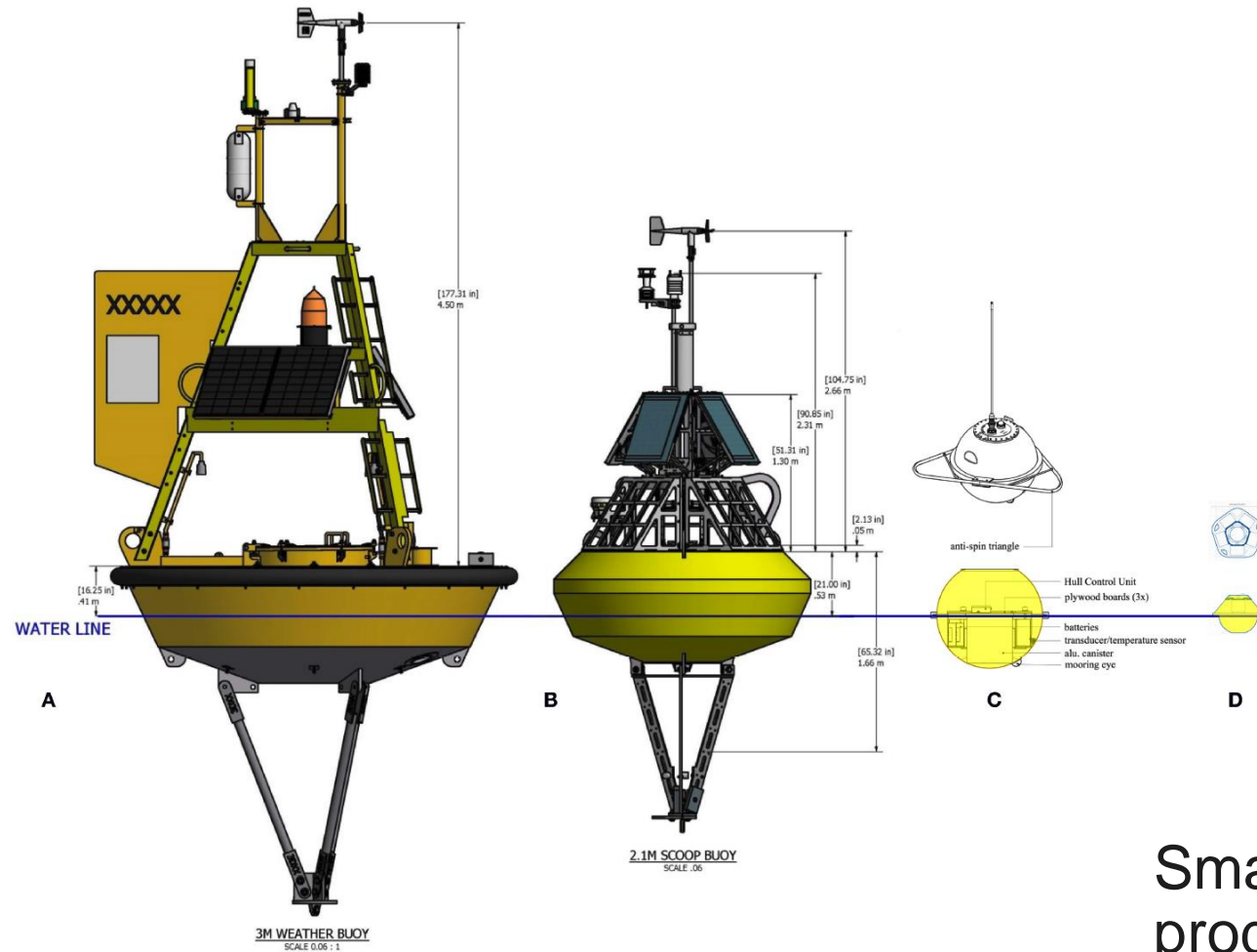


# Innovations in low-cost metocean buoys for aerial deployments

P.B. Smit and T.T. Janssen (and many others)

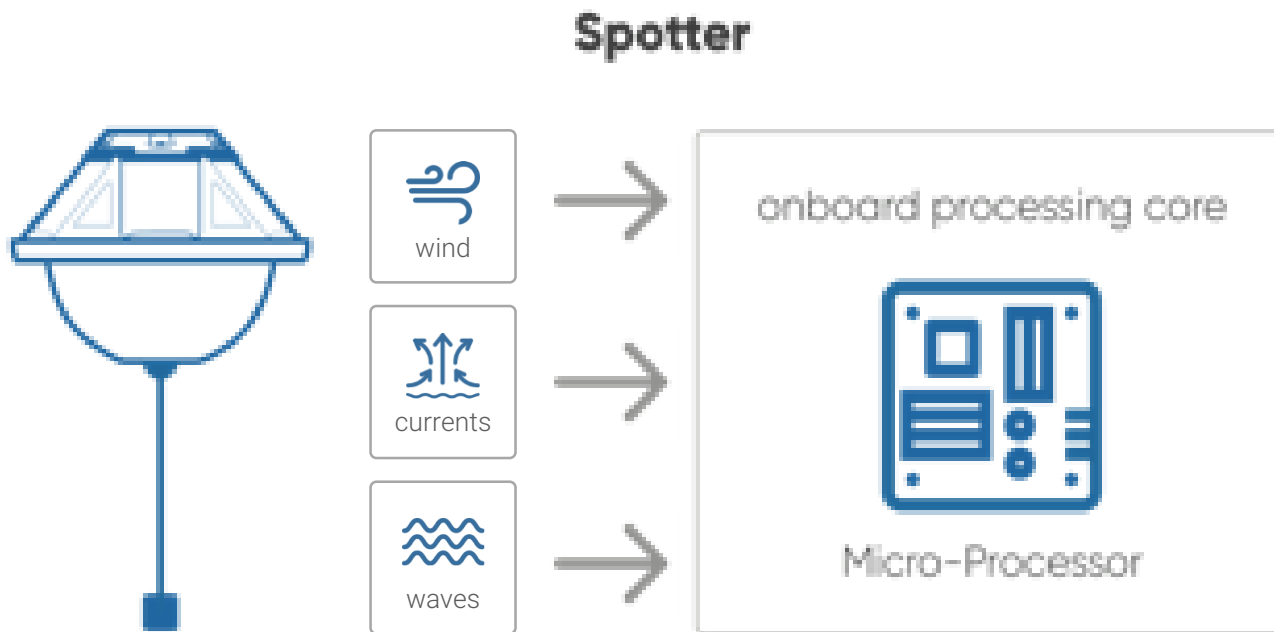
Ocean instruments are often highly capable, but complex, large, and consequently costly to operate.



Small, easy to deploy, mass producible and low cost instruments allow for rapid and large scale deployment

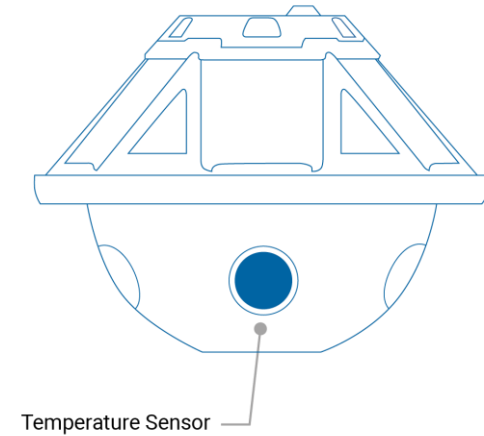
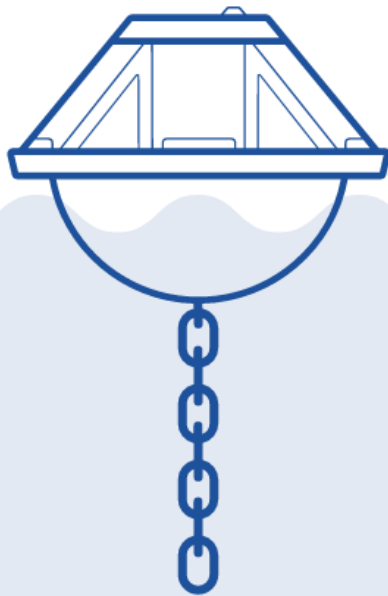
# Spotter

a two-way connected, compact weather buoy. Designed for usability and agility.



