

Directional acoustic sensing using the NoiseSpotter®

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Frank Spada

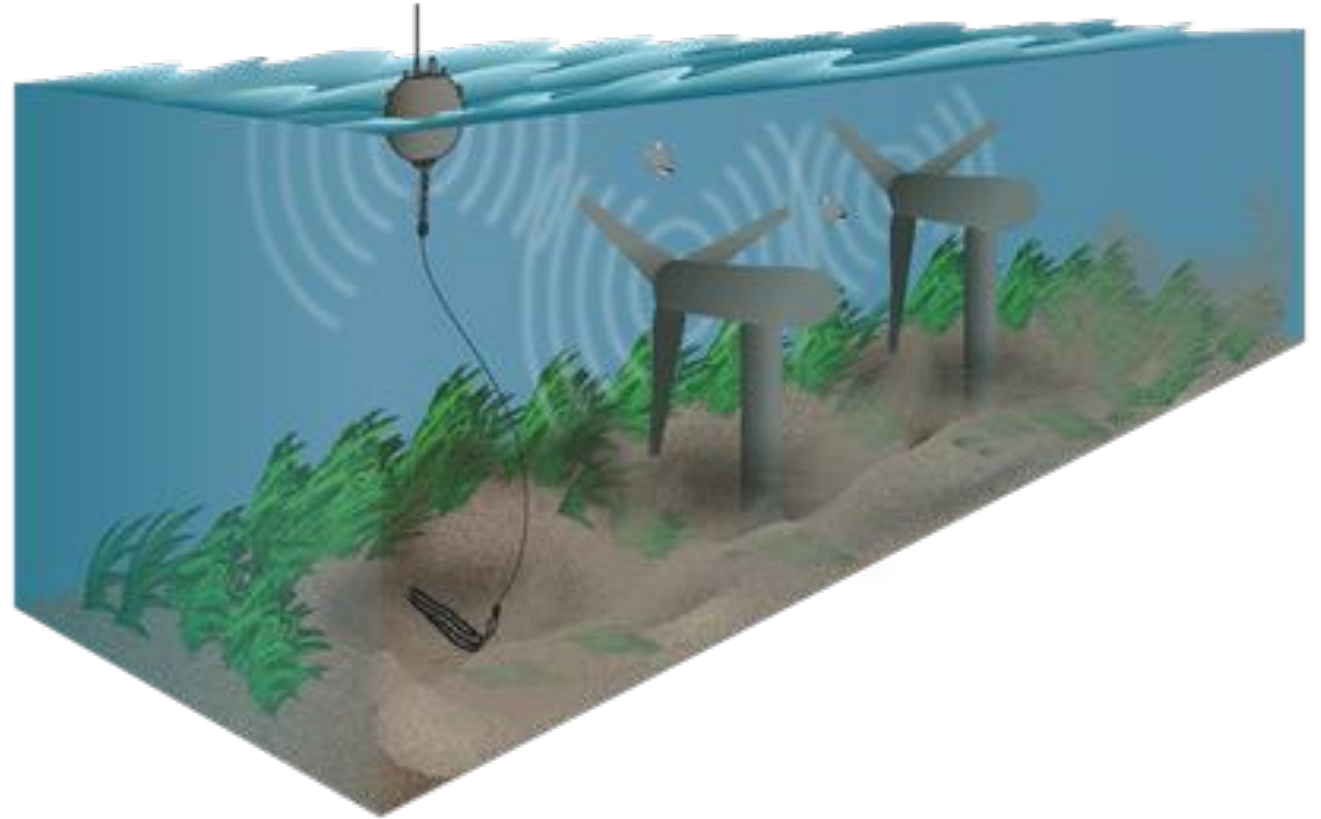
Grace Chang

September 29, 2023

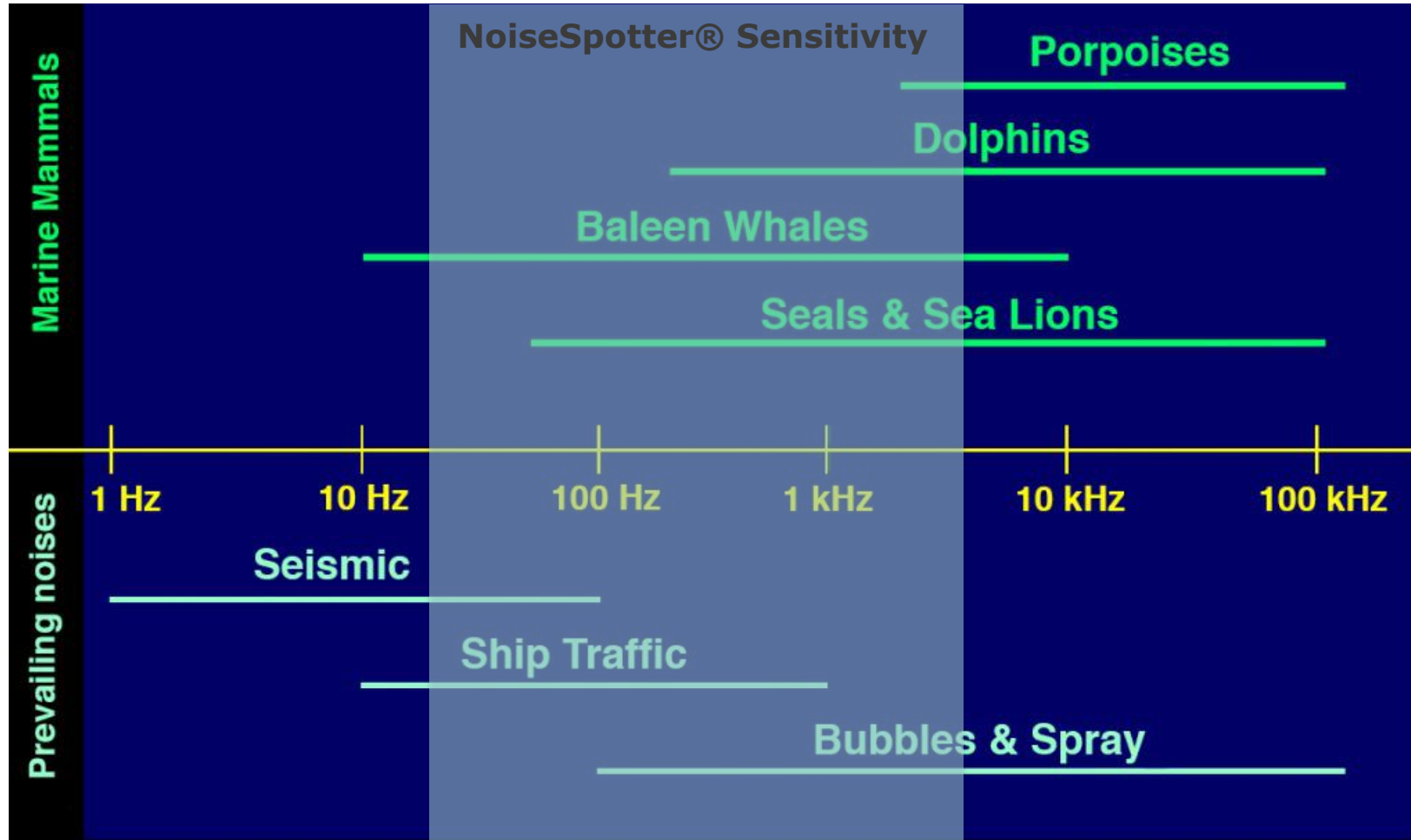


Motivation

- Instrumentation that will facilitate acoustic data collection as a means to reduce risk and streamline environmental permitting
- Expected source intensity levels 106-109 dB re 1 μ Pa in 125-250 Hz range, 25 m from source (Tougaard et al. 2015)
- Source localization can help isolate device noise from other sounds
- Real-time characterization can help with mitigation efforts.



