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Seismic Structure of Villarrica Volcano obtained through Local Tomography

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We present a first model of the inner structure of the Villarrica volcano (Southern Chile) derived from P-wave arrival time inversion from local volcano tectonic (VT) events. A total set of 75 DSS-Cube stations was installed at the volcano surroundings between March 1st and 14th, 2012, with 50 of them at the crater, flanks and around the volcano. Volcano tectonic earthquakes located inside the network describe a NS-trending structure between 2 and 7 km below sea level at a transition zone between low and high P-wave velocity zones. The location and trend of the volume is consistent with a branch of the Liquiñe - Ofqui Fault Zone, a long lived arc-parallel 1000 km long strike-slip fault at the Chilean subduction zone. Values for P-wave velocity (Vp) averaged 4.5 km/s, and Vp/Vs ratios gave values of 1.6 to 1.7. The maximum variation of Vp is of the order of $\pm$20%.
Checkerboard test and Bootstrap method were applied. Bootstrap method shows that the standard deviation of the tomographic solutions is of the order of $\pm$9%. Resolution given by Checkerboard test is of the order of 2-3 km.
We observed three low velocity zones (LVZs) located between 1 and 5 km depth that can be associated with magma and/or other fluids. One main LVZ at 1-2 km towards NNW from the locus of seismicity; and two conduit-like LVZ s reaching from the locus of seismicity towards the surface features of the Los Nevados and Challupén pyroclastic flows (ENE and S of the crater, respectively). These two LVZs are thought to be remnant conduits of these previous eruptions. High velocity zones are observed to the east and below the crater, and can be interpreted as consolidated crustal rocks and volcanic products from previously collapsed caldera.