

Powering Oceanographic Observations with a Wave Energy Converter

August 9th, 2024

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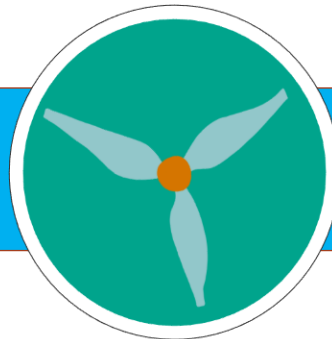
A. Turpin, B. Roberts, M. Wickett, M. Wickett

M. Steele, A. Nawaz

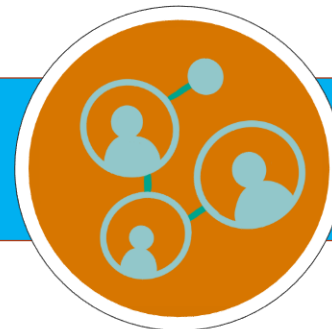
The Vision

Demonstrate a wave energy converter can power ocean observations in the Arctic

- *Design a wave energy converter buoy to be used in the Arctic*
- *Build a prototype*
- *Field test the prototype at PNNL-Sequim*



Private Company



Government Lab



University

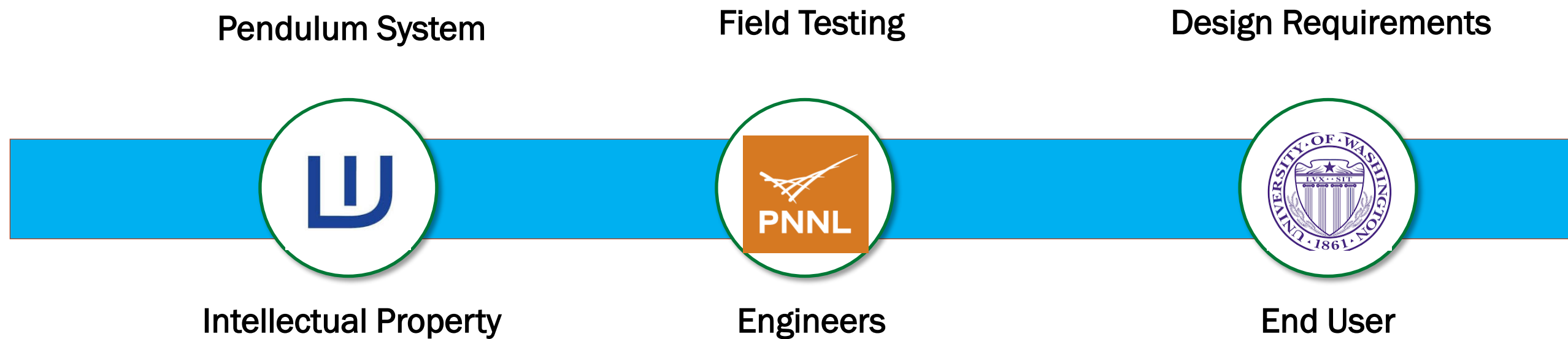
The Vision

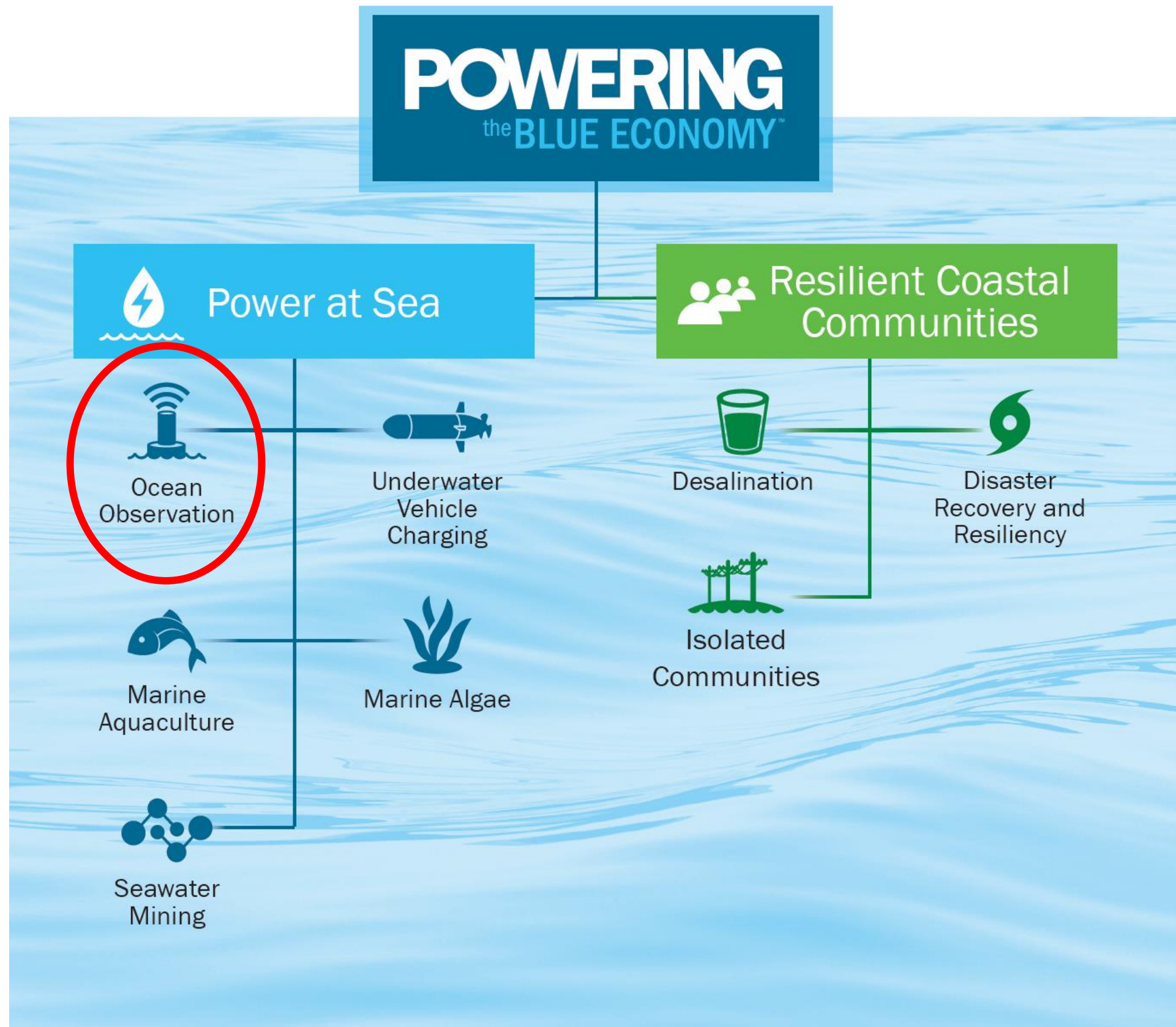
Industry + University + National Lab



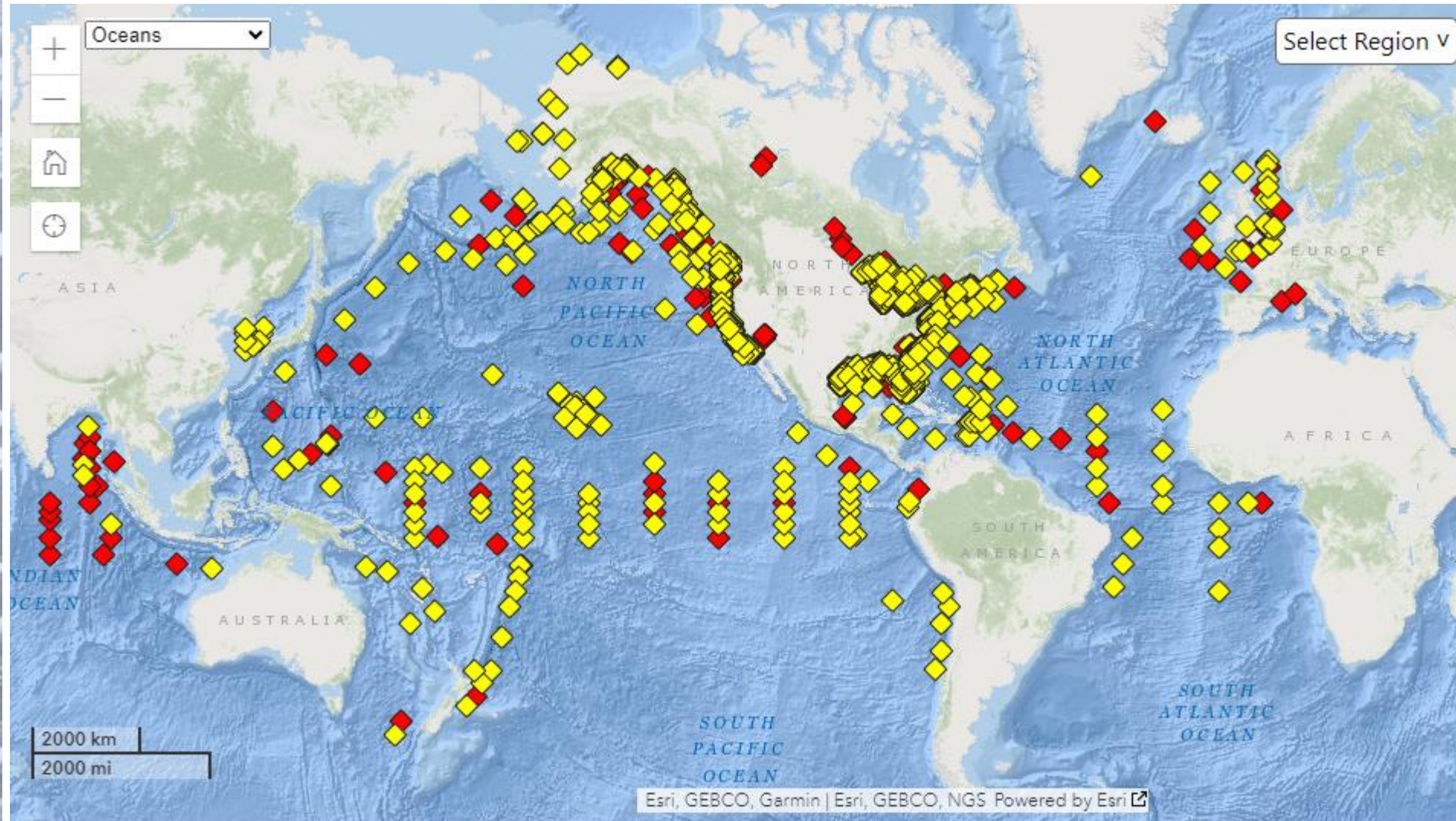
The Vision

Unique Roles of Each Institution

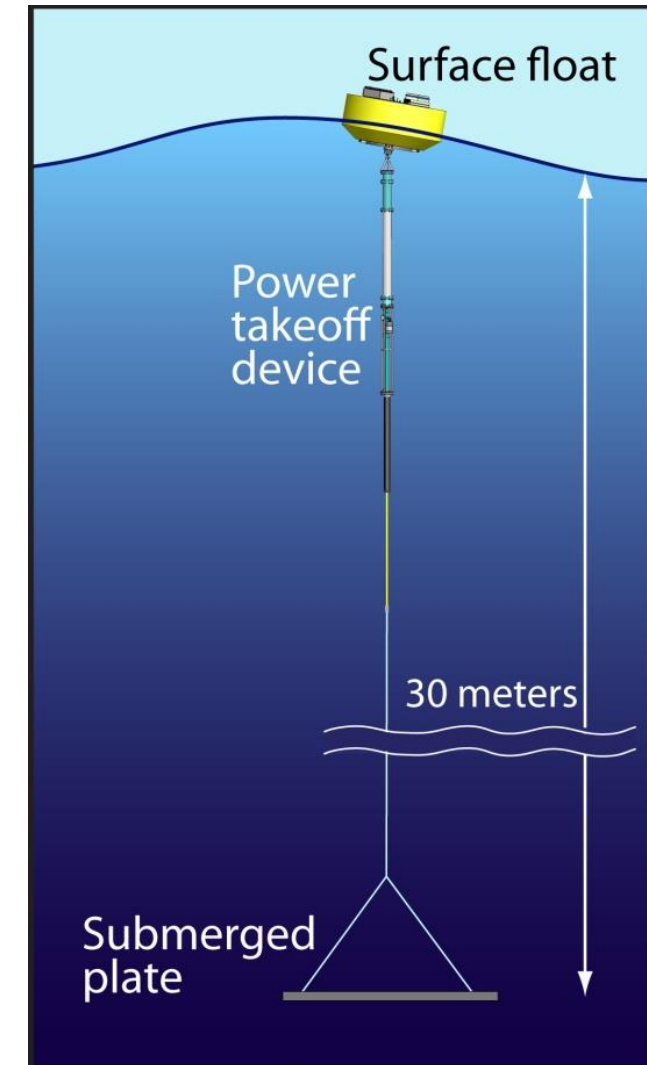




Moored Wave Energy Converter Buoys



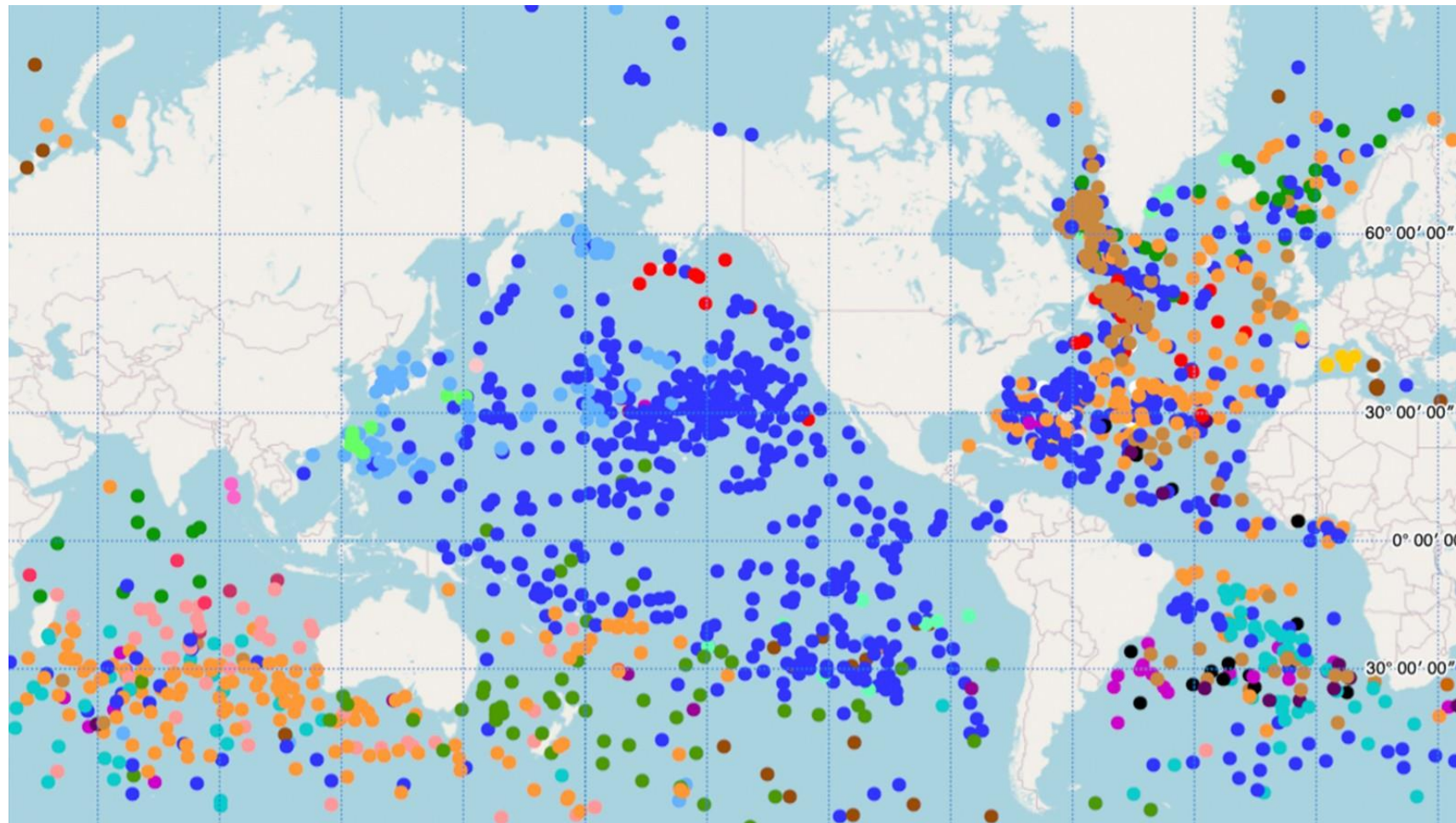
<https://www.ndbc.noaa.gov/obs.shtml>



MBARI

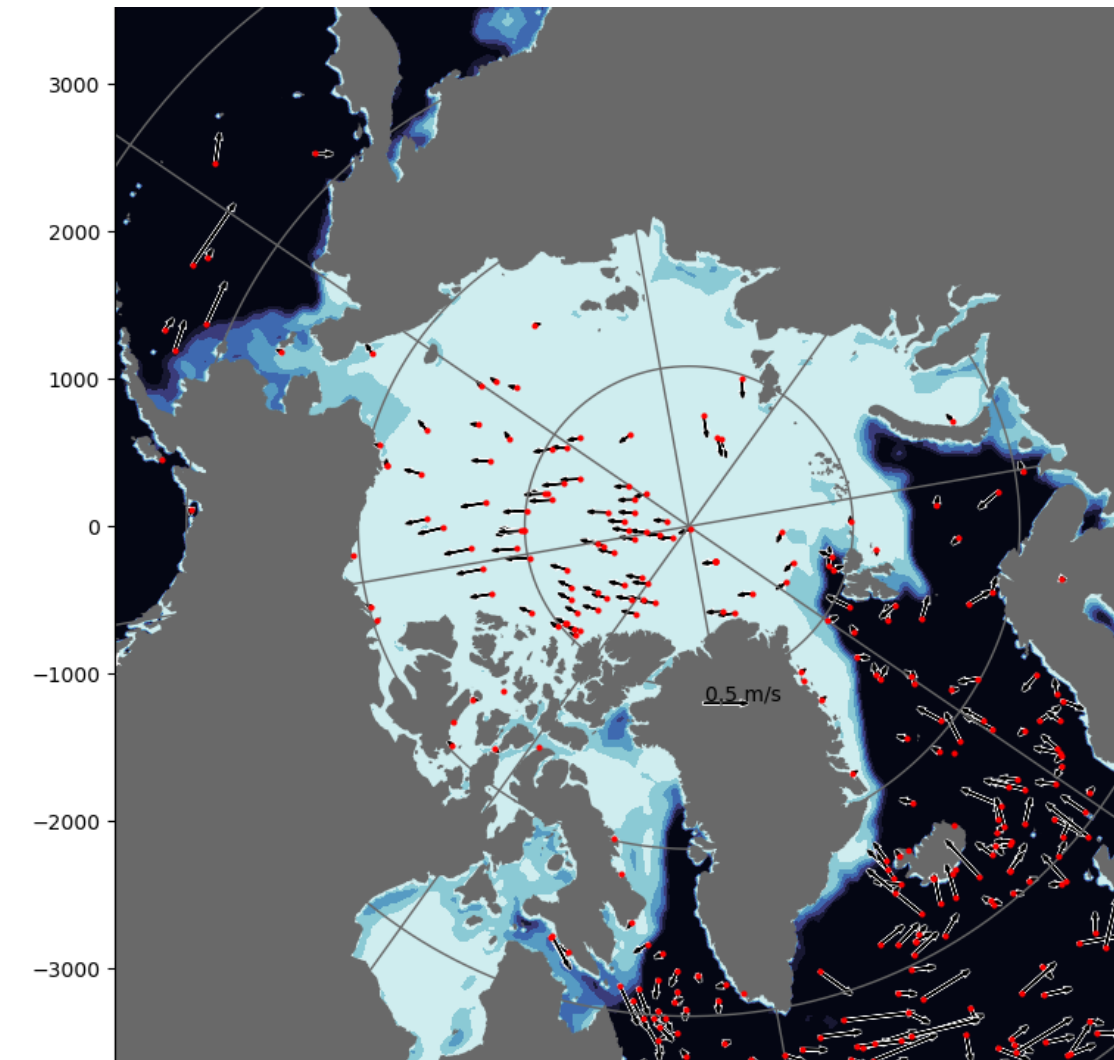
Drifting Wave Energy Converter Buoys

NOAA Global Drifter Program



<https://www.aoml.noaa.gov/global-drifter-program/>

