# Forecasting Seasonal Hydrologic Response in Major River Basins under Climate Variations

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Global climate change has already had observable effects on the environment. Changes include sea level rise, decrease of sea ice, intense heat waves, more frequent temperature extremes, enhanced seasonal precipitation and runoff, reduced dry season precipitation etc. However, under these changing climate circumstances, science projects that these phenomenon will likely increase in frequency and extreme magnitude including events like floods, droughts, cyclone and diurnal temperature variations. Research studies are needed to assess and quantify the historical occurrence context of these extreme events and develop innovative forecasting techniques to reduce adverse impacts on society. Previous studies have focused on developing basin scale hydrologic forecasts models based on climate anomalies such as El Nino, La Nina episodes which significantly influence global climate and as well as annual and seasonal rainfall and stream flow. Specifically, the impact of climate change on streamflow could be significantly modified by anomalies in temperature and rainfall quantity and geographic distribution. This work intends to identify and quantify changes in continental scale runoff and connect with correlations between flows of major rivers globally. The goal is for this information to be used in developing a technique combining flow conditions of major rivers with environmental forcing variables like El Nino, La Nina, sunspot cycle, and others with a view to improve flow forecasting skill. The scale of interest is extreme events such as droughts and floods on a seasonal to annual basis. Additionally, this research will characterize hydrologic flow variation from large scale watersheds and quantify the relation of external environmental processes influencing flow on a seasonal to annual time scales. Preliminary work illustrates the relation among annual, monthly and seasonal flow records of 4 major rivers: Parana, Danube, Rhine and Missouri. The river flows are studied in a seasonal context with the external environmental forcings such as sun spot numbers (SSN) and Southern Oscillation Index (SOI). Initially, the characteristics of each river flow records were identified and analyzed to illustrate the ability of stochastic models to reproduce simulated and forecast historical flow rates. Then relations between continental flows and external climate variables responsible for the changes in flows incorporated. The current work focuses on extreme events and evaluation of response under probabilistic variations in each component of environmental forcing to understand and quantify expected responses to stream flow under climate change scenarios.

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