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Abstract: Superensemble Statistical Forecasting of Monthly Precipitation over the Contiguous United States, with Improvements from Ocean-Area Precipitation Predictors

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Extended precipitation forecasts, with leads of weeks to seasons, are valuable for planning water use and are produced by the U.S. National Weather Service. Forecast skill tends to be low and any skill improvement could be valuable. Here, methods are discussed for improving statistical precipitation forecasting over the contiguous United States. Monthly precipitation is forecast using predictors from the previous month. Testing shows that improvements are obtained from both improved statistical methods and from the use of satellite-based ocean-area precipitation predictors. The statistical superensemble method gives higher skill compared to traditional statistical forecasting. Ensemble statistical forecasting combines individual forecasts. The proposed superensemble is a weighted mean of many forecasts or of forecasts from different prediction systems and uses the forecast reliability estimate to define weights. The method is tested with different predictors to show its skill and how skill can be improved using additional predictors. Cross validation is used to evaluate the skill. Although predictions are strongly influenced by ENSO, in the superensemble other regions contribute more to the forecast skill. The superensemble optimally combines forecasts based on different predictor regions and predictor types. The contribution from multiple predictor regions

improves skill and reduces the ENSO spring barrier. Adding satellite-based ocean-area precipitation predictors noticeably increases forecast skill. The resulting skill is comparable to that from dynamic-model forecasts, but the regions with best forecast skill may be different. This paper shows that the statistical superensemble forecasts may be complementary to dynamic forecasts and that combining them may further increase forecast skill.