International Arctic Buoy Program



<https://iabp.apl.uw.edu/>

Arctic Boundaries

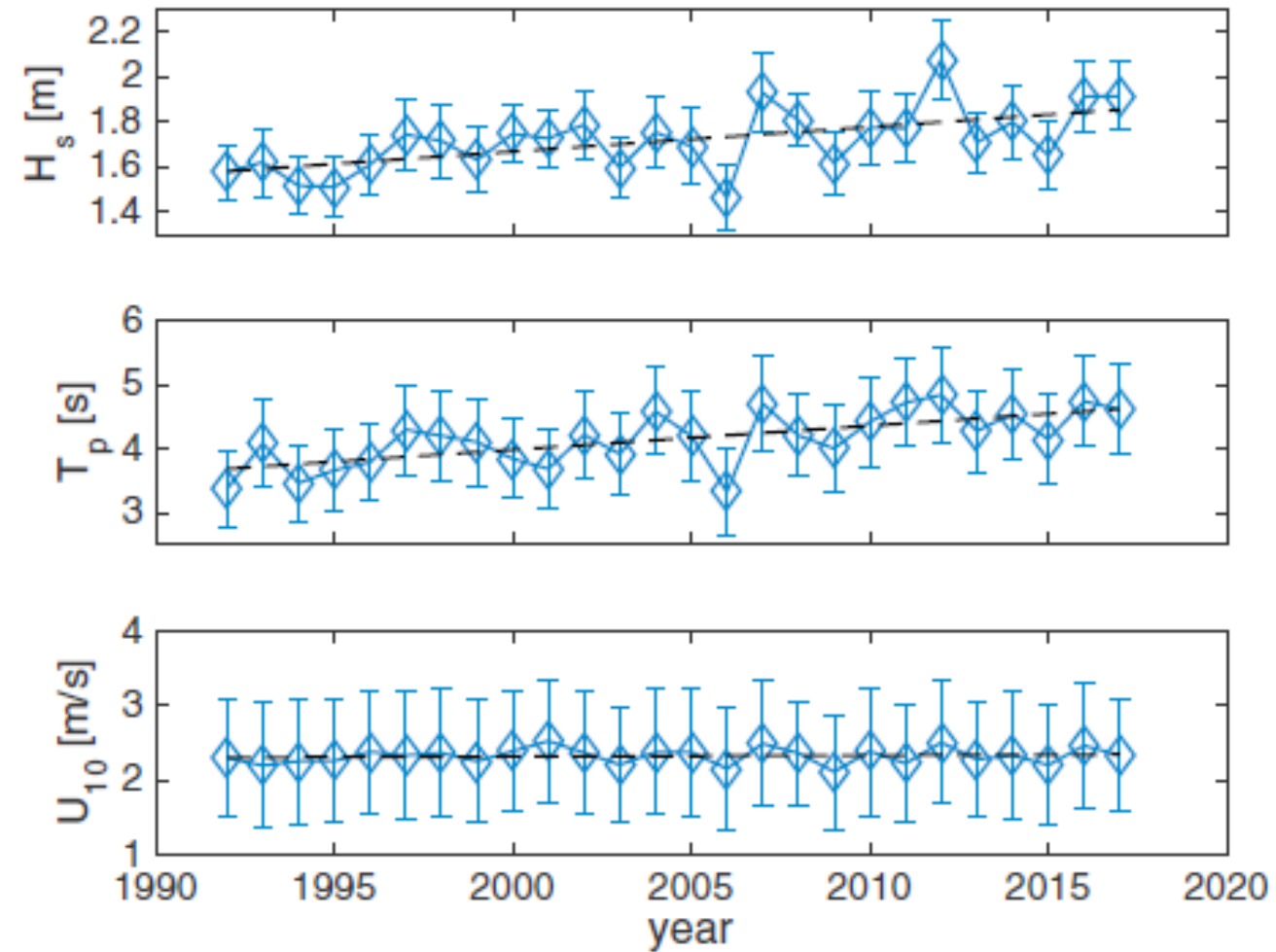


Why the Arctic?



- More observations are needed
- In-situ power generation = more observations and longer deployments
- Batteries drain quickly in the cold temperatures
- Battery performance degrades
- Remote locations make ship time expensive

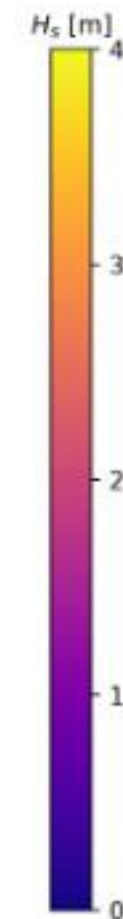
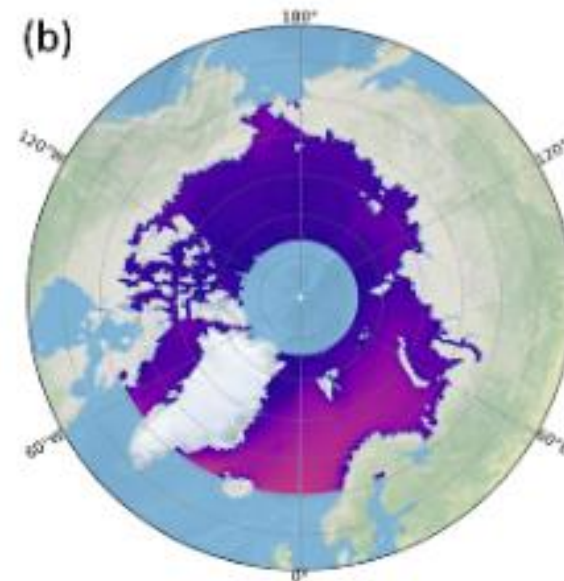
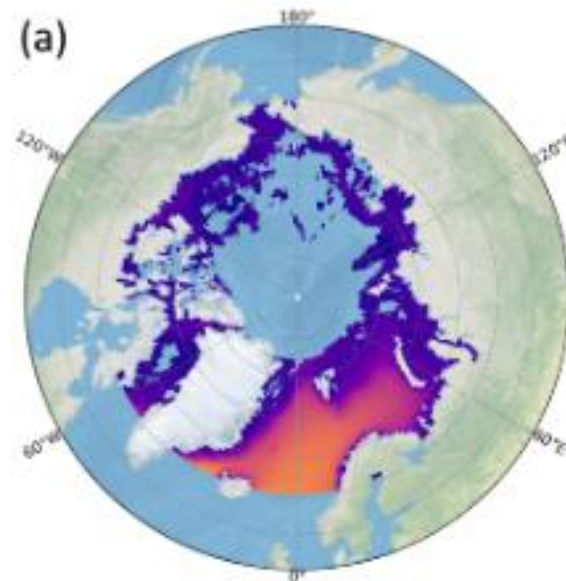
Wave Energy is increasing in the Arctic





