Volcanism and Tectonics in Action along the Southern Andes

space-time analysis of current deformation recorded by GNSS and seismicity

Andrés Tassara (1), Scott Giorgis (2), Vicente Yáñez (1), Francisco García (1), Rodrigo Mora (1), Juan Carlos Baez (3) and Luis Lara (4)

**Tectonic Setting and Recent Activity**

**GNSS Surface Deformation and Seismicity**

**Time-Variable Analysis of Vorticity**

We use surface velocity vectors computed from campaign (Wang et al., 2007) and continuous GNSS stations (most of them administrated by the Chilean national seismic center CSN) before the 2010 Maule earthquake. With these vectors we interpolate an interseismic velocity field from which we calculate velocity gradients parallel and normal to the strike of the LOFZ. From the velocity gradient field we finally computed this map of kinematic vorticity Wk assuming monoclinic transpression. Into this conceptual framework, Wk is the ratio between LOFZ-parallel simple shear and LOFZ-normal pure shear. Wk values near unity (warm colors) indicate dominance of strike-slip deformation parallel to the LOFZ, whereas low Wk (cold colors) shows predominant compression normal to the LOFZ. Note (1) the strong concentration of high Wk along the traces of the LOFZ between 38° and 41.5°S, (2) the location of recently erupted volcanoes in regions of maximum Wk into this segment, (3) a more spotty distribution of high Wk in partial coincidence with the LOFZ south of 41.5°S, and (4) the apparent segmentation of the LOFZ.

We interpolate velocity fields from time-series of continuous GNSS stations and derive maps of Wk (without imposing monoclinic transpression). Upper panels are for the time period 01/07/2007 - 26/10/2010 encompassing eruptions of Llaima, Villarica and Chaitén. Vorticity anomaly is the difference between maps of both periods, highlighting regions of enhanced surface deformation that seems to (loosely) correlate with erupted volcanoes.

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**Time-variable Analysis of Vorticity**

Topography/bathymetry map of the Southern Andean margin showing main tectonic features. White arrow is convergence velocity. White numbers are ages of the Nazca plate. Green contours are co-seismic slip (1, 5, 10 m) of the Mw8.8 Maule 27/2/2010 earthquake (Moreno et al., 2012). Blue contours are afterslip (1.2 m) cumulated during the first year after the Maule earthquake (Bedford et al., 2013). Beach balls represent focal mechanisms of shallow earthquakes (<15 km) as reported by the GCMT; note variable percentages of a left-lateral strike-slip double couple component and a significant compensated linear vector dipole (magma injection?). Bold lines are mapped faults and 5.3 (size scaled by magnitude). Red triangles are active volcanoes (Smithsonian Institute Global Volcanic Program SI-GVP) with enlarged ones corresponding to those that have erupted since 2008. The eruptive activity of these 7 volcanoes is described in the right panel in terms of the approximate time period and Volcanic Explosivity Index (VEI) of most notable events (SI-GVP).