Engaging Citizen Scientist in Ocean Observing

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eMOLT evolving

- Environmental Monitors on **Lobster Traps**
  - 2001-present
  - Continuous time series at fixed locations
  - Primarily temperature at the bottom

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  - Student-built drifters and unmanned sailboats
  - Primarily surface currents

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  - Surface currents

- Environmental Monitors **on Large Trawlers**
  - 2014-present
  - Real-time observations from Study Fleet mobile gear
  - Primarily temperature but now includes weather

Environmental Monitors on Lobster Traps (eMOLT)
>50 lobstermen involved

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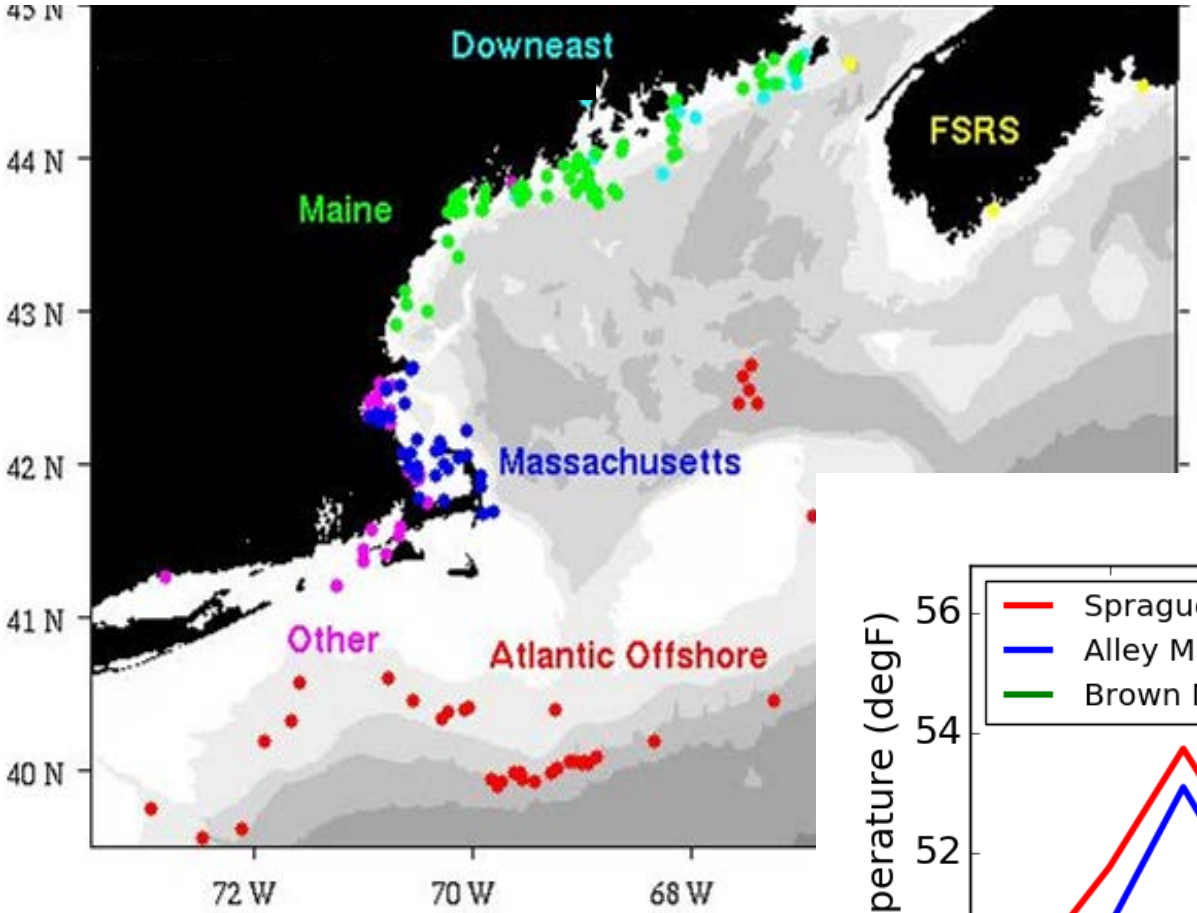
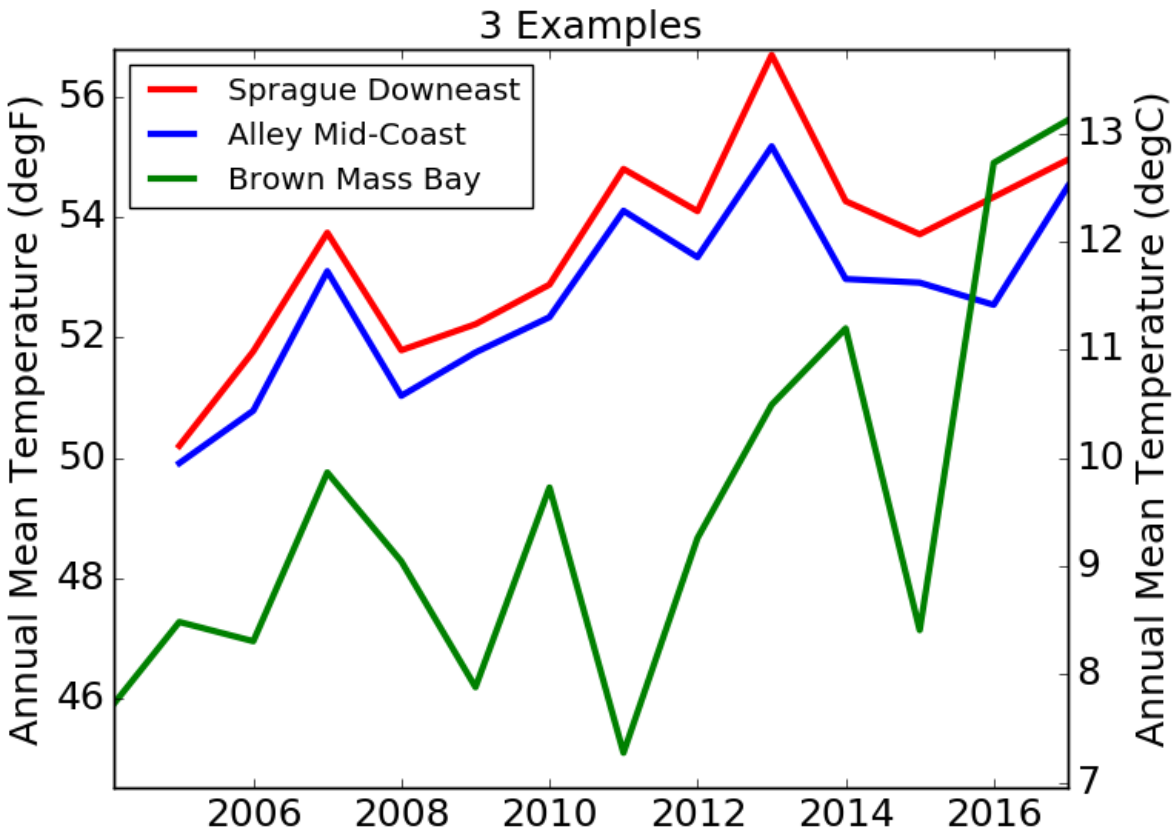


