# Expanding Flood-Monitoring Capabilities using Seismic Tremor and Infrasound

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Weather- and glacier-related floods are common in Iceland. Floods of meteorological origin can result from intense rainfall or snow-melt, with various seasonal factors, such as frozen ground, compounding the severity of flooding. Glacial outburst floods (jökulhlaup) can occur anytime; sources include ice-dammed lakes and water reservoirs that develop at the base of ice-caps overlying volcanic or hydrothermal areas. Jökulhlaup due to volcanic unrest often occur with little warning and they usually cause damage to infrastructure and agricultural land.

River monitoring in Iceland is the responsibility of the Icelandic Meteorological Office (IMO). Floods are detected through a national network of over 20 gauging stations, which sends measurements to IMO in near-real-time. However, in relation to catchment sizes, the network covers only a small fraction of Iceland's major rivers. Compromises between station locations and accessibility result in flood warnings from the lower part of a catchment, which impacts on the effective response-time for mitigating hazards.

In this presentation, we highlight the possibility of expanding flood-monitoring capabilities using seismic tremor and infrasound. Over 70 permanent seismic (SIL) stations, also operated by IMO, are sited throughout the country for monitoring earthquake and volcanic hazards. Several stations are located near or on the Mýrdalsjökull and Vatnajökull ice-caps, where jökulhlaup occur frequently. At sites where SIL stations are in close proximity to gauging equipment, seismic amplitude measurements have been compared to water-level readings. The results show a remarkable positive correlation between water-level - a proxy for discharge - and tremor intensity. This relationship is especially apparent at fast-flowing, turbulent rivers. Similarly, an infrasound array to the north of the Vatnajökull ice-cap shows diurnal variations in acoustic signals that follow water-level changes in a nearby glacial river - Jökulsá á Fjöllum. The analysed seismic and infrasound measurements show how fluid movement can generate elastic waves that propagate through the ground and atmosphere. This underlines the potential for using tremor-amplitude and infrasonic measurements as an early warning for hazardous floods, particularly in regions where hydrological measurements are sparse.