Session 14: The link between fluids and fault slip: The state-of-the-art in observations, experiments, and models

Fluid diffusion footprint in three sequences at the N-edge of the Adriatic microplate.

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Most seismic swarms exhibit spatial and temporal migration at different velocity, depending on the trigger. Fluid-driven swarms in particular have typical migration velocities in the order of m/day.

Based on deformation data, i.e., GNSS and tiltmeter data, showing two episodes of slow transients migrating in an area about 100 km wide, Rossi et al. (2016; 2018; 2021) hypothesised that repeated episodes of faulting, in which fluids trapped at depth are released as pore pressure bulges, are closely spaced in time and space and occurred in 1983 (MD=4.2) and 2004 (MD=5.1) respectively. The affected region lies on the north-eastern edge of the Adriatic microplate, on the border between NW Slovenia and NE Italy. The geometry and kinematics of the recent deformation, as revealed by seismic and structural data, show how the south-directed thrusting of the Friulian Alps (Italy) is gradually transforming into an oblique and predominantly dextral strike-slip deformation in western Slovenia (Kastelic et al., 2008; Bressan et al., 2018; Saraò et al., 2021). However, the area is an area of continental collision, i.e., a context different from subduction or transform margins for which fault-valve behavior is more often reported in literature.The complex tectonic conditions in this area can lead to overpressure at depth, as highly permeable dolomitic limestones are in contact with low-permeability fine-grained limestones and flysch formations. Hence, fault movements, in close relation with seismic events, can enable fluid diffusion in the surroundings, inducing the observed deformation (Rossi et al., 2021).

The present work aims to investigate the space-time pattern of three seismic sequences that have occurred in this area since the beginning of instrumental recordings in order to discover possible traces of shock migration and fluid diffusion that can confirm the deformation observations.