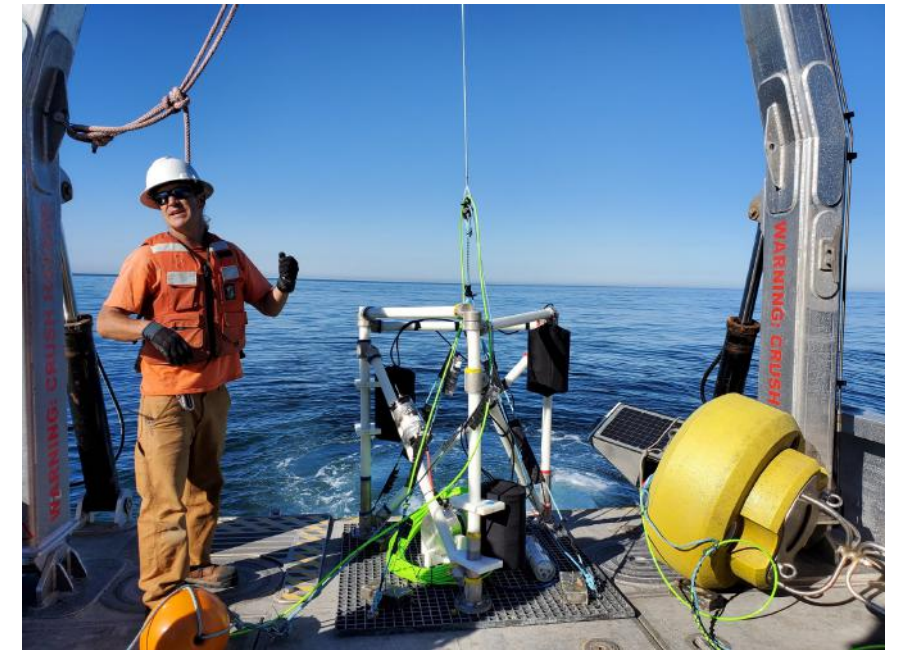
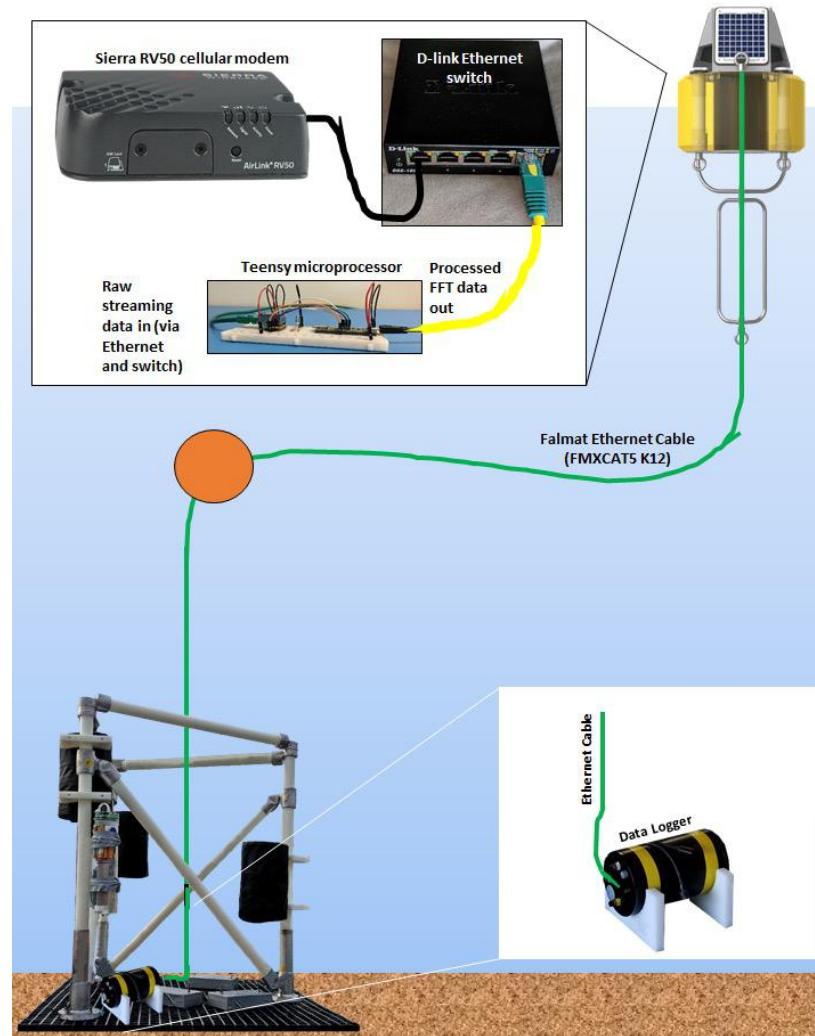
Sources of sound in the ocean



Adapted from www.dosits.org

Methods

- NoiseSpotter® passive acoustic monitoring system offshore of the CalWave xWave™ WEC
- Each sensor measures acoustic pressure and 3D particle motion, 50 Hz-3 kHz
- Water depth 18-25 m
- Sensor spacing:
 - Vertical: 35 cm, 50 cm, 70 cm above sea bed.
 - Horizontal: 1 m separation
- Sensors enclosed in flow noise-removal shields



