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Catchment classification coupling Canonical Correlation Analysis and Self Organising Maps

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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 classification, and in general to pattern recognition, makes use of unsupervised neural networks, and in particular Self Organising Maps (SOM), which organize input data through non-linear techniques depending on the intrinsic similarity of the data themselves. This study assesses the effectiveness of SOM for the identification of groups of catchments that are similar in terms of hydrological response, considering a set of some 300 Italian catchments scattered nationwide. A reference classification is first obtained by using indices of the streamflow regime (i.e., sample statistics of annual maxima and mean annual flow). The reference classification is then compared with classifications identified using only sets of indices that can be derived for ungauged catchments, that is sets of geomorphological and climatic catchment descriptors such as drainage area, main channel length and slope, mean annual precipitation, etc. Additional classifications will be based upon indices derived from the original set of catchment descriptors by applying a multivariate analysis technique known in the literature as Canonical Correlation Analysis (CCA). This technique is used to summarize two inter-correlated groups of variables (i.e., catchment descriptors and indices of the streamflow regime). The technique identifies two new groups of artificial variables (canonical variables) in such way that the correlation between the canonical variables of a pair is maximized and the correlation between the variables of different pairs is null. The main objective of the study is to asses whether the application of CCA techniques improves the effectiveness of SOM for classification of ungauged sites.