PCA and ICA for stochastic simulation of streamflow

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Abstract

Stochastic simulation of multivariate hydrologic variables has a key role in evaluating alternative designs and operation rules of hydrologic facilities. The recently developed decomposition analysis, Independent Component Analysis (ICA), allows us to apply the simple univariate time series model to each extracted component by: (1) decomposing multivariate time series into independent components with ICA; (2) modelling and generating each component independently; and (3) mixing the generated components to come back to observational domain. However, we illustrate in the current study that fitting a univariate time series model to each extracted component might end up with the underestimation of the serial dependence that the observation data might contain. A alternative for parameter estimation is suggested to preserve the serial dependence of the observation variable using the relationship between the observation variable and the decomposed variable. The case study of the Upper Colorado River basin shows that some improvement is made through the suggested alternative.

Key words: colorado river, independent component analysis, multivariate stochastic simulation, serial dependence, streamflow

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