



A Multi-Scale Approach for fracture characterization

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The study of fractured reservoirs is of primary importance for hydrocarbons, water and geothermal exploration. The investigation of natural fracture networks affecting potential reservoir is a key point in the present field of research since fracturing may constitute preferential flow paths for fluids consequently to an increase of the secondary permeability.

Performed in the context of a geothermal project in the Western Alps of Switzerland, the present work focuses on the characterization of the fracturing pattern in order to better understand water circulations affecting a gneissic geology (tectonic unit of the “Aiguilles Rouges Massif”). The fracturing interpretation is here mainly based on a terrestrial LiDAR survey of outcrops close to (future) production wells as well as on discrete fracture network (DFN) modelling.

The different sets of fractures are characterized in terms of orientation, spacing and trace length. In addition, traditional field survey observations and measurements from outcrops allow documenting the fracture aperture, types of fillings and the evidences of past and present-day fluid circulations. Fracturing patterns from outcrops and LIDAR analysis are then compared to regional structures observed on a DEM.

Main objectives of this study are: (1) to compare and check the consistence of various sets of fracturing data, acquired by various methods at different scales; (2) to develop the most representative fracture model (DFN), taking into account these datasets. Once a DFN model established, each of the different fracture sets will be associated with permeability values in order to get a preliminary hydrodynamic model that will be confronted to borehole tests data and eventually used as inputs for flow simulation.

Keywords: Fracturing analysis, LiDAR, borehole, Discrete Fracture Network, Flow simulation