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Reducing model structural uncertainty in predictions for ungauged basins via Bayesian approach.

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A catchment is a complex system where a multitude of interrelated energy, water and vegetation processes occur at different temporal and spatial scales. A rainfall-runoff model is a simplified representation of the system, and serves as a hypothesis about an inner catchment working. In predictions for ungauged basins, a common practice is to use a pre-selected assumed-to-be-perfect model structure to represent all catchments under analysis. However, it is unlikely that the same model structure is appropriate for diverse catchments due to the 'uniqueness of the place'. At the same time, there is no obvious justification to select a single model structure as a suitable description of the system.

The contribution of this research is a move forward in the 'one size fits all' problem for predicting flows in ungauged basins. We present a statistical methodology, which allows regionalization that considers the information given by different hydrological model structures. First, the information to be regionalised is compactly represented via Principal Component Analysis. Second, the most significant principal components are regionalised using non-linear regionalisation method based on Random Forests. Third, a regionalisation error structure is derived based on the gauged catchments to be used in the Bayesian condition of the rainfall-runoff structures and their parameters. The methodological developments are demonstrated for predicting flows in ungauged basins of Northern Spain; and the results show that the methodology allows improving the flow prediction.