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Analysis of civil works and nonstructural measures to mitigate lahars risk in Villarrica volcano

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Recently the Instituto Nacional de Hidráulica, commissioned by the Dirección de Obras Hidráulicas, developed a study at the prefeasibility level called ``Construcción Mitigación Riesgo Volcánico y Geológicos asociados al Volcán Villarrica, comuna de Villarrica, Pucón y Curarrehue, Región de la Araucanía". The objective of this pioneering study in our country was to propose structural or non-structural measures in urban areas in the Araucanía Region exposed to lahar flows from the Villarrica Volcano.

In this study, surveys of relevant information were conducted, which included topography, hydrology, river hydraulics, geology, glaciology, among others. This information was used for implementing numerical simulations with four models typically used in lahar flows (Titan2DMSF, LAHARZ and FLO2D- PRO). These models were analyzed according to their use and delivery of results. Floo-2d was selected to be used for determining the areas threatened by lahar flows in seven channels located in the area of study.

Three scenarios of lahar events were modeled, which correspond to Strombolian or Hawaiian, sub Plinian and Plinian eruptions. The first was selected for the protection works design, which included an eruption with a return period of 5 to 10 years and maximum melting of ice and snow (associated with a return period of 50 years).

Considering the above, civil works for Turbio-Correntoso, Zanjón Seco, Estero Correntoso and Estero Seco channels were proposed. In addition, non-structural measures were identified in order to mitigate the impacts in urban areas, integrating environmental analyses and citizen involvement in the proposal.

Under the studied conditions, the structural measures proved to be of significant cost and magnitude, far exceeding the available budget for such works. Thus, the risk mitigation must be developed primarily from non-structural measures, such as education of the population, information for the floating population, emergency management and the incorporation of lahar flow risk to the land-use planning.

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