SURFACE WAVE INSTRUMENT FLOATS WITH TRACKING (SWIFT BUOYS)

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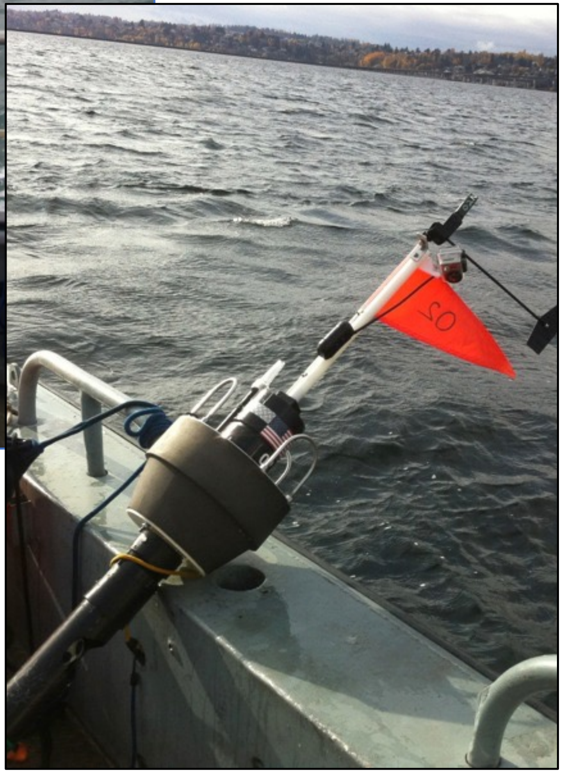
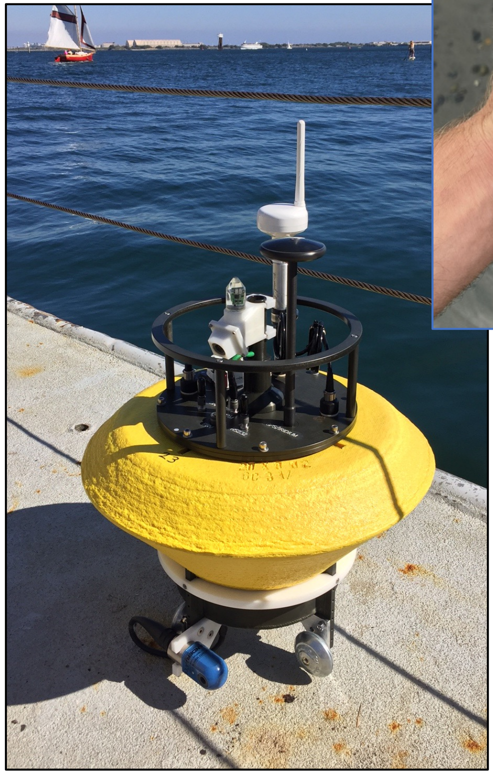
SWIFT versions

v1 (2009)



v2 (2012)

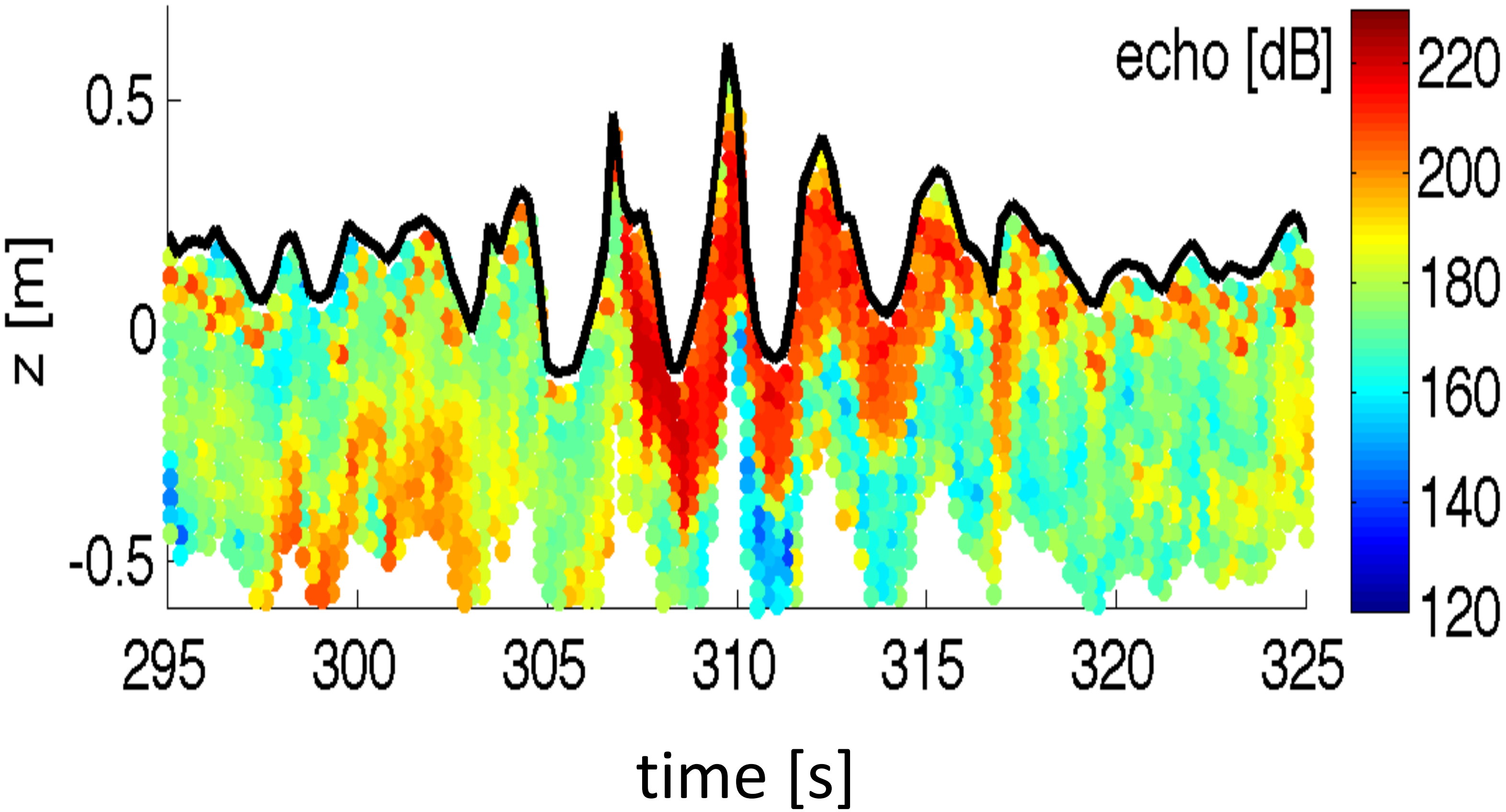
v3 (2014)

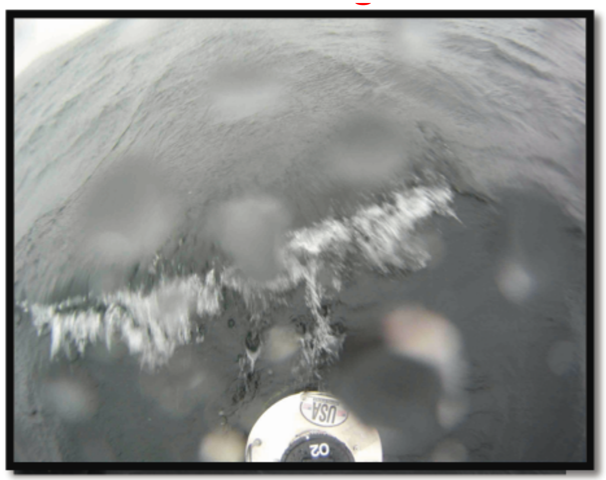


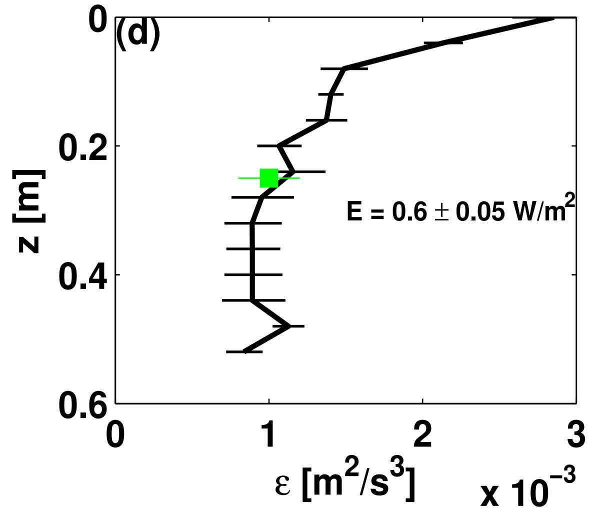
v4 (2017)

micro (2021)