# Focus on expanding capabilities...

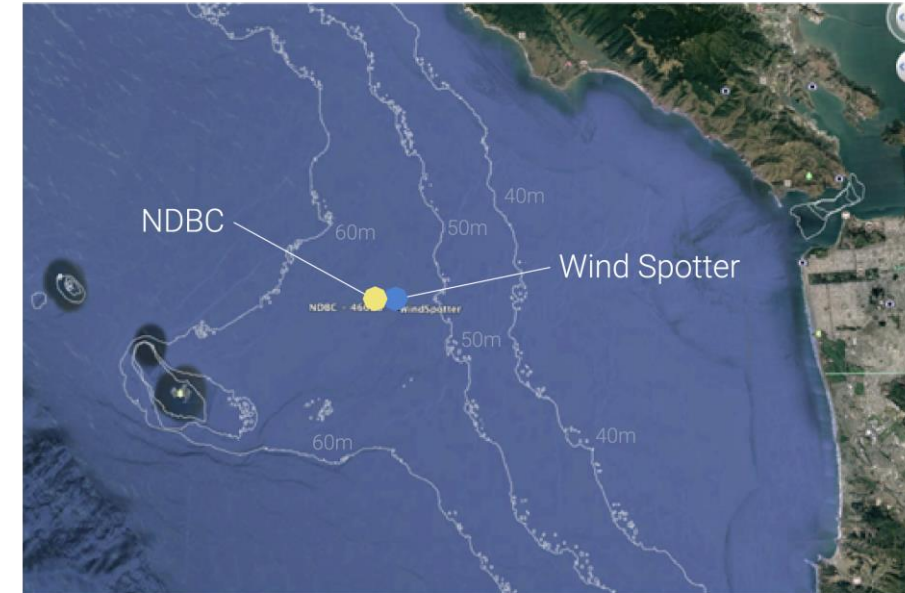
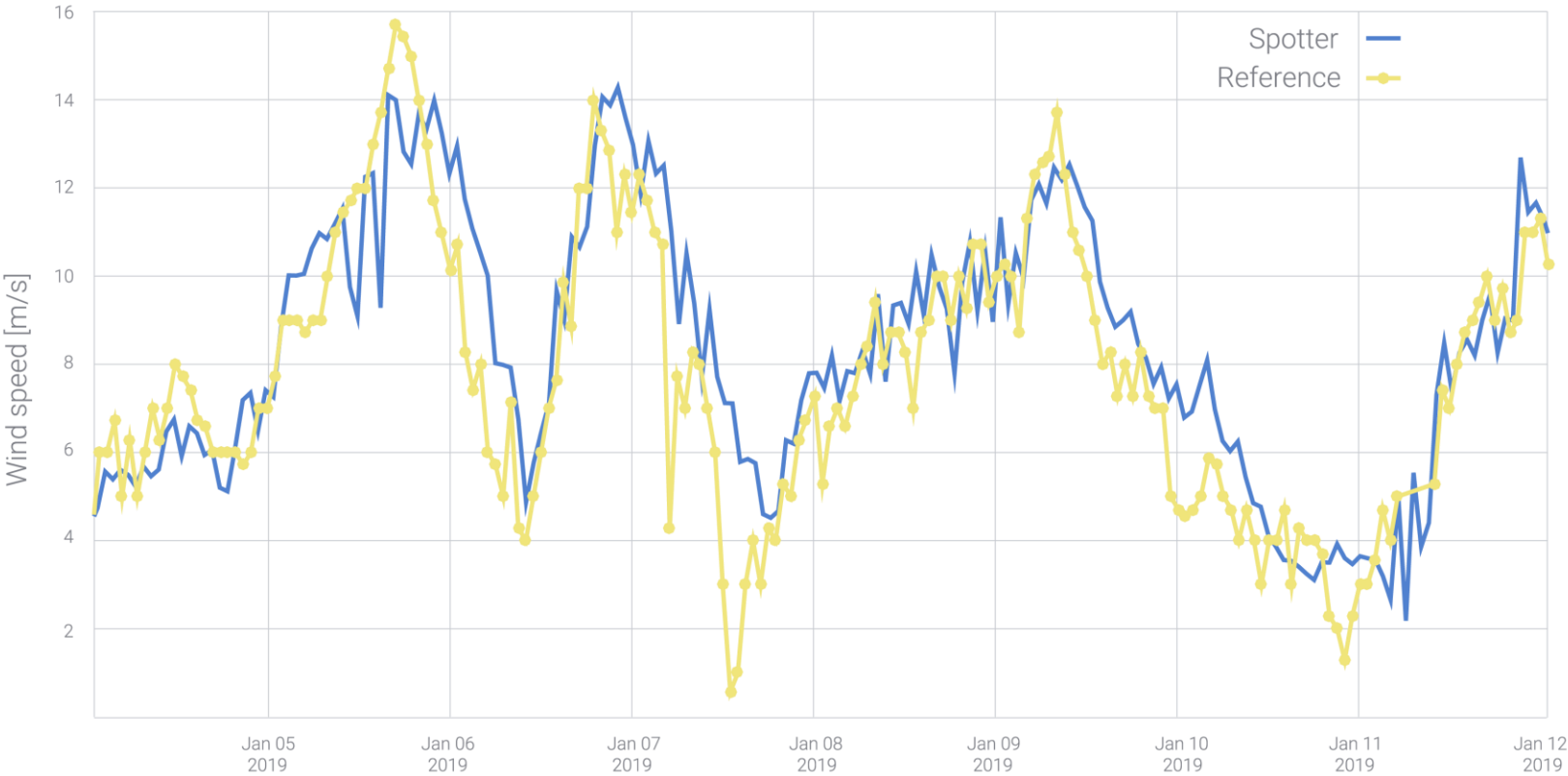
Wind estimate, SST observations  
external interface...



...without compromising on platform  
characteristics

Affordable, easy to deploy, easy to use,  
easy to produce.

