ISTerre
Institut des Sciences de la Terre

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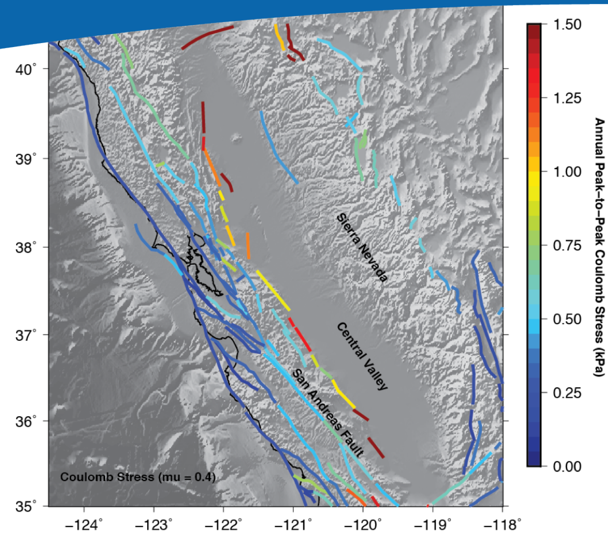

Water and Tides Modulate Deformation, Seismicity and Tremor in California

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Establishing what controls the timing of earthquakes is fundamental to understanding the nature of the earthquake cycle and critical to determining time-dependent earthquake hazard. Seasonal loading provides a natural laboratory to explore the crustal response to a quantifiable transient force. In California, the accumulation of winter snowpack in the Sierra Nevada, surface water in lakes and reservoirs, and groundwater in sedimentary basins follow the annual cycle of wet winters and dry summers. The surface loads resulting from the seasonal changes in water storage produce elastic deformation of the Earth's crust. We use vertical GNSS displacement time series to constrain models of monthly water loading and compute the resulting stress changes on fault planes of small earthquakes. Additionally, we model the seasonal stress changes for tidal, thermal, and atmospheric loading sources with annual periods to produce an aggregate stressing history for faults in the study area. We find the hydrological loads are the largest source of seasonal stresses and produce resolvable modulation of micro-seismicity. While much shorter-period diurnal and semi-diurnal stress cycles fail to substantially modulate upper crustal seismicity, they dramatically influence the timing of tremors on the lower-crustal extension of the San Andreas fault. Near-lithostatic fluid pressure allows tidal stresses to dominate the timing of low-frequency earthquakes and associated slow slip deep in the roots of the fault.

Jeudi 28 juin 2018 à 11 h

Amphithéâtre W. Killian, ISTerre

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