SEASONAL RAINFALL PREDICTION FOR THE SOUTHEAST U.S. USING SEA SURFACE TEMPERATURE INFORMATION

Chia-Jeng Chen and Aris Georgakakos

AUTHORS: Georgia Institute of Technology, Atlanta, GA.
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Abstract. This article presents a novel method able to identify and use the most relevant sea surface temperature (SST) information for seasonal rainfall prediction in the Southeast United States (SE US). The method searches for oceanic dipole areas with strong teleconnection relationships with rainfall, and generates seasonal forecasts based on a Bayesian forecasting scheme. The dipoles comprise oceanic areas of various sizes and geographic location, with the difference of the average SST over the poles being the predictor information. Dipole generation is based on teleconnection strength evaluation by the Gerrity Skill Score (GSS).

In this application, seasonal rainfall series in the SE US is adopted as the predictand variable. Results show that the strongest predictability exists in winter (December – February). Even at lead times of 3 – 6 months, ensemble forecasts explain more than 50% of the observed rainfall variation. Zonal dipoles in North Atlantic near the Tropic of Cancer, dipoles between North Pacific and Northeast Atlantic, and ENSO-like dipoles are the most statistically significant patterns influencing winter SE US rainfall. Temporal and spatial persistence of SST are identified as oceanic patterns driving corresponding atmospheric circulation modes and affecting rainfall. Skill in other seasons are moderate compared to winter, however useful predictabilities appear in different lead times. On-going work focuses on assessing the value of the forecasts for agriculture and water resources management.

Three rainfall stations at Buford dam, West Point Dam, and Montezuma as shown in **Figure 1** are used for generating seasonal rainfall series. The monthly average rainfall climatology is also shown indicating that winter rainfall is significant for the ACF water resources. **Figure 2** presents ensemble forecast results of winter rainfall with 6 months lead time compared with observations. In the model calibration period, from 1951 to 2000, more than 80% of observations fall in the reliability band. The remaining 9 years, from 2001 to 2009, are used to test the skill of model forecasts. The figure shows that 8 of the 9 seasons fall within the forecast band, indicating considerable skill. Overall the root mean square error (RMSE) and the correlation coefficient (CORREL), derived between the observation series and the average forecasting trace, are 0.021 (m) and 0.730 respectively. These values indicate that the model compares favorably with other existing methods.

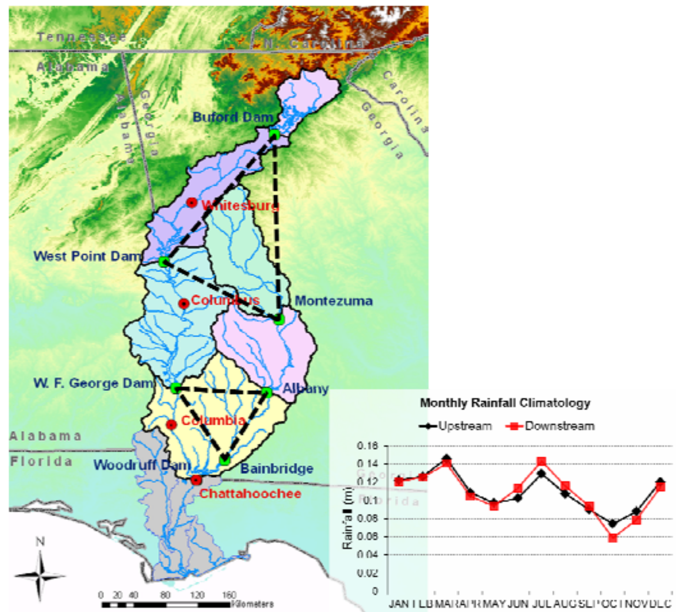

Figure 1: The ACF basin in the SE US showing rainfall stations used (upper Chattahoochee) and monthly rainfall climatology.

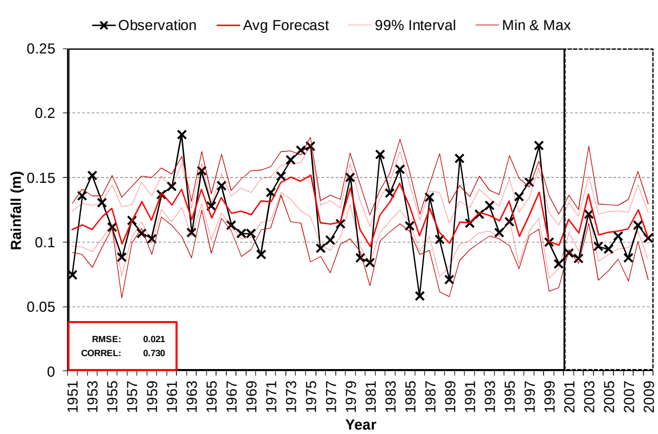

Figure 2: Inter-comparison between observed winter rainfall time series and ensemble forecastings. Data prior to 2000 are used for model calibration. Data after

2000 are used to test model skill. The results compare favorably with existing methods.