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Interseismic strain accumulation at the Mw8.8 2010 Maule earthquake by means of finite element modeling

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We implemented a two-dimensional finite element model that simulates the accumulation of crustal deformation due to the tectonic loading on a locked subduction fault and applied this model to study the seismic cycle of the Mw8.8 2010 Maule (Central Chile) earthquake. Our goal is to gain insigth into the fundamental factors controling elastic strain build-up and release in subduction zones and to evaluate different approaches proposed for modeling surface deformation as observed by GPS-based crustal velocities. By applying the finite element technique we developed a linear elasticity solver that allows us to assess a realistic plate geometry, rheology and relative velocity of subducting plate in a coupled seismic zone. Constraining parameters such as convergence velocity as well as the geometry of the subduction zone are supported by independent geophysical data so we concentrate on the influence of mechanical slab thickness, variations in the updip and downdip limit, degree of coupling and rheology. We have introduced idealized geometric models, noting that our numerical solution reproduce the analytical solution for an elastic half-space and that the surface displacement field obtained for a curved fault and non-zero slab thickness model mimics the predictions of a simple backslip model when the slab thickness tends to zero. We compared model predictions with GPS observations in a EW profile crossing the Maule earthquake rupture area in an attempt for determining the parameters of the seismogenic zone most suitable for this region. Our preliminary results, that consider a realistic geometry and uniform convergence velocity, suggest little influence of the subducting plate thickness for the same downdip limit and the fit to observations is only locally achieved within the margin of error of GPS speeds. We will show results for the inter- and co-seismic phases of the seismic cycle.