Stochastic Generation of Spatial Temporal Weather Variable fields Using Circulation Indices

A. Mezghani(1), Hingray B. (1), and Musy A. (1)

(1) Laboratory of Hydrology and Land Improvement, Swiss Federal Institute of Technology, Lausanne (abdelkader.mezghani@epfl.ch)

An original methodology for a multi-site stochastic generation of hourly weather variables (precipitation and temperature) is presented. This methodology combines two kinds of models that have been widely used for hydrological applications: Generalized Linear Models (GLM's) and Analogue Models (AM's). The GLM, developed for this study, generates regional weather variables at a daily time step. It uses atmospheric circulation indices derived from the National Centre of Environmental Prediction (NCEP) reanalysis data set. The AM uses next the output of the GLM to produce the spatial (multi-site) and temporal (hourly) pattern of these weather variables for the studied region. It extracts from the historical record of the observed weather variables a similar regional situation to that obtained from the first model. It finally applies its temporal and spatial structure for the day of interest.

This methodology is applied for the generation of hourly 40 year time series at 48 meteorological stations in the Wallis canton located in the Swiss Alps. It reproduces synthetic series that largely preserve classical statistics (mean, variance,...), seasonality and N-days extreme rainfall events. This method also preserves the cross correlation between weather variables and the spatial correlation between weather stations.