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Megathrust-induced deformation in volcanic arcs of oblique subduction zones and the GEOTEAM seismic experiment in the southern Andes

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In this study we point out that volcanic arcs in oblique subduction settings undergo short-lived lateral kinematics driven by the reduction of the maximum horizontal stress. More specifically, the reduction of the horizontal intermediate stress σh, that is proportional to the reduction of the principal horizontal stress σH, promotes the occurrence of short-lived strike-slip kinematics rather than reverse faulting in the volcanic arcs. Such relaxation of the pre-earthquake (mainly) compressional regime facilitates magma mobilization by providing a short-circuit pathway to shallow depths by significantly increasing the hydraulic properties of the crust in the upper plate. The timescale for the onset of strike-slip faulting depends on the degree of shear stress accumulated in the arc during inter-seismic periods, which in turn is connected to the degree of strain-partitioning at convergent margins. This may explain the increase of eruptive rates in volcanic arcs after the mega-thrust event and the occurrence of crustal seismic events characterized by strike slip focal mechanisms.
Coulomb stress transfer analysis show that the stress imparted by the 2005 M8.6 Nias, Sumatra, earthquake; the 2010 M8.8 Maule, Chile earthquake; and the 2012 M7.6 Nicoya, Costa Rica, earthquake perturbed the respective volcanic arcs to different degrees, with almost no perturbation occurring in Costa Rica. In addition, shallow seismic events larger than M4.5 occurring in the arcs after the mega-thrust slip confirm the presence of lateral motions. We also use data from six seismic stations located around and atop the Turrialba-Irazù volcanic complex, Costa Rica, to highlight increases and decreases of seismic activity along a fault plane after the Nicoya megathrust earthquake and its aftershocks.
Finally, we will introduce the ongoing GEOTEAM seismic experiment in the southern Andes from 35.5ºS to 37.3ºS. The experiment uses 21 seismic stations (11 broadbands and 10 short-periods) to record the seismic activity connected to the post-Maule deformation of the volcanic arc and to investigate the main lithospheric structures by means of noise tomography.