Original goal: wave breaking process study

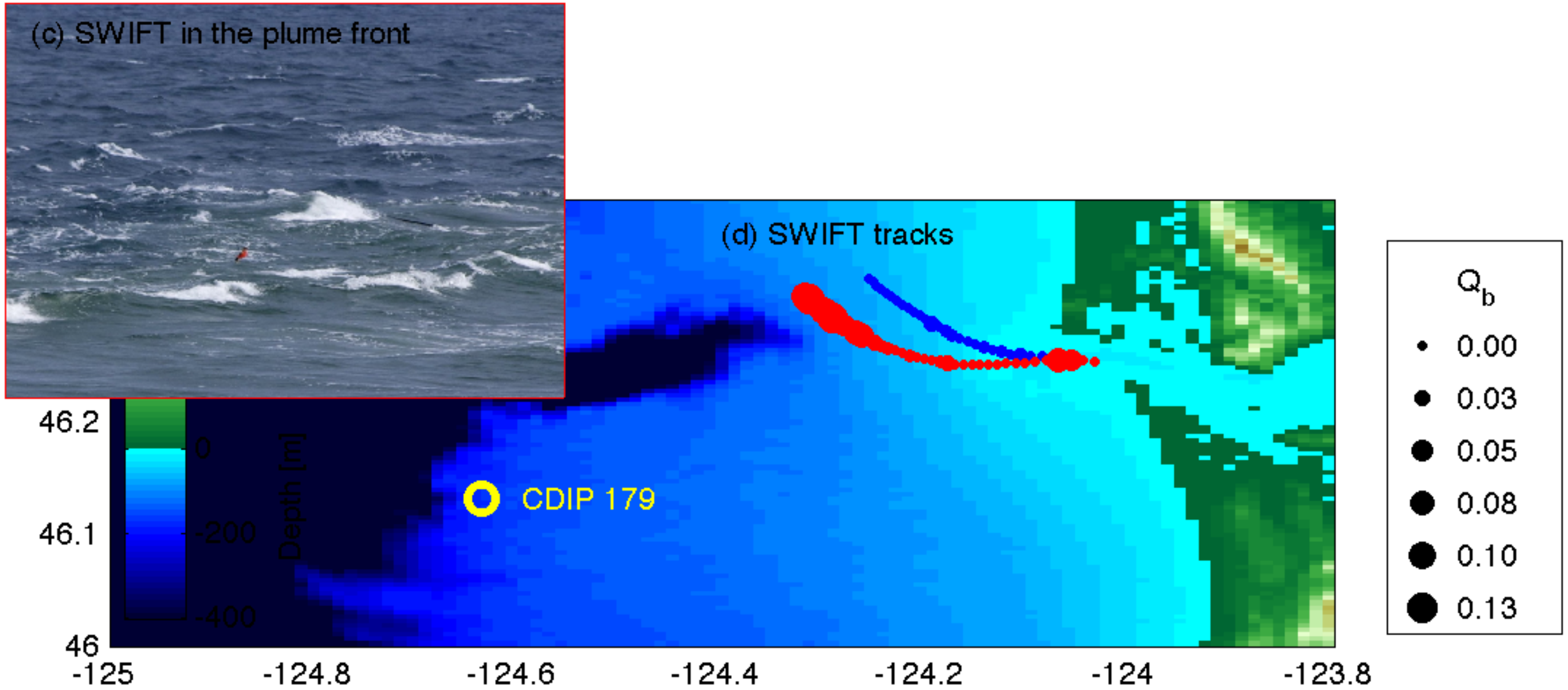






Thomson, J. *Journal of Atmospheric and Oceanic Technology*, ***29***, *2012.*

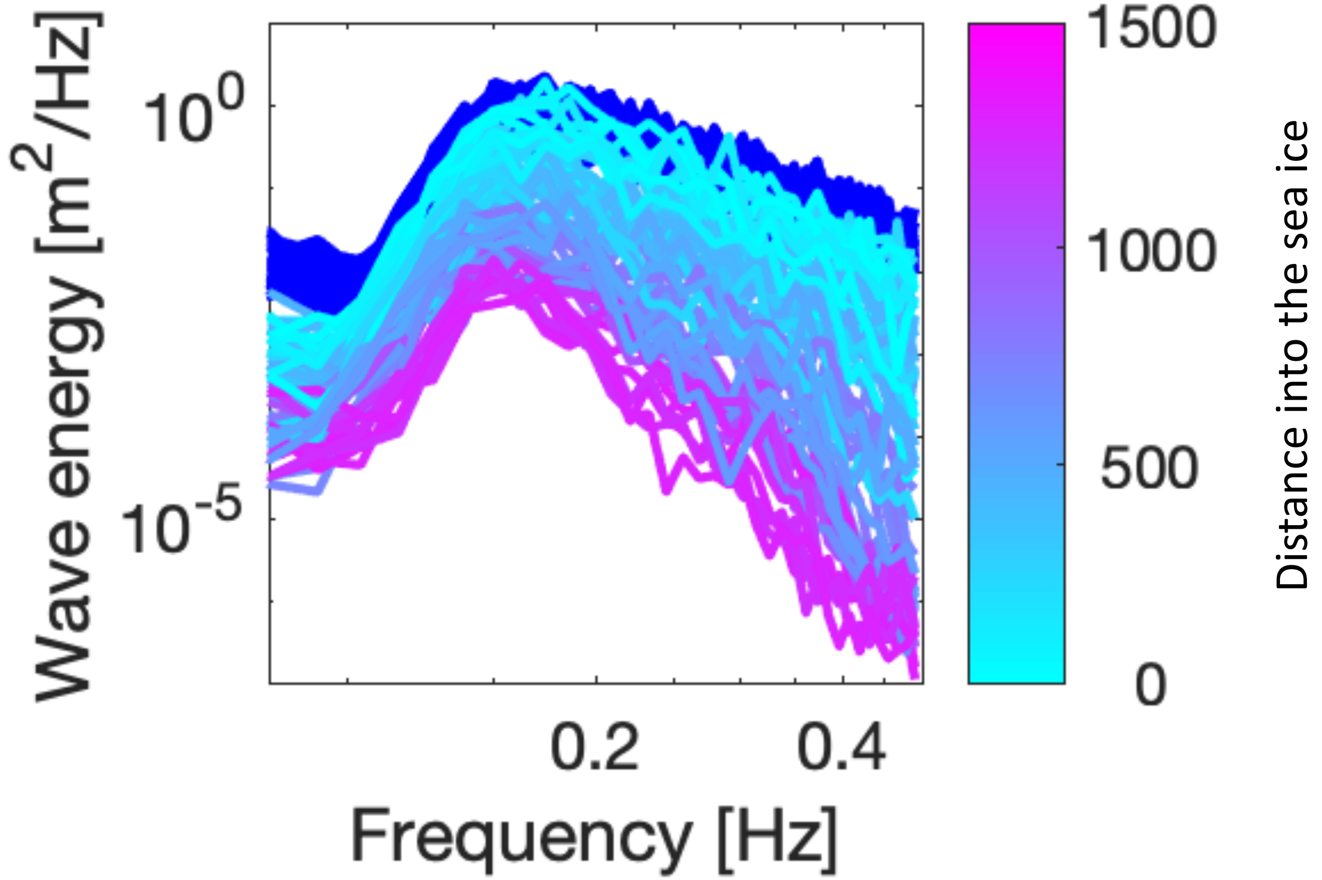
Wave breaking at the Columbia River Plume



