Geophysical Research Abstracts
Vol. 18, EGU2016-2074, 2016
EGU General Assembly 2016

Implementing ground surface deformation tools to characterize field-scale properties of a fractured aquifer during a short hydraulic test

Jonathan Schuite (1), Laurent Longuevergne (1), Olivier Bour (1), Frédérick Boudin (2), and Stéphane Durand (3)

(1) Université de Rennes 1, Géosciences Rennes, Rennes, France (jonathan.schuite@univ-rennes1.fr), (2) Laboratoire de Géologie, Ecole Normale Supérieure, Paris, France, (3) Laboratoire Géomatique et Foncier (GeF/Cnam), Le Mans, France

In naturally fractured reservoirs, fluid flow is governed by the structural and hydromechanical properties of fracture networks or conductive fault zones. In order to ensure a sustained exploitation of resources or to assess the safety of underground storage, it is necessary to evaluate these properties. As they generally form highly heterogeneous and anisotropic reservoirs, fractured media may be well characterized by means of several complementary experimental methods or sounding techniques. In this framework, the observation of ground deformation has been proved useful to gain insight of a fractured reservoir's geometry and hydraulic properties. Commonly, large conductive structures like faults can be studied from surface deformation from satellite methods at monthly time scales, whereas meter scale fractures have to be examined under short-term in situ experiments using high accuracy intruments like tiltmeters or extensometers installed in boreholes or at the ground's surface. To the best of our knowledge, the feasability of a field scale ($\sim$ 100 m) characterization of a fractured reservoir with geodetic tools in a short term experiment has not yet been addressed. In the present study, we implement two complementary ground surface geodetic tools, namely tiltmetry and optical leveling, to monitor the deformation induced by a hydraulic recovery test at the Ploemeur hydrological observatory (France). Employing a simple purely elastic modeling approach, we show that the joint use of time constraining data (tilt) and spatially constraining data (vertical displacement) makes it possible to evaluate the geometry (dip, root depth and lateral extent) and the storativity of a hydraulically active fault zone, in good agreement with previous studies. Hence we demonstrate that the adequate use of two complementary ground surface deformation methods offer a rich insight of large conductive structure's properties using a single short term hydraulic load. Ground surface deformation tools therefore constitute an interesting addition to traditional fractured media sounding techniques.