Session 10 & 14

Control on fault slip nucleation and dynamics: role of fluids, physical mechanisms at play, and their interplay

Session 10

Conveners:
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Seismogenic faults accommodate strain at a range, perhaps a continuum, of slip velocities ranging from cm/yr to m/s, commonly generating aseismic and seismic signals, respectively. The spatial distribution of distinct fault patches that host seismic and aseismic slip is non-uniform for a given fault or fault system. How seismic and aseismic slip patches interact in space and time and whether individual patches can host slip at a range of velocities, as well as how geometrical complexities and lithology govern slip behavior, remain open questions. Aseismic and slow seismic events generally produce lowamplitude signals relative to regular earthquakes, making them hard to observe and robustly link to geological features or to quantify their interactions. However, recent observations using new types of data or integrated datasets combined with novel processing techniques are starting to uncover a range of fault slip behavior that correlates with geological and lithological properties. This session welcomes contributions that aim to advance our understanding of the mechanisms promoting seismic and aseismic fault deformation on seismogenic faults and their interaction. We especially welcome multidisciplinary contributions with any combination of geophysical and geological observations, laboratory experiments, and numerical modeling, including those which incorporate new types of data (such as distributed Fiber Optic Sensing, e.g. DAS, DSS, DTS) and analysis techniques, including AI approaches.

Session 14

Conveners:
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Fluids are a key factor that control the friction laws governing fault slip, nucleation, and the dynamics of earthquake rupture. Fluid pressure can reduce the normal stress on faults and promote reactivation, while fluid pressure gradients can explain seismicity migration, earthquake clustering and fault segmentation. Recent work also postulates that fluids play an active role in driving aseismic slip and associated seismic signals, such as tectonic tremor at the down-dip edge of the seismogenic zone, where fluid overpressure results from dehydration of hydrous minerals. Fluids are also linked to anthropogenic activity related to georesource exploitation and reservoir management that can cause earthquakes. Similarly, volcanic earthquakes are commonly modeled as turbulent flow of magmatic fluids extruded at shallow depths and coupled to geological structures, such as the walls of crack-like structures.

The goal of this session is to provide an overview of the current knowledge of the relation between fluids and earthquakes by inviting contributions related to a range of environments – tectonic, anthropogenic, volcanic, etc. – with the aim of understanding the role of fluids in generating seismic signals and deformation. We particularly welcome contributions reporting not only observations, but also work from laboratory experiments reproducing earthquake nucleation and propagation, as well as numerical and mathematical models.