Thomson et al, GRL 2014

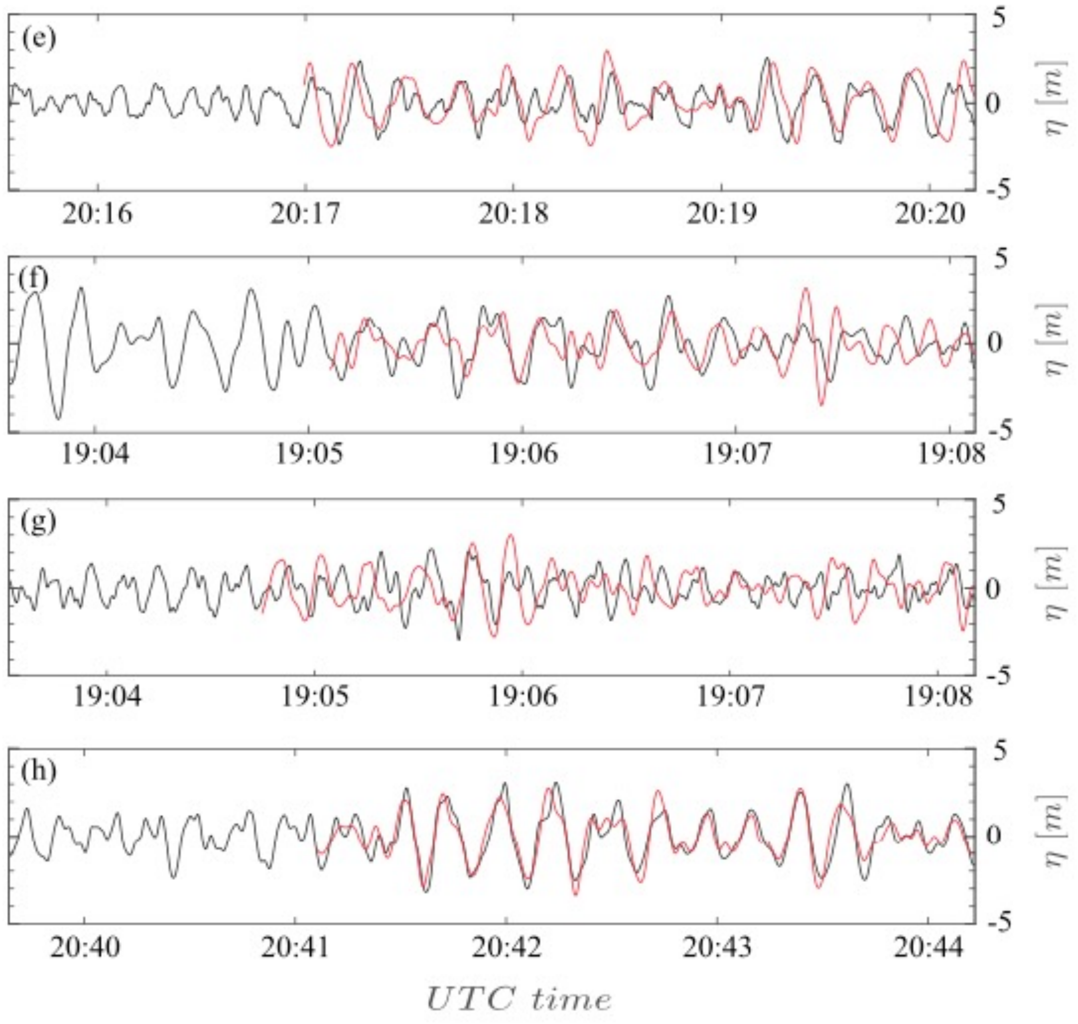
Wave attenuation in sea ice

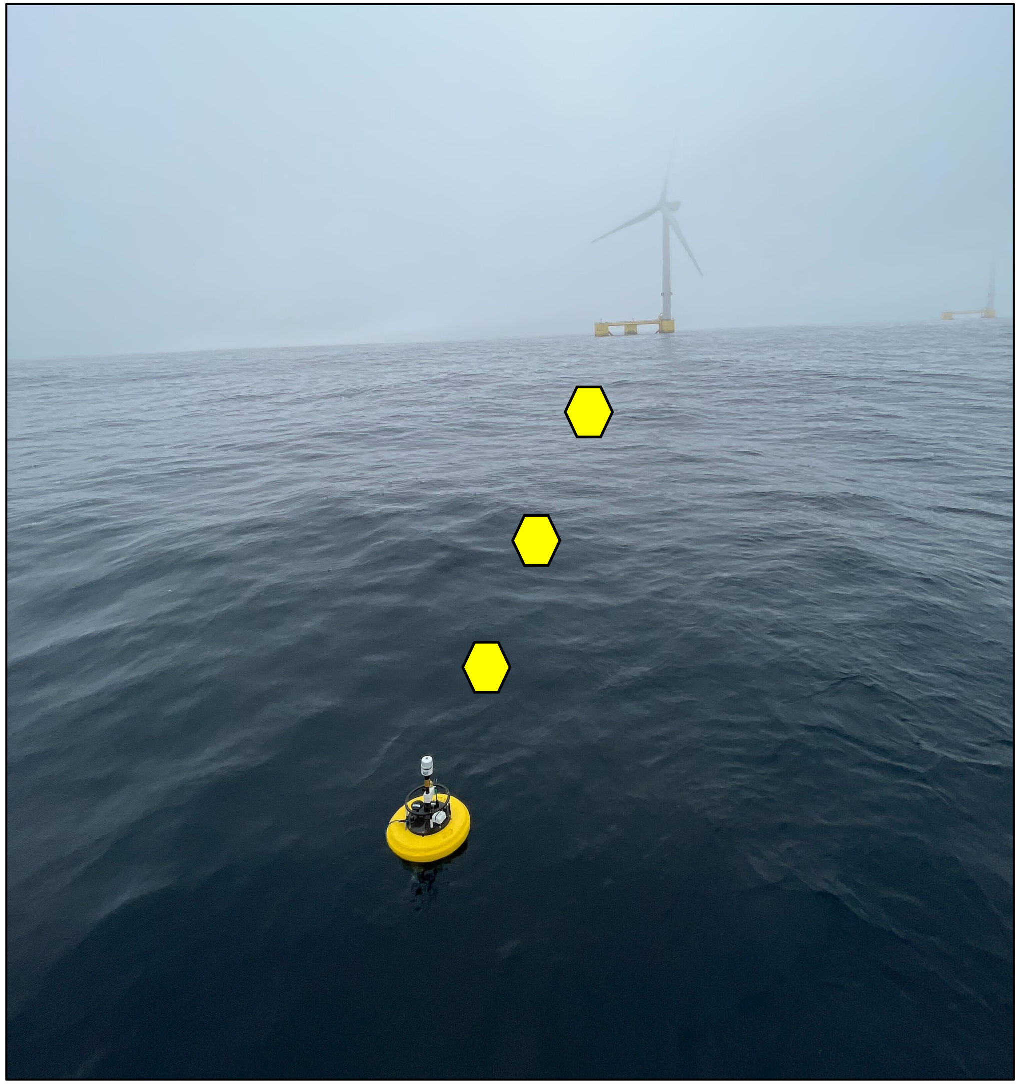
Wave attenuation in sea ice



Thomson et al, *GRL, 2022*

Phase-resolved waves at offshore structures





Fisher and Thomson, *J. Ocean. Eng., 2021*

SWIFT wave measurements

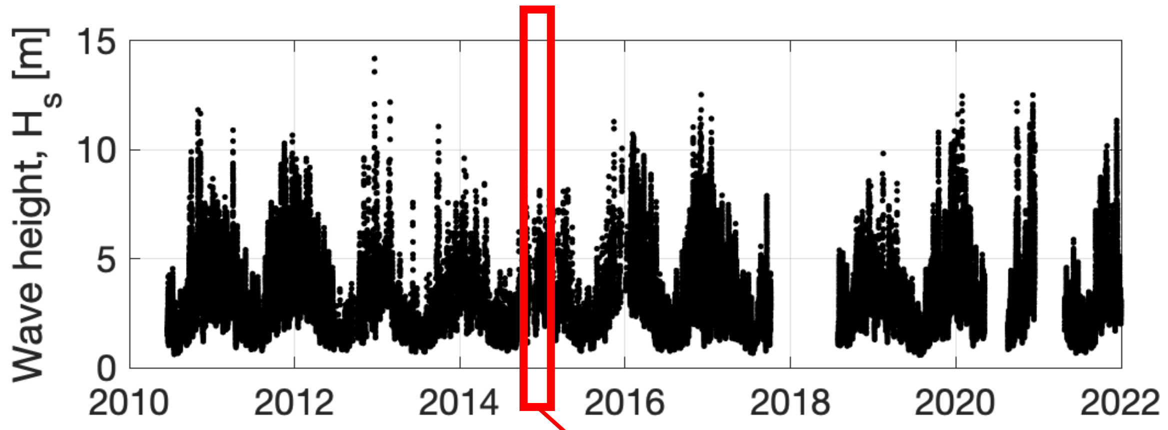
- Website (projects, data access, etc): **www.apl.uw.edu/swift**
- Public code: https://github.com/jthomson-apluw/SWIFT-codes
- Telemetry products: Hs, Tp, Dp, E(f), a1(f), a2(f), b1(f), b2(f), check(f)
- Details:
  - Use GPS horizontal velocities (u,v) to make scalar spectra
  - Use cross-spectra of vertical acceleration and GPS velocity for directional moments
