

Hydro-geophysical and hydro-thermo-geochemical processes in heterogeneous fractured porous media – Characterization, modeling, and inversion at several scales

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Abstract: In the context of the increasing use of the subsurface, in terms of resource extraction/protection and geological storage, modeling tools are required for characterizing the natural environment and understanding the processes occurring in. This includes (i) the extraction of information from laboratory and field data collected with various characterization methods and (ii) the implementation of predictive models for providing exploitation, pollution and remediation scenarios. Focusing on highly heterogeneous systems such as fractured domains, requires to consider structural properties and processes that are challenging in terms of mathematical conceptualization and numerical resources. The processes considered range from electrical current propagation for the interpretation of geophysical data to heat transfer for geothermal characterization and optimization, including the transport of reactive solutes at several scales. The main objectives are to (i) make the link between laboratory/field data and numerical models, and (ii) provide predictive and inversion modeling tools that are able to tackle the well-known challenges of scale change, structural heterogeneities, and uncertainties of the natural environment.