Development of a Near-Real-Time GOES-Based Satellite Verification and Forecaster Guidance System for the HRRR Model

Jason A. Otkin¹, Justin Sieglaff¹, Sarah Griffin¹, Lee Cronce¹, and Curtis Alexander²

¹Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin-Madison
²Global System Division, Earth Systems Research Laboratory

Motivation
We are developing a near real-time GOES satellite-based verification system for the High Resolution Rapid Refresh (HRRR) model that will provide forecasters objective tools to quickly determine the accuracy of the many overlapping HRRR model forecasts. This system has the potential to greatly increase the efficiency and effectiveness of forecaster evaluations of the HRRR model output by allowing forecasters to quickly identify which forecast cycle is most accurate at the current time (which may not be the most recent forecast cycle due to initialization errors or the sensitivity of the model to small perturbations in the initial state) and then use the remaining portion of that forecast cycle to prepare or update their short-range forecasts.

Methodology
Simulated GOES infrared brightness temperatures for the 6.7 µm water vapor and 11 µm window bands are generated at the Earth Systems Research Laboratory (ESRL) for each HRRR model forecast cycle using the Community Radiative Transfer Model (CRTM) implemented in the Unified Post Processor (UPP). The cloud effective particle diameters used by the CRTM are computed for each hydrometeor species using assumptions made by the Thompson microphysics scheme and realistically vary in both space and time.

Statistical Analysis
Grid point statistics, including root mean square error, bias, and mean absolute error, are computed each hour for each GOES band to assess the accuracy of the simulated cloud and water vapor fields. The simulated satellite observations are remapped to the GOES satellite projection prior to computing the statistics. These statistics are computed for the entire model domain and also for smaller sectors mimicking the Storm Prediction Center’s mesoscale analysis page in order to allow forecasters to zoom into specific regions of interest (see image to the right).

Project Webpage
Simulated and observed satellite imagery and the verification statistics from the near real-time system can be seen on our project webpage (http://cimss.ssec.wisc.edu/hrrrval/).

Future Work
During the next year, we plan to enhance the HRRR verification system by including neighborhood verification statistics more suitable for evaluating the accuracy of high-resolution numerical models. We also plan to develop new verification metrics that combine information from multiple statistical measures into a total accuracy value. In addition, we will use long-term statistics and additional analysis methods to evaluate the accuracy of the HRRR model forecasts for different regions, seasons, and flow regimes, and also as a function of forecast cycle and forecast hour.

This work is supported by the National Oceanic and Atmospheric Administration GOES-R Program Office under grant NA10NES4400013. Contact information: jason.otkin@ssec.wisc.edu.