SnT 2025 8 SEPTEMBER ONLINE DAY 9 TO 12 SEPTEMBER AT HOFBURG PALACE, VIENNA & ONLINE
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

Detecting Seismoacoustic Events in the Arctic Ocean

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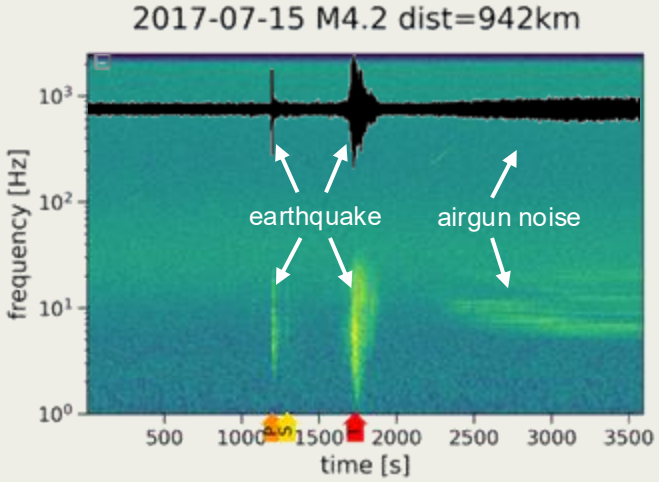
INTRODUCTION AND MAIN RESULTS

Changes to the natural and human environment are impacting the Arctic Ocean's soundscape. These changes can affect hydroacoustic detection of events in the Arctic.

We find that regional sea ice concentration controls acoustic seasons in the Arctic Ocen. Intraseasonal noise is dominated by ocean wave height, wind speed and airgun surveys.



This Ground-based Nuclear Detonation Detection (GNDD) research was funded by the National Nuclear Security Administration, Defense Nuclear Nonproliferation Research and Development (NNSA DNN R&D) and the Nuclear Testing Limitations (NTL) Program in the NNA Office of Nuclear Verification (NA-243) and LANL Laboratory Directed Research & Development (LDRD). The views expressed here do not necessarily reflect the opinion of the United States Government, the United States Department of Energy, or Los Alamos National Laboratory. LA-UR-25-28414

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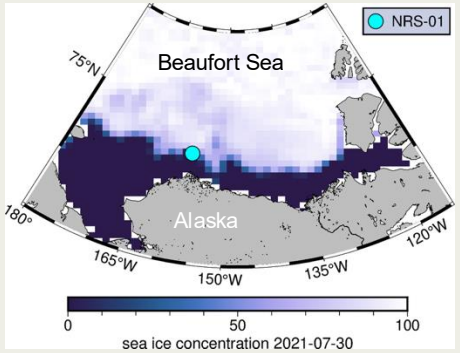
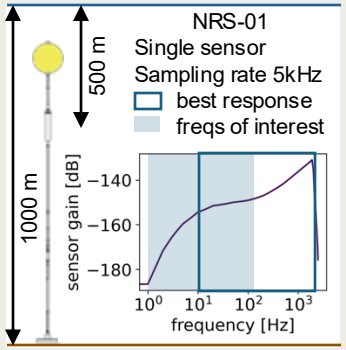
P1.3-405

Introduction: Beaufort Sea hydrophone





The NRS-01 hydrophone is part of NOAA's passive acoustic Ocen Noise Reference Station (NRS) network. Data available from 2014-2022. Regional average sea ice concentration ~60% at onset of summer.

Methods: Acoustic power vs enviro data

Compute power spectral density (PSD) for acoustic data
- 1-hour average PSDs for all times 2014-2022
- 10-second windows; 0.1 Hz frequency resolution

Integrate bandpower over frequency ranges:
- 1-125 Hz, 1-2 Hz, 15-125 Hz

Compare to environmental data sets
- Sea ice concentration, wave height, wind speed
- Get environmental vs acoustic data at 1 hr intervals
- Find median noise level for environmental data bins
- Weighted least squares regression to find acoustic-environmental relationships

