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Self Organising Maps and Canonical Correlation Analysis: application to catchment classification and PUB

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The scientific community indicates that the formulation of objective criteria for catchment classification is one of the main objectives for obtaining a better interpretation and representation of the spatiotemporal variability of streamflows. A promising approach to catchment classification, and in general to pattern recognition, makes use of unsupervised neural networks, and in particular Self Organising Maps (SOM), which organise input data through non-linear techniques depending on the intrinsic similarity of the data themselves (see e.g., Toth, HESS, 2009). This study considers a set of some 300 Italian catchments scattered nationwide, for which several descriptors of the streamflow regime and geomorphoclimatic characteristics are available. We qualitatively and quantitatively compared a reference classification, RC, with three alternative classifications, ACs. RC was identified by using indices of the streamflow regime as input to SOM, whereas ACs were identified on the basis of catchment descriptors available for ungauged basins. The first AC adopts the available catchment geomorphoclimatic descriptors as input to SOM. The other ACs were identified by applying SOM to sets of derived variables, which were obtained by applying Principal Component Analysis (PCA, second AC) and Canonical Correlation Analysis (CCA, third AC) to the available indices. First, the similarity between each AC and RC is assessed qualitatively, analysing how the study catchments were grouped together. Second, ACs are compared with RC in terms of accuracy of streamflow prediction. In particular, we performed an extensive cross-validation procedure to quantify nationwide the accuracy of estimates of the mean annual flow, mean annual flood and flood quantiles associated with given exceedance probabilities. Results of the study show that CCA can significantly improve the effectiveness of SOM classifications for the estimation of streamflow regime in ungauged basins.