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Integrated characterization of groundwater contamination in an alluvial system. Case study of Allier alluvial aquifer (Massif Central, France).

Nabaz Mohammed (1), Hélène Celle-Jeanton (1), Isabelle Batisson (2), Corinne Bardot (2), Jonathan Colombet (2), Frédéric Huneau (3), Philippe Le Coustumer (4), Marie-Laure Clauzet (5), and Véronique Lavastre (1)

(1) Clermont University, UMR 6524 CNRS IRD, Clermont-Ferrand, France (h.celle-jeanton@univ-bpclermont.fr), (2) Clermont University, UMR CNRS 6023, Clermont-Ferrand, France, (3) University of Corsica, UMR 6134 SPE CNRS, Hydrogeology Dept., Corte, France, (4) University of Bordeaux, EA 4592, Bordeaux, France, (5) Clermont-Ferrand Municipality, Water Department, Clermont-Ferrand, France

Hydrogeology is an intrinsically multi-disciplinary field because of the critical role water plays in both human health and natural ecosystems. The NAA (Nappe Alluviale de l'Allier) project proposes an integrated research (hydrodynamic, hydrochemistry and biology) on the shallow aquifer of the Allier River (one of the main tributaries of the Loire River). This aquifer plays an important role in the regional water supply for it represents more than 60% of the total water abstraction. As an example, the sampling site, located near the city of Clermont-Ferrand (France) constitutes the major source of drinking water supply for more than 100 000 inhabitants and then plays a major role on the local socio-economy. A biweekly following sampling, that concerns hydrodynamical parameters, major ions and isotopes (oxygen-18, deuterium and carbon-13), has been achieved during two years on 2 rivers, 1 pond, 2 springs and 17 boreholes with the aim of defining the functioning of the aquifer in terms of quality and quantity of the water resources and then on the main processes that governs hydrodynamic and hydrochemistry. Preliminary results allowed discriminating different origins of groundwater with a part due to surface waters/groundwater interactions and a secondary origin that implies water circulating from the surrounding hills. A monthly following sampling of pesticides, pharmaceuticals and traces ions provides information on contaminants sources. In parallel, the dynamics of the microbial communities (bacteria, pico-cyanobacteria and pico-eukaryotes) was followed by flow cytometer. The bacterial diversity has been measured through PCR-DGGE analysis in order to evaluate the impact of the occurrence of contaminants.