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Ensemble precipitation calibration and extreme event prediction

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While ensembles of dynamical weather and climate models simulate a range of possible future states, extreme events, which inherently have a low probability of occurrence, are often poorly captured by the ensemble envelope. The predictability of extreme precipitation events by ensemble, dynamical, climate model simulations is examined in this study. The probability density function (PDF) of daily precipitation (stratified by season) is assessed over recent decades using the Climate Forecast System Reanalysis (CFSR) and the CPC Unified Precipitation gridded analysis on a common grid with model forecasts. A kernel smoothing methodology that corrects the sampling error of the PDF is utilized. PDFs are then created for each, daily, lead time of 45-day ensemble model forecasts from the Climate Forecast System version 2 model (CFSv2) reforecast data from 1999-2010, corresponding to the gridded observational analysis and CFSv2 reanalysis PDFs. Because model forecast precipitation amounts can have very different bias characteristics for larger and smaller quantities, an adaptive piecewise, bias correction method that determines model bias from near-miss forecasts, is compared with a standard PDF percentile-matching bias correction method. The adaptive correction method calculates bias for quantitatively near forecasts and observations, influencing the bias determination of marginally near precipitation forecast quantities, such that an estimate of bias for quantities that are neither observed or forecast in the data record can be made. The goal of this work is to improve determination of bias in extreme value forecasts. Once bias corrections of the probability density functions of CFSv2 ensemble model forecasts are determined, the predictability of extreme events will be assessed. Future plans include analysis of trends in extreme precipitation using the longer, 30-year reforecast period.