Applying Critical Wedge Theory to the Sunda Megathrust

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Geodetic studies of subduction megathrusts have shown that the pattern of interseismic strain is heterogeneous, varying between locked seismic and creeping aseismic sections. Paleoseismology reveals that large earthquakes have occurred repeatedly on the same section, implying that variability in interface frictional properties are long-term features. Based on stick-slip frictional laws this in turn suggests that locked regions are subject mainly to dynamic friction whereas creeping sections are subject to higher static friction. Critical wedge theory provides a means to test this hypothesis as the thrust and wedge frictional coefficients are a function of the covariance of the accretionary wedge taper and slab dip. Application of the theory requires detailed knowledge of the slab interface and has previously not been applicable over a wide area. However due to high levels of recent activity the Sunda megathrust has unprecedented geometrical resolution, allowing the development of a fully 3D interface model. Using this 3D model and bathymetric data the critical wedge theory is applied over the Sunda region, with seismic profiles used as additional constraints on backstop and deformation locations. The possibility is that critical wedge theory can be used to map lateral variation in frictional properties, aiding the assessment of where future large earthquakes may occur.