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Current crustal deformation in the Southern Andes from GPS: Active tectonics ans volcanism associated to the seismic cycle

F. García[1], A. Tassara[1], V. Yáñez[2]

[1]Departamento de ciencias de la tierra, Universidad de Concepción

[2]Universidad de Chile

The Southern Andes is probably one of the best places on earth to study the link between active tectonics and volcanism. Since 2009 (the older GPS data used in this study) there have been at least five clear eruptive events and one big megathrust earthquake (2010 8.8 Maule earthquake). The volcanic line in the study area (between the 36º-47º S) has a strong relation with the Liquiñe-Ofqui Fault Zone (LOFZ), a 1100 km long dextral system that accommodates the margin-parallel component of oblique convergence. Interaction of the LOFZ with inherited structures control the first order characteristics of the different volcanic systems, like the location and the residence time of the magmas in the crust that directly affects the composition of volcanoes.

Volcanic eruption can be triggered by variations in the strain fields around the volcanic system. These variations can be produced by megathrust earthquakes and also by activity of crustal faults near or under a volcano. Geodetic data, allow us to observe the superficial expression of these processes, and using geological information such as location of faults or volcanic systems is possible to evaluate the role of tectonics in the triggering of a specific eruption.

This study uses continuous GPS data and trajectory models to calculate velocity and strain fields. In order to better understand how crustal deformation can induce volcanic eruptions, the GPS time series were fitted using a trajectory model (tm). Using these tm to evaluate the velocity of a point in any time of the tm, and iterating a process of calculation of velocity fields, velocity gradients and kinematic vorticity (Wk). The main focus of this study is to connect variations in the crustal deformation with volcanic eruptions and/or activation of structural systems. Wk is very useful to study the volcano-tectonic relation in the study area, because most of the deformation that affects the volcanic arc is accommodated by the LOFZ. This study, shows that during the seimic cycle oposite strain regimes can affect specific portions of the margin, showin differences in over two order of magnitude between the interseismic and the postseismic. The change in the way that crust accommodates strain, can be interpreted as the reactivation of traces of the LOFZ and other structural systems. This not only allows having a better understanding of the role that crustal structures play on the triggering of volcanic eruptions, but also could be use as a strong tool for volcanic and seismic monitoring.