Geophysical Research Abstracts
Vol. 19, EGU2017-5690, 2017
EGU General Assembly 2017

Boundary conditions traps when modeling interseismic deformation at subduction zones

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In order to gain insight on the controling factors for elastic strain build-up in subduction zones, such as those triggering the Mw 8. 2010 Maule earthquake, we published a modeling study to test the influence of the subducting plate thickness, variations in the updip and downdip limit of a 100% locked interplate zone, elastic parameters, and velocity reduction at the base of the subducted slab (Contreras et al., Andean Geology 43(3), 2016). When comparing our modeled predictions with interseismic GPS observations, our results indicated little influence of the subducting plate thickness, but a necessity to reduce the velocity at the corner-base of the subducted slab below the trench region, to 10% of the far-field convergence rate. Complementary numerical models allowed us to link this velocity reduction at the base of subducting slab with a long-term high flexural stress resulting from the mechanical interaction of the slab with the underlying mantle. This study discusses that even if only a small amount of these high deviatoric stresses transfer energy towards the upper portion of the slab, it may participate in triggering large earthquakes such as the Mw8.8 Maule event. The definition of initial and boundary conditions between short-term to long-term models evidence the mechanical inconsistencies that may appear when considering pre-flexed subducting slabs and unloaded underlying asthenosphere, potentially creating mis-balanced large stress discontinuities.