  - RC high-pass filter, f > 0.04 Hz
- Known issues:
  - Low frequency drift and integration errors (spurious energy)
  - GPS dropouts and/or spikes
  - Buoy natural frequency f ~ 0.8 Hz (so limit results to f < 0.5 Hz)
  - Spectral ensembles from 8.5 minutes of raw data only have 12 degrees of freedom

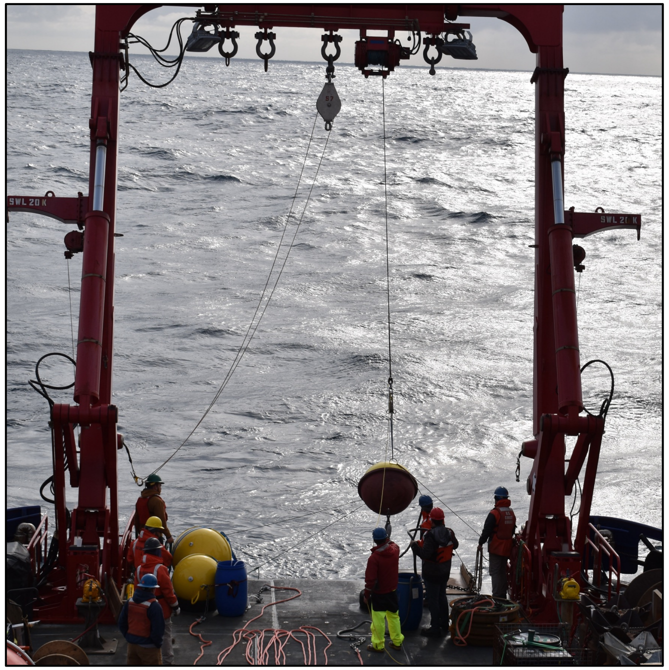
GPS:
+ agnostic to orientation
+ no calibration
- assume dispersion
- signal dropouts

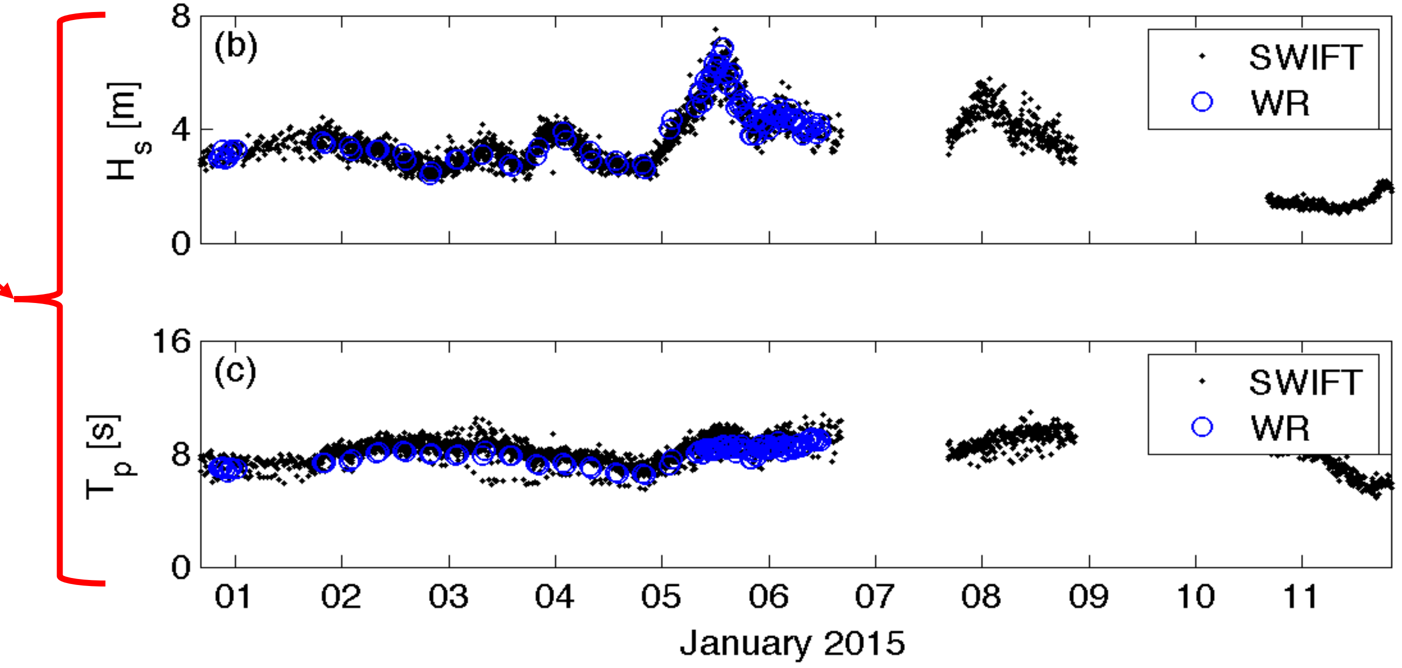
IMU:
+ low power
+ direct measurement
- orientation matters
- calibration matters

Thomson et al, *Journal of Atmospheric and Oceanic Technology, 2018.*

Calibration at Station Papa (CDIP 166)