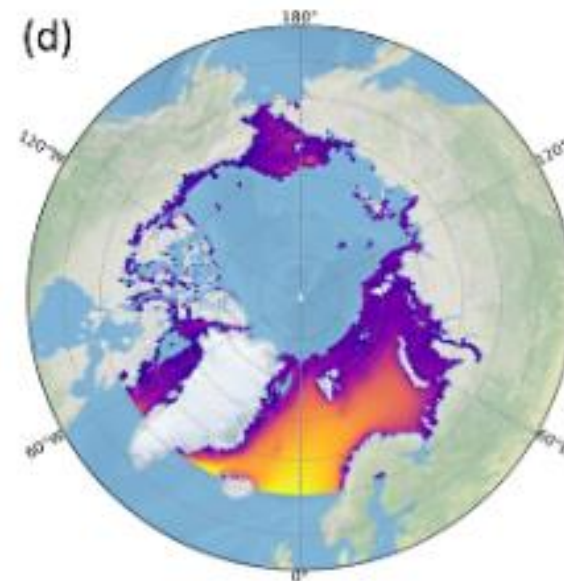
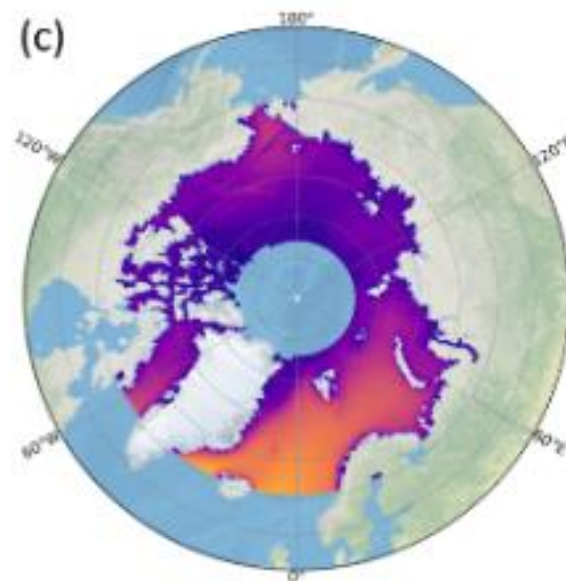
Wave Energy in the Arctic

Spring



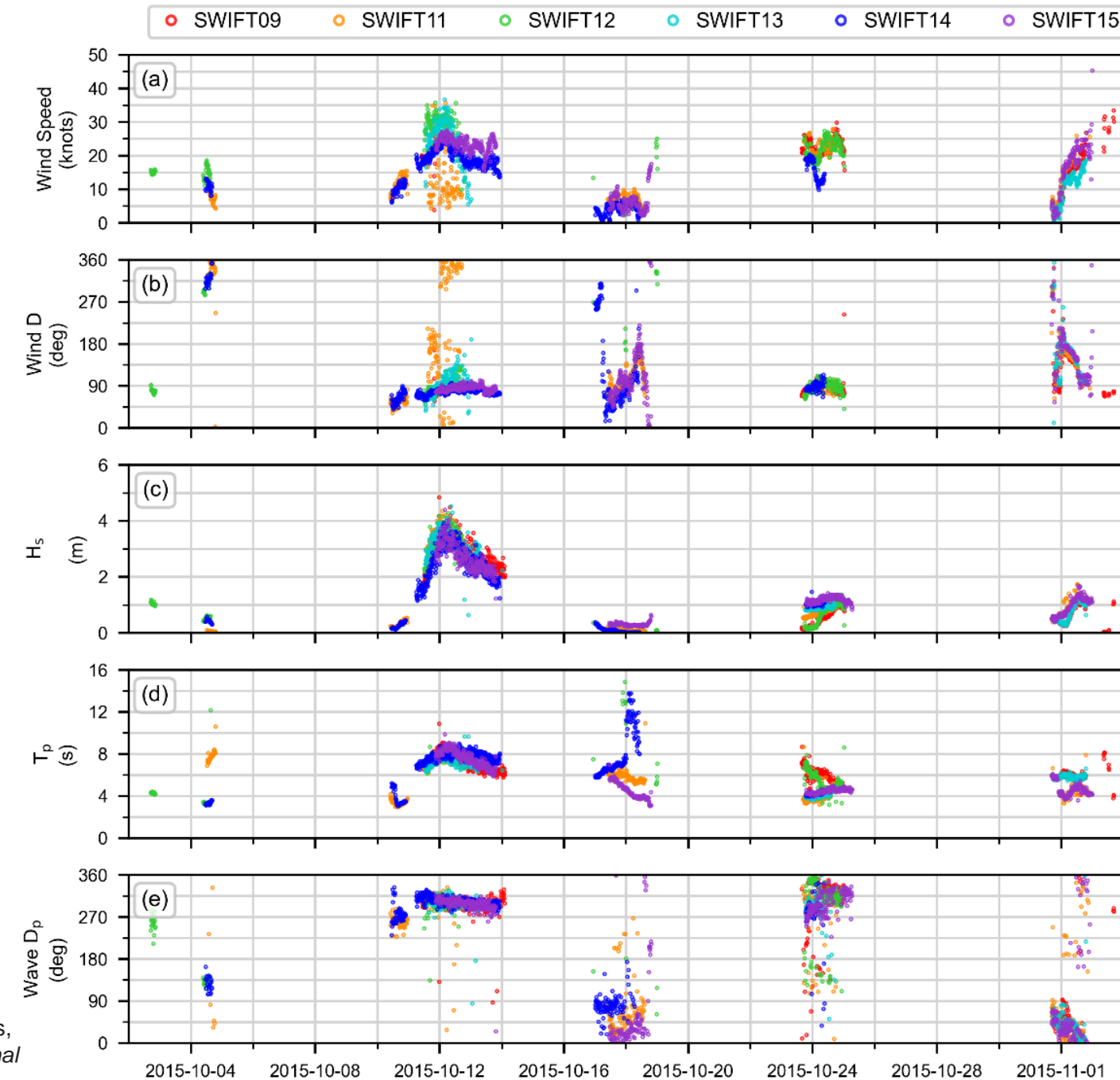
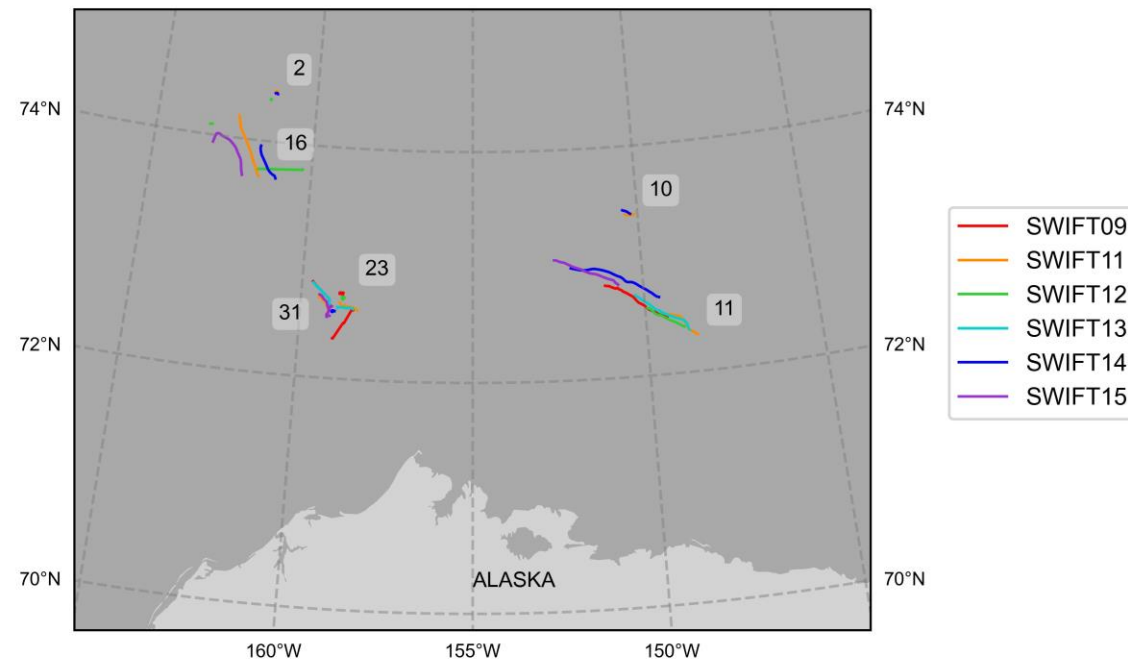
Summer

