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Towards measuring large-scale hydraulic properties of the seismogenic Gole Larghe Fault Zone at 8 km depth

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Fluid flow along fault zones is a major issue in structural geology and seismology. The permeability of fault rocks can be measured in laboratory experiments (e.g. Mitchell et al., this meeting) but its upscaling to large scale structures is not an easy task. On the other hand, in-situ measurements of permeability have been carried out just at relatively shallow depths, only exceptionally up to 3 km for active tectonic settings (e.g. SAFOD), whilst deeper experiments have been performed only in the stable continental crust (e.g. KTB). In this contribution we combine field and microstructural observations, fracture network modelling techniques borrowed from the oil industry, and geochemistry, in order to characterize the (possibly transient) hydraulic structure of the Gole Larghe Fault Zone (GLFZ, Italian Southern Alps), exhumed from ca. 8 km where it was characterized by a well-documented seismic activity. Our strategy consists of: (1) quantitative field characterization of the large- and meso-scale fault and fracture network of the GLFZ, combining DGPS scanlines and image analysis; (2) evaluation of the aperture of fractures based on microstructural and mechanical considerations; (3) reconstruction of realistic Discrete Fracture Network (DFN) 3D models; (4) output in terms of upscaled hydraulic parameters; (5) calibration based on the observed large scale fluid-rock interaction pattern. In this contribution we present the first results of this study performed on the GLFZ, which reveals a composite, heterogeneous, and highly anisotropic hydraulic structure.