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A semiparametric multisite streamflow generator

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The intent of this study is to develop a framework that can capture short-term characteristics of daily hydrograph as well as the correlation of streamflow in temporal and spatial domains, which is physically consistent with the hydrologic processes. A semiparametric two-step lag-1 K-nearest neighbor (KNN) streamflow generator for multiple stations is presented, with a motivation to generate sequences that extend beyond the variability represented in the historical record of streamflow time series. The novelty of the proposed method comes from altering the traditional KNN resampling approach by considering two steps: (i) a parametric step to simulate rich variety of streamflow sequences consistent with the hydrologic processes and (ii) a nonparametric step to model correlation characteristics of streamflow with a lag-1 dependence structure in the resampling scheme. In the parametric step, a two-state first-order Markov chain is applied to generate the states of streamflow. Two-parameter gamma distribution is used for modelling the ascension limb of the hydrograph, and the recession limb is considered to decay exponentially. The streamflow generated with parametric step is input to a lag-1 KNN resampling scheme in the second step. The applicability of the proposed framework is tested with two sets of station data in climatologically diverse regions: Great Lakes basin of the United States and Godavari Basin of southern India. The simulations show the capability of the proposed method to obtain a combination of wet and dry sequences, which generates variability in the streamflow. Further, the generated streamflow sequences are consistent with the observed series in terms of temporal and spatial correlations.