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**FORECASTING FRAMEWORK FOR THE NORTH AMERICAN MONSOON AND APPLICATION TO WATER  
MANAGEMENT IN THE PECOS RIVER BASIN**

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**ABSTRACT:** The North American Monsoon (NAM) is the large-scale atmospheric circulation system responsible for up to 55% of the annual precipitation in the southwestern U.S. These summer thunderstorms, however, are highly variable and predicting the variability in the strength, location and timing of the monsoonal precipitation and streamflow is important for efficient water resources management. In this study we examined the interannual variability of precipitation and streamflow in the NAM region of the southwest U.S. The large-scale and local climate features that drive the variability were diagnosed using robust Spearman rank correlation analysis and Kendall Theil slope estimators. These analyses revealed that antecedent Pacific sea surface temperatures (SSTs) modulate the winter/spring hydroclimate and land conditions of the NAM region, thus playing an important role in setting up the land-ocean temperature gradient (the key driver of the NAM), and consequently in modulating monsoonal rainfall and precipitation. This offers potential for long-lead forecasts of summer hydrologic conditions in the NAM region. Based on this, a framework for generating ensemble forecasts of spring and summer stream flow was developed using the large-scale climate information obtained from the diagnostics. The forecast technique was applied to the Pecos River Basin to explore improving water management. The Pecos River receives a significant portion of its annual streamflow in the summertime from monsoon thunderstorms; however, operations on the river do not utilize forecasts of this important moisture source. Based on forecast ensembles generated in the framework using large-scale climate information, streamflow exceedance probabilities are calculated and used by an operations decision model to evaluate various water management options such as reservoir releases, irrigation diversions and spill. New operating policies that utilize the forecasts were applied using the RiverWare operations model of the Pecos River system developed by the Bureau of Reclamation. The results demonstrate that improved management in terms of less water spilled and more water delivered for irrigation could be achieved by using these forecasts.

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