Tracking Multiple Subglacial Floods in Iceland Using Seismic Arrays

Eva P. S. Eibl (1,2,3), Christopher J. Bean (3), Kristin S. Vogfjörd (4), Bergur Einarsson (4), Tómas Jóhannesson (4), and Finnur Pálsson (5)

(1) Institute of Geosciences, University of Potsdam, Karl-Liebknecht-Str. 24, 14476 Potsdam, Germany, (2) School of Earth Sciences, University College Dublin, Dublin 4, Ireland, (3) School of Cosmic Physics, Dublin Institute for Advanced Studies, 5 Merrion Square, Dublin 2, Ireland, (4) Icelandic Meteorological Office, Bústaðavegi 7-9, 108 Reykjavík, Iceland, (5) Institute of Earth Sciences, University of Iceland, Sturlugata 7, 101 Reykjavík, Iceland

Glacier-covered volcanoes are not only prone to explosive eruptions but can also generate huge subglacial floods. Interactions of the volcanoes' associated geothermal areas within the ice can also generate substantial subglacial floods. In Iceland, these floods can travel up to 50 km beneath the ice before they reach a glacial river, to subsequently flood the lowland and damage or destroy infrastructure such as large hydropower reservoirs and the only road circling the whole island. Hydrological instruments in the flooded river can provide up to 4-5 hours of early-warning for floods from W-Vatnajökull ice cap. During a flood in 2011 from Katla this early warning, however was only 50 minutes before the flood hit the main road.

We present hydrological, GPS and seismic recordings of four floods in southeast Iceland. We show that in one specific flood the GPS instrument increased the early-warning time for floods to several days. Operation of these instruments on the ice surface however, can be sensitive to the harsh environment and costly. Therefore, to simultaneously monitor multiple subglacial lakes in a more reliable and less costly way, we suggest the use of seismic arrays situated outside the glacier margin. They are able to track the flood front at high temporal and spatial resolution and provide an early-warning for all four floods of more than 18 hours.