# Waves as proxy for wind

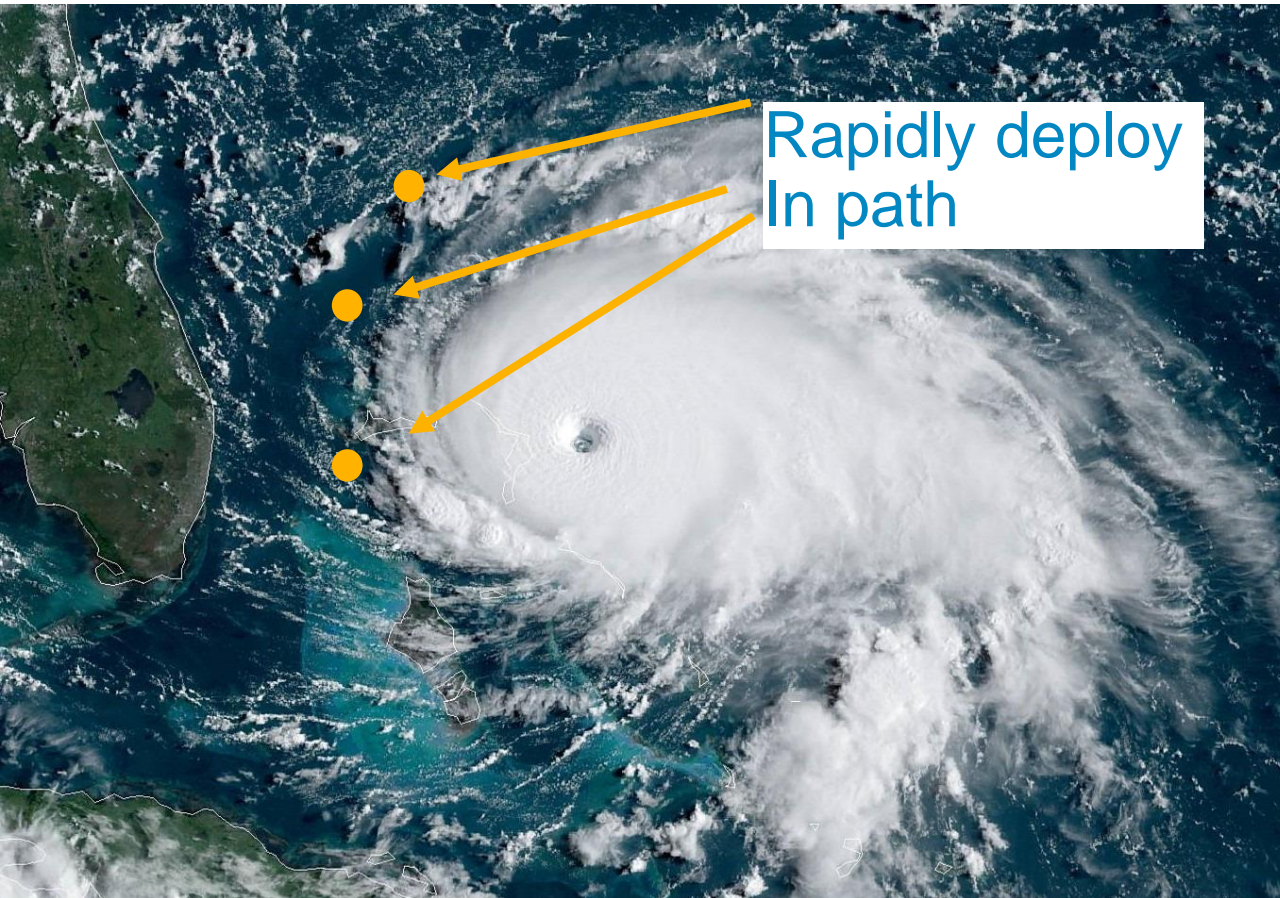


(Based on equilibrium range)

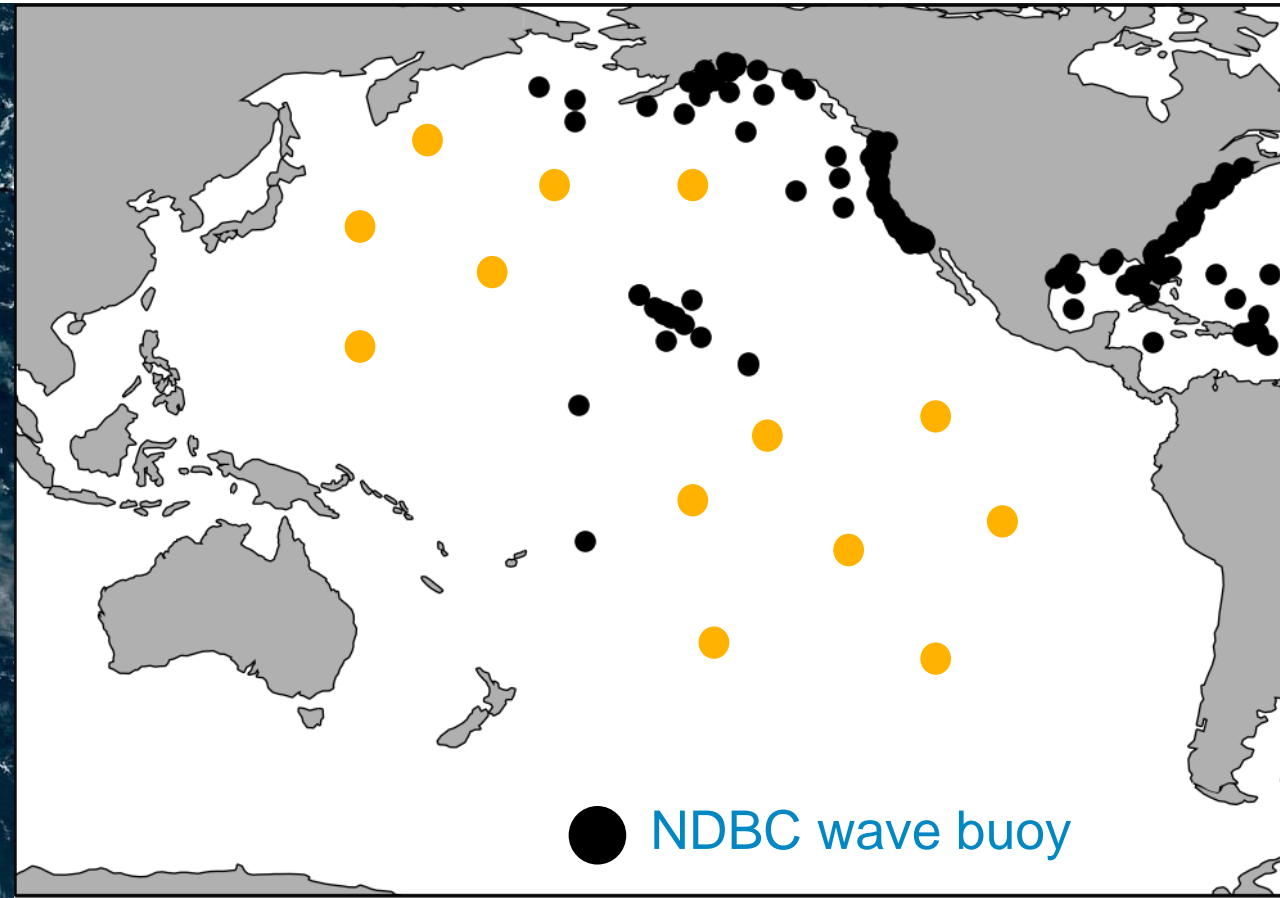
Phillips 1985; Thomson et al., 2013; Voermans et al. (under review)



