Vertical line array measurements of the sound radiated by melting glaciers in Hornsund Fjord

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ABSTRACT

Marine-terminating glaciers worldwide are melting rapidly in response to climate shifts, resulting in the delivery of freshwater into the oceans. Submarine melting at the glacier-water interface accounts for a significant component of the freshwater delivery from the glacier. This melting produces a distinct acoustic signature, providing a potentially viable modality to monitor glacial ice melting on a large scale via acoustic sensing. In order to evaluate the utility of ambient noise oceanography as a tool to quantify glacial ice-melt, in June 2019 we deployed a vertical hydrophone array and made acoustic measurements at some glacier termini in Hornsund Fjord, Spitsbergen. Quantification via array processing proves to be challenging due to (1) the space- and time-varying sound-speed profile in the underwater channel, and the way it refracts sound in an unknown manner, (2) limited vertical resolution of the array due to its aperture, and (3) interference from other noise sources such as melting icebergs, for example, contaminating the melt sound recordings. We present preliminary results from the processing which reveal different acoustic levels arising from submarine melting at different glaciers. The sound from the melt seems to be more dominant in the upper layers of the water at the glacier-sea interface.