
Estimation of XM Model Parameters' in Ungauged Catchments Based on Support Vector Regression and Catchment Attributes

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Abstract:

The problem of parameters estimation is the most significant obstacle to the effective implementation of conceptual models in ungauged catchments. Regionalization seeks to determine such parameters by transferring hydrologic information from gauged to ungauged basins. However, previous regionalization studies were generally constrained by limited datasets, in terms of the number of catchments or their characteristics. This hinders generalizable insights into parameter-attribute relationships. This study introduces a regionalization approach to estimate XM parameters across the contiguous USA using Support Vector Regression (SVR), while also examining the meaning of these parameters through their associations with catchment attributes. Results show that soil moisture parameter is strongly associated with climatic and hydrological attributes, while the scaling parameter is associated with groundwater flow component related attributes such as the baseflow index and the runoff ratio. Performance analysis revealed that regionalization-based XM exhibited moderate performance, achieving an average NSE of 0.57 in cross-validation, close to the calibrated XM (0.62), and superior to multiple linear regression-based regionalization (0.52). Overall, SVR-based regionalization proved effective, with XM emerging as robust model.

Keywords:

Regionalization, XM, Support Vector Regression, Parameters Estimation, Catchment Attributes, CAMELS-US Dataset.