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Groundwater contribution to riverine wetlands in a chalk area: geochemical and isotopic evidences.

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The understanding of surface water and groundwater interactions and especially the role of groundwater in the context of wetlands is required for water quantity and quality preservation.

The present study proposed a geochemical and multi-isotopes approach to characterise the role of groundwaters from chalk aquifers on the quality of surface water draining riverine wetlands.

The studied area on located in the Austreberthe river basin, a tributary of the Seine River near Rouen (France). The Austreberthe River is fed by only one permanent tributary (Suffimbec) and numerous springs disseminated along the river course. The substratum is mainly composed of Cretaceous chalk, with the Santonian white chalk (up to 30-40 m thick), Coniacian white-grey chalk in the lower part of the basin, Turonian grey-white chalk with some flints in the upper part of the basin and Cenomanian glauconitic grey chalk in the Suffimbec valley.

Due to tectonic and climatic variations, the chalk has been affected by numerous accidents (faults ....) and subjected to alterations resulting in the development of karstic systems. Chalk is a mixed medium: porous, fissured and karstified. When the chalk is compact (in the plateaus and deep), water flows in the intergranular pores of about one micron. Groundwater flow in the aquifer is about 1 to 10 meters per year. Whereas within the millimetric crack, the water speed can reach several tens or hundreds of meters per year.

The system functioning was constrain trough geochemical (major and trace elements) and isotopic (^{87}Sr/^{86}Sr, δ^{11}B) approaches. The isotopic tracer of water-rock interactions (^{87}Sr/^{86}Sr) shows that the river downstream is a mixture of all groundwater from the basin, reflecting the different drained lithologies. The tracers of anthropogenic impacts (nitrate, chloride, boron and δ^{11}B) trace a spatial deconvolution of the different anthropogenic pressures: agricultural inputs upstream (mainly nitrate and chloride) and urban wastewater in the downstream part of the basin (chloride and boron). The geochemical and isotopic approaches allowed go further in terms of knowledge of water and dissolved nutrients circulation trough 3 samples of the river from up- to downstream of the basin. It was shown that the evolution of the geochemistry of the river strictly follows that of groundwater contributing to surface runoff. The integrative power of the river, although expected, is clearly demonstrated; each river section reflecting the diversity of the dissolved inputs, corresponding both to natural inputs (related to water-rock interaction) and anthropogenic inputs (agricultural and urban). Thus, according to the hydrological conditions during the two sampling campaigns, i.e. no significant surface runoff, surface waters chemistry reflects almost exclusively the groundwater contribution all along the river.