Geophysical Research Abstracts
Vol. 20, EGU2018-16362, 2018
EGU General Assembly 2018

Interpreting the Hydraulic Connectivity within a Karstic Field through the Utilization of a Harmonic Pumping Tomography to Image the Distribution of Properties in a Model

Pierre Fischer (1), Abderrahim Jardani (1), Hervé Jourde (2), Michael Cardiff (3), Xiaoguang Wang (2), Stéphane Chedeville (2), and Nicolas Lecoq (1)

(1) Normandie Univ, UNIROUEN, UNICAEN, CNRS, M2C, 76000 Rouen, France , (2) Laboratoire Hydrosciences, Université de Montpellier, CNRS, 34000 Montpellier, France, (3) Department of Geoscience, University of Wisconsin-Madison, Madison, WI, USA

For the protection and the management of the water resources, it is necessary to understand and localize the flow paths in the ground. Therefore one needs to characterize the distribution of the hydraulic properties in the field subsurface.

In our recent works, we developed a complete and innovative method to interpret the flow paths generated from a pumping in a karstified aquifer. This method uses several recent and innovative tools.

For the field investigation we chose to apply harmonic pumping tests (pumping with a sinusoidal signal). We show a way to easily process the responses signals generated by this type of investigation, which appears to be more efficient than a classical pumping for highlighting the heterogeneities within a karstic aquifer.

Then, the interpretation of this investigation relies on an imagery of the highly contrasted distribution of the hydraulic properties in a model, with a higher conductivity for the karstic conduits and a lower conductivity of the matrix. The modeling part, solved in a frequency domain, permits to simulate the amplitudes and phase shifts of the spatial responses to the harmonic pumping tests. The reproduction of the field responses in the distributed model, for the properties imagery, is realized with a Cellular Automata-based Deterministic Inversion algorithm, which was developed to constrain the model to be generated with a network of linear structure (karstic conduits) within a background (matrix).

We present the results from an application of this method on a field scale on the Terrieu experimental karstic site in France, and we discuss on the effect of the period of the harmonic signal toward the characterization of the karstic network in this case.