November 2021 deployment

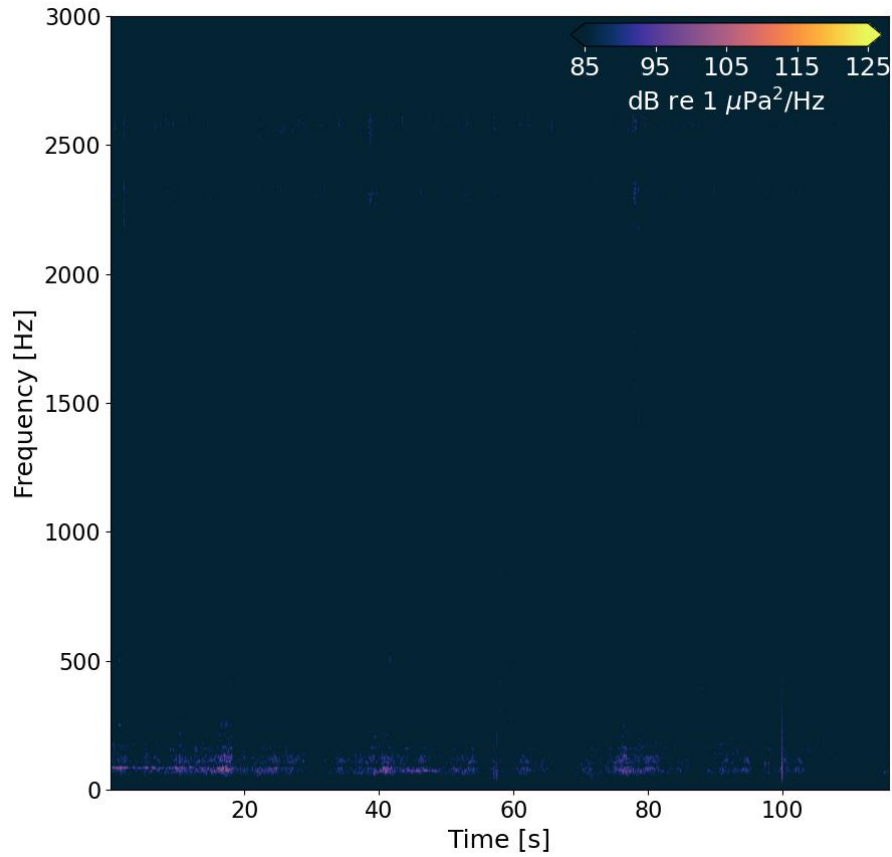


Date	Objective
November 13	Mobilization
November 14	NoiseSpotter® as drifting system, along with DAISY
November 15-16	Real-time NoiseSpotter®
November 17-18	Non-real time NoiseSpotter®, 100 m and 200 m from WEC along four cardinal directions
November 19-22	Multi-day non-real time NoiseSpotter®
November 22	Demobilization