# Flexible Deployment



Rapidly deploy  
In path

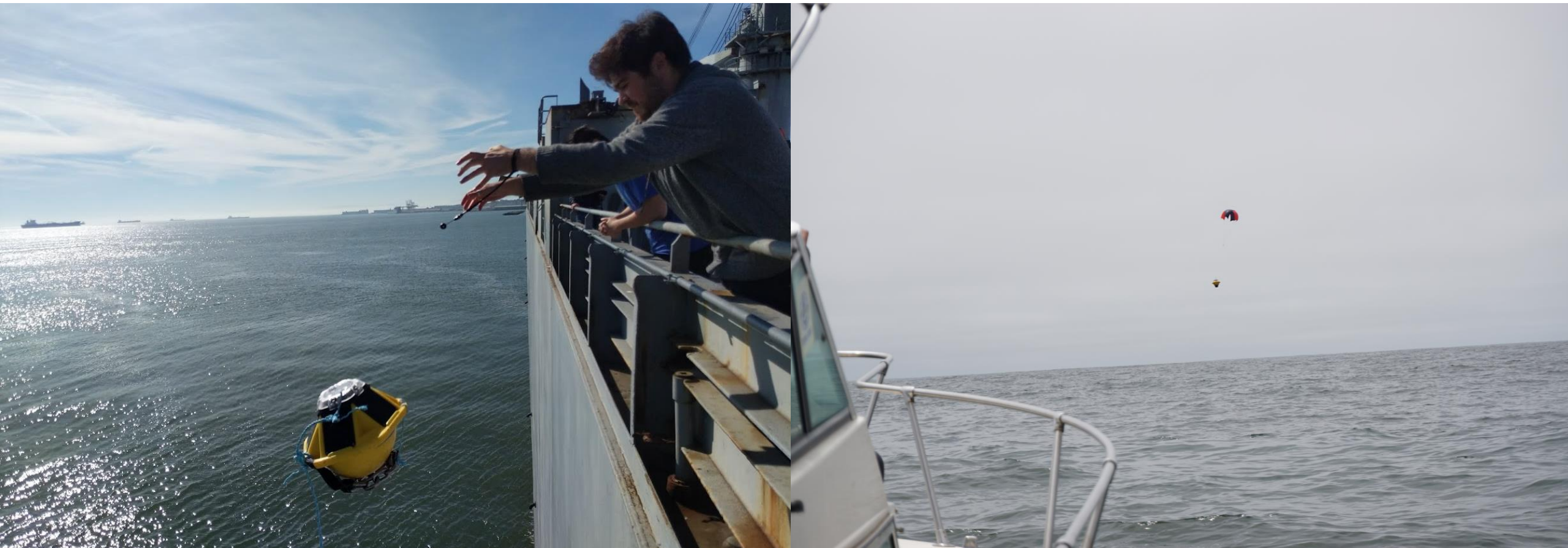


● NDBC wave buoy

Rapidly developing weather systems  
require flexible deployment options

Moored assets mostly concentrated along  
coasts. Free floating networks are  
feasible.

Deployment should be as simple  
as tossing it overboard....

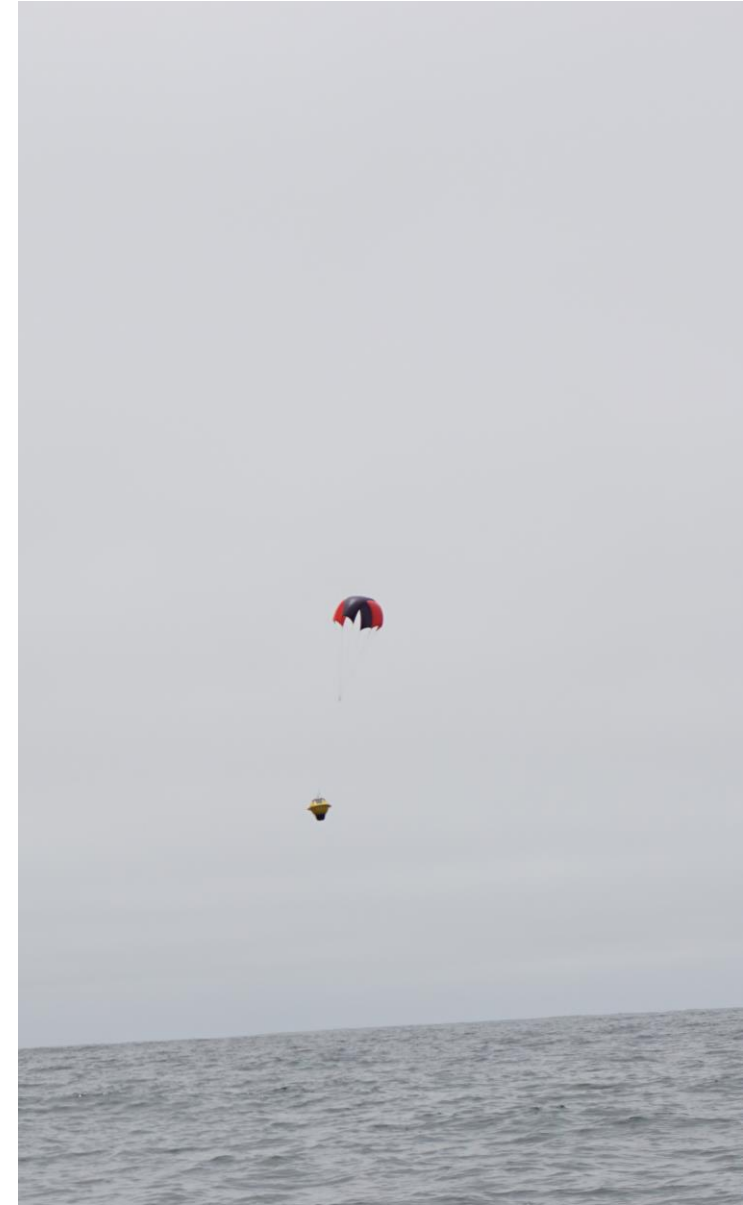


...from a ship or a plane.



# Deployment:

- Large scale deployments
  - Low cost, easy to manufacture, easy to deploy
- Environmentally friendly
  - Biodegradable materials
- Fast descent, but robust
  - Avoid large drifts, impact resistant



