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Using the GFS Ensemble Mean to Generate Medium-range Precipitation Ensemble Forecasts for Hydrologic Ensemble Prediction

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We present an ensemble preprocessor (EPP) that extracts information from single-valued, as well as ensemble, precipitation and temperature forecasts produced by a number of weather and climate forecast systems. The extracted forecast information is then turned into forcing ensembles to drive hydrological models to generate streamflow ensembles. In this presentation, we describe the methodology employed in the EPP and demonstrate its performance in generating forcing precipitation ensembles with the use of the source ensembles from the 1998 frozen version of the Global Forecast System (GFS), a medium range system developed by the National Centers for Environmental Prediction of U. S. National Weather Service. It is widely recognized that the raw ensemble forecasts produced by numerical weather prediction models tend to be biased in the mean and spread, both unconditionally, and conditionally based on precipitation amount, season, storm type, and other factors. However, the predictive skill of the raw ensemble forecasts can often be captured by the ensemble mean. In the EPP, the historical relationship of the observed and the GFS ensemble mean is conditioned by the values of the GFS ensemble mean at various lead times to derive medium-range ensemble forecasts. The EPP is calibrated using the historical observed basin mean areal precipitation (also used in calibrating the hydrologic models) and the corresponding GFS ensemble reforecasts, which are available for over 20 years. We have conducted dependent validation for selected test river basins in the U.S. states of California, Oklahoma, and Washington using several ensemble verification metrics, namely: Reliability Diagram, Continuous Ranked Probability Skill Score, and Relative Operating Characteristic Score. The verification results show that the precipitation ensembles generated by the EPP are overall reliable when evaluated at the 24-hour time scale and possess predictive skill up to about a week.