

Dynamics of 2015 Villarrica and Calbuco lahar flows, Chile

Felipe Flores¹

¹Servicio Nacional De Geología Y Minería

Keywords: lahar, debris flow,

During 2015, two volcanic eruptions affected the central southern Andes of Chile. The first one was on March 3th at Villarrica Volcano, and the second one on April 22th at Calbuco Volcano. A common process in both eruptions was the occurrence of primary lahars, triggered by sudden ice and snow melt. At Villarrica volcano, these ones flowed downstream through northeast to northwest rivers and creeks, damaging bridges and touristic infrastructure. At Calbuco, laharic flows descended towards the south and northeast to northwest flanks, destroying some houses, fisheries, roads and bridges. The most voluminous lahars took place in Calbuco reaching almost $8 \cdot 10^6$ m³ versus $0.6 \cdot 10^6$ m³ for Zanjón Seco lahar at Villarrica. Despite differences between lahar volumes, velocities calculated by Manning's equation were bigger in Villarrica, reaching 20 m/s, while in Calbuco reached 16 m/s. Nevertheless, peak discharge was higher at Calbuco with values around 6000 m³/s. In contrast, at Villarrica it reached a maximum value of only 4000 m³/s. Furthermore, wave heights were estimated up to 6 m for Cuevas Volcánicas area at Villarrica and 7.3 m for Calbuco at proximal zones. Grain-size distribution and petrographic analysis of the deposits suggest that Villarrica lahars are transitional flows (40% - 60% solids), with intervals of debris and hiperconcentrated flows. On the other hand, Calbuco lahars are dominated by debris flow facies, with higher clay content and higher viscosity, which might explain the lower velocities. These field results can be compared with empirical relationships, and also be used as controlling factors for numerical modelling, in order to get a better approach to laharic inundation hazard assessment for different eruptive scenarios.