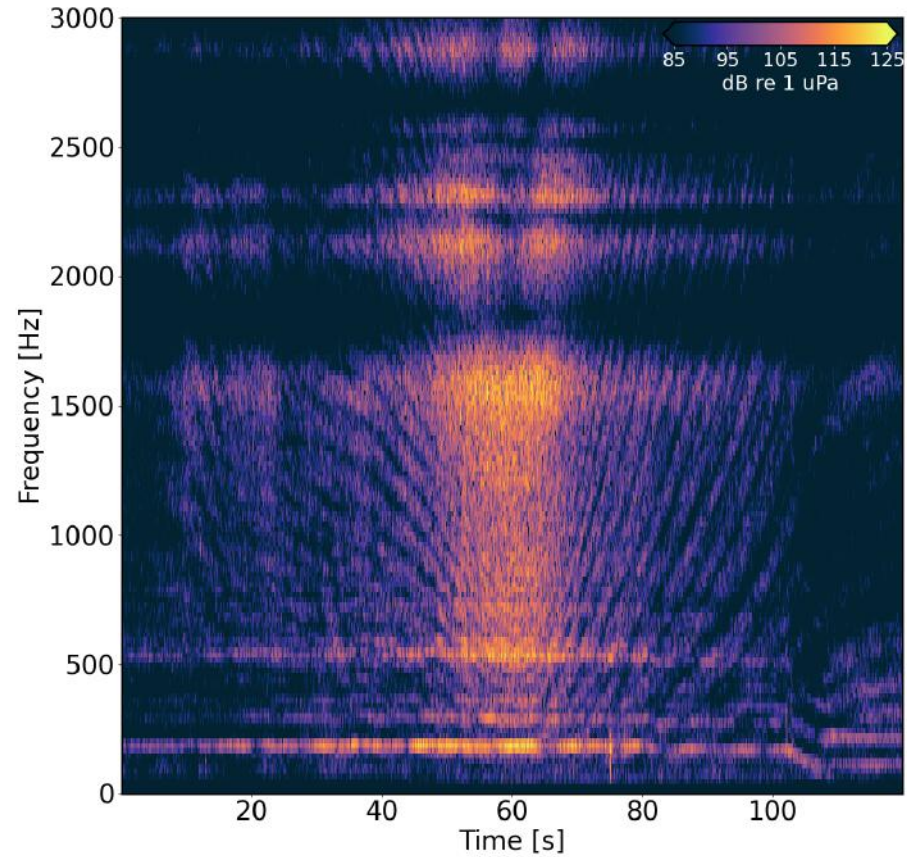


WEC versus boat sounds

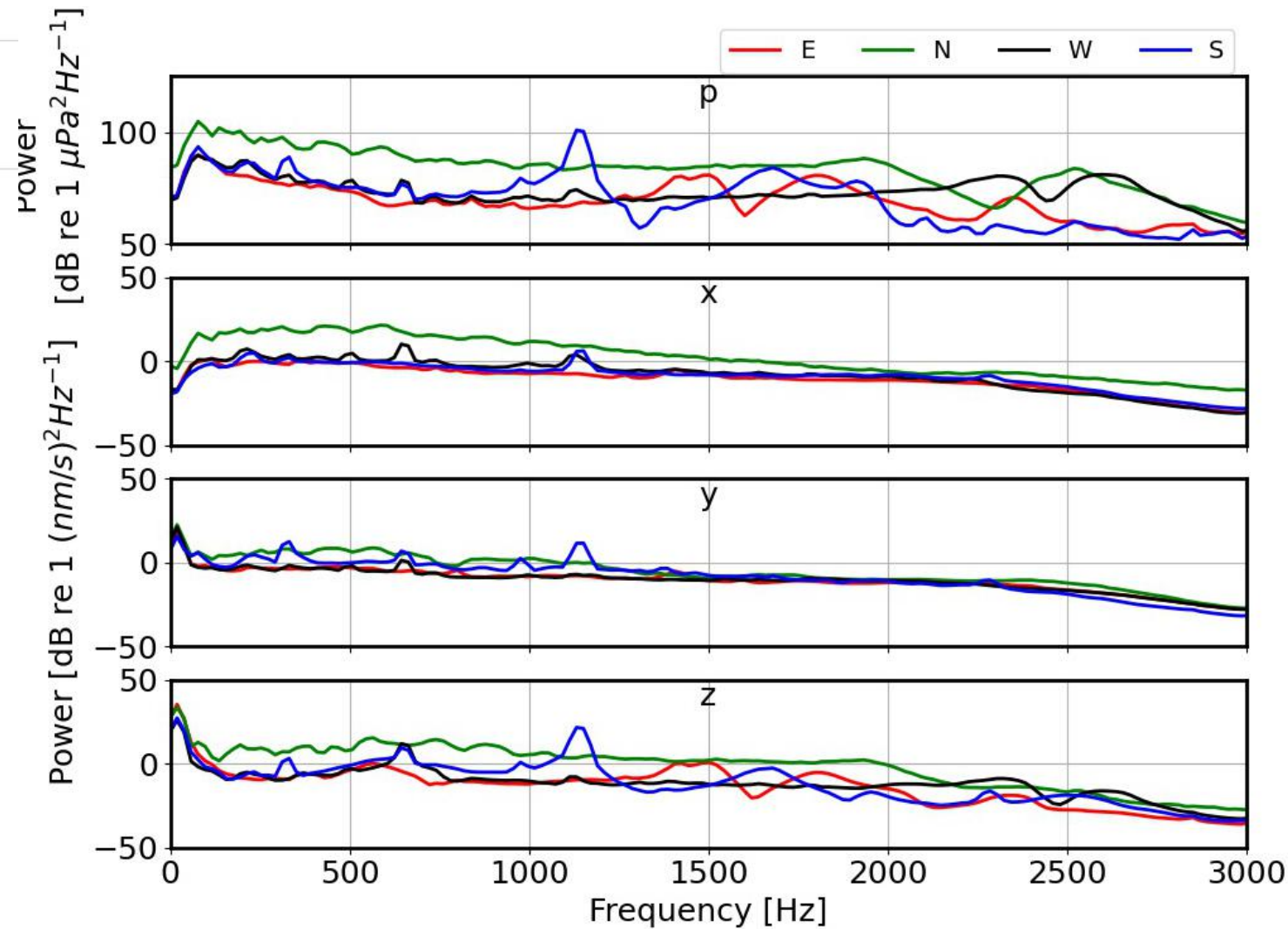
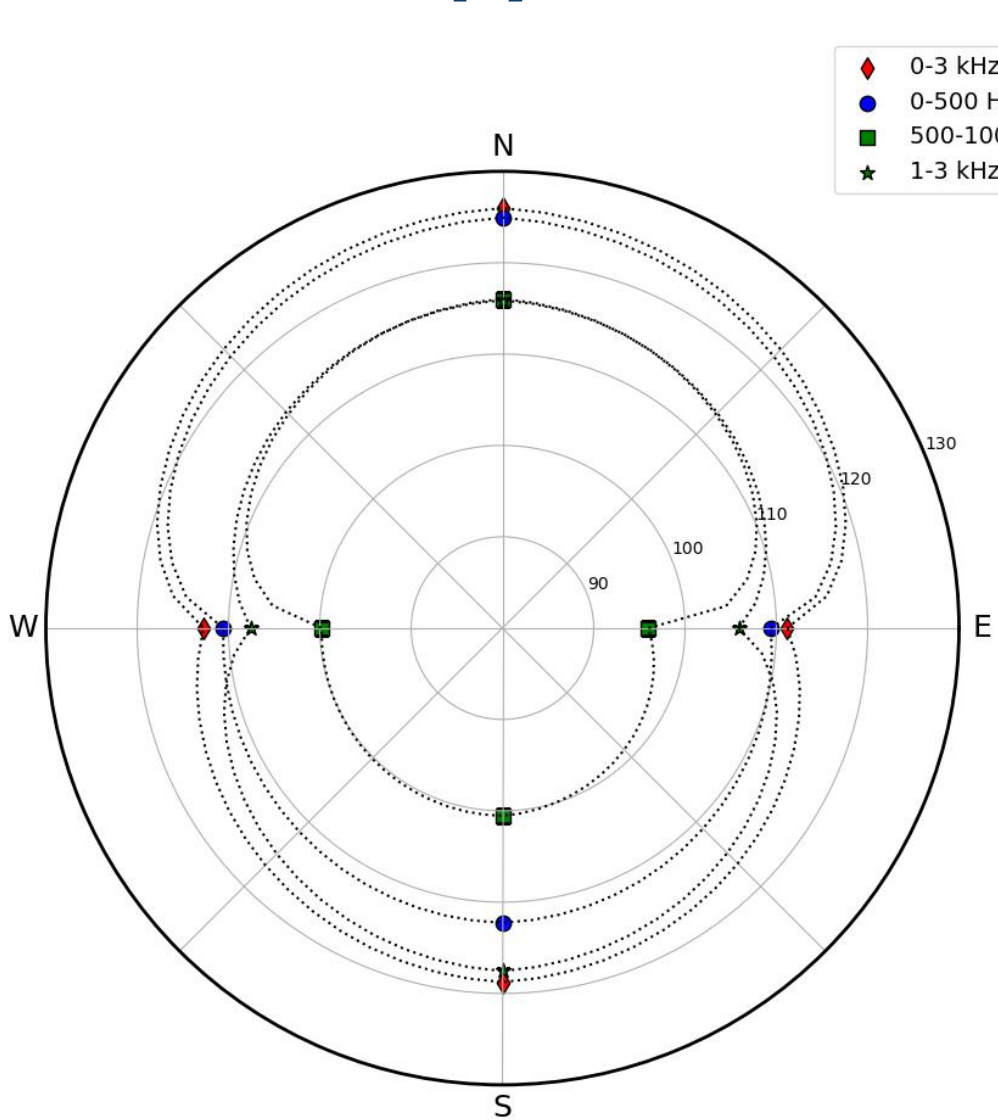
WEC