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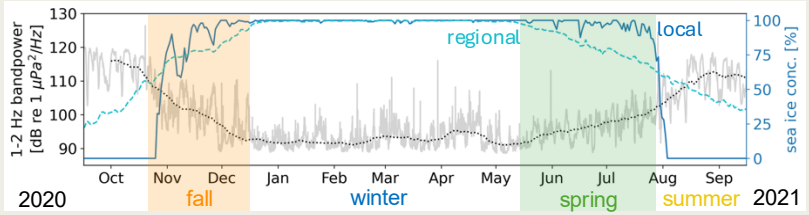
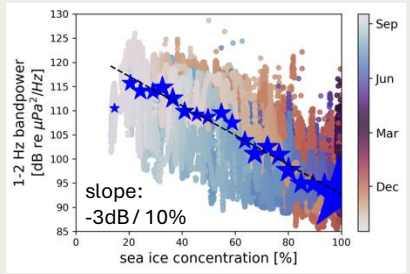
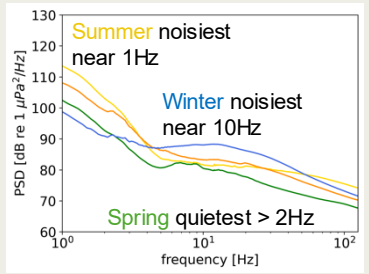
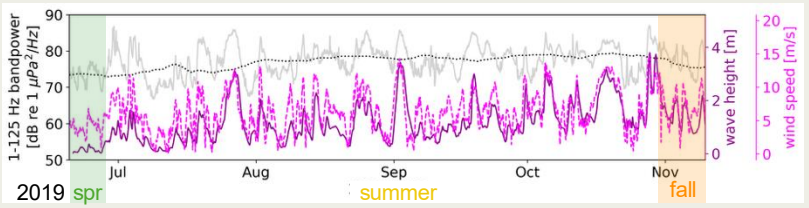
Results: Natural forcings

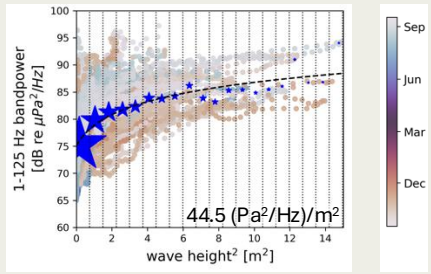


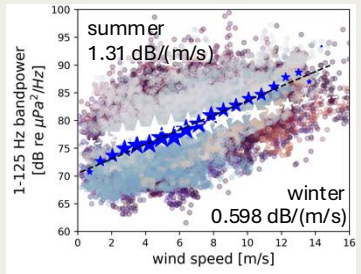




Sea ice concentration controls acoustic seasons. Changes to sea ice patterns will affect the noise regime.



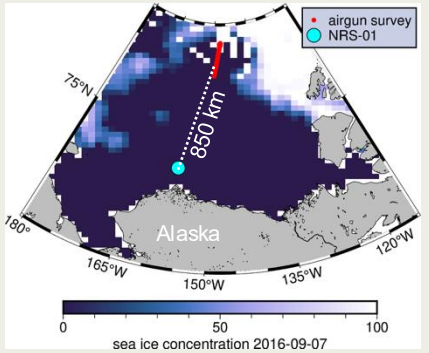




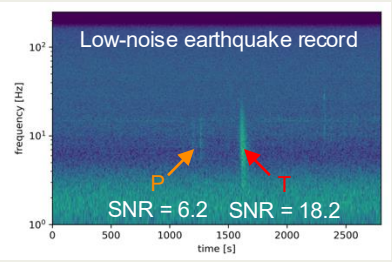
Intraseasonal variations are driven by wave height (in low-ice seasons) and wind speed.

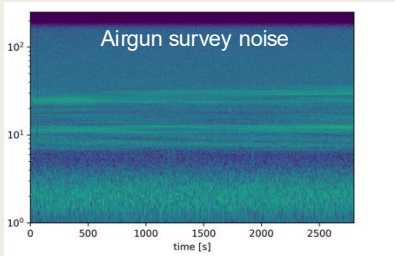
Results: Anthropogenic noise

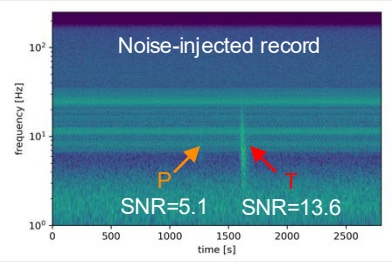
A powerful airgun survey located 730-970km from NRS-01 raised the 1-125 Hz noise level by 3.07dB. The propagation path was largely ice free. Human maritime activities are likely to intensify in coming years.



Discussion: Impact on event detection







Augmenting a hydrophone earthquake record with noise from an airgun survey results in reduced SNR and potential for missed detections.

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