



## **Low flow estimation in ungauged sites in Tuscany (Italy)**

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Analyses of low flow characteristics are needed for a number of purposes in water resources planning and environmental management including water demands and availability, watershed and river basin management, environmental flow requirements definition. Low flow characteristics are estimated from observed streamflow data, defining some duration and percentile indexes of low flow. For sites where data are not available different techniques can be used to infer them from other catchments where stream flow data have been recorded. An analysis to evaluate low flow indexes is carried out on the discharge data recorded in 121 hydrometric stations in several river basins in Tuscany region, located in central Italy. The streamflow data set is validated and criteria to take into account the anthropogenic factors and to characterize the natural streamflow are introduced. A suitable set of catchment physiographic and climatic characteristics is defined and a physiographical space-based method is used to relate the duration and percentile indexes of low flow to the investigated territory characteristics. The new physiographical space is built as a linear combination of the physiographic and climatic catchment characteristics. Different interpolation techniques of the low flow indexes, either geostatistical or deterministic, such as Kriging, Inverse Distance and Thiessen polygon methods, are applied. Uncertainties measurements are implemented using jack-knife and bootstrap methods. Different error measurement (mean square error, mean relative error...) are assessed to compare the results, to quantify the accuracy of the different techniques and to define the most suitable procedure.

Keywords: low-flow, spatial interpolation, geostatistical technique.