Modeling Large Scale Climate Indicators Using Wavelet-based Time Series Method

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Abstract. Large scale climate forcings such as El Nino Southern Oscillation (ENSO), Pacific Decadal Oscillation (PDO) and Atlantic Multidecadal Oscillation (AMO) are known to modulate regional hydrology, especially in the Colorado River Basin. Thus, understanding and modeling the temporal variability of these forcings is important for robust modeling of the hydrology and consequently for water resources planning purposes. Thus, in this study sea surface temperature based indices of these climate forcings are modeled using a wavelet-based time series method, Wavelet Auto Regressive Model (WARM). In this, for a given time series, dominant periodicities are identified and the corresponding time components computed; these orthogonal components along with the residual (i.e. noise), when added, results in the original time series. These components are modeled using auto regressive time series analysis, since they are quite periodic. The auto regressive models are used to simulate the individual components which are added to obtain simulation of the original series. The WARM approach will be employed to the climate indicators spanning 1900 – present and will be simulated. A suite of statistics, such as wet/dry spells, decadal mean and variance, along with distributional properties, will be computed to evaluate the ability to reproduce temporal variability. These will be compared with the variability observed in the paleo data to provide a longer term context. The ability to generate robust multidecadal climate variability can be subsequently used to conditionally generate realistic scenarios of basin-wide streamflow, crucial for effective water resources planning.

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