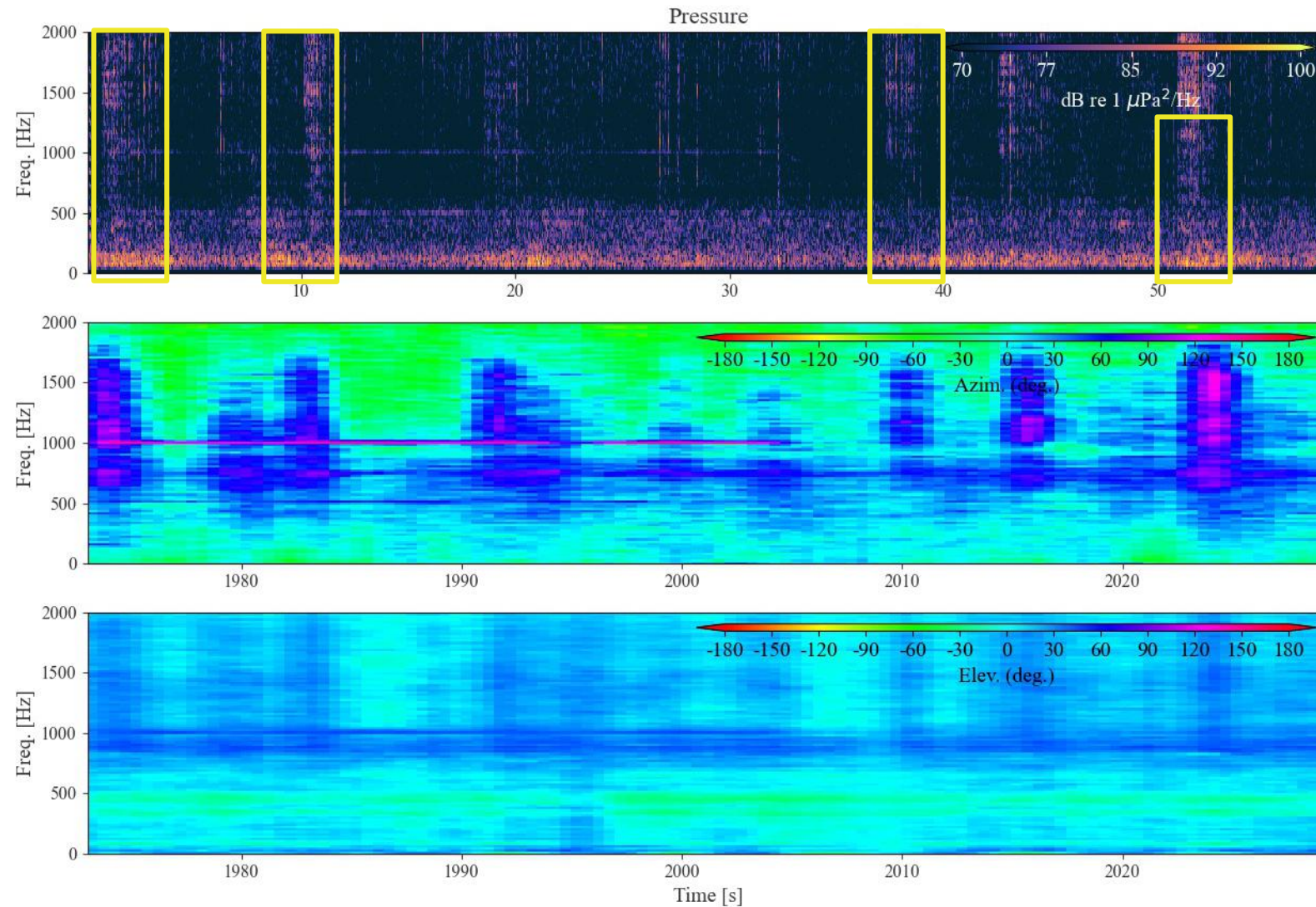
Boat



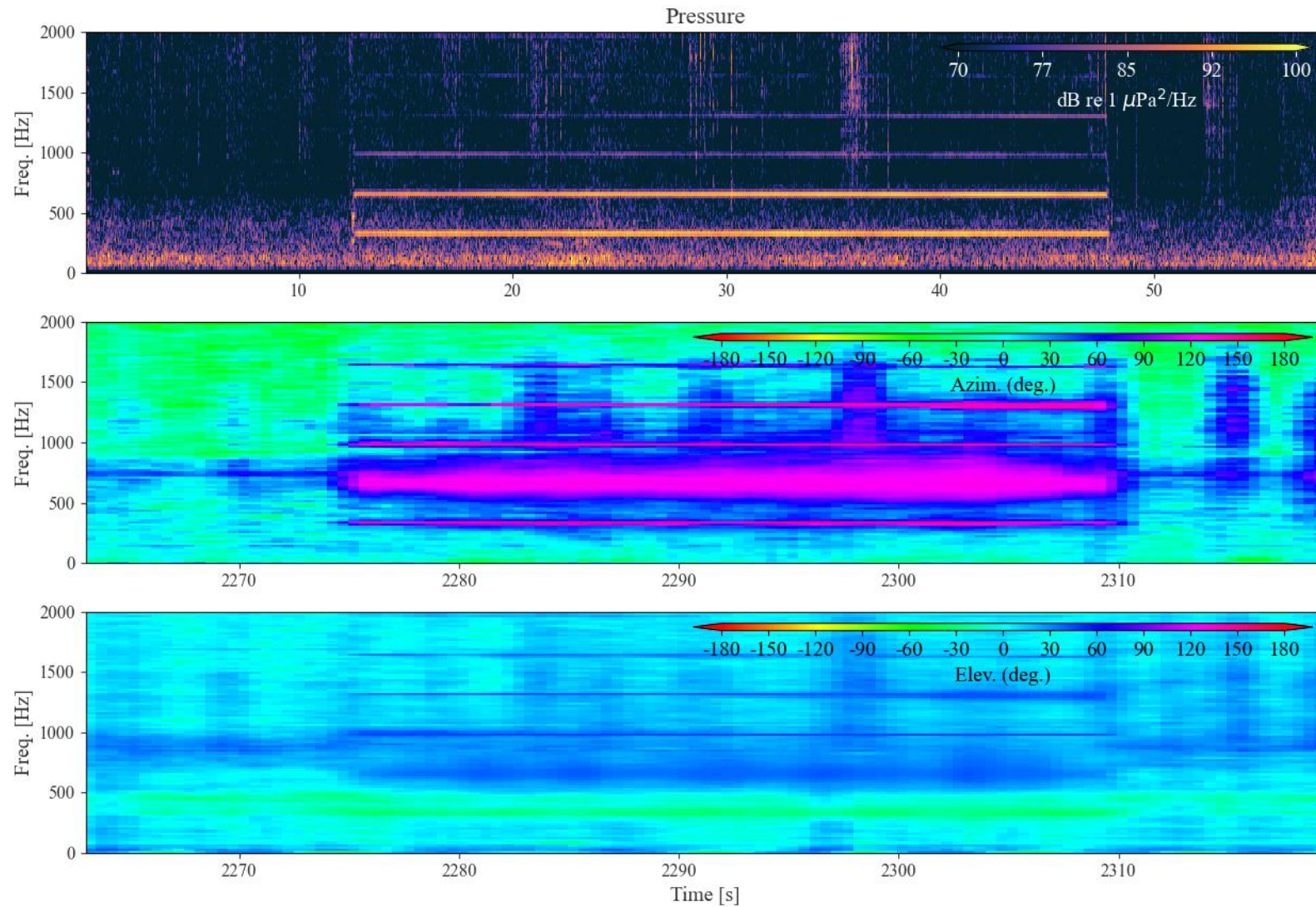
CalWave deployment: azimuthal anisotropy



