**Seasonal variations in seismic noise emissions of Arctic sea ice recorded by deep-water ocean bottom seismometers: implications for ice deformation and swell generation**

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Stress and deformation of sea ice produces icequakes and other seismic emissions that can be exploited to monitor the stress state of the sea ice cover. Ambient and transient seismic wavefields recorded by seismic sensors on ice floes have also been used to estimate the thickness and elastic properties of sea ice. During the first year-round deployment of broadband ocean bottom seismometers at a deep-water location in the Laptev Sea, Arctic Ocean, we accidentally discovered that the seismic noise emissions of sea ice are recordable also at water depths of 4000 m. Thus, information on the state of the sea ice cover can also be gained from spectral analysis of the ambient seismic noise recorded at the seafloor.

Microseisms with periods of 2-5 s are strongly seasonally modulated and appear when the Laptev Shelf area becomes ice-free. At high frequencies (6-50Hz), short, distinct noise bands appear in winter time. We associate these signals to noise generated by the sea ice over an area of at least tens of kilometers in extent. To analyze the seasonality of the noise sources, we extracted the spectral power in various frequency bands and compared it with variations of the significant wave height from Wave Watch III hindcast models and of ice concentration and drift from satellite data. This comparison revealed that sea ice-related noise decays suddenly in late May while sea ice concentration is still 100%, suggesting that the physical properties of the sea ice change at this time prior to break-up. Likewise, sea ice only gradually develops its noise-generating capabilities after the freezing period, likely when compression of ice floes contributes to their thickening. During autumn, several swell events cause large-amplitude microseisms and simultaneously high-frequency noise although ice-noise is otherwise not present in this season. Ice concentration decreases following the swell events, showing the impact of swell on the state of the sea ice during the freezing season.