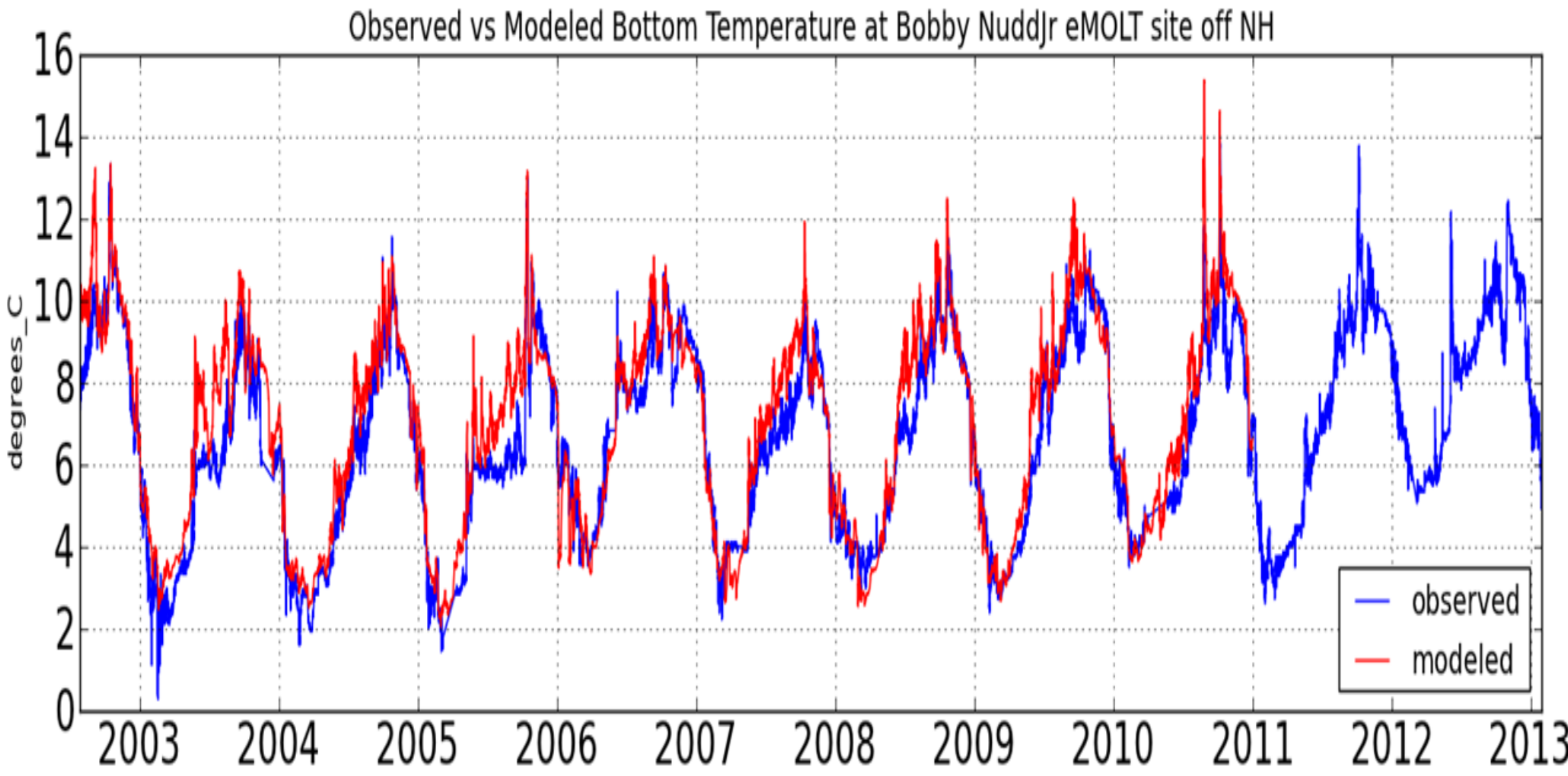
Geographic scale

Time scale



- > six million hourly bottom temperatures
- tuning ocean models
- detect climate variability?