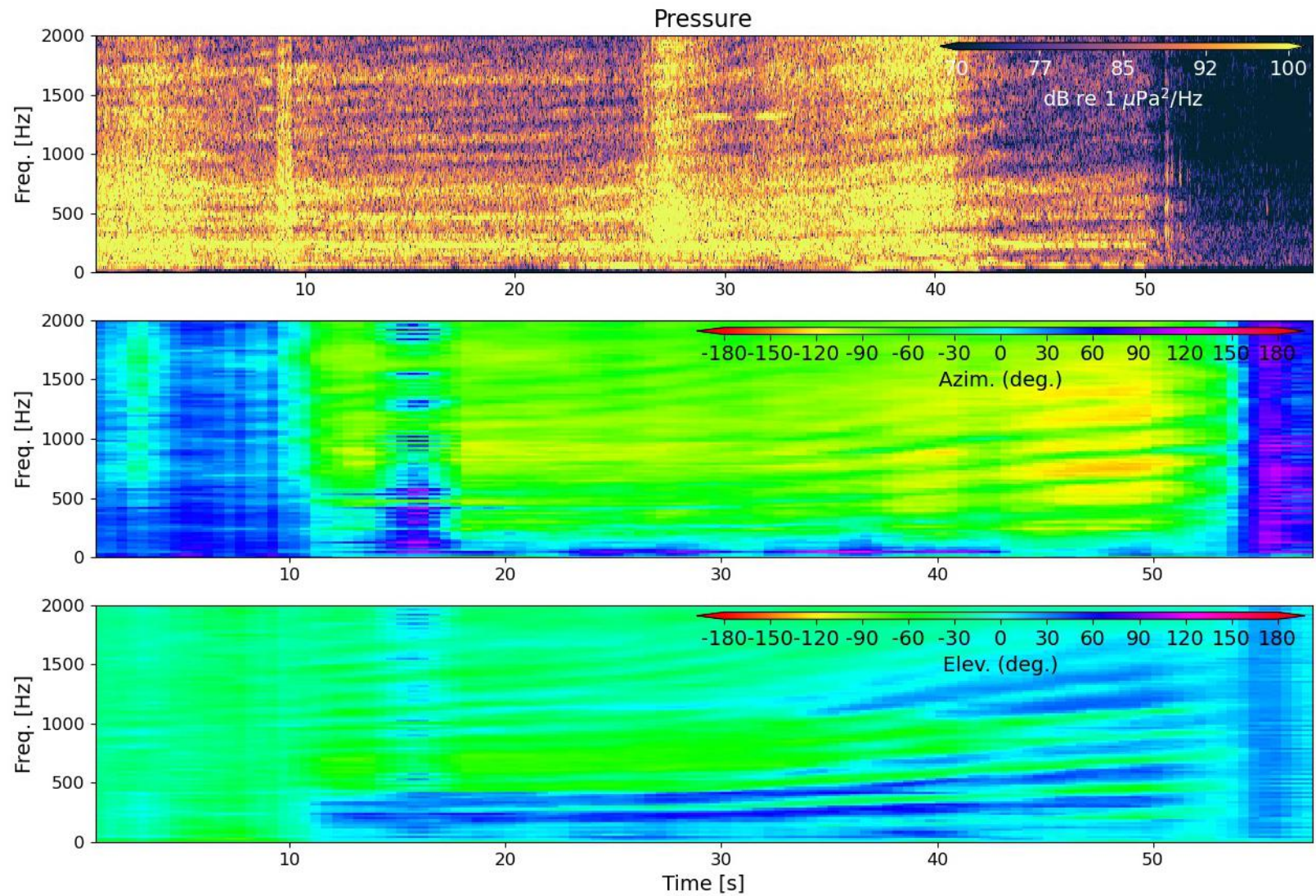
CalWave WEC sounds



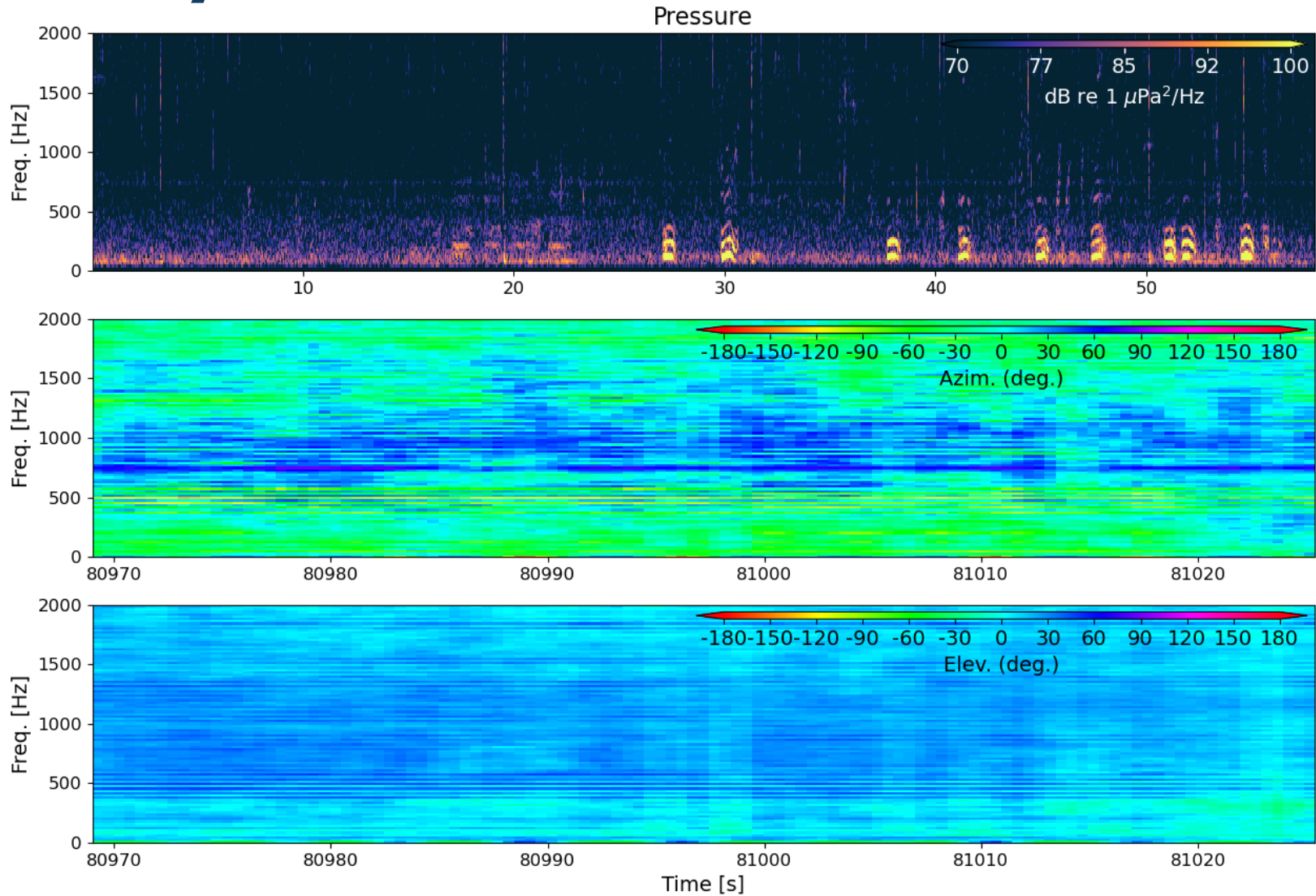
Helicopter sounds



Boat

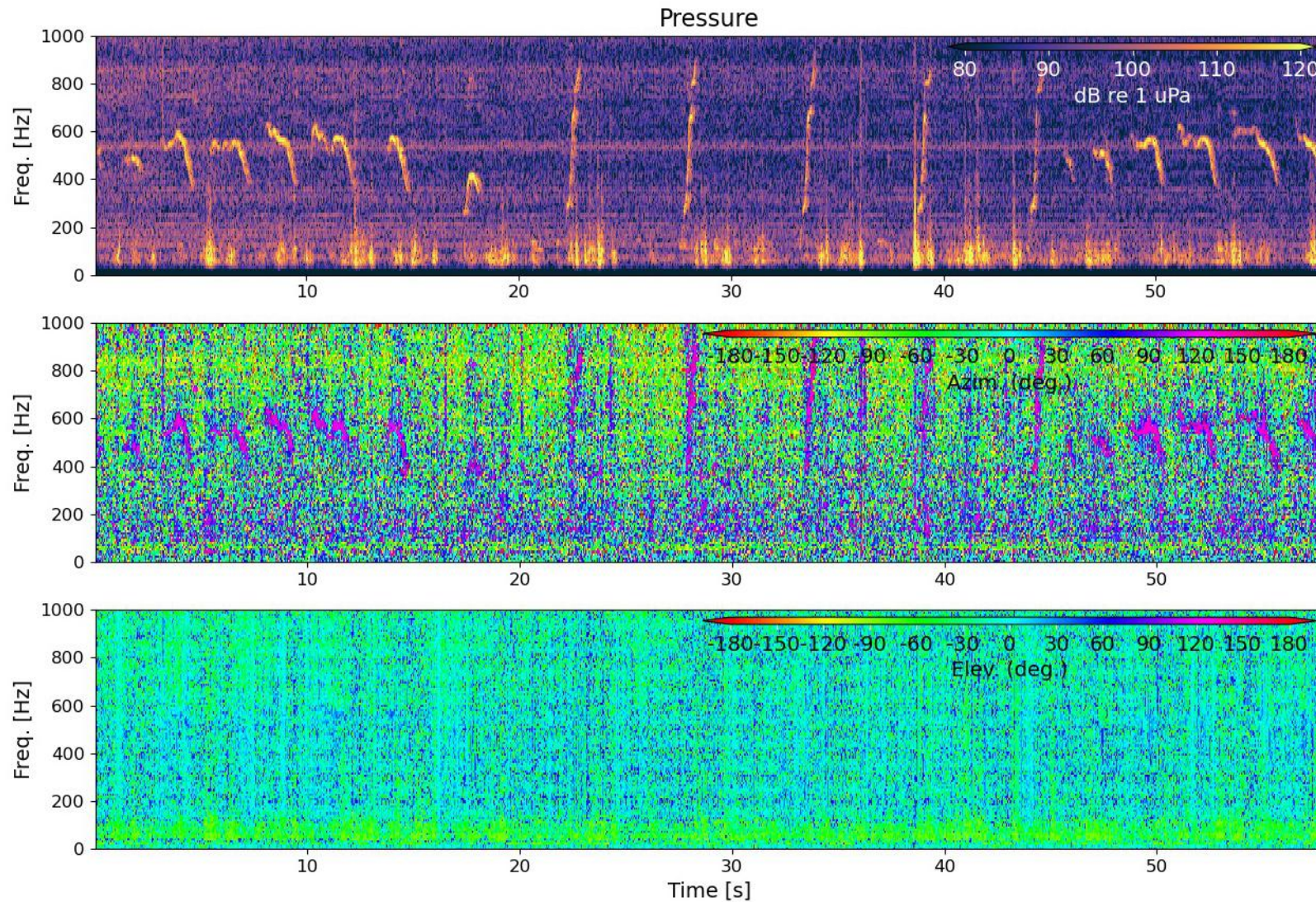


