Isotopic and geochemical tools for characterizing surface water-groundwater relationships in la Bassée floodplain area (Seine River Basin, France)

Laurence Gourcy, Agnès Brenot, Emmanuelle Petelet-Giraud

Geophysical Research Abstracts
Vol. 13, EGU2011-14023, 2011
EGU General Assembly 2011

Isotopic and geochemical tools for characterizing surface water-groundwater relationships in la Bassee floodplain area (Seine River Basin, France)

Laurence Gourcy, Agnès Brenot, and Emmanuelle Petelet-Giraud
BRGM, Avenue C. Guillemin, BP 36009, 45060 Orléans Cedex 02, France

The evaluation of good qualitative and quantitative status of groundwater (WFD requirement) needs a comprehensive estimation of the short and long term trends in order to establish adequate river basin management plans. In this context, the understanding of surface water/ groundwater interactions is required for water quantity and quality preservation. Hydrogeochemistry permits characterizing water and dissolved element origin and flow in both ground and surface water.

The present study proposed testing the applicability of classical and isotope geochemical tools to characterize surface/groundwater relationship in the flooding area of the Seine River few kms before Paris, the Bassée floodplain. In this area, hydrological fluxes between surface and groundwater are expected to be complex due to the presence of three interconnected aquifers, numerous wetlands, ponds, gravel-pit lakes, and rivers.

Borrow pits were initiated in the area beginning of the 70's and are increasing rapidly. This mining activity does not seem to have a direct qualitative impact on the groundwater. Agriculture occupied today 40% of the territory of the Bassée plain for about 46% in 1976. Cereals (wheat, maize, barley, rape, sunflower) and beetroot cropping dominating since many years, diffuse pollution is expecting in the studies area.

We proposed the use of various tracers of the water cycle such as δ^2H, δ^{18}O, of water-rock interactions ^{87}Sr/^{86}Sr, of residence time and transfer mode CFCs and SF6 and of anthropogenic impact 3H in order to evaluate the interconnection between aquifers and possible relationships between surface water and groundwater in a flooded plain.

The geochemical approach proposed in this study permitted to highlight the usefulness of Ca/Sr, water stable isotopes, ^{87}Sr/^{86}Sr, dissolved gases and tritium to characterize the relationship between surface and groundwater. The combined use of different tracers permitted the understanding of space and time variations as well as the determination of the nature and intensity of the relationships between water bodies. In la Bassée, a clear discrimination exists between surface and groundwater and the influence of surface water to groundwater is decreasing when distance to the Seine River is increasing. The infiltration of surface water is taking place mainly close to the river bed and the flooded areas and recharge rates are quite variable.

Improving the hydrogeological knowledge may be also necessary to understand groundwater contamination. In La Bassée, surface water infiltration has a positive impact on groundwater quality. River water may decrease groundwater nitrate concentration by dilution and wetlands or gravel-pit lakes have also a positive impact by dilution, plant adsorption or denitrification processes.