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Time series analysis of the stable isotope composition in the catchment of karst springs in the Kvarner bay (Croatia)

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The water supply system of the city of Rijeka and surrounding towns mostly relies on the biggest spring in the Kvarner area: Izvor Rjecine. In dry periods, however, when demands for potable water are increased, Izvor Rjecine dries out and several other springs are included into the water supply system. Big amounts of rain after the dry period are characteristic for the area under investigation, and that is when karst springs are most sensitive to potential contamination.
Groundwater samples from the above mentioned springs were collected at weekly intervals over a 20-month period. During the same period, monthly and daily precipitation samples were collected. The data set includes a period of above-average precipitation in September 2010, as well as an extremely dry period in August 2011.
The stable isotope composition of precipitation was analysed. In groundwater, beside stable isotopes, we also measured the temperature, electrical conductivity, hardness, turbidity, salinity and BOD5.
The statistical interpretation of the obtained time series includes multivariate analysis, cross-correlation and Box-Jenkins method for ARIMA process modelling. Information about springs' reaction time on the meteorological input and therefore on the possible contamination input were obtained. Seasonal behaviour of the stable isotope composition of spring water indicates MRT of the water shorter than 5 years. Reaction of the springs on storm events confirms the dual porosity concept of the karst system. Isotopic altitude effect of precipitation was used to determine mean recharge altitudes of the springs.