Analysis of the relationships between hydrogeological characteristics of mountain basins and low flow discharge: regional-scale prediction of hydrological indexes in ungauged basins of the northern Apennines (Italy)

F. Cervi (1), L. Borgatti (2), A. Corsini (1), F. Ronchetti (1), and G. Bloschl (3)

(1) University of Modena, Earth Sciences, Modena, Italy (federico.cervi@unimore.it), (2) University of Bologna, DISTART,
(3) Technische Universitat Wien, Institut fur Wasserbau and Ingenieur Hydrologie

In the last decade the north of Italy suffered a marked hydrologic deficit as a consequence of decreasing mean annual precipitation and increasing demand from industry and agriculture. Rivers that outflow from the northern Apennines display a highly variable discharge rate, mainly because of inherited hydro-geological factors such as the extensive presence of low permeability sedimentary rocks with low storage coefficient in the mountain catchments. The growing interest for a proper management of water courses, that has led to directives regulating the amount of minimum water that must permanently flow downstream from points of water diversions and yield, makes the prediction of hydrological indexes in ungauged basins located in the mountain areas of relevant practical importance, since it can support a sustainable planning of surface water management along the entire water course.

The research has being aimed at developing a spatial analysis tool for regional-scale prediction of hydro-geological indexes in ungauged basins, that still represent the majority of cases in the upper catchment areas of the northern Apennines. This has been dealt with by linking statistical indexes of discharge calculated for gauged basins (Q95, Q355,Q347), obtained with five years of continuous daily data, to the results of spatial analysis methods (such as Weight of Evidence, Logistic Regression, Neural Networks), that allow the storage coefficient of different bedrock types to be relatively ranked using the spatial distribution of permanent groundwater springs as main supporting evidence. The paper summarises the main results obtained that were validated in three basis within the whole study area.