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Fault displacement rates on a range of timescales

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Displacements on tectonic faults primarily accrue during earthquakes at rates that vary through time. To examine the processes that underlie the temporal changes in fault displacement rates we analyse displacements and displacement rates for time periods from the present to 5, 10, 20, 300, 500, 1000 and 5000 kyr for 261 active reverse or normal faults from a worldwide dataset. Displacement rates depart from million-year average rates by up to three orders of magnitude with the size of these departures inversely related to the duration of the sample period and to fault length. Short-term ($\leq$ 20 kyr) displacement rates generally span a greater range on small faults than large, a feature which suggests more variable growth on smaller faults. Simple earthquake-slip modeling shows that variations in displacement rates require changes in both recurrence interval and slip per event and do not support the Characteristic-slip earthquake model. As long as fault system strain rates are uniform, displacement rates generally become constant over time periods between 20 - 300 kyr, with the length of time required to reach stability being inversely related to the regional basin-wide strain rates. Stable long-term displacements rates and fluctuations in earthquake recurrence intervals and slip arise, in part, due to fault interactions.