EGU21-4193, updated on 16 May 2021
https://doi.org/10.5194/egusphere-egu21-4193
EGU General Assembly 2021

Long-lasting impacts of a glacial lake outburst flood on the hydrology of a fjord-river system (Pascua River, Chilean Patagonia)

Loic Piret[1], Sebastien Bertrand[1], Nhut Nguyen[1], Jon Hawkings[2,3], Cristian Rodrigo[4], and Jemma Wadham[5]

[1]Renard Centre of Marine Geology, Department of Geology, Ghent University, Ghent, Belgium
[2]Department of Earth, Ocean and Atmospheric Sciences, Florida State University, Tallahassee, Florida, United States
[3]German Research Centre for Geosciences GFZ, Potsdam, Germany
[4]School of Earth Sciences, University Andrés Bello, Viña del Mar, Chile
[5]Bristol Glaciology Centre, School of Geographical Sciences, University of Bristol, Bristol, UK

Glacial Lake Outburst Floods (GLOFs) are an increasing threat to Patagonian environments and communities. Here, we investigate the geomorphological and hydrological impact of a recent GLOF from Pascua River, which discharges at the head of Baker Fjord (Chile, 48°S). To do so, a sediment core was taken ~4 km offshore of the Pascua River mouth at a water depth of 248 m. The coring site is located on the flank of a submarine channel incised trough the subaquatic delta of Pascua River, 30 m above the bottom of the channel. The sediment physical and chemical properties were analysed at high resolution with X-ray CT, MSCL and XRF core scanning, in combination with lower resolution grain-size and bulk organic geochemistry measurements, and a core chronology was established using downcore variations in ^{137}Cs activity. In addition, historical maps and satellite imagery of the past century were examined in combination with multibeam bathymetry of Baker Fjord to aid the interpretation of the sediment record.

Results show that the sediments are composed of two distinct units separated by a 5-cm thick event deposit dated 1945±9 CE. Below the event, the sediment consists of coarse silt and fine sand, likely representing sediment deposition from turbidity currents. Above it, it consists of very fine silts, likely representing settling from the surficial sediment plume. Historical evidence shows that the event deposit corresponds to a ~256 10^6 m^3 GLOF from Bergues Lake, the proglacial lake of Lucia Glacier that discharges directly into Pascua River. Before 1945, historical information shows that Pascua River drained via two active river branches that were most likely connected to the two submarine channels visible in the bathymetry of the subaquatic delta. After 1945, only the western river branch appears active, which likely caused the abandonment of the eastern submarine channel near which the sediment core was taken. Therefore, we hypothesize that the 1945 Bergues Lake GLOF caused the abandonment of the eastern river branch and submarine channel, which explains the absence of coarse-grained sediments in our sediment record after 1945±9 CE.

This study provides the first report of a GLOF from the northeastern part of the Southern

Patagonian Icefield, and it demonstrates that GLOFs can have long-term impacts on the hydrology of fjord-river systems.