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Preliminary results from numerical subduction zone models investigating the slip behaviour of the plate interface during changes in surface loads

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Numerical models showed that the slip evolution of intra-continental normal and thrust faults may be considerably affected by climate-driven changes in loads on Earth's surface (e.g. Hampel et al. 2009,2010). For subduction zones like Alaska, space-geodetic measurements combined with numerical modelling revealed that glacier ice mass fluctuations induce significant vertical displacements and stress changes that may modulate the background seismicity of the subduction zone (Cohen 1993; Sauber et al. 2000; Sauber & Ruppert 2008). Recently, Luttrell & Sandwell (2010) calculated the stress perturbations to be expected from sea-level changes and their effect on the stress state of transfrom faults at plate boundaries. To investigate how the subduction thrust at convergent margins responds to climate-driven changes in surface loads on different timescales, we are developing finite-element models with a subducting oceanic plate and an upper continental plate, which are in contact along a frictional interface. Preliminary results indicate that sea-level changes - such as the 120-m increase after the last glacial maximum - may cause significant changes in the stress state of the plate interface, which may potentially affect the earth¬quake cycle of the subduction zone. We will further use the models to investigate the interseismic and coseismic deformation of the upper plate and the impact of climate-driven mass fluctuations. These include the loading of the crust on- and offshore by transport and deposition of large amounts of sediment during and after glacial periods (e.g. Church & Slaymaker 1989). At the Cascadia and Chilean convergent margins, such variable sediment input was inferred to have affected the defor¬mation of accretionary prisms (Bourgois et al. 2000; Adam et al. 2004).