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Seismic and triggered behavior of the Nevados de Chillán volcanic complex following the 2010 M8.8 Maule, Chile earthquake.

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The link between megathrust earthquakes and the long-term response of their respective arcs remains enigmatic. The 2010 M8.8 Maule earthquake, which ruptured about 500 km along strike in the south-central part of Chile, provides an opportunity to investigate the response of volcano-rich arc to the east. We deployed five broadband seismometers from November, 2011 to April 2012, four of which were installed atop and surrounding the Nevados de Chillán volcanic complex.

The data highlight the "normal" seismic activity of the volcano, which is characterised by numerous volcano tectonic (VT) events and tremor episodes within the volcanic complex. Moment tensor inversion suggest that VT events are mainly strike-slip events along the fault line in which volcanic cones reside. We also recorded two strong Maule aftershocks (an M6.1 in January 2012, and an M7.1 in April, 2012), and investigated the subsequent (triggered) changes in the normal seismicity in the volcano. In the week following the M6.1 event, we recorded a significant increase in volcanic tremor within Nevados de Chillán, and when this increased tremor activity subsided, we observed the onset of a significant increase in VT events. This indicates that the volcano is very sensitive to external stimuli, and also indicates that the earthquake instigated fluid/magma migration that readjusted the stress state to induce the VT events. On the other hand, the M7.1 at a similar epicentral distance caused no significant response within the volcanic complex.

Our study analyses and compares the physical parameters (i.e. amplitude, frequency content, incoming direction) of the seismic waves generated by the two events. This is then discussed within the geological framework of Nevados de Chillán to highlight what might have maximised dilatancy at the fine scale and the concomitant pressure diffusion and increase of the seismic activity. We find that direction of the incoming seismic energy plays a role in triggering a response. Our results show that the Nevados de Chillán complex, and other volcanoes residing behind the Maule earthquake, should be intensively monitored in the years to come because we expect accelerated activity due to stress regime changes from pre-Maule compression to post-Maule transtension.