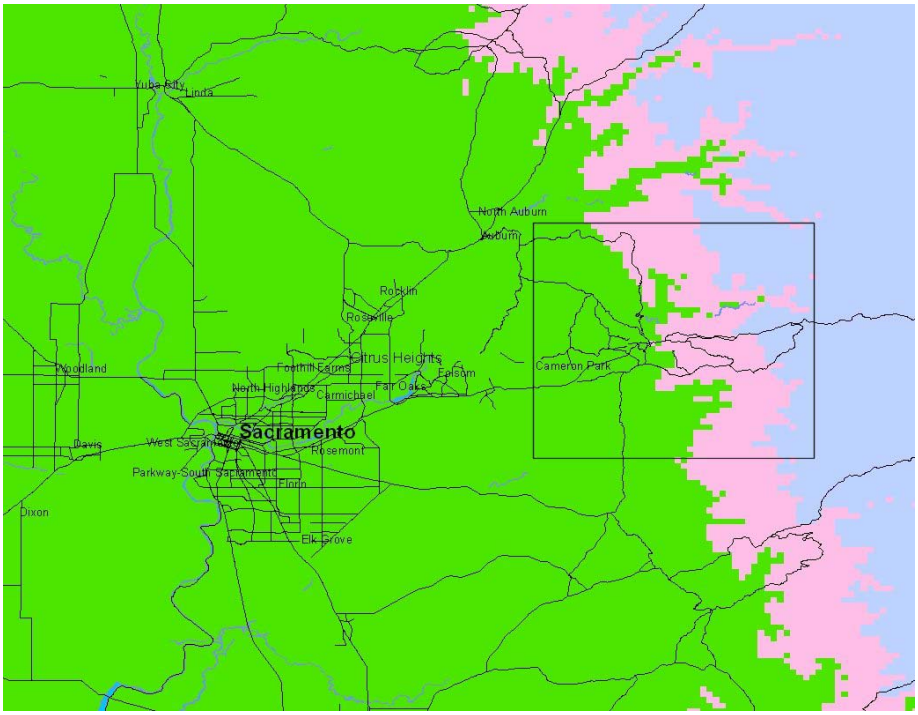

Figure 2: Precipitation-Phase Forecast Grid Detail, Cameron Park Area