Primary Goal:
Validating Ocean Models

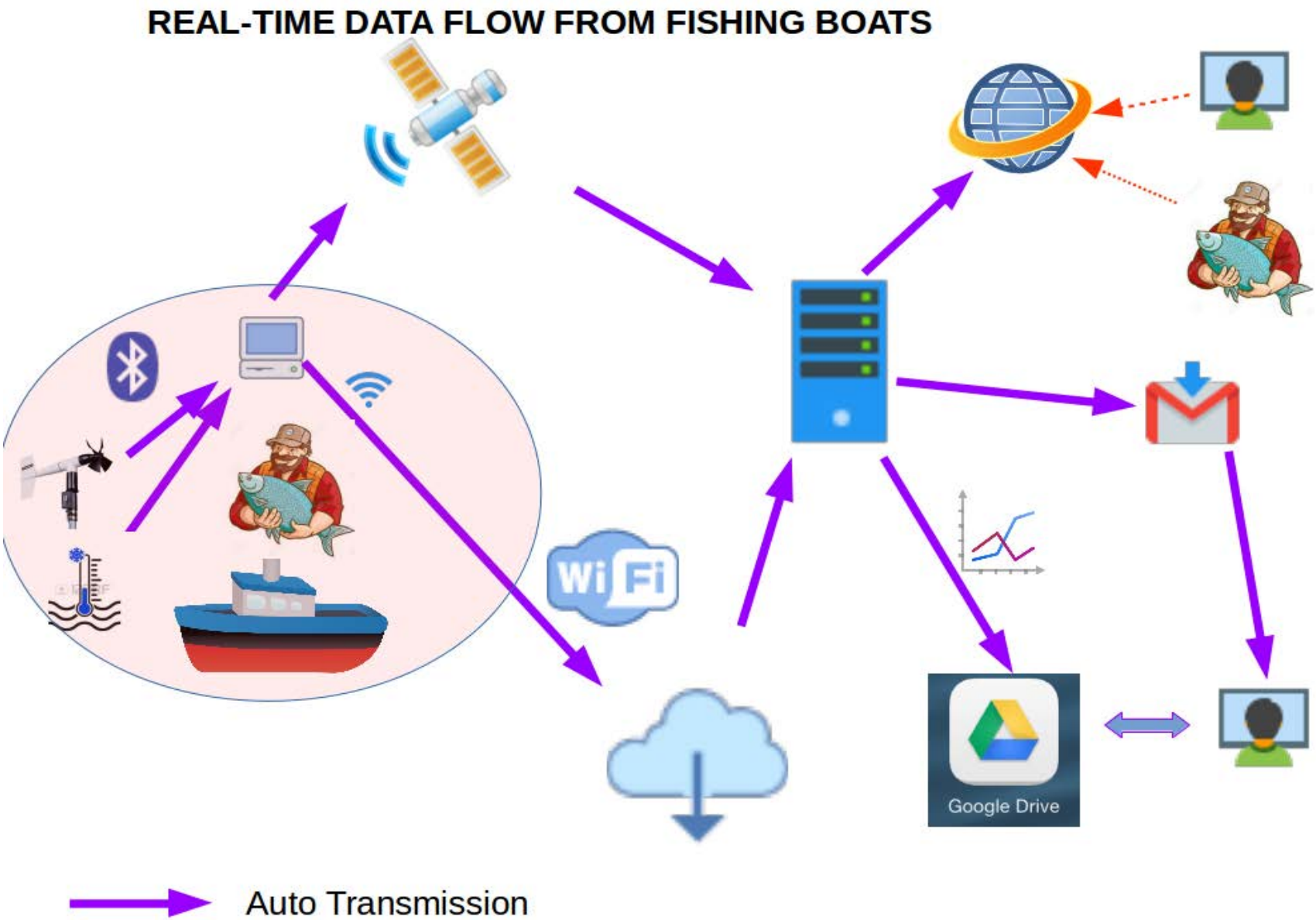


Fishing boats fitted with telemetry equipment

Boat	Port
Mystic	Hyannis
Ellen Diane	Hampton
Virginia Marise	Pt Judith
Lisa Ann II	Newburyport
Dyrsten	Gloucester
Mister G	Pt Judith
Illusion	Greenport
Elizabeth & Katherine	Pt Judith
SanPaolo	New Bedford
BantryBay	Gloucester
Linda Marie	Pt Judith
MaryK	New Bedford
Resolve	Sandwich