Fall



Winter

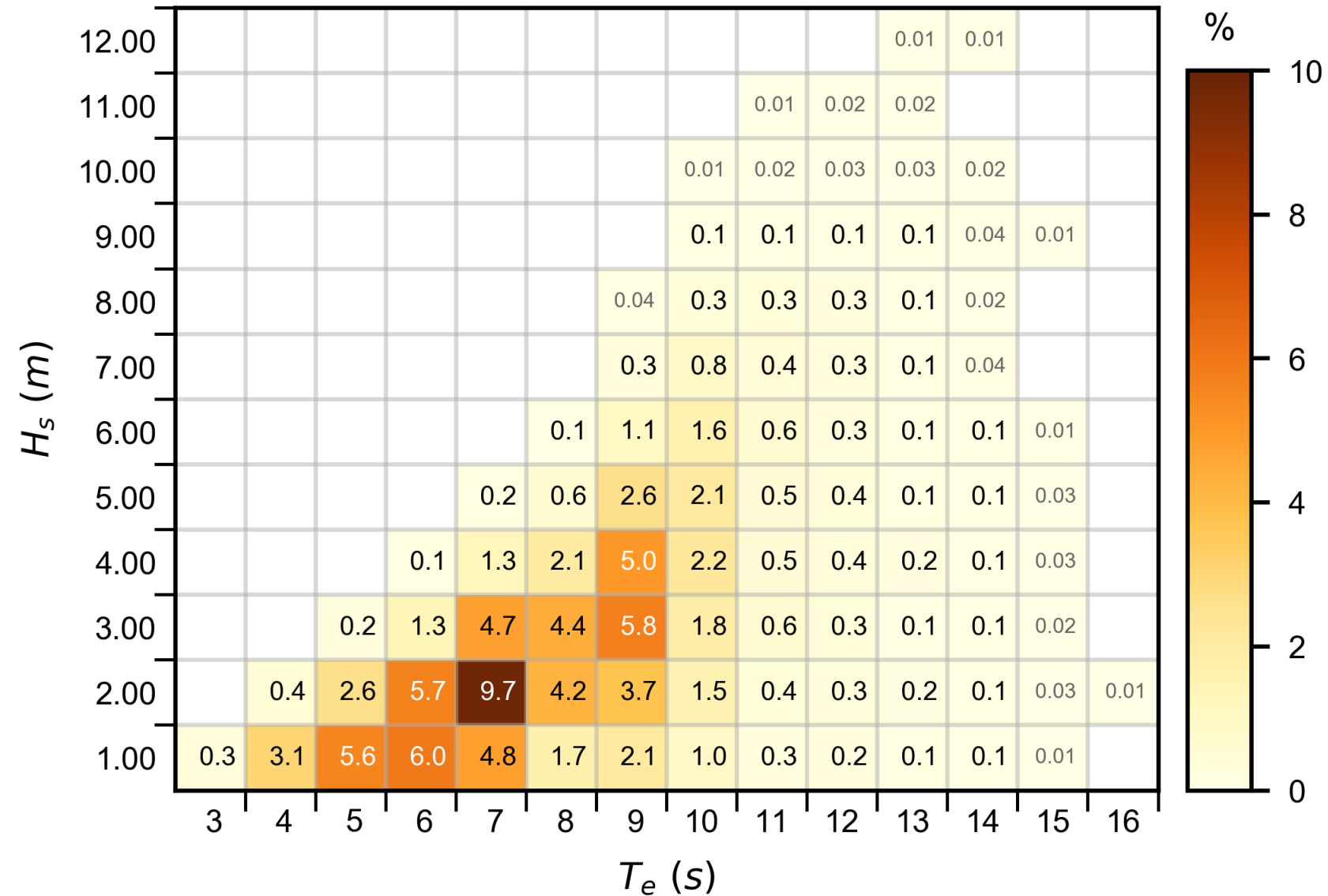
Wave Energy in the Arctic



Thomson, J., Ackley, S., Girard-Ardhuin, F., Ardhuin, F., Babanin, A., Boutin, G., Brozena, J., Cheng, S., Collins, C., Doble, M. and Fairall, C., 2018. Overview of the arctic sea state and boundary layer physics program. *Journal of Geophysical Research: Oceans*, 123(12), pp.8674-8687.

Wave Energy in the Arctic

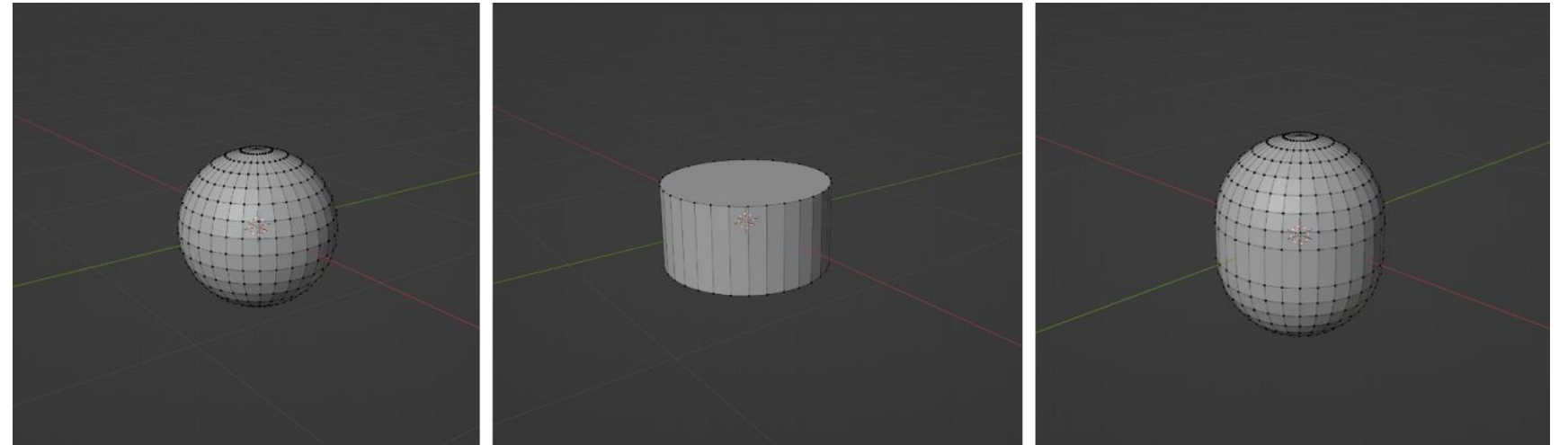
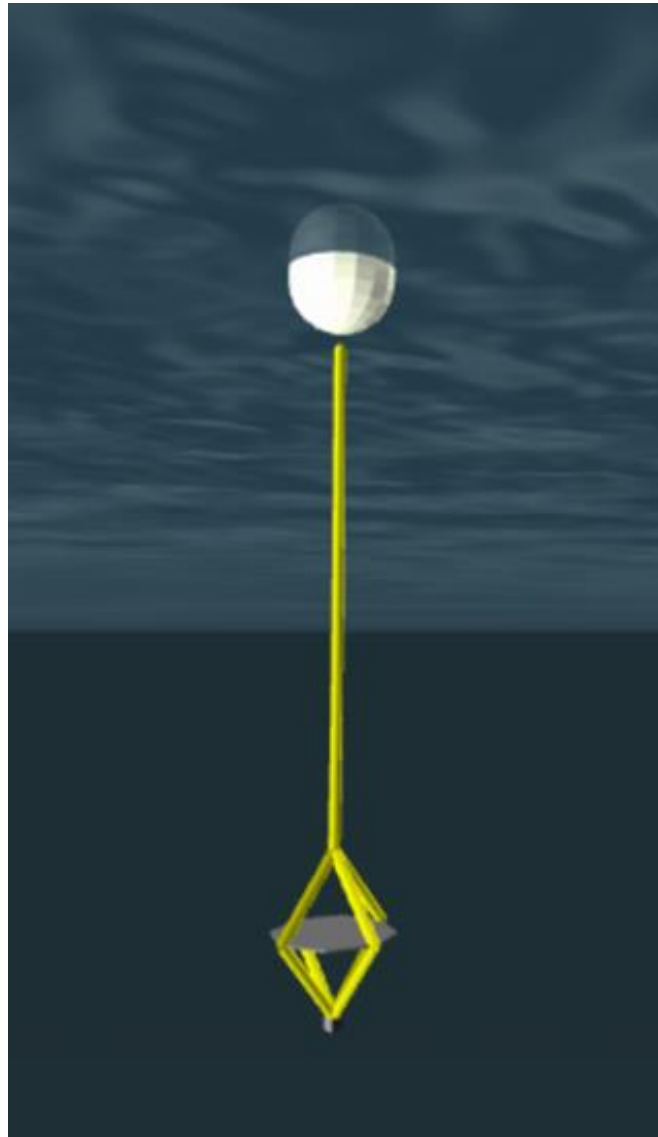
(a) 46035 - Central Bering Sea



