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Reconstruction constraints on the Estero Parraguirre ice-rock avalanche in 1987, Central Andes of Chile: New insights from remote sensing and numerical modeling.

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On 29th of November of 1987, a large ice-rock avalanche occurred in a permafrost area of the central Andes of Chile. This event has been considered one of the most destructive events in that area in the last decades. The ice-rock avalanche initiated at an elevation of 4350 m, above the Estero Parraguirre. Due to the large amounts of ice and snow and the high potential energy, this avalanche developed into a debris flow propagating down the valley, reaching a travel distance of approx. 57 km after 2 hours. On the way, many people lost their lives, and two hydroelectric power plants were destroyed. The avalanche was likely triggered by warm temperature anomalies and snow build-up at high elevation linked to the concurrent and strong El Nino event in 1987.

In this study, we use old topographic maps and aerial photographs, acquired just a few days after the event, and satellite imagery to constrain the trigger volume and to accurately compute the general mass displacement. A physically-based multi-phase mass flow model is employed to retrace the dynamics and characteristics of this debris-flow event. Previous studies suggested a trigger volume of about 6 x 10^6 m^3. After entrainment along the flow path, the debris flow reached a total volume of 15 x 10^6 m^3. First results of our study suggest that the trigger volume was significantly larger than previously thought. The next step is to shed light on possible entrainment scenarios, which will be constrained by and assessed against the observed elevation changes/mass displacement.

The reconstruction of this event is crucial to better assess future events and thus to develop successful mitigation strategies.