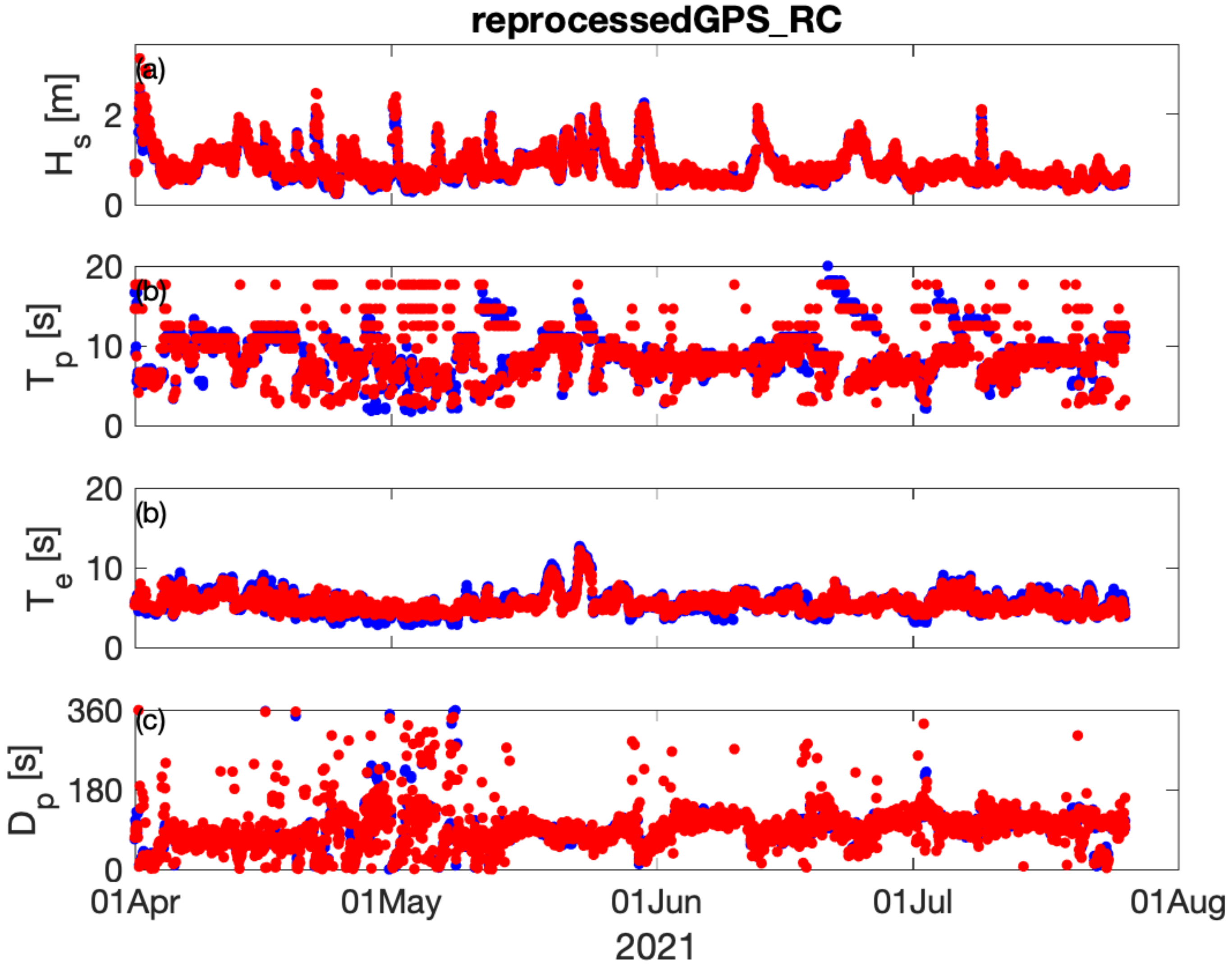


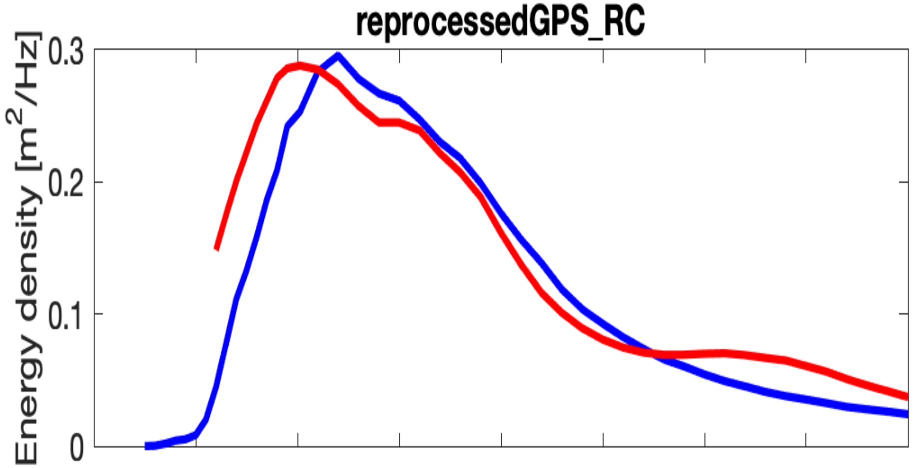


Thomson et al, JPO 2016

Calibration at Duck FRF (GPS results)

CDIP (blue)
SWIFT (red)





Calibration at Duck FRF (IMU results)

