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A combined approach for generating skillful forecasts of weather variable forcings for global streamflow forecasts

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Novel approaches to pre-process (calibrate) 2-m temperature and precipitation forecasts for hydrologic applications are explored using both ECMWF medium-range ensemble weather forecasts and the ensemble reforecast data set published by the NOAA Earth Systems Laboratory (Climate Analysis Branch). As in several previous studies, verification indicates that post-processing (calibrating) the ensemble may be necessary to provide meaningful probabilistic inputs for hydrologic applications, here focusing on forecasting streamflow of large international river basins. We apply a novel statistical correction approach by combining a selection of approaches used in the literature [e.g. logistic regression, and quantile regression] under the general framework of quantile regression to improve forecasts at specific probability intervals. Second, we also introduce climatological quantile probabilities in the model selection and calibration so that our approach ensures that the forecast probability distribution function represented by the ensembles has skill no worse than either a forecast of persistence or climatology. Third, we introduce a post-processing methodology for performing model selection that generates ensemble forecasts with an informative ensemble skill and spread relationship. To do this we conditionally select different historic scenarios for model development with similar atmospheric stability as the current state of interest. Finally, we examine the issue of spatial and temporal scale decomposition on calibration performance of the weather forcing skill and resultant streamflow forecasts. Results for a few selected river basins with different climatic regimes will be assessed using traditional (probabilistic) verification measures as well as a new measure we introduce that examines the utility of the ensemble spread as an estimator of forecast uncertainty.