Application of Subseasonal-to-Seasonal (S2S) precipitation forecasts for hydrologic Ensemble Streamflow Prediction (ESP) with Bias Correction and Spatial Disaggregation (BCSD)

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Abstract (245 words)

Dynamical Subseasonal-to-Seasonal (S2S) precipitation forecasts could assist water resource planning, hydropower generation, and proactive flood mitigation through hydrologic Ensemble Streamflow Predictions (ESP). However, compromised performance of raw S2S precipitation forecasts are commonly reported, especially in the central south region of the United States. This raises the question of whether available S2S precipitation could lead to better streamflow forecasting in the region, compared to the conventional ESP driven by the randomly resampled precipitation. In this study, we carry out a series of ESP-based streamflow hindcast experiments at four watersheds in the region to validate the hydrologic performance of the S2S precipitation from North America Multi-Model Ensemble Phase II (NMME-2). The raw S2S precipitation from NMME-2 is adapted through Bias Correction and Spatial Disaggregation (BCSD) before passing to the Sacramental Soil Moisture Accounting model-based ESP for streamflow hindcast experiments. The performance of the S2S precipitation-driven ESP are benchmarked with the conventional ESP driven by the randomly resampled precipitation. Evaluation statistics of Kling-Gupta Efficiency (KGE), probability of detections (POD), and false alarm ratios (FAR) are employed for a comprehensive evaluation of the resulting streamflow hindcasts. Our result shows that the S2S precipitation from NMME-2 leads to better streamflow predictions with higher KGE values. Evaluation of daily extreme streamflow values within different quantile segments (i.e., 75%-90%, 90-95%, 95%-99%, and above 99%) also suggests the advantages of the S2S precipitation. Overall, the S2S precipitation from NMME-2 has shown promising performances, highlighting its potential broader applications for river and flood forecasting.