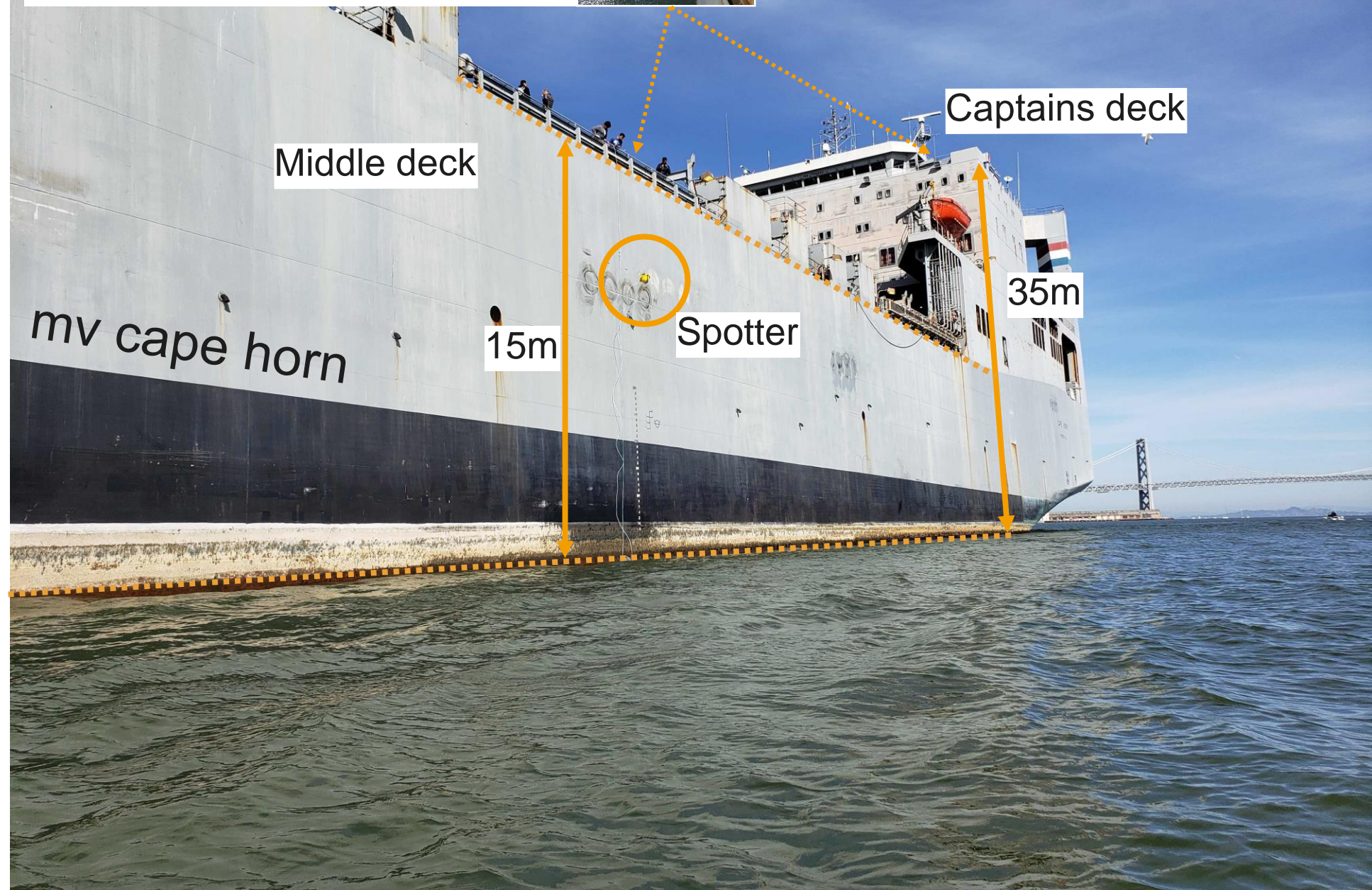


# Hardening system: Drop Testing





# Drop testing







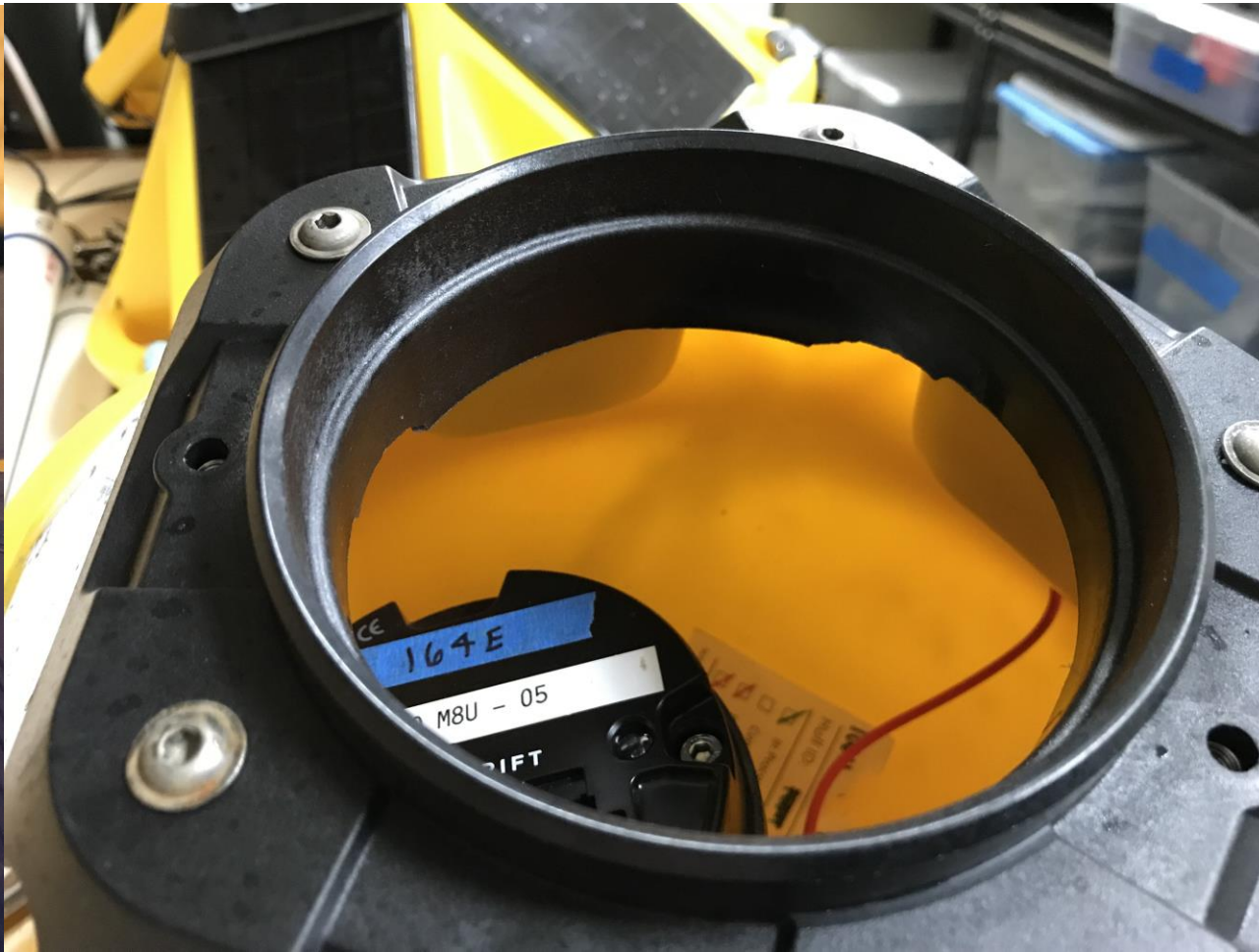


# Failure modes (identified, and fixed)

Iridium connector on pcb



Flange holding e-box







Ballast chain



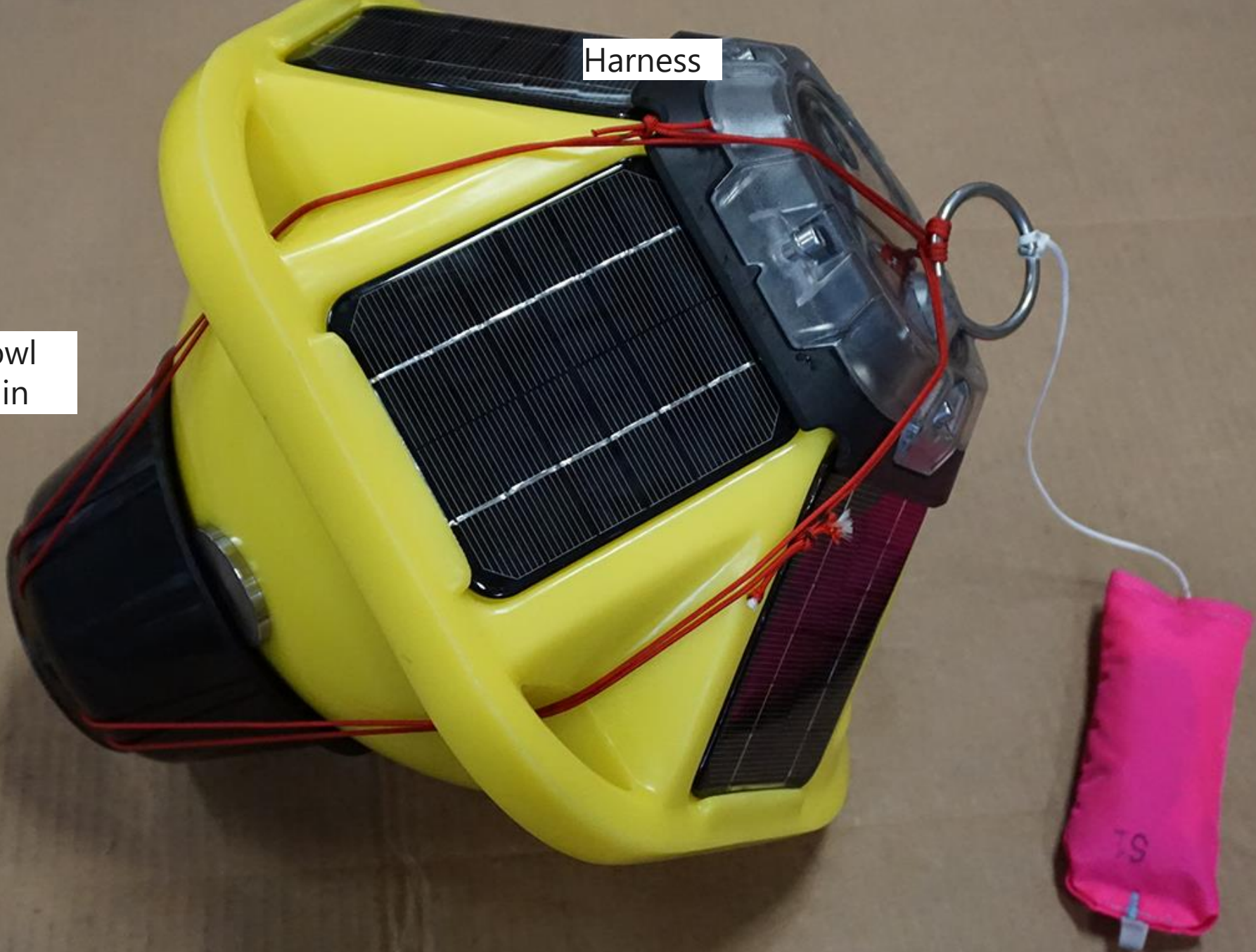
Ballast Bowl



Cruciform  
Parachute



Harness



A yellow plastic ballast bowl is shown from a top-down perspective. It has two large