Design Requirements

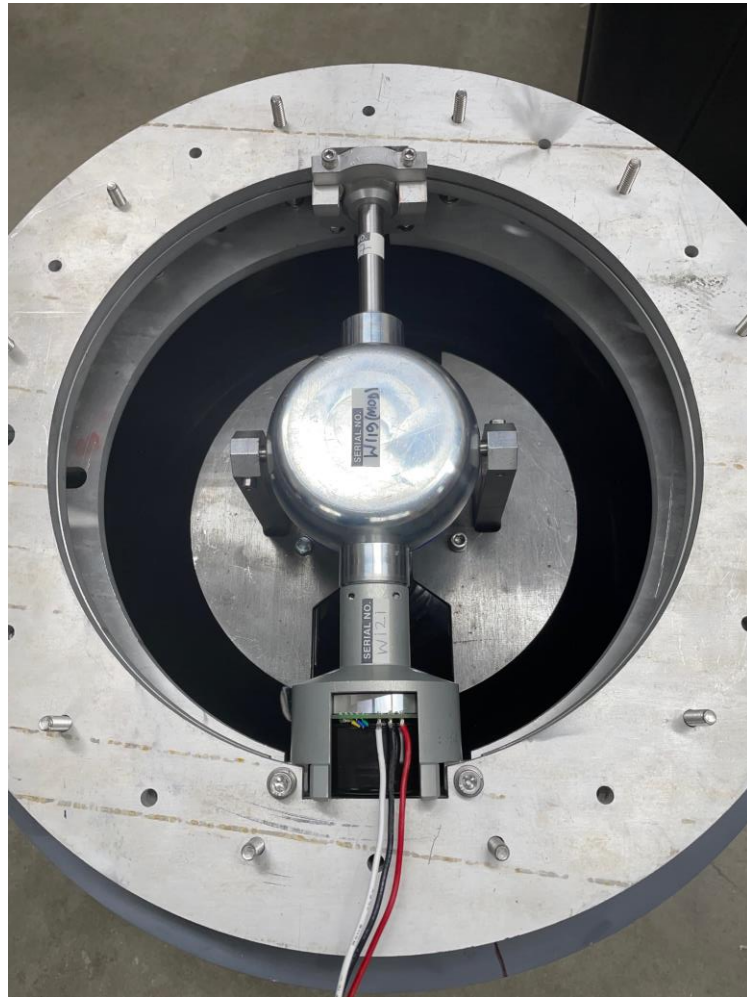
- Measure sea surface temperature
- Operating temperatures: -2 °C to 20 °C
- Deployable by small boat
- Communicate via satellite
- Six rapid-burst measurements every hour
- 60 mW average power

Drifting Wave Energy Converter Buoy



Proteus DS used to choose the buoy hull shape

Drifting Wave Energy Converter Buoy



Witt Energy



Pacific Gyre Buoy

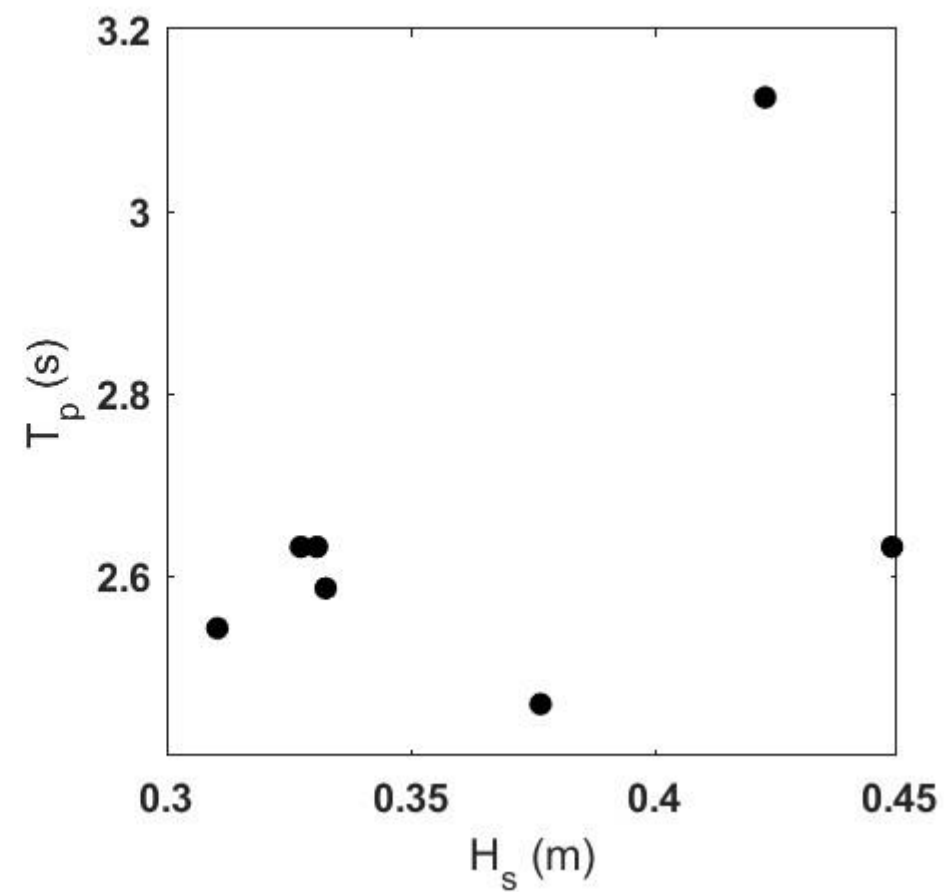
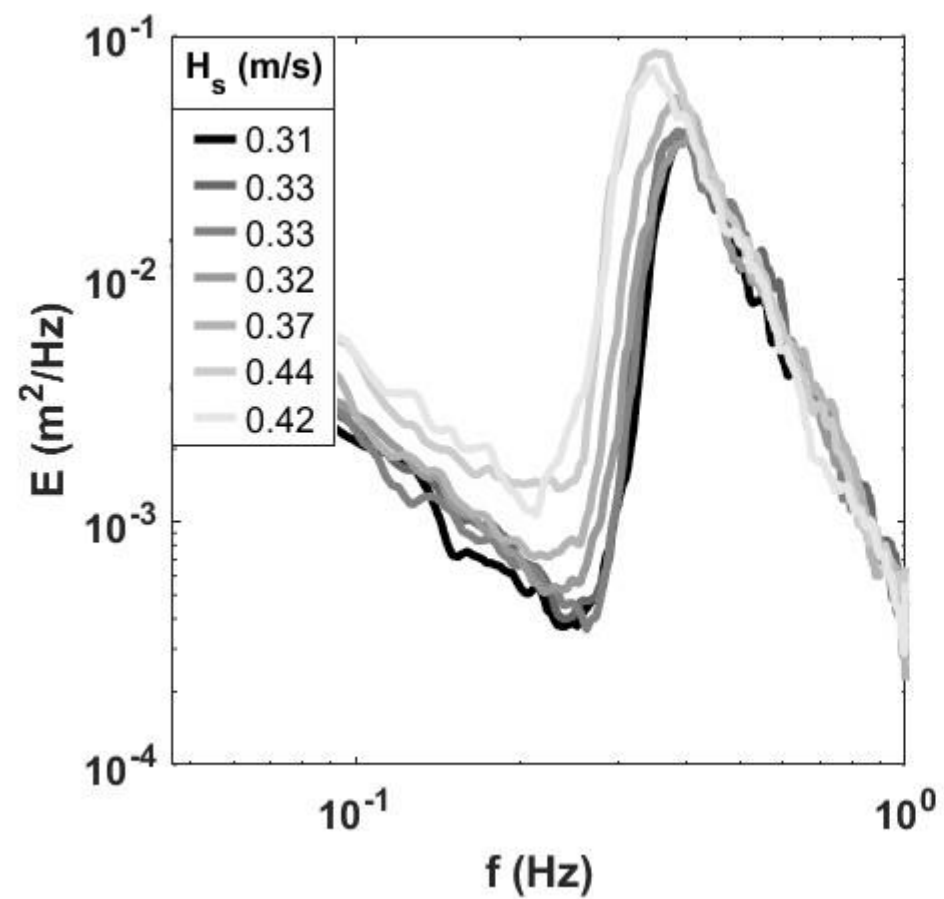
Field Tests



