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Title: *Acoustical signatures of melting and calving glaciers as indicator of dynamic processes in the Arctic*

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Ice activity is a main source of underwater ambient noise in the Arctic Ocean. The physical processes accompanying melting glaciers generate underwater sound audible in the fjords of marine-terminating glaciers, and these are potentially useful in the study of their changing dynamics. The noise generated by glaciers allows for the quantification of melting processes and can be a good indicator of rapid climate changes. Detection and analysis of hydro-acoustic signals from a glacier will provide a valuable method to predict the effects of global warming on the Earth's environment.

In August 2009 we made measurements of the underwater ambient noise in two Spitsbergen fjords, which differ significantly in their surrounding environment. The Hornsund fjord is surrounded by mountains and melting glaciers, whereas the Murchison fjord, located in the northern part of Spitsbergen, is devoid of glaciers but full of floating ice floes. During the measurement campaign, the weather was calm, with no wind, rain or breaking waves, but there were fast currents of water flowing from glaciers in the Hornsund and tidal currents in the Murchison fjord.

Measurements were conducted at frequencies from 20 Hz to 24 kHz using an omnidirectional hydrophone deployed at a depth of 18 m. Our work was focused on detecting the acoustic signature of melting and calving events in recorded ambient noise. Spectral, wavelet, fractal and statistical parameters of the noise were computed in a sliding window as used as inputs into a neural network algorithm, which classified ambient noise into three different groups of signal events. However, some events were difficult to classify correctly and reliably. This fact inspired us to search for more sophisticated statistical analyses, which could deliver trustworthy information on the occurrence of calving events in acoustical measurements. We put forward the hypothesis that, at low frequencies, the probability density distribution of the noise differs significantly from the normal distribution and gives clues about the number and diversity of contributing sources.

In summer 2013 and 2014 we plan to conduct long-term acoustic measurements in the Hornsund. Detection and analysis of hydro-acoustic signals from a glacier will provide a valuable method to predict the effects of global warming on the Earth's

environment.

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