What drives the long-term evolution of water quality in the Jura Mountains? A combined analysis of climate and anthropic impacts

Jean-Baptiste Charlier, Bernard Ladouche, Yvan Caballero, Julie Lions, Enora Lucas

What drives the long-term evolution of water quality in the Jura Mountains? A combined analysis of climate and anthropic impacts

Jean-Baptiste Charlier[1,*], Bernard Ladouche[1], Yvan Caballero[1], Julie Lions[2], Enora Lucas[1]

[1] BRGM, 1039 rue de Pinville, F-34000 Montpellier, France

[2] BRGM, 3 avenue Claude Guillemin, BP 6009, F-45060 Orléans, France

[*] corresponding author: e-mail: j.charlier@brgm.fr; Tel: +33 (0)4 67 15 79 77; Fax: +33 (0)4 67 64 58 51.

The aim of this study is to explore the long term decadal response of the chemical composition of surface and groundwaters to the global environmental changes. Focusing on karstic basins, we ask how climate and anthropic forcing could influence trends and/or large-scale oscillations of the physico-chemistry of springs and rivers.

In this setting, we present in this study an analysis of more than 45 yrs of hydrological and physico-chemical data recorded in springs and rivers of the north of the French Jura Mountains (Doubs and Loue basins, i.e. about 5000 km²). We used climate data (air temperature, rainfall, snowfall) from METEO FRANCE, hydrological data (discharge) from Banque Hydro. Water quality (air temperature, electrical conductivity, NO_3) data were collected from public agencies (ADES, EauFrance) at a monthly or a quarterly time step since 50's.

A first analysis is carried out on the Loue river where continuous long-term time series are available. Increase of mean annual water temperature (2°C over 45 yr), daily evapotranspiration (0.4 mm over 45 yr), electrical conductivity (200 µS/cm over 35 yr), and NO_3 (2 mg/l over 45 yrs) were recorded. We investigated relationships between these evolutions in the water, and climatic and hydrological fluctuations. Statistical methods and wavelet analysis were applied to characterize trends and large-scale oscillations, respectively.

Finally, our analysis on about 20 sites (springs and rivers) over the study area in the Jura Mountains showed that the physico-chemical variations observed in the Loue river is generalized at the regional scale. It highlights the regional influence of the environmental changes on the water quality evolution.