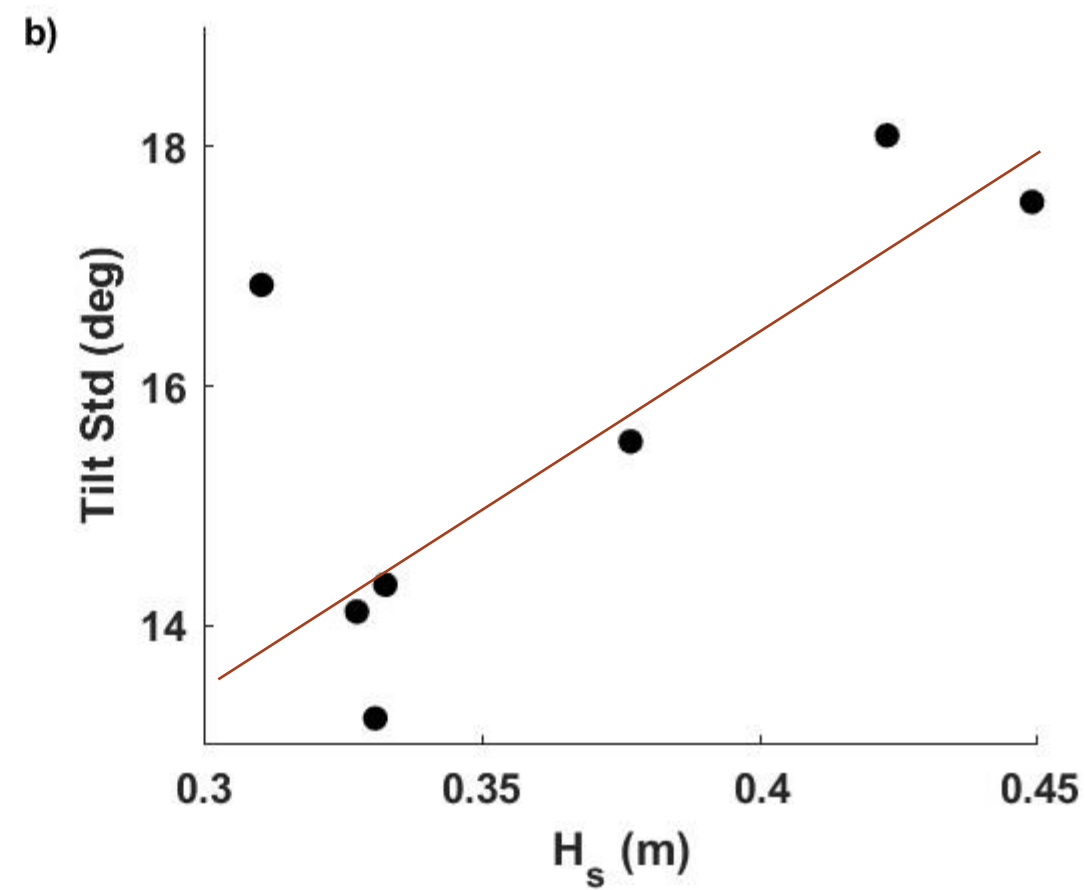
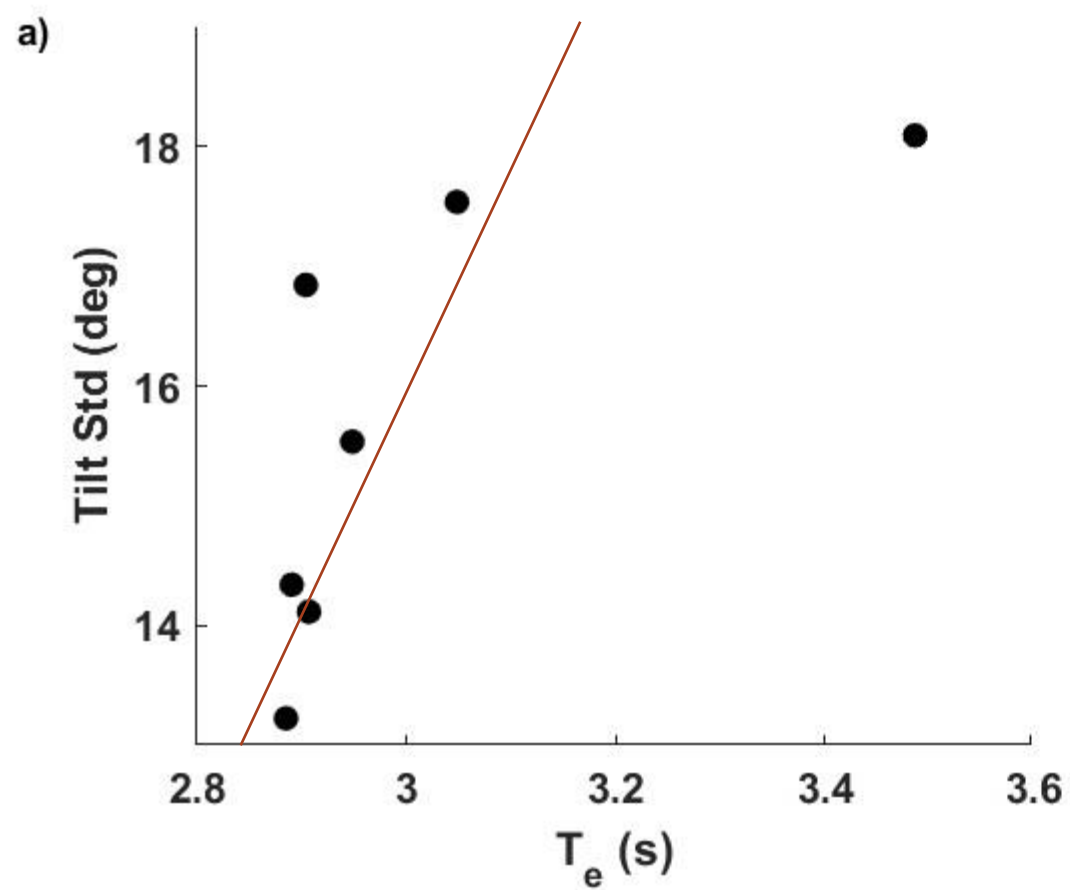
Field Tests



