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An Evaluation of Predictions of Convective Environments using the Climate Forecast System Version 2 - Methods and Results

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The prospect for skillful long-term predictions of atmospheric conditions known to directly contribute to the onset and maintenance of severe convective storms remains unclear. Increasing levels of interest in extended-range predictions of severe weather continue to motivate our ongoing assessment of the NCEP Climate Forecast System Version 2 (CFSv2) forecasts for periods coinciding with climatological peaks in tornadoes, large hail and severe winds. Our assessment of the CFSv2 has a strict focus on real-time model runs in lieu of reforecasts or reanalyses, and is verified against objectively analyzed upper-air sounding data from locations across the contiguous United States. Furthermore, a 20-year climatology from the objectively analyzed upper-air data has been generated upon which predictions can be made and scrutinized with regard to the long-term mean.

Our particular focus is on the prediction of convective environments, which we represent in the form of environmental parameters. Because environmental convective available potential energy (CAPE) and deep layer vertical wind shear can be used to distinguish an atmosphere conducive to intense rotating convection from one supportive of primarily non-severe ‘ordinary’ convection, we have limited our assessment to these two parameters. Each parameter is addressed individually to avoid the potential of one robust parameter masking the weakness of another.

Utilizing a series of methodologies designed to analyze the CFSv2 output from different perspectives, results from Spring (AMJ) and Fall (SON) 2014 indicate potential value in CFSv2 forecasts over periods as long as multiple weeks. Trends in root-mean-squared difference (RMSD) and Spearman rank correlation coefficient demonstrate skill out to an approximate 3-week lead time both in terms of magnitude and geospatial distribution, dependent on time of year. Larger RMSD errors tend to be more closely correlated with parameter magnitude and/or number of days exceeding a predetermined parameter threshold (e.g. 2000 J kg-1 of surface based CAPE or 20 m s-1 of surface–500 hPa shear) than widespread errors in geographical coverage. Conceivable methods for probabilistic outcomes will be presented both in terms of seasonal and monthly time frames from the results of the research with the goal of iterating towards an operationally useful product.