CDIP (blue)
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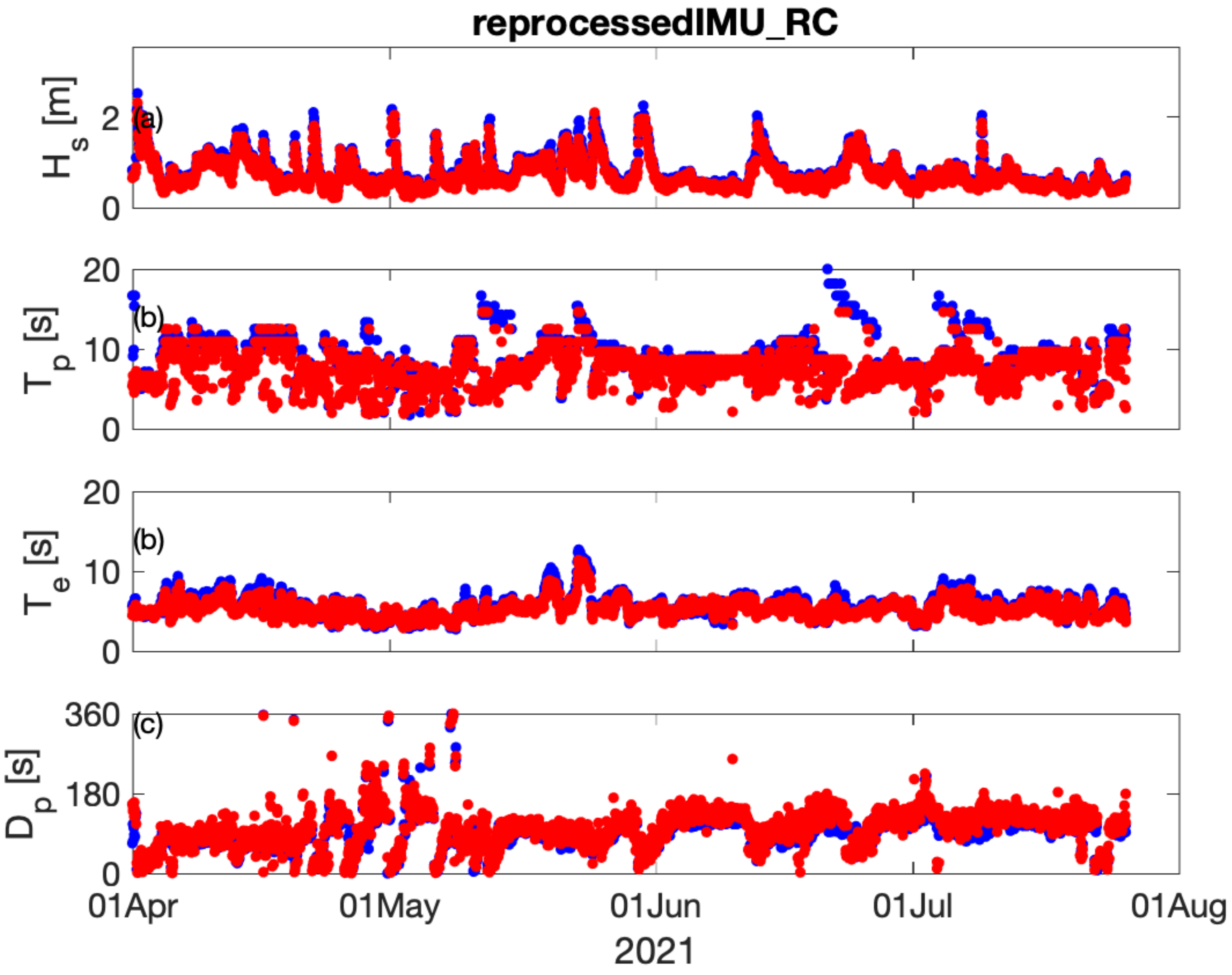
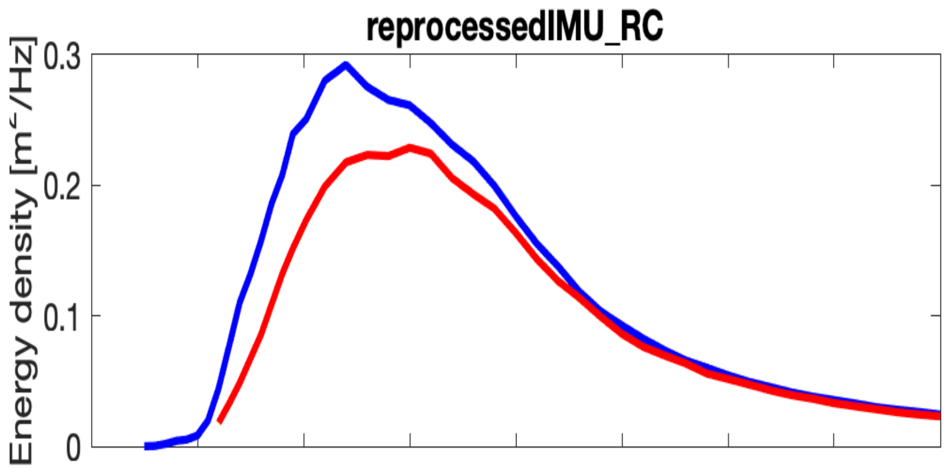
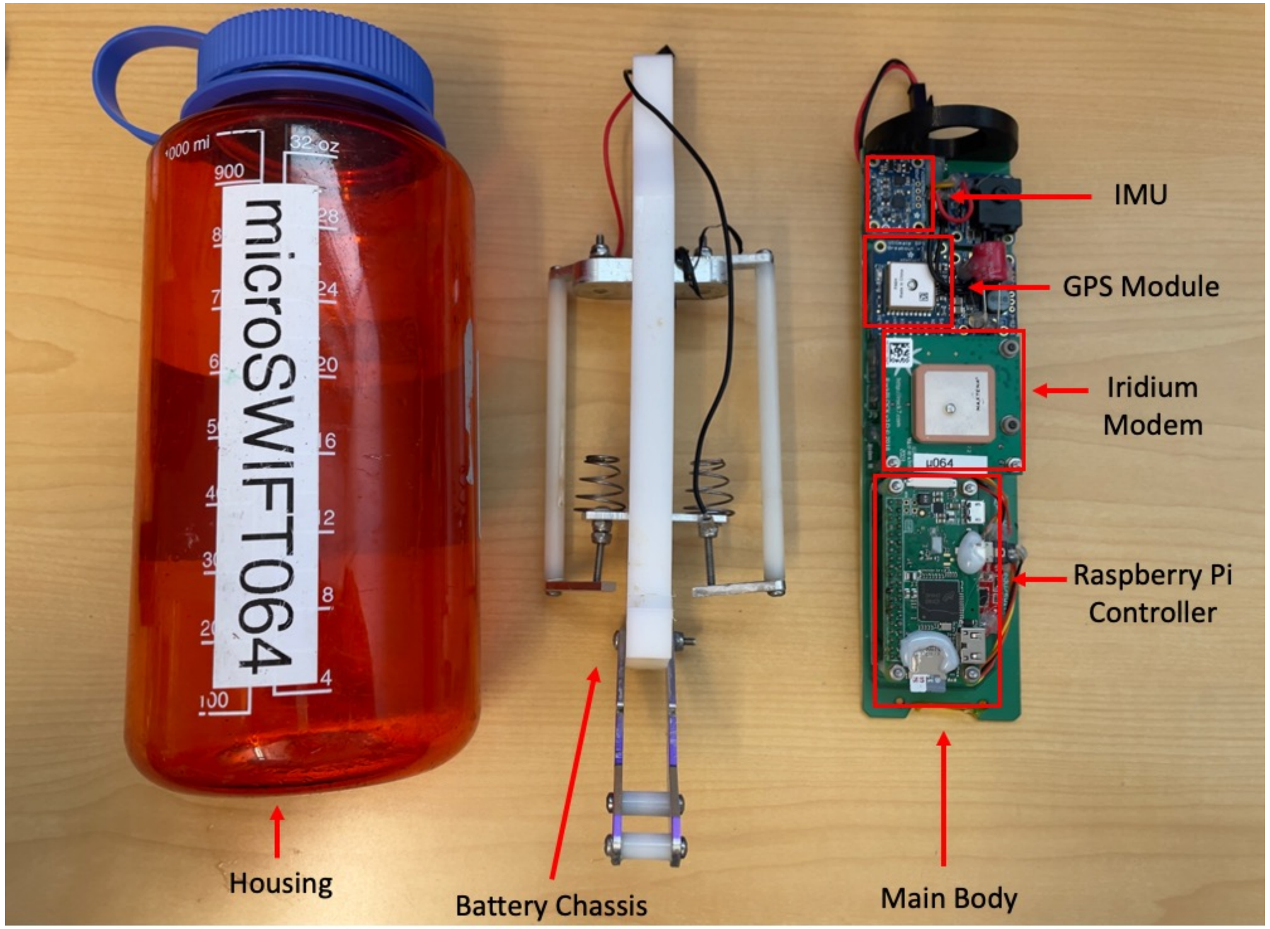




microSWIFT buoys

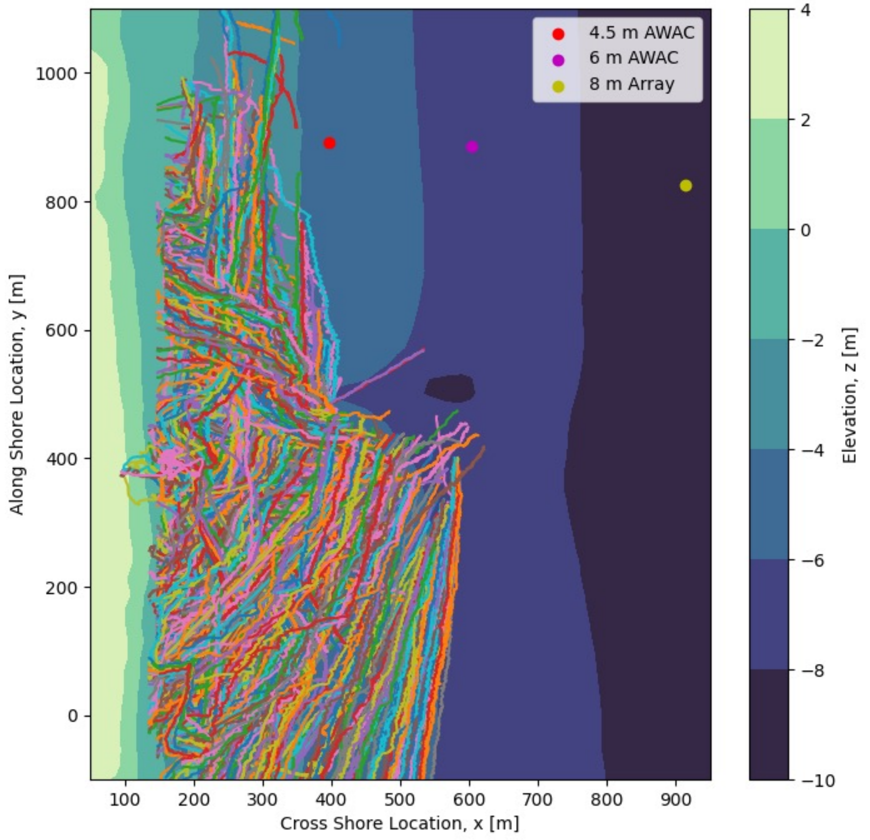
- $500 unit cost
- Iridium telemetry (hourly)
- GPS and IMU wave processing
- 1 week endurance*