Gray whale?

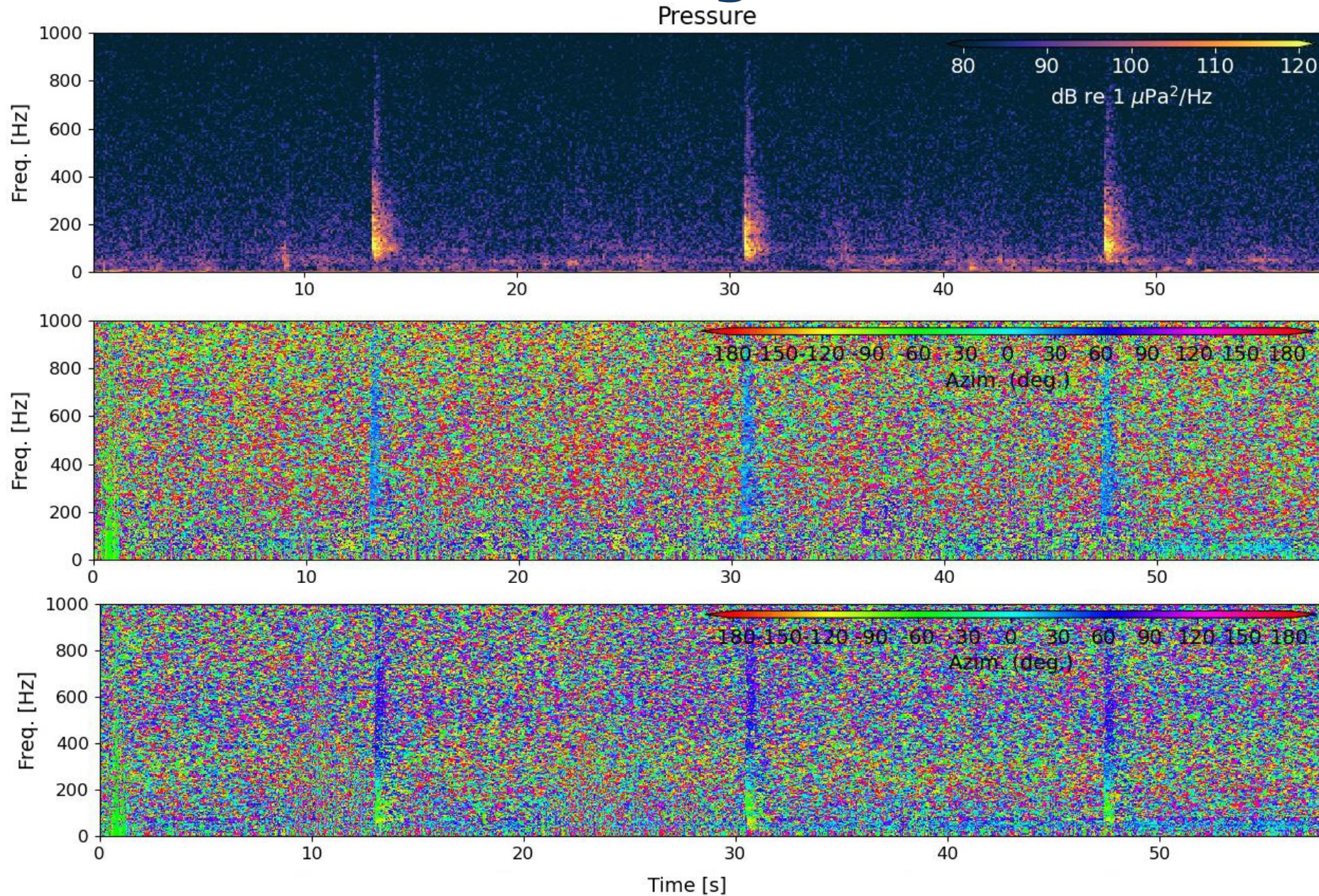


Source	$L_{E,60s}$ (dB re 1 $\mu\text{Pa}^2 s$)
WEC	139 dB re 1 μPa
Boat	147
Helicopter	140
Gray Whale	138 dB

