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Kinematics of strike-slip faults: the geological perspective

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The variability of co-seismic ruptures or slip-rates estimates along strike-slip faults is not well explained. The repetition of coeval ruptures as well as similar slip-rates at all time and spatial scales is probably indicative of a replicable strain pattern in a stable stress regime. Similar geological and geodetic rates are usually interpreted as a constant behavior throughout the seismic cycle and throughout the lifetime of the fault. However, due to the short time of geodetic measurements and the sparse geologic rate determinations, slip-rate variations are rarely observed. Thus many questions remain: Do rate changes imply seismic behavior modifications ? Or do changing rupture patterns affect the slip-rate ? Do faults interact, both in term of rupture pattern and slip-rate modifications, at the scale of fault junctions, at the scale of block boundaries ? Here we review both short-term geodetic and long-term geological rates obtained along some of the major strike-slip faults in and around Tibet. Although geodesy is now widely used access difficulties and field conditions in some cases do not allow to calculate a significant geodetic rate. Along some faults there is a rather good agreement between geodetic and geological rates, while others show large discrepancies. The accuracy of geologic rate determinations is still poor that slip-rate variations at the millennial scale are difficult to establish. For longer time scales, that evidently involve significant geometric changes in boundary conditions for some faults, variations in slip-rates can be documented. From examples along the Altyn Tagh and Kunlun fault we will show the difficulties in reconstructing past slip histories over several seismic cycle or possible slip-rate changes at the millennial scale from reconstruction of displaced geomorphic markers such as alluvial fans and terraces. We emphasize the need for both geodetic and geologic rates to reduce measurements uncertainties to be able to discuss slip-rate variations at various time scales.