black solar panels mounted on its top surface. Red strings are tied around the bowl, and a metal ring is attached to one of them. A white string extends from the ring to a small, bright pink cruciform parachute. The entire assembly is on a brown cardboard surface.

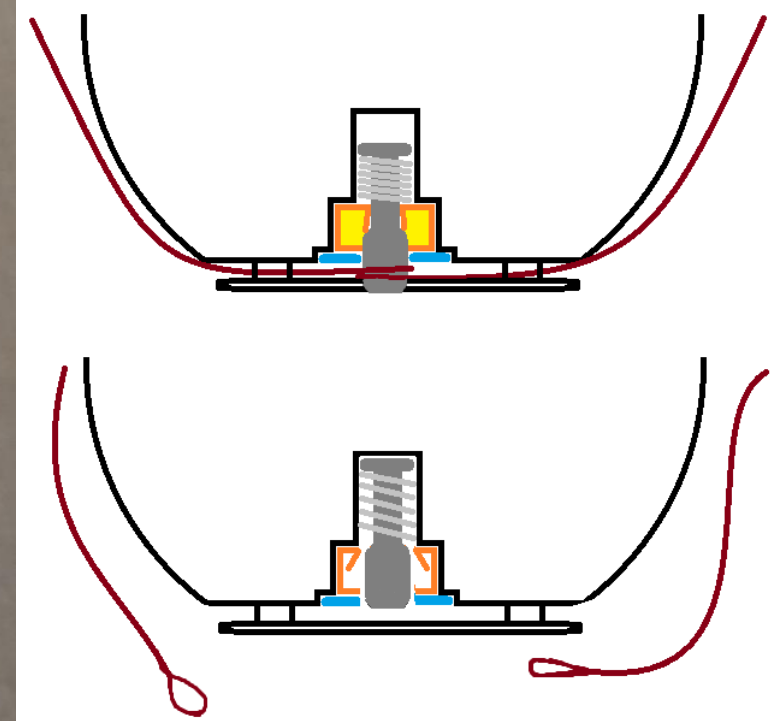
Harness

Ballast bowl  
holds chain

Cruciform parachute

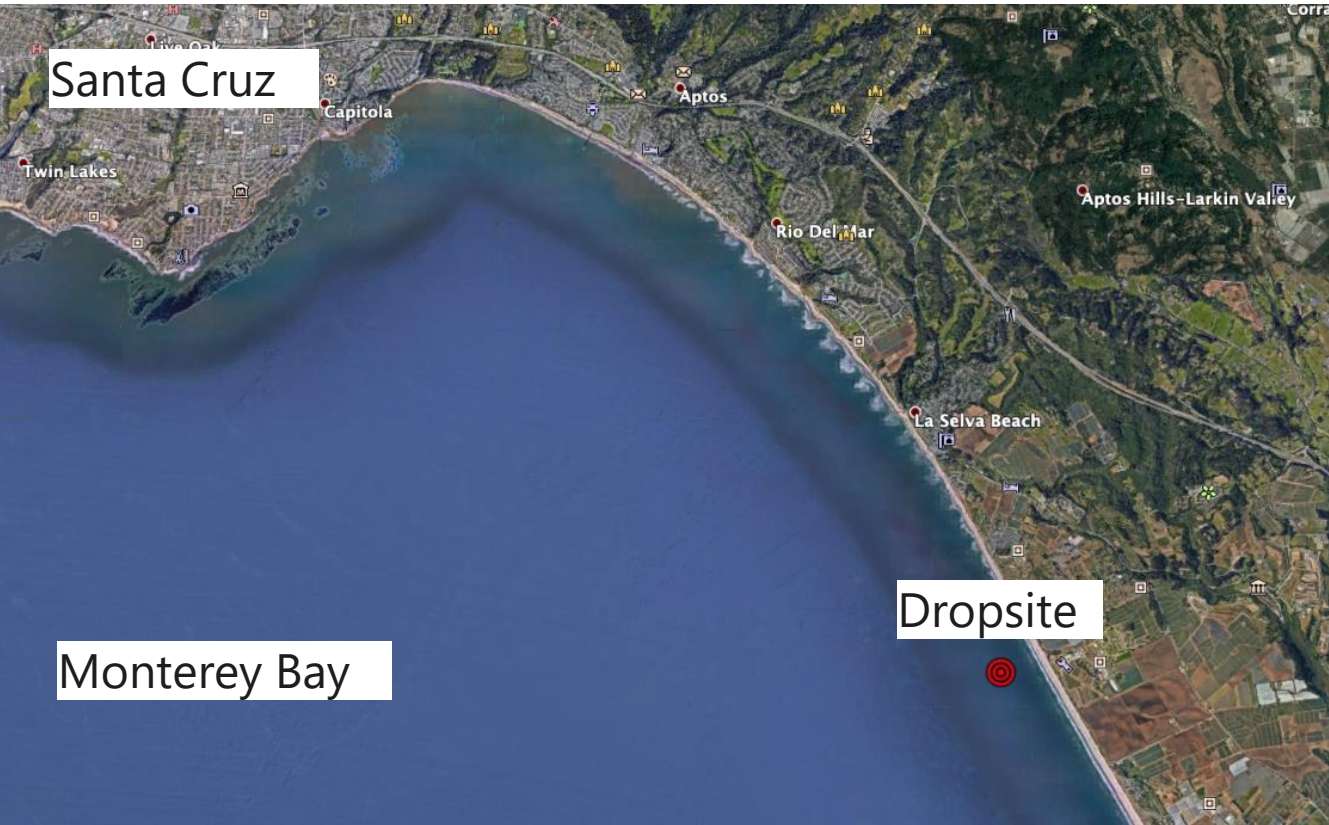


Trigger mechanism for release.



