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Volcano-seismic activity before and after the Maule 2010 Earthquake (Southern Chile): a comparison between Llaima and Villarrica volcanoes

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Llaima and Villarrica are two of the most actives volcanoes in the Southern Volcanic Zone in the Chilean Andes, with different type of activity and edifice. Llaima is a close vent volcano with constant seismic activity, while Villarrica is an open vent volcano with lava lake at the summit and constant degassing. The relation between volcano eruptions following a great earthquake has been studied in different cases around the world, and it has been the case for the 1960 Valdivia earthquake in southern Chile, where Llaima and Villarrica presented eruptions on the following months to years. This study is focused on characterizing the volcano-seismic activity in the months before and after the M8.8 Maule earthquake on the 27th February 2010. Time series for tremors, long period and volcano tectonic events were obtained from the catalogue of the Volcanic Observatory of the Southern Andes (OVDAS in Spanish) and from the continuous record of the SFB 574 temporary volcanic network. In Villarrica volcano, peaks of activity of tremor and long period events were observed months prior to and after the earthquake, followed by degassing activity, which is consistent with an increase in the activity related to fluids (gas and magma). While in Llaima volcano, a high increase in the volcano tectonic activity was observed directly after the earthquake, consistent with a possible structural adjustment response. The values for pressure change and normal stress were calculated for the Maule earthquake (M8.8) giving results two orders of magnitude lower in comparison to the ones obtained for Valdivia earthquake (M9.5). Finally, these changes in the seismic behavior had lasted over a year, than it is possible to state that the Maule earthquake affected Llaima and Villarrica in some way due to static stress, but given the location and the insufficient critical state of both edifices, it was not possible to generate a great eruption.