Verification of Precipitation Forecasts Associated with Mid-Latitude Cyclones across the Eastern United States

Abstract

The accuracy of weather forecasts is crucial in preparing the community for potentially dangerous weather. Geographic Information Systems (GIS) are used to display information spatially in order to assist in decision making processes. Forecast Meteorologists use much data and information in making decisions to provide the most accurate forecast possible. One important piece of information used in the forecast process is how well Numerical Weather Prediction (NWP) models are performing, or verifying. Currently, NWP model verification information is not displayed spatially, with only descriptive statistical scores being computed operationally. Displaying this verification information spatially will provide more useful information to help in the forecast process decisions, thereby increasing the likelihood of more accurate forecasts. This research used GIS to verify a sample of 32 Global Forecast System (GFS) NWP model 24 hour precipitation forecasts associated with mid-latitude cyclones over the Eastern US. The research methodology produced spatial verification maps which show model errors spatially related to the mid-latitude cyclones alongside quantitative verification scores for each day and overall. A hypothesis test was performed to determine if the GFS total precipitation over the study area is statistically different from the observation during mid-latitude cyclones. The hypothesis test results infer with 95% confidence that the GFS total precipitation means are statistically different from the observation total precipitation means. Based on the study of 32 sample days for the 2013 winter and spring season, the spatial verification maps as
well as the quantitative scores reveal that the GFS model has a tendency to over forecast precipitation coverage associated with mid-latitude cyclones over the Eastern US. Finally, GIS models were built to investigate the possibility of having a near real-time automated process to provide spatial verification maps which could potentially be used in forecast operations.