Experimental LAMP Convection Guidance Forecasts: Performance of Probabilities and a New Categorical Product

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A Localized Aviation MOS Program (LAMP) model developed by the National Weather Service's Meteorological Development Laboratory has been producing experimental, gridded 2-h probability and categorical guidance forecasts of "convection" for 20-km grid boxes in the 3- to 25-h time range over the conterminous U. S. since April 2011. This guidance was developed for aviation traffic management and various other applications. A previous article discussed development of the convection probabilities and provided a limited assessment of performance of the probabilities. This article extends the latter and describes a new categorical forecast product derived from the probabilities.

"Convection" is defined as the occurrence of either ≥ 40 dBZ radar reflectivity or ≥ 1 cloud-to-ground (CTG) lightning strikes (or both) in a 2-h period for a 20-km grid box. In two "sister" LAMP lightning probability models, one presently operational and the other a recently upgraded version (a concurrent article appears in the Sixth Conference on Meteorological Applications of Lightning Data), the predictand is identical to the convection predictand except an occurrence involves only ≥ 1 CTG lightning strikes. The forecast performance of the convection and lightning probabilities is assessed by comparing the Brier skill score (bss) for the respective probabilities, which approximates relative performance since each probability is verified against the corresponding predicted event. Results show the convection bss's are clearly higher (better) than the lightning bss's. Also, the convection probabilities have better sharpness, especially for forecast projections beyond about six hours.

A new categorical convection forecast product consists of three convection threat ("potential") levels, which are specified from the probabilities by applying objectively-predetermined probability exceedance thresholds. That is, "low," "medium," and "high" convection potential (along with the "no" default) is specified, each with an associated probability exceedance threshold. This categorization of the convection probabilities extends the conventional yes/no dichotomization based on one threshold used in the operational LAMP lightning model. The thresholding-categorization procedure maximizes the Critical Success Index (CSI) for low, medium, and high potential combined (a yes/no convection re-categorization) subject to a bias constrained to be near 2.7 (for every 27 predicted events just 10 are observed, i.e., a low threshold probability results in a strong overforecast). Similarly, for medium and high potential combined, the prescribed bias is about 1.1 (about the same as for the operational LAMP yes/no lightning forecasts), and for high potential the bias is about 0.4 (a high threshold probability results in a strong underforecast). Thus, the bias for each potential level is fixed ("standardized"),

whereas the threshold probabilities (along with the probability ranges) vary with forecast projection, geographical location, season, or time of day.

Objective scoring shows the CSI for yes/no forecasts of medium and high convection potential combined is substantially higher (better) than the CSI for LAMP operational yes/no lightning forecasts. This result together with enhanced forecast information provided by the multiple potential levels implies the new categorical product should have better guidance value than a conventional two-category product.