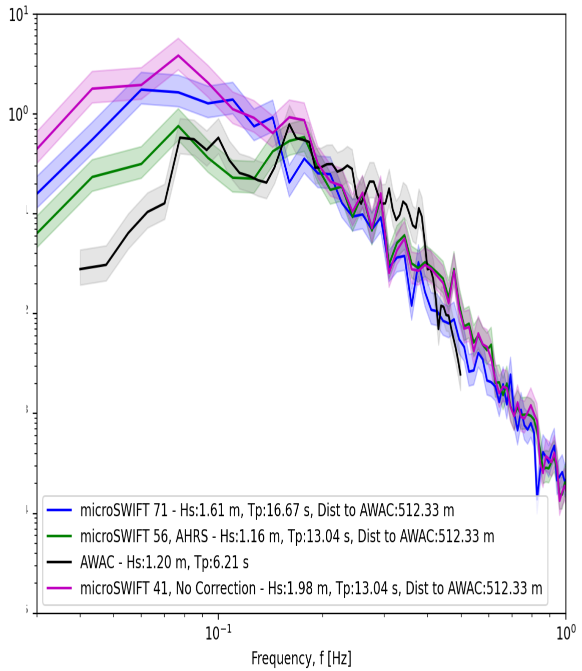


"1L" version

"2L" version

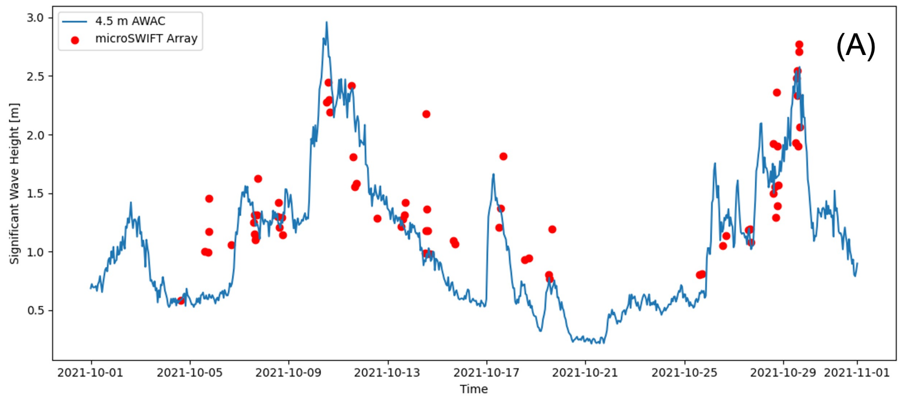
microSWIFTs at DUNEX 2021





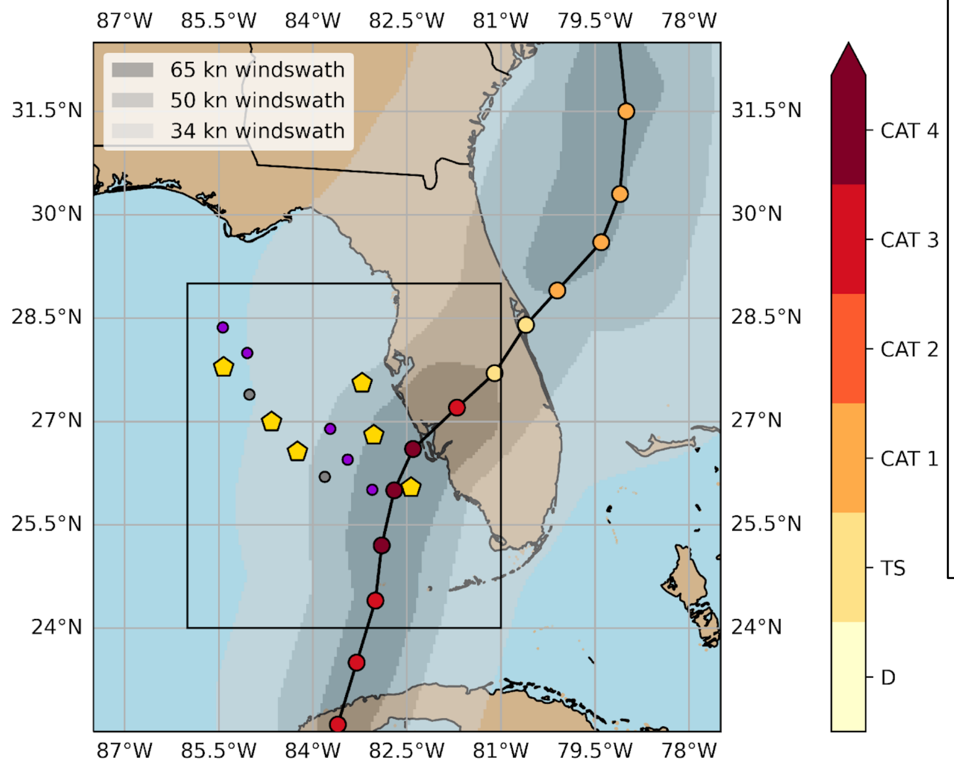
- Correct IMU data from body to earth reference frame
- Band-pass filter at each time integration

