Use of SOM networks for delineating hydrologically homogeneous regions in ungauged conditions: application to the Italian watersheds

Elena Toth

DISTART - University of Bologna (elena.toth@unibo.it)

For many hydrological applications, and in particular for regionalisation procedures, it is needed to identify catchments that are sufficiently similar to the target catchment to provide a basis for information transfer. The choice of the similar catchments is based on some similarity measure, which may be based on geographical proximity but also on other attributes representing the variables that dominate the main hydrological processes.

This work presents the results of the implementation of unsupervised neural networks of the Self Organising Maps (SOM) type (or Kohonen networks) for the identification of hydrologically similar watersheds, on the basis of the homogeneity of some attributes characterising the streamflow generation processes.

An extended data base of information on the principal Italian watersheds, from Sicily and Sardinia up to the Alps, is available for the analysis. The data base is formed by attributes describing the watersheds from the geographical, physiographic, climatic and soil use/type points of view: such attributes are independent from the availability of hydrometric measures in the closure section of the catchments and may therefore be used for characterising also ungauged catchments. In addition, the data base includes also hydrometric measures, that may be used to verify if the ungauged characterisation of the watersheds is well-founded also when considering the actual measures of streamflow.

A SOM network is implemented with the objective to get a set of disjoint clusters containing all the case study watersheds: each cluster is formed by similar catchments, according to the available descriptors, but the topology of the SOM output layer allows also the identification of the similarity among the classes, so that larger regions may be obtained by merging the most similar classes. The possibility to identify such larger regions may be extremely useful especially in the cases in which the small dimension of the original classes does not guarantee a sufficient information content to be transferred to the target catchment.