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Global crustal dynamics of Magnetars in relation to their bright X-ray outbursts HUAN YANG, Princeton University, CHRISTOPHER THOMPSON, Canadian Institute for Theoretical Astrophysics, NESTOR ORTIZ, Perimeter Institute for Theoretical Physics — We consider the yielding response of a neutron star crust to smooth, unbalanced Maxwell stresses imposed at the core-crust boundary, and the coupling of the dynamic crust to the external magnetic field. Stress buildup and yielding in a magnetar crust is a global phenomenon: an elastic distortion radiating from one plastically deforming zone is shown to dramatically increase the creep rate in distant zones. Runaway creep to dynamical rates is shown to be possible, being enhanced by in situ heating and suppressed by thermal conduction and shearing of an embedded magnetic field. A global and time-dependent model of elastic, plastic, magnetic, and thermal evolution is developed. Fault-like structures develop naturally, and a range of outburst timescales is observed. Transient events with time profiles similar to giant magnetar flares (millisecond rise, about 0.1 s duration, and decaying power-law tails) result from runaway creep that starts in localized sub-km-sized patches and spreads across the crust. We also discuss the key role of crust's plastic and elastic motion in Magnetar short bursts and after-flare quasi-periodic oscillations.

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