ELECTRICAL CONDUCTIVITY AS A TOOL TO EVALUATE THE VARIOUS RECHARGES OF A KARST AQUIFER

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One of the challenges in karst hydrogeology has always been the necessity to identify the various contributions to groundwater recharge in order to evaluate and protect water resources. Over the centuries, several different techniques have been used such as the chemical analysis of major ions, isotope analyses, dye-tracing and trace element analyses.
Electrical Conductivity, which is easy to collect and inexpensive to carry out, can also be used to discriminate between the different contributions of recharge, if the only meaningful differences in the ion composition are due to the concentration of calcium bicarbonate. In the Classical Karst Region (NE Italy-SW Slovenia), researchers focussed on this parameter in order to distinguish between the allogenic and autogenic contributions in the chosen sampling points under various hydrogeological conditions. Electrical Conductivity measurements were periodically supported by chemical analyses defining anions, cations and organic concentration.
The Classical Karst Region is a carbonate plateau approximately 750 km^2 wide and about 2000 m thick, made of limestone, dolomitic limestone and dolostone, aged between the Cretaceous and Paleogene. It is a mature karst where conduits allow a fast infiltration and drainage to the springs. The aquifer is replenished by the leakages of two rivers present in the area (Reka/Timavo and Soča/Isonzo) and by the effective infiltration.
At the extreme South-East of the karst plateau, the Reka River flows for approximately 50 km over a Flysch basin. Once it has reached the carbonates, it is completely swallowed, disappearing into the Vreme and Škocjan swallow holes with an average discharge of 8.6 m^3/s.
On the western side of the study area, the Soča/Isonzo River (with its source in the Slovenian Julian Alps), has an influent character and an estimated recharge of the Karst hydrostructure of about 10 m^3/s of water. The third contribution is due to the effective infiltration calculated at 21 m^3/s.
The three inputs outflow into a wide spring area which extends for about 9 km, from Monfalcone (to the W) to Aurisina (to the East), consisting of more than 50 spring points having a total discharge of 35 m^3/s.
Thanks to the experience gained over the last decade and thanks to the help received by the speleological groups (G.S. Amici del Fante and G.S. Talpe del Carso), a monitoring campaign regarding caves, piezometers and springs has taken place over the last three years.
The results on the western side of the hydrostructure, during low flow conditions, show a prevailing contribution due to the Soča/Isonzo River with EC values in the range 240 µS/cm.

Moving eastward, the role of the effective infiltration is more and more significant. The EC values measured in the caves and deep wells are usually higher reaching values of 470 µS/cm East of the Timavo Spring, still in low flow conditions, the input of the effective infiltration prevails and the Reka involvement is non-influential. In contrast, during floods on the western side, the effective infiltration prevails on the Soča/Isonzo. Moving eastward, the Reka/Timavo represents the major contribution into the spring discharge.