# Air Drop:

(May 31, 2019)



Drop four units from 350m





ENABLES QUICK  
AIR DEPLOYMENT

The image shows two yellow autonomous underwater vehicles (AUVs) positioned on a dark, textured surface. Each AUV is equipped with a solar panel on its top surface and a pink float attached to its top. The AUV in the foreground has a white rope tied around its base and a yellow rope tied around its side. A cardboard box is visible in the background, with the text "GOJAN AMERICA" and "feel the breeze." printed on it.

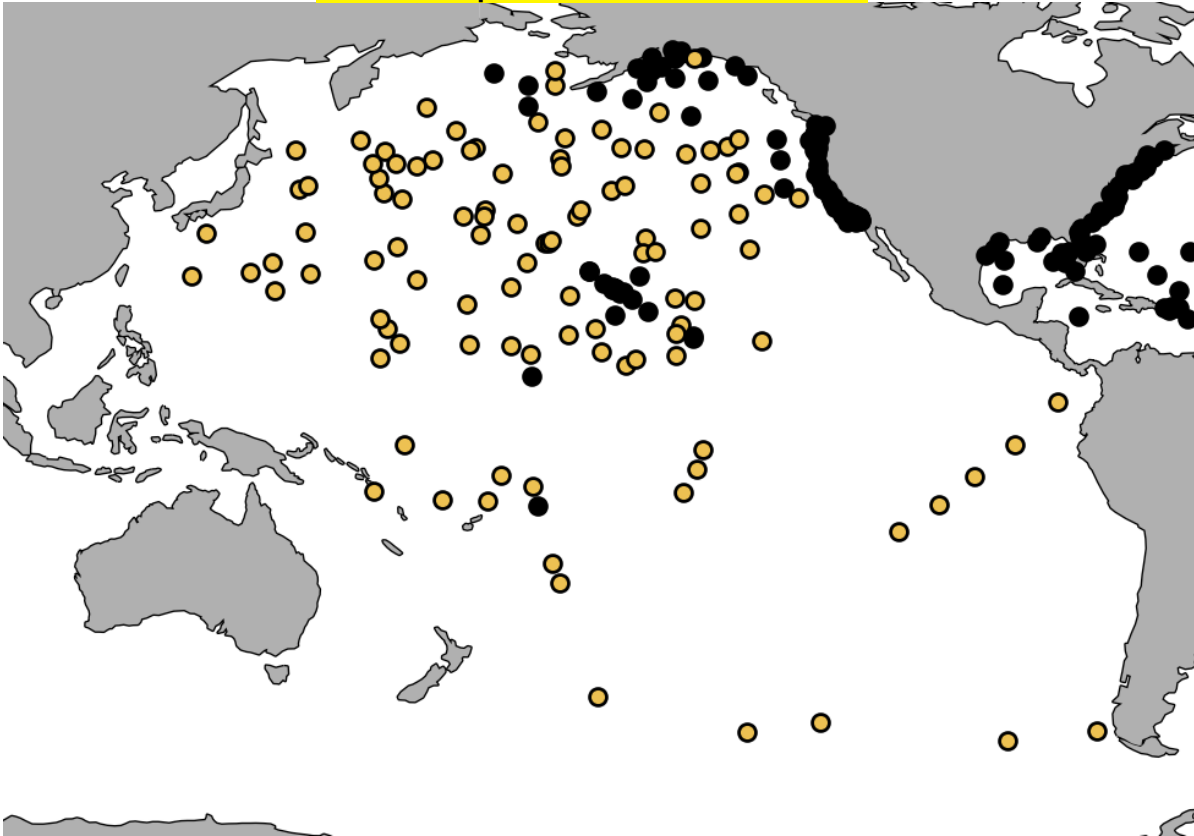