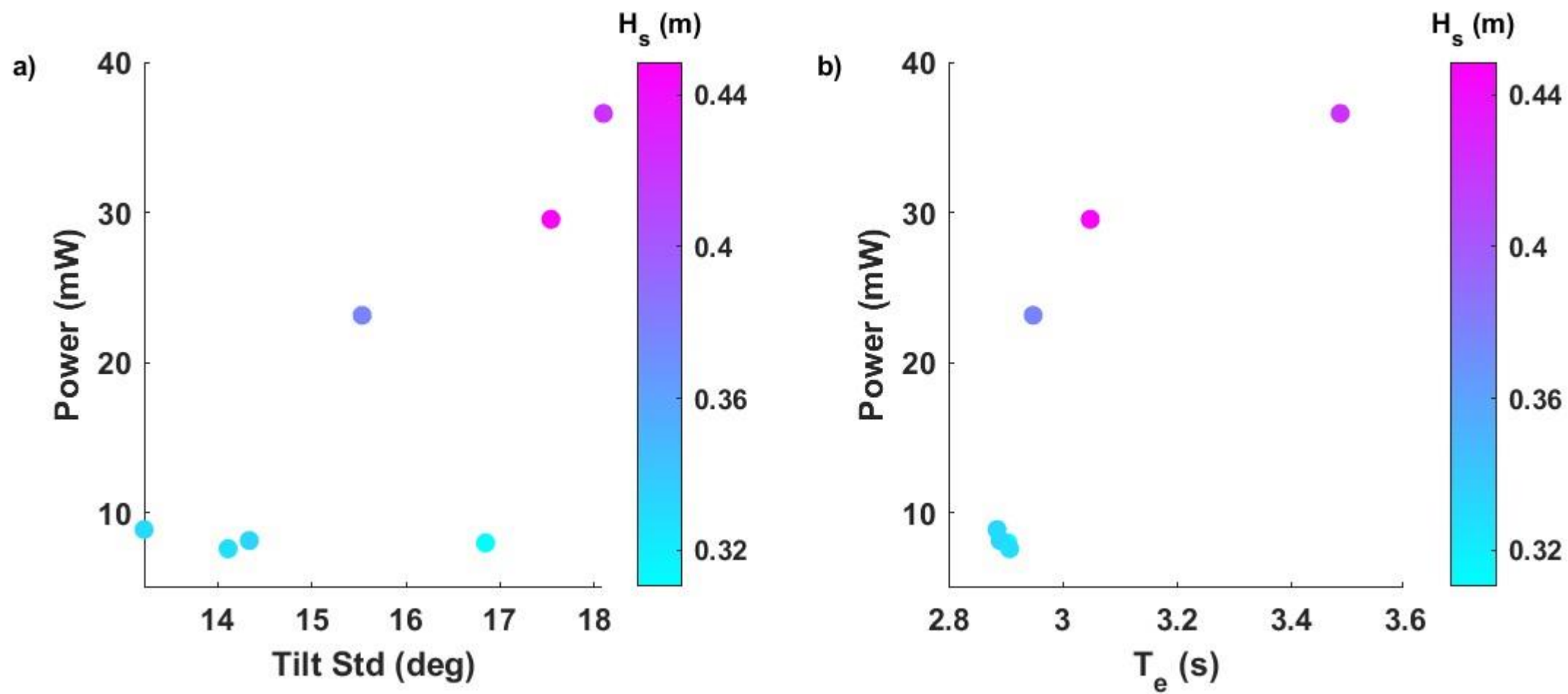
Wave Conditions



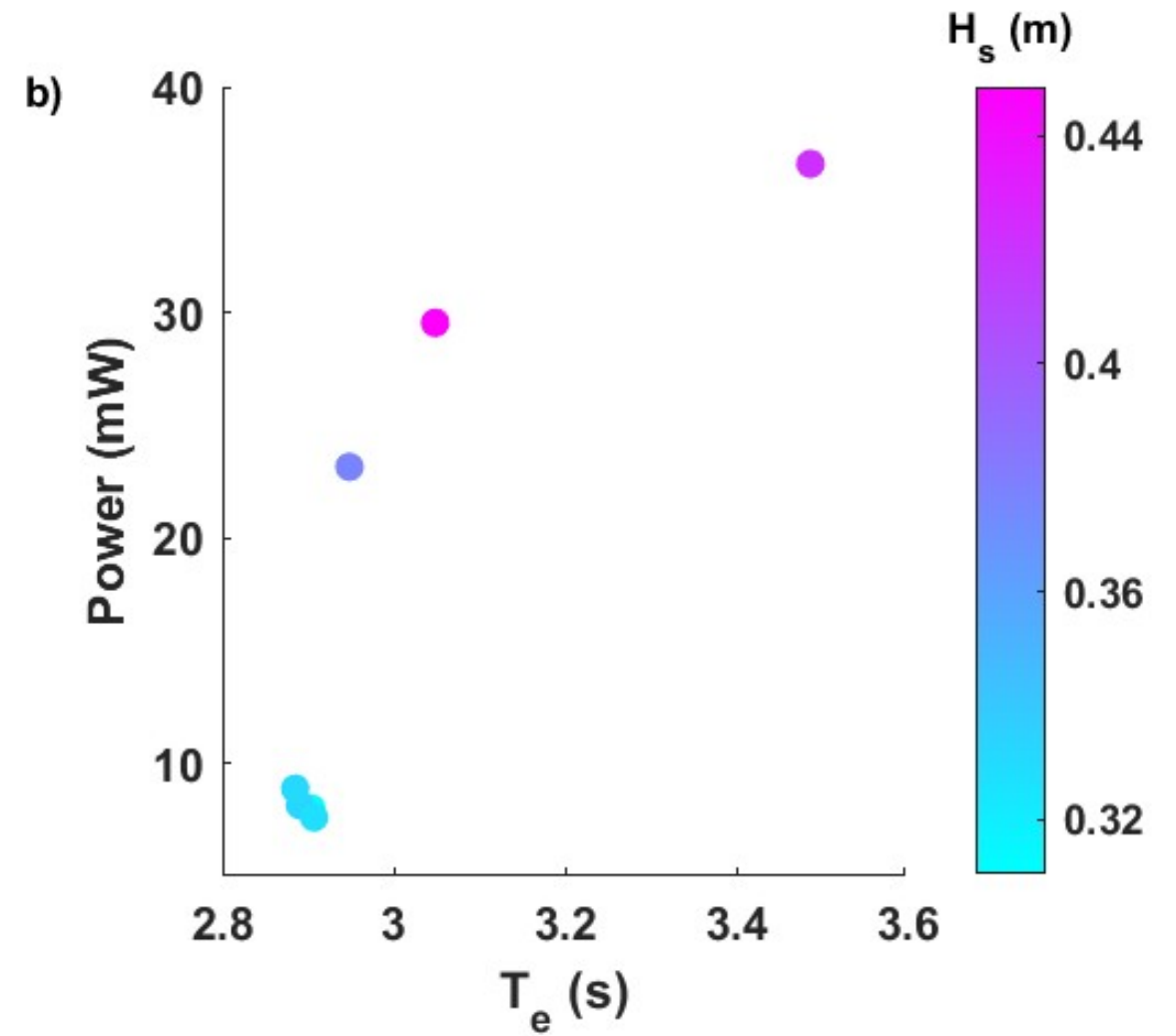
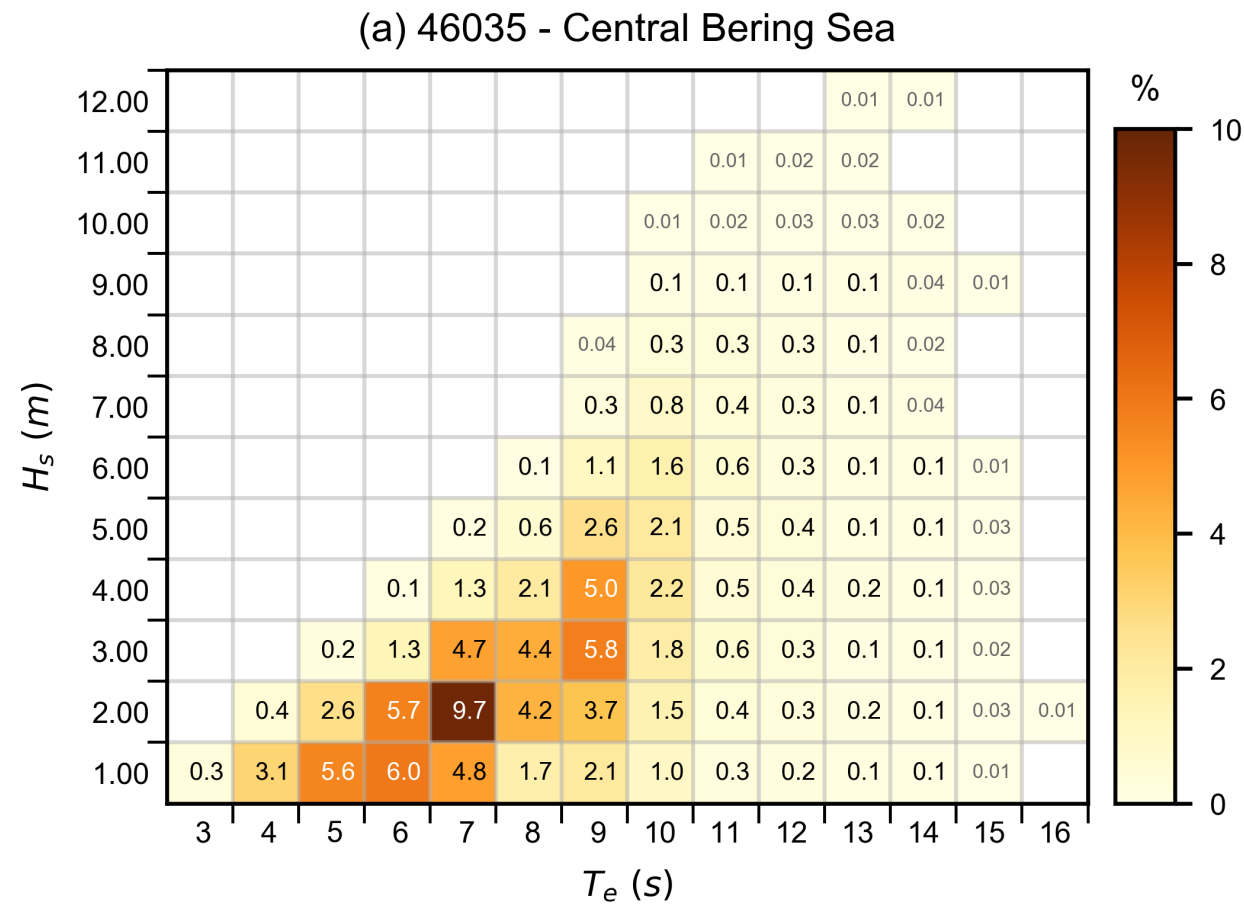
Buoy Tilt



Power Produced



Power Produced



Future Testing



Thank you

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