

## Transport of suspended particulate material and bacteria in the Cretaceous chalk aquifer of Upper Normandy (France)

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We are investigating transport of suspended particulate matter (SPM) in the karst chalk aquifer in Upper Normandy (France). Our approach includes: (1) analysis of high frequency recordings (rainfall, water level and discharge, turbidity, electric conductivity), (2) characterization of the SPM (grain size and SEM observations of particle nature), and (3) investigation of the relation between SPM transport and bacteria (including waste-water indicators and other particles such as *Cryptosporidium* and *Giardia*).

Based on hydrologic data, we know that the karst in this area typically is binary. Comparison of the hydrologic responses following strong rain events in different study areas allow the construction of conceptual models of groundwater transport, which can be compared with geomorphological models of the organization of the karst network.

Identification of the SPM allows us to use different types of particles as markers, which can indicate, for example,: (1) rapid connections between soil surface and groundwater (e.g., algal cells), (2) soil erosion versus resuspension of intrakarstic deposits, and (3) erosion and dissolution of the chalk substratum. When the groundwater becomes turbid, an increase in the sorting coefficients of the SPM grain size underlines the importance of forced transport through karst conduits.

Factor analysis of geochemical data is a complementary tool for characterizing the functioning of the aquifer. Comparison of turbidity, electric conductivity, and grain-size data allows us to identify chemical characteristics that act as markers of transport conditions, the contribution of surface water to groundwater discharge, and the karstic connections within the aquifer.

In parallel, understanding the relation between turbidity and water quality from a public-health point of view is one of our most basic interests. For this reason, the relation between the turbidity and concentrations of planktonic and sessile bacteria were analyzed. This novel approach, which combines hydrogeological and microbiological measurements, has demonstrated that transport and/or storage of bacterial communities within the karst network are dependent on previous hydrological events and groundwater pumping conditions. Finally, the recurring presence of the bacterial species *Pseudomonas oryzihabitans* in the Norville karst network and its high resistance to chlorine when in a sessile state demonstrate the importance of the investigation of biofilms to the evaluation of public-health risks.