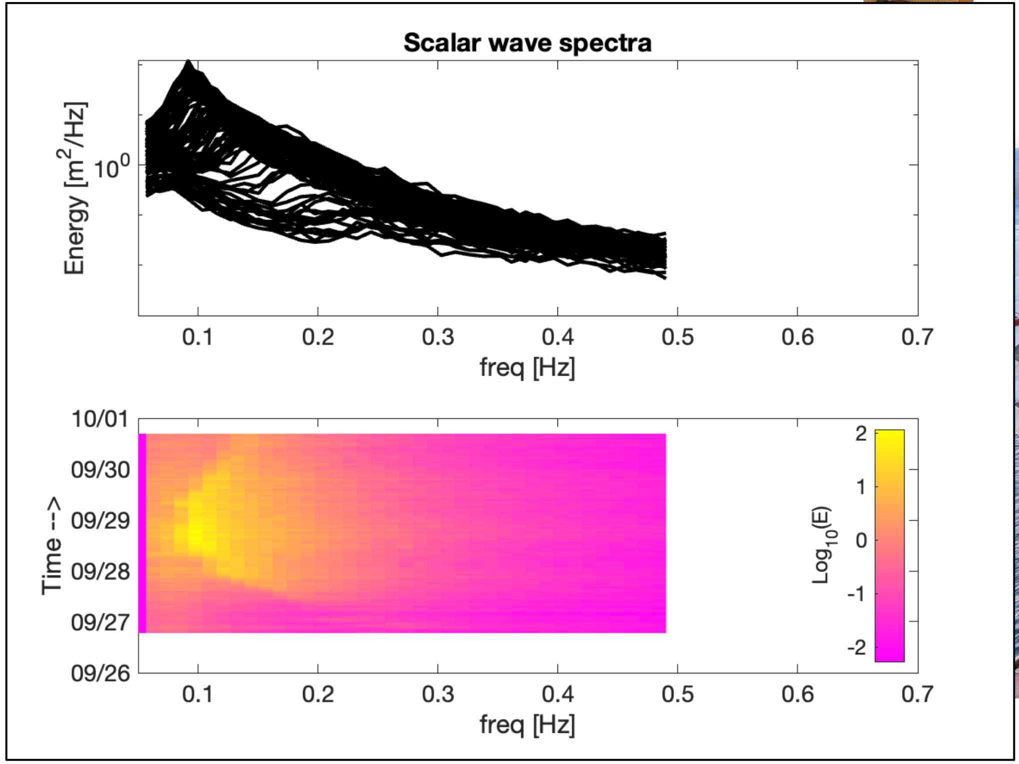
PhD student EJ Rainville

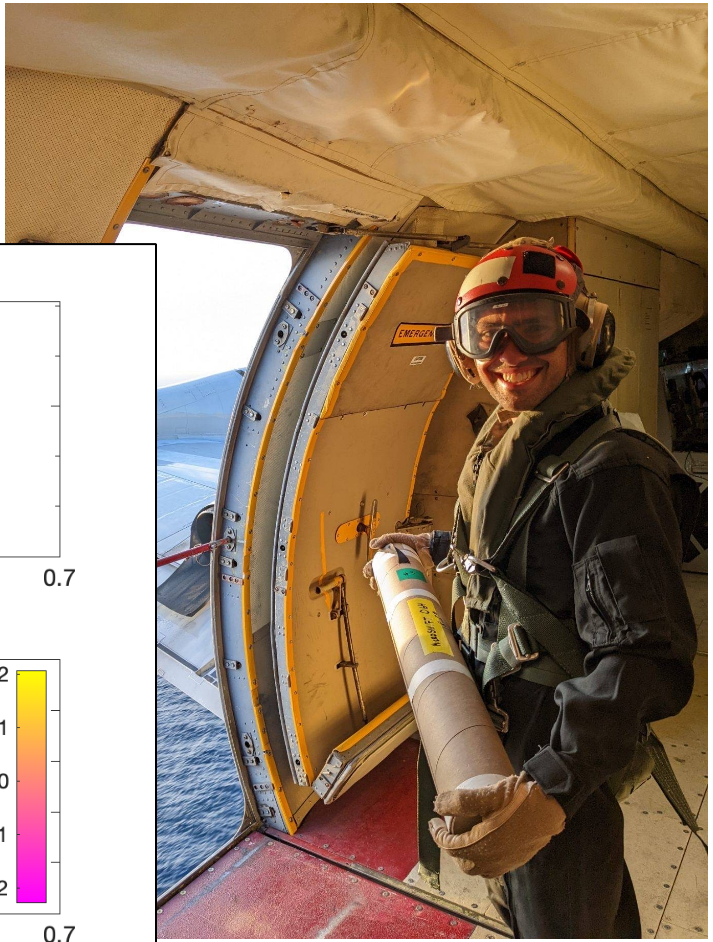


microSWIFTs in NOPP Hurricane Coastal Impacts

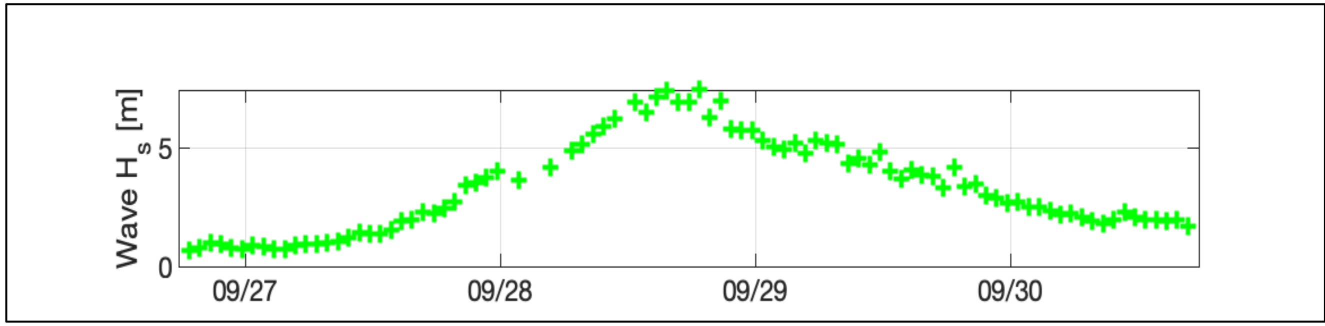
Hurricane Ian track and air-deployed buoys





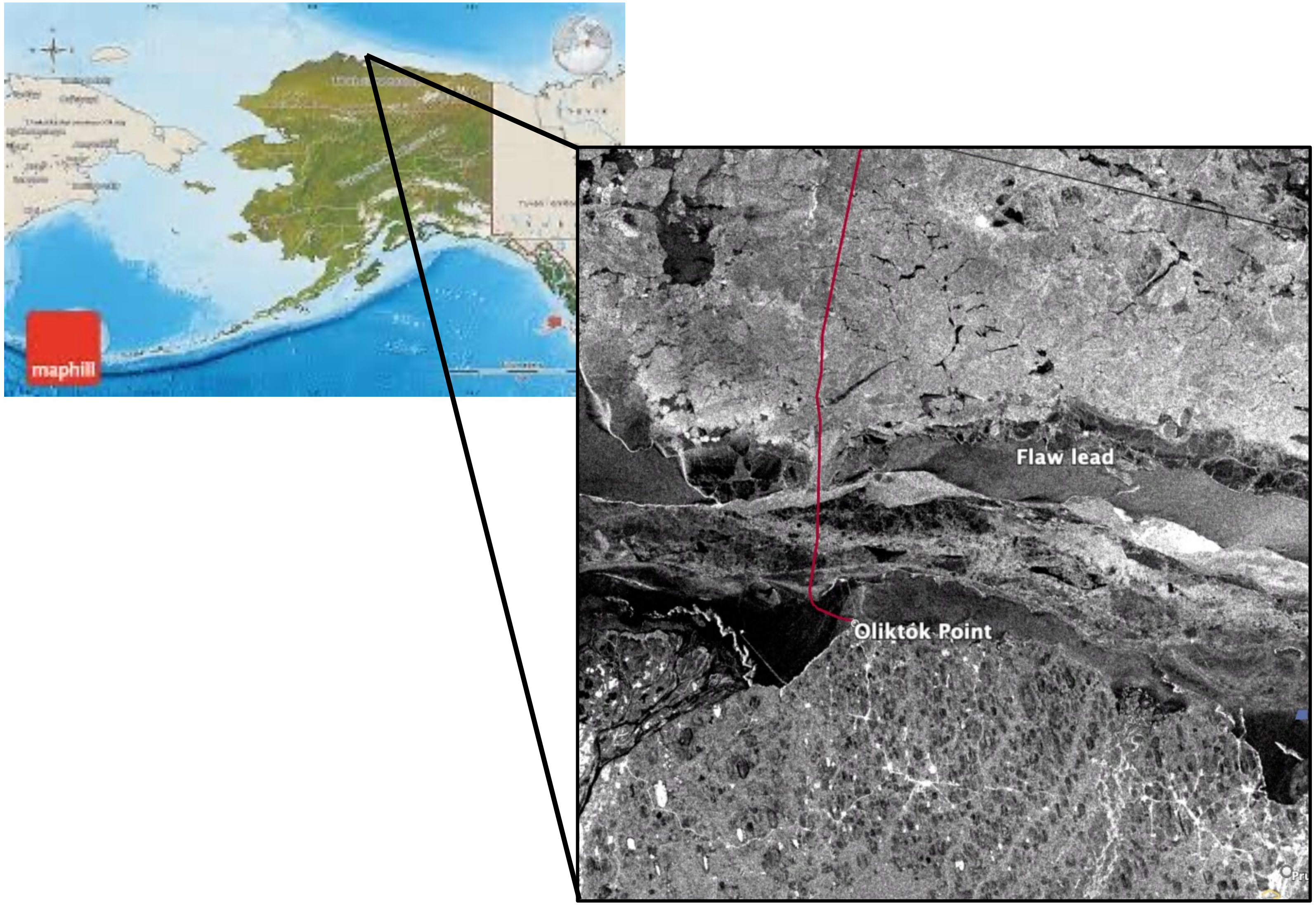


PhD student Jake Davis



Collaboration with Sofar Spotters and SIO LDL ADWS

microSWIFTs for Alaska landfast ice measurements



Fiber optic cable collaboration with Sandia Nat. Labs

Dr. Maddie Smith (WHOI)

Conclusions / Questions

- SWIFTs were developed for process studies and specific projects… how to incorporate into an observing system?
- What QC standards to prioritize?
- How well do we understand the band-pass filters we use?
- How well do we understand the hydrodynamic response of each buoy?
- How far can we push the open source / science model?
  - e.g., the Open Met buoy: https://www.labmaker.org/collections/ecology/products/openmetbuoy