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# First Ocean Bottom Seismometer network underneath the ice-covered Arctic Ocean: Operational challenges and chances for monitoring the state of the sea ice cover

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Active and passive seismic monitoring of the cryosphere is mostly done with land seismometers on the surface of ice masses. Seismic monitoring beneath sea ice at the bottom of ice covered oceans has hardly been attempted, because ocean bottom seismometers (OBS) are difficult to recover in perennial sea ice. As a result, for example the tectonic activity of the Arctic mid-ocean ridge system is poorly known. Recently, the ambient seismic noise in long-term seismic records proved a useful tool to monitor the state of the sea ice cover. Since sea ice effectively dampens the formation of wave action, the power in the microseismic noise band, that is mostly generated by ocean wave action, shows seasonal variations which can be explored to study ocean wave climate in relation to the sea ice cover.

From September 2018 - September 2019, we deployed for the first time a network of 4 broadband ocean bottom seismometers at distances of about 10 km at a water depth of roughly 4 km near Gakkel Deep on eastern Gakkel Ridge, Arctic Ocean, from board RV Polarstern. We modified the Lobster-type OBS to include a Posidonia transponder that allowed to accurately track the OBS during descent and ascent and when surfacing underneath an ice floe. We then carefully broke the ice floes until the OBSs appeared in open water and could be recovered.

The network was designed to record local earthquakes along Gakkel Ridge, but it also yields valuable year-round data on the microseismic noise signal at the bottom of the Arctic Ocean in a marginal ice zone.

A first inspection of the data shows a clearly reduced power in the microseismic noise band compared to the Norwegian-Greenland Sea and strongly time dependent noise levels, that may potentially be related to temporary wave action when sea ice retreats during summer. However, the modified OBS structure with a large head buoy fixed to the OBS structure may also be prone to vibrations caused by ocean bottom currents. We will present an initial analysis of the seasonal evolution of the ambient seismic noise that will help to discriminate noise sources and evaluate the potential of such records to monitor the state of the sea ice cover.