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# Seismology on drifting ice floes

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The local earthquake activity in the Arctic basin is hardly known as a perennial cover with sea ice prevents the use of Ocean Bottom Seismometers to detect and record small earthquakes. Therefore, active processes along the ultraslow-spreading Arctic mid-ocean ridge system remain largely unexplored. To gain a first insight into ongoing magmatic and tectonic processes at Gakkel Ridge and Lena Trough, we deployed small seismic arrays on drifting ice floes to record the local seismicity.

We illustrate the challenges and curiosities encountered during 4 deployments of seismometers on drifting sea ice in 2001, 2007, 2008 and 2009. The survey area was reached by icebreaking vessels carrying a helicopter which was used for transport of equipment to and from the ice floes.

We instrumented km-sized multi-year ice floes with 3-4 seismic stations arranged in a triangular array. The stations consisted of three-component passive short period sensors or active broadband sensors, a Reftek RT130 data logger sampling at 100 Hz, batteries and an ARGOS transmitter to track the station. The seismometers were installed on a wooden plate and covered with a bucket and a large snow heap for insulation. The GPS position of each station was logged hourly. The arrays were recovered after drifting at speeds of up to 1 km/h for 4-15 days. Altogether we acquired 72 days of microseismicity data with 1-3 arrays simultaneously.

Earthquakes can be discriminated from a variety of signals arising from the noisy and unstable ice platforms by the fact that their waves arrive from steeply below and produce almost simultaneously at all array seismometers larger vertical component signals than horizontal component signals. We detected teleseismic ($\sim$mb 6), regional ($\sim$mb 2) and local earthquakes, as well as acoustic signals from distant earthquakes and sounds of submarine volcanic activity.

The localization of the recorded earthquakes requires special processing techniques. Strongly varying water depth and a constantly changing position and geometry of the receiving arrays need to be accounted for. S-phases are only recorded as converted SP-phases are often difficult to identify. The lack of detailed seafloor topography data limits the accuracy of earthquake location. Despite these limitations, we could detect and localize hundreds of microearthquakes in Lena Trough and along different segments of Gakkel Ridge demonstrating active tectonic and magmatic rifting.