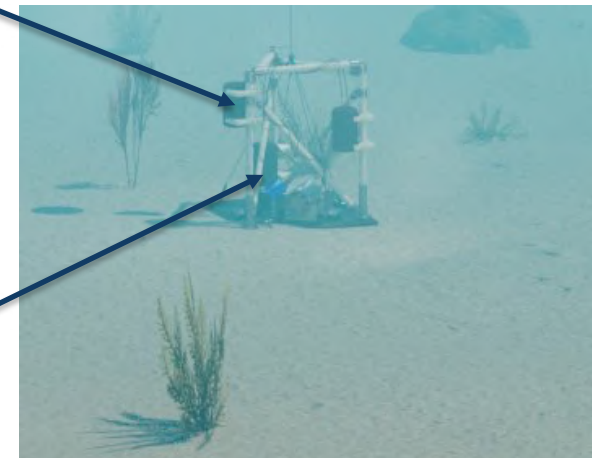
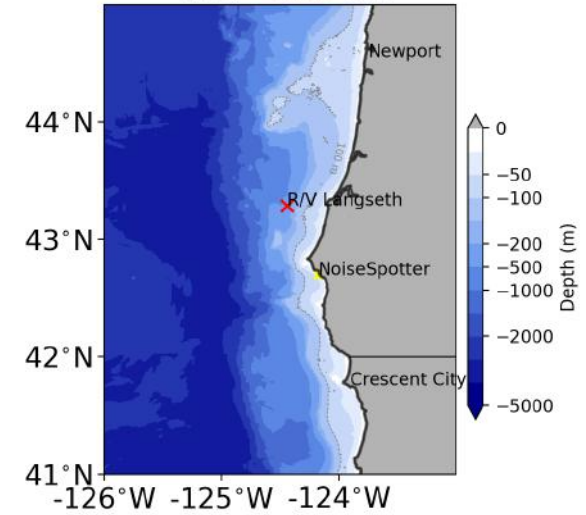
Humpback Whale



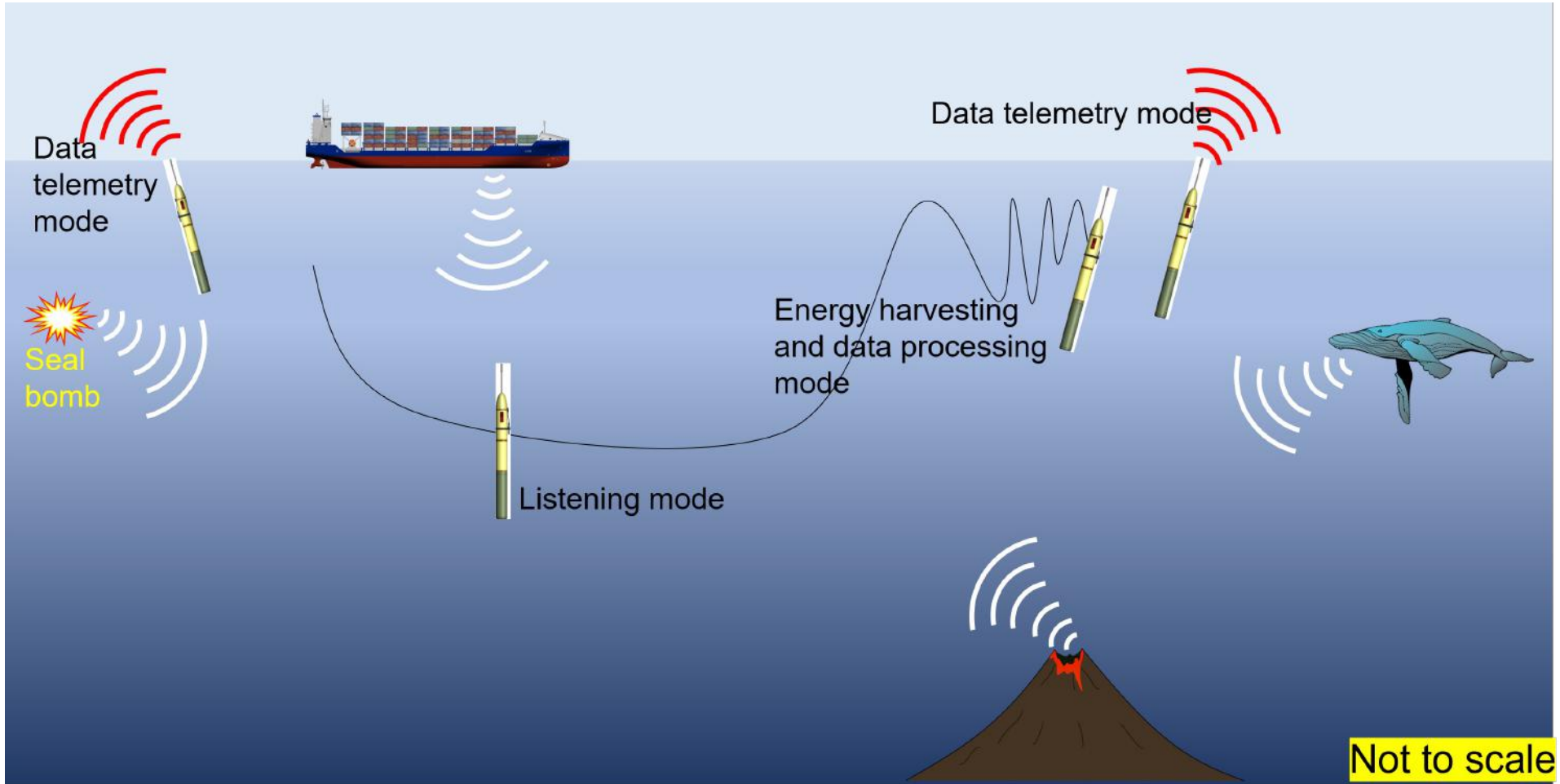
Directional Processing



2021-06-11 00:18:38+00:00
dist = 69.0 km



Ongoing NOAA OER project



Conclusions

- WEC sounds at considerably lower levels than ambient sounds such as boats
- Directional processing helps isolate WEC sounds from background
- Some directional anisotropy, likely due to bathymetric variability around WEC



Acknowledgements

- › Garrett Staines, Joe Haxel (PNNL)
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- › Aaron Thode (SIO)
- › Sarah Henkel, Taylor Chapple, Scott Heppell (OSU)



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