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Stochastic Downscaling of Daily Rainfall: Analysis of future hydroclimatic changes and their impact on the Pontinia plain using Nonhomogeneous Hidden Markov Model and Dynamic Hierarchical Bayesian Network Model.

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The Nonhomogeneous Hidden Markov Model is an established technique that usually provides excellent results for the downscaling of multi-site precipitation. However, the selection of the number of states is subjective and results in a model that can be over parameterized and overfit leading to por performance in applications. A dynamic hierarchical Bayesian network model (DHBN) that is continuous and is not based on discretization into states is tested here and compared against NHMM for the downscaling of daily precipitation for Pontinia Plain. This región is a relevant example of coastal area particularly vulnerable to hydrological changes. The winter (October-March) wet season is considered. Weather states and atmospheric variables from CMIP5 GCM are used as exogenous predictors. The daily rainfall occurrence and amount at 32 stations over the region for the winters of 1916-2004 is used as the primary data. Rainfall variability is described in terms of occurrence of 'weather state' as classified by a Hidden Markov Model, and associated to variables representing the main characteristics of large scale atmospheric circulation as obtained by reanalysis data. A nonhomogeneous hidden Markov model (NHHM) and a DHBN model are used to make future projections of the downscaled precipitation as by using the GCM's simulations under different global warming scenarios.The spatial interaction between the sites is modeled through the underlying covariance function and the uncertainty in the model parameters is explicitly represented in their posterior distribution. Preliminary results show that the seasonal statistics are adequately captures for the 20th century runs. The structural differences between the two models are discussed.