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# On the earthquake potential of creeping faults: Insights from labscale fault analogues

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A paradigm of creeping faults is that they are not seismogenic, i.e. that creeping segments do not generate earthquakes. Based on original stick-slip experiments on a laboratory fault we here demonstrate, however, that significant interseismic creep and large earthquakes may not be mutually exclusive phenomena and that creep signals vary systematically with the fault's seismic potential. The experimental setup used for this study includes granular material sheared in a ring-shear tester under controlled normal loads with varying velocity, both over a wide range of values (1 – 16 kPa, 0.1 – 25 mm/min) mimicking upper crustal deformation conditions at hydrostatic to lithostatic fluid pressures. According to our labscale analogue observations, transience of interseismic fault creep scales with fault strength and seismic coupling as well as with the maturity of the seismic cycle. Timescale independence of creep transience suggest that it should be possible to estimate longterm fault properties and behavior from short-term observations, e.g. during triggered slip or aftershocks. The number of episodic creep events increase steadily towards the end of the seismic cycle giving a unique observable of the fault stress state relative to its seismic cycle. For very weak faults in a late stage of their seismic cycle, the observed creep systematics may lead to the chimera of a perennially creeping fault releasing stress by continuous creep and/or transient slow slip instead of large earthquakes.