

## **Estimated lahar volumes at Llaima Volcano, Southern Andes**

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In the definition of lahar hazard zones models are typically based on water volumes inferred from mapping of past events. Only in a few cases real estimations of available water volumes, either in the form of snow, ice or liquid bodies (lakes and ponds) have been used to complement lahar models and derive more realistic scenarios. In the Southern Volcanic Zone of Chile volcanoes are frequently covered by glaciers and also by snow during the winter season, which provide a main source of water feeding lahars that can occur in this area. The volume of a glacier can be assessed by means of radio echo sounding to derive ice thickness, in combination with surface geometry data. The amount of snow cover can be evaluated for different recurrences based on field measurements and available meteorological data. In addition, by using accurate digital terrain models and ideally also water depth data, the water volume from lakes and river basins can also be calculated for specific basins which exhibit large potential lahar hazard. As the request of Instituto Nacional de Hidráulica, this methodology to assess water volume was used to estimate the lahar volumes at Llaima Volcano in southern Chile, to be used as a main input for modeling at a later stage. For this objective glacier ice volumes were obtained by means of ground and airborne radio echo sounding data, as well as analysis of meteorological data to estimate snow cover. Water depths at several lakes and ponds were also measured, in combination with a digital elevation model, to assess the contribution of surface water sources. Different melt scenarios produced by eruptive events were considered as an input for subsequent modelling studies.