



## SEISMIC MONITORING OF GLACIER CALVING, TREMORING, AND SURGING ON SPITSBERGEN, SVALBARD

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Seismic observations can be used to monitor glacier activity such as basal sliding, crevassing, and calving. We use seismic data recorded on permanent broadband stations on Svalbard to detect, locate and analyze near-regional glacier seismicity. We observe a high number of icequakes around Kongsfjorden (northwestern Spitsbergen) and Hornsund (southern Spitsbergen) that are clearly related to individual tidewater glaciers in these areas. Seismicity shows clear seasonal variability, i.e. much more events are observed during melt season. We have strong evidences from a local monitoring experiment at Kongsfjorden as well as from direct observations that those icequakes are related to calving. A second type of glacier-related seismic emission around Kongsfjorden is a tidally modulated tremor-like signal. Tremoring could be due to tidally modulated hydrostatic pressure changes which could influence the flow of water through the basal hydrological system of glaciers. We also find that glacier surges can be observed seismically. A cluster of seismic events in Southern Spitsbergen is related to the surge of the Nathorstbreen glacier system in 2009. We suggest that the source mechanism is bed-failure. Furthermore, as an indirect indicator for surging, we observe a higher number of seismic calving events during surges of Tunabreen (2003) and Wahlenbergbreen (2011) compared to melt seasons in other years. In summary, our results show the great potential of using seismic observations to quantify calving, to better understand the glacier basal-hydrological system, and to detect surging on Svalbard and thereby supporting glaciologists in better dating surging events.

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