Geophysical Research Abstracts,
Vol. 10, EGU2008-A-10172, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-10172
EGU General Assembly 2008

Behavior of karstic system of the Radicatel springs (Haute-Normandie, France) under climatic and structural constraints

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In many places throughout the world, turbidity in drinking water involves serious sanitary and engineering problems. This is particularly the case in Haute-Normandy (North-western of France). In addition, the use of turbidity as tracer of flow in conduits constitutes a major tool of particulate transfer in karst.

This study relates to the survey of the karstic springs of Radicatel located in the West of the basin of Paris (near the Seine estuary) which account for approximately 50% of drinking water of the city of Le Havre. This work aims at characterizing the functioning of the karstic system under climatic and structural constraints.

The site is composed of 3 springs located at the foot of a chalk plateau, usually considered as homogeneous, culminating with 154m and presenting lots of sinkholes and swallow holes. This hydrogeologic study is coupled with a geomorphological study because of the presence of a major fault localised near the spring which very likely influences both the structure and the functioning of the karst system. The GIS analysis of the space distribution of the sinkholes and the talweg network morphology is used as complementary approach to investigate the links between surface hydrological processes and groundwater flows.

For each spring, high-frequency times series (15 min time step) of precipitation, turbidity, specific conductivity were recorded. Correlation analyses (autocorrelation and cross-correlation functions) are then used for the comparison between these regional-

ized variables.

The observation of the turbidity series shows similar behaviors for 2 of the 3 springs whereas the third has a much shorter response time. Precipitation/turbidity cross-correlations on each series shows a complex response. It presents many peaks associated to response times ranging from 9h30 to 23h30 and relatively low coefficients of correlation (0,23) as a consequence of the strong non-linearity of the karst environment. Conductivity/turbidity cross-correlations are generally negative, which shows a clear anticorrelation between turbidity and specific conductivity (-0,98 for the peak of anticorrelation) for lags ranging from 30 minutes to 2h30. The increase in turbidity precedes the decrease of conductivity, highlighting resuspension of intrakarstic sediments on the three sites.

These differents behaviors can be due to a well-developed karstic system with multiple inputs (fast-infiltration point-source recharge). The proximity of a major fault is probably mainly at the origin of this complex structure implying such varied dynamics of the three springs in spite of their relative proximity.