

SAGAZ: Development of a prototype alert system to reduce the impact of glacier-related flood events

Oral

Amenazas asociadas a la criósfera

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Chile hosts the largest glacial surface in the southern hemisphere outside Antarctica. This glacier abundance brings important benefits to Chile, such as water reserves, reducing the severity of seasonal flooding and droughts, and tourism. However, glaciers also bring significant challenges, mainly due to their widespread retreat and the associated increase in landslides and floods. As glaciers retreat, new lakes form. These lakes are dammed by unconsolidated glacier deposits (moraines) or ice. Floods associated with the breaching of these natural dams are known as Glacial Lake Outburst Floods (GLOFs). GLOFs have killed more than 5,700 people over the past century along the Andes Range. Further, glacial lakes are becoming more numerous and larger, and their floods are expected to increase in frequency due to climate change.

These trends have been observed in Chile, where the impact of GLOFs has increased in the last decades. This increased damage results from the combination of increased GLOF frequency and the growth of the road network and touristic circuits into areas at risk. Most countries vulnerable to GLOFs are developing or running early warning

systems that detect GLOFs in their early stages. However, the rapid development of these floods only allows issuing warnings a day to a few hours in advance, often not enough to prevent loss of life and infrastructure. We propose that GLOFs are often associated with the combination of unusually high lake levels and a flood trigger, such as high water input (due to rain or snowmelt), a landslide, or an avalanche.

We developed a system capable of leveraging this relationship between GLOFs and unusually high lake levels to anticipate periods of increased risk of GLOF. We refer to this system as SAGAZ (Sistema de Alertas Glaciares Avanzado). SAGAZ will identify these periods of increased risk of GLOF using a predictive model fed by past and future meteorology combined with local data from in-situ monitoring stations. Therefore, in addition to operating as an early warning system upon the onset of a glacier flood, SAGAZ will be unique in its capability to increase the readiness of authorities and the population to act upon these flood warnings by anticipating periods with a high risk of floods.

SAGAZ alert system is composed of the outlined predictive model and a network of lake monitoring stations equipped with a real-time satellite link. This network is made out of innovative low-cost, low-weight, and open-hardware monitoring stations developed and built at Universidad de Magallanes in Chile. Currently, SAGAZ monitoring network includes 10 monitoring stations on lakes with a high risk of flooding houses, farmland, bridges or roads located downstream. The network has been operating since 2020, and real-time data can be visualized at www.SAGAZ.org.

Palabras Clave

(1) GLOF, (2) Risks, (3) Climate change, (4) Adaptation, (5) Monitoring.

Financiamiento:

FONDEF IDeA I+D 2021 ID21I10094

Agradecimientos:

We thank FONDEF and our associated institutions: Corporación Nacional Forestal Región de Magallanes y la Antártica Chilena, Ecoturismo Patagonia Exploradores EIRL, University of Calgary, Naviera y Turismo Skorpions S.A., Dirección General de Aguas.