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The aim of this study is to explore the changes in water quality from local to large spatial scale and from short to long term periods, in order to better understand the fate and transport of pollutants. Our work focused on the analysis of nutrients in surface and groundwaters in the karstic catchment of the Loue river (~ 1000 km²) in the French Jura Mountains. The hydrological behavior of this large basin is highly controlled by surface water-groundwater interactions. Recurrent algae proliferation and a scarcity of species considered to be sensitive are indices of a chronic degradation of the water quality.

A first analysis of long term evolution of nitrate over 45 yrs in surface water shows that the nitrate concentration in waters (mean value of 10 mg/l) is controlled mainly by a seasonal effect (from 2 to 40 mg/l). A long term component is also observed showing an increase of several mg/l from 70's to 90's and then a decrease from 2000 to present. This long-term evolution is correlated to the annual amount of synthetic fertilizers used in cultivated areas of the Jura Mountains. On the contrary to nitrate, phosphorous evolution shows no long-term trend. Changes are mostly controlled by several peaks often superior to 0.2 mg/l, and occurring more frequently during autumn.

A second analysis of short-term evolution was carried out at the seasonal and event-time scales comparing concentrations and fluxes at 5 gauging stations over the catchment. This analysis showed contrasted nitrate and phosphorous evolutions depending the location. High level nitrate concentrations occurred after recharge events in autumn and winter. The nitrate decrease during spring and summer reaches in some locations the detection limit. This pattern is attributed to the biomass productivity during hottest and driest months. Regarding phosphorous evolution, erratic peaks occurred after rainfalls without their amplitude being correlated with that one of the rainfalls, meaning that it originated probably from effluents from wastewater treatment plants.

Finally, these first results showed the spatial and temporal variability of water contamination by nutrients, highlighting the complex hydrological and ecological behaviour on the various sub-catchments. The spatio-temporal variability of anthropogenic activities associated with the complexity of transport processes and with the hydrological conditions are the key processes that explain these contrasting responses within the same hydrosystem.