(Air)drop allows for greater deployment flexibility

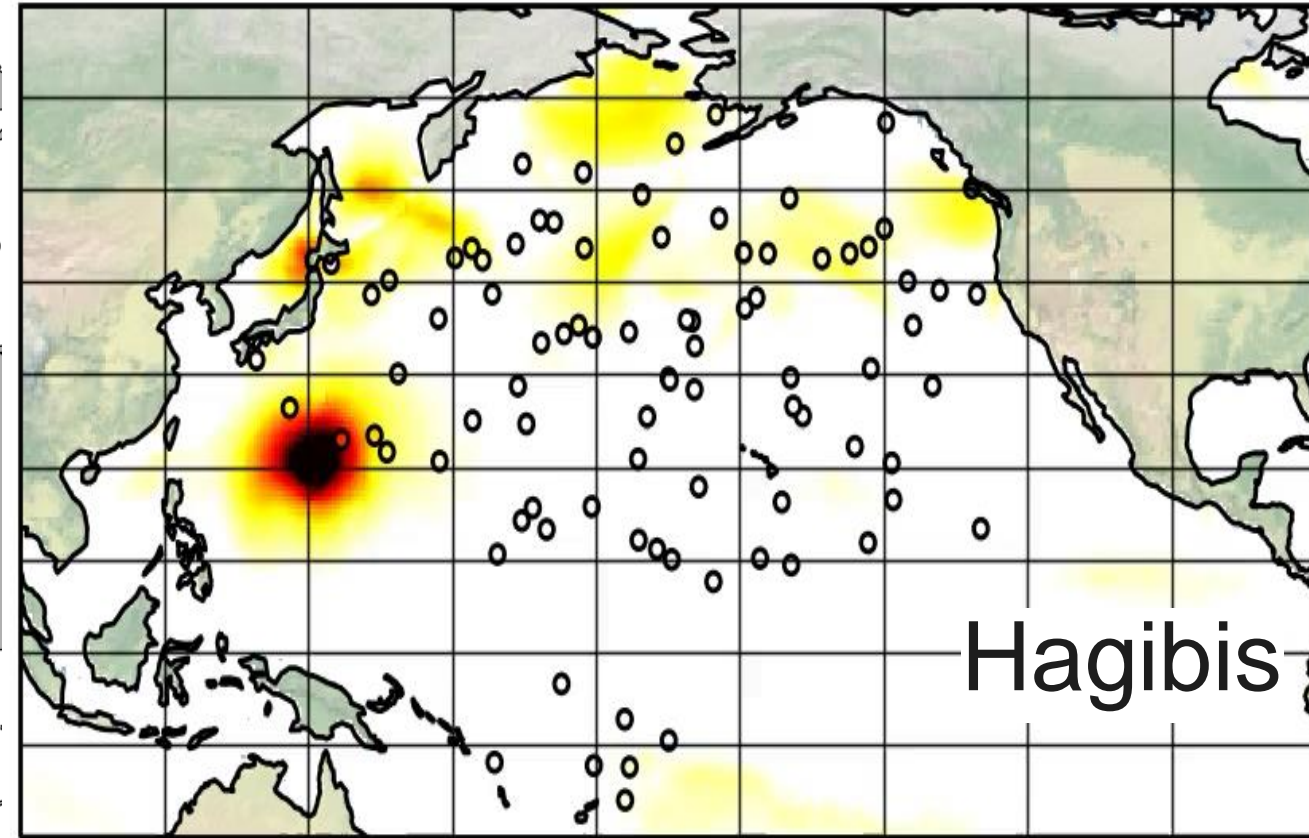


# Why it matters

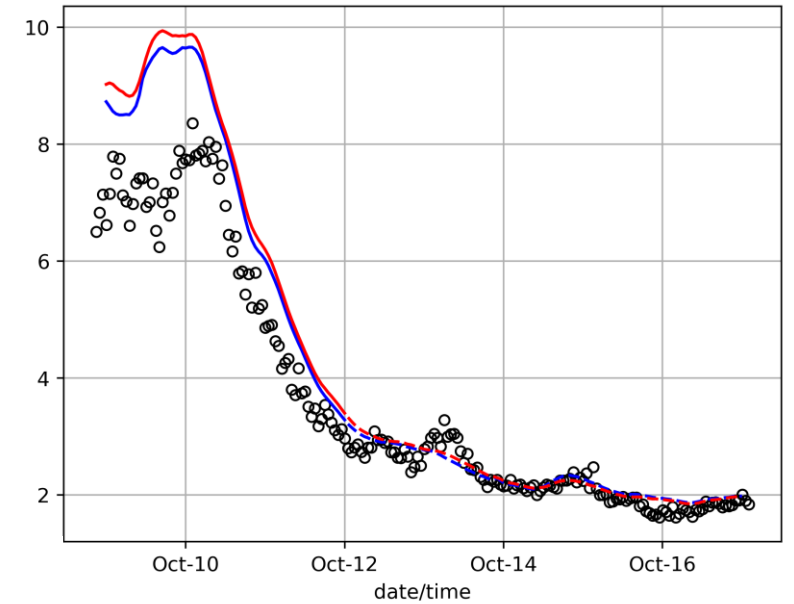
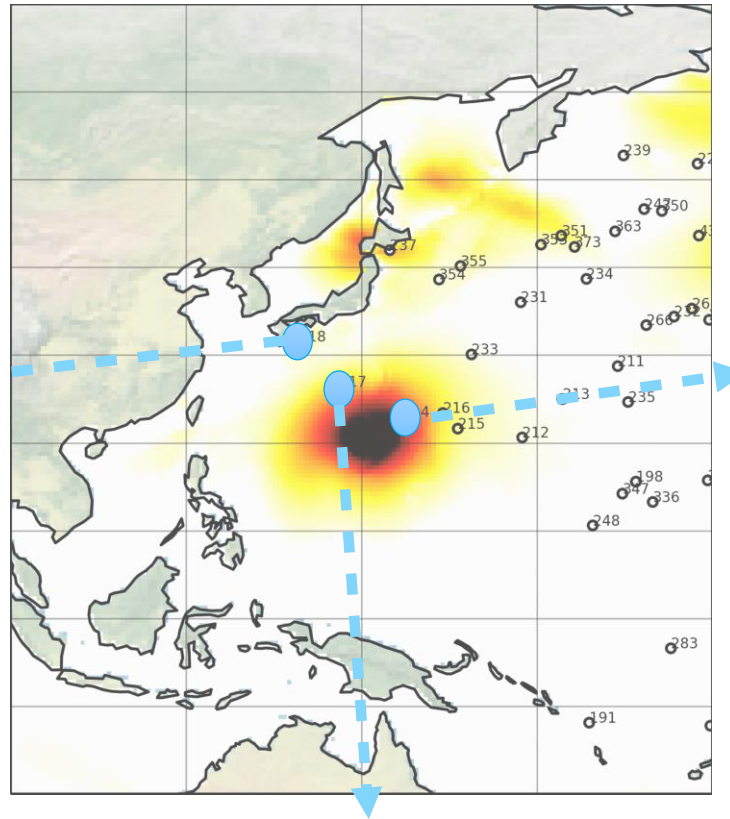
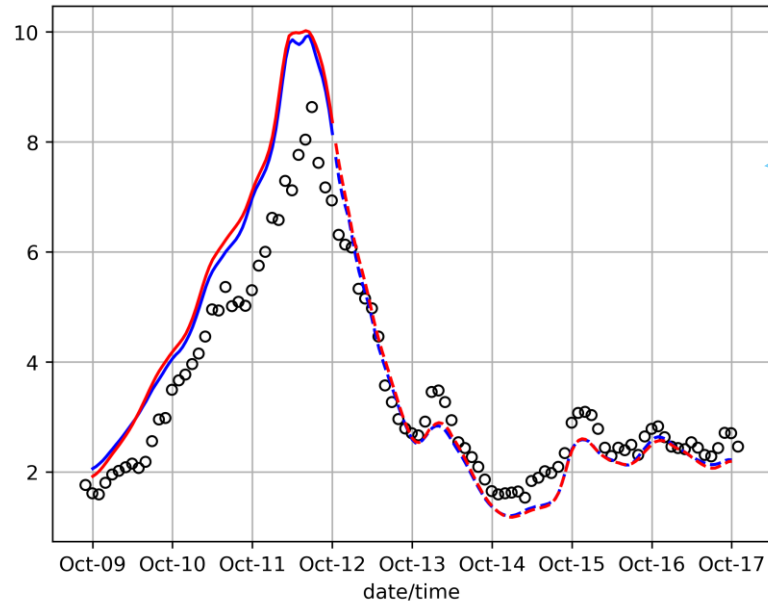
Sofar Operational Grid



Oct 09, 12 AM (PDT)



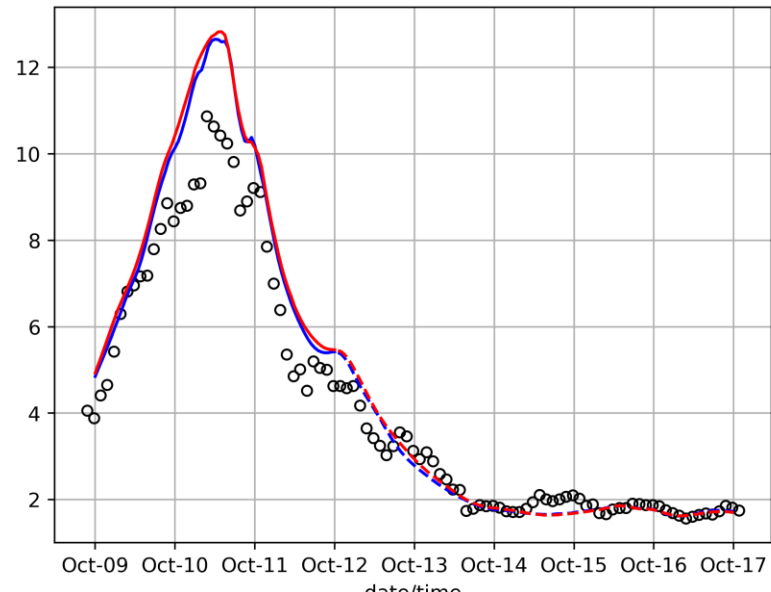
Making sensors affordable and easy to deploy has allowed us to deploy a large grid of Spotters (>100)



○ Observation

NOAA ww3

Sofar ww3





# Takeaway



Moving towards a data abundant ocean!