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TEMPORAL VARIABILITY OF FREQUENCY-WAVENUMBER PATTERNS AT SPITSBERGEN BROADBAND ARRAY

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For the purpose of automatically detecting and classifying icequakes (any seismic transient related to ice-movement, including ice-rock and ice-water interactions) in the arctic environment we have analysed three years of continuous data (2009-2012) at the small-aperture broadband array installation SPITS located on the Svalbard archipelago. The final goal of the study is testing possible links between climate change in the arctic and potential variations of icequake acitvity. In order to obtain reliable event statistics the automatic identification of icequake related events needs to be robust. We make use of a hidden Markov model (HMM) based classification approach that tries to improve robustness of transient event detection by exploiting the abundance of observations of the seismic background wavefield to learn the parameters of a stoachstic background model. Combining this information with training examples from transient event classes into a stochastic framework allows effcient and robust classification of distinct seismic transient signal classes as shown in different application domains (Hammer et al., 2012, 2013).

The success of the employed classification method depends strongly on the proper background model description as has been shown by Riggelsen and Ohrnberger (2012) using a similar technique (dynamic Bayesian network classifier). It is therefore necessary to know, at what time scales the background seismic wavefield exhibits significant changes in signal properties in order to collect and re-initiate training of the background model in an efficient manner. In this particular classification task we have based our signal descriptions on the analysis results of a multi-broadband f-k processing scheme. It is thus important to get insight into the temporal variability of noise patterns of frequency wavenumber results on different time scales.

Opposed to our expectation the temporal variability does not follow simple seasonal variations. Changes in wave field directions (we report backazimuth here, i.e. direction towards seismic source locations) and slowness occurr on short term, even within a couple of hours and -given the remote location of the array SPITS- without being clearly related to anthropogenic activity. Summarizing the observations in hourly, daily and monthly histograms we are able to identify a rather small number of (returning) patterns in the slowness space for three different frequency bands (1.5-4.5Hz, 3.0-9.0 Hz, 6.0-18.0 Hz). We observe long-term stable localized wave field directions in south-western directions in months February to May changing abruptly to south-eastern direction in June and continuing to south-eastern and north-eastern directions during months September to November. Months December and January show a broader spread in wave field directions although returning again preferentially to western directions. Interestingly, the observed slowness bands are confined almost all the year to the band of typical crustal and upper mantle P-velocities, indicating a dominance of the wave field composition to local and regional wave propagation. The Rayleigh wave slowness window -typically

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observed on small aperture arrays in the continuous seismic wave field- is only dominating wave field characteristics in June, July and declining intensity within August.

Although the origin of the described patterns are yet unknown and the investigated frequency range is not the typical one for microseisms we suppose a relation to climatic/weather conditions that we try to uncover studying records of temperatur, wind speeds and sea ice cover on Svalbard and its surrounding area.

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