- >3000 trawls telemetered with bottom temperatures in the last two years
- Weather updated hourly for two boats sending data to NWS

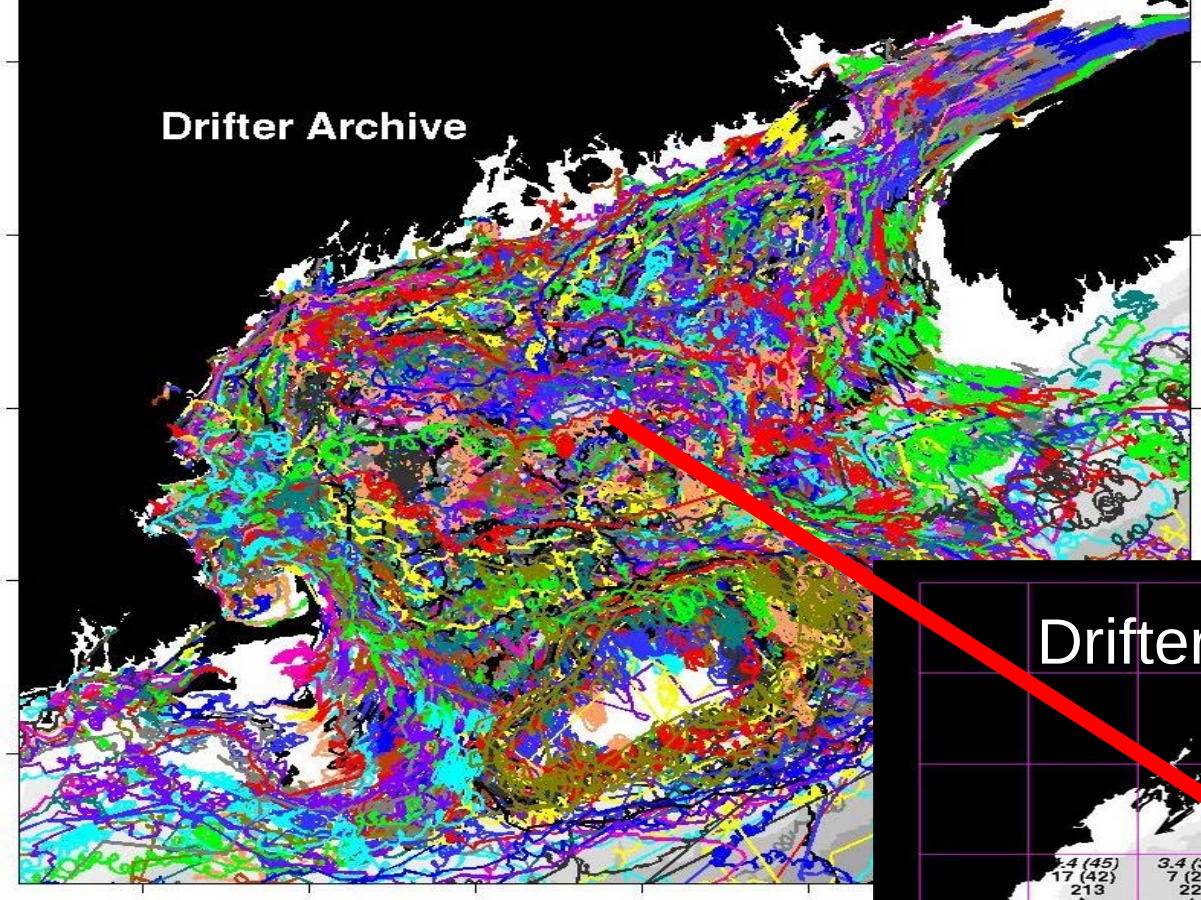
2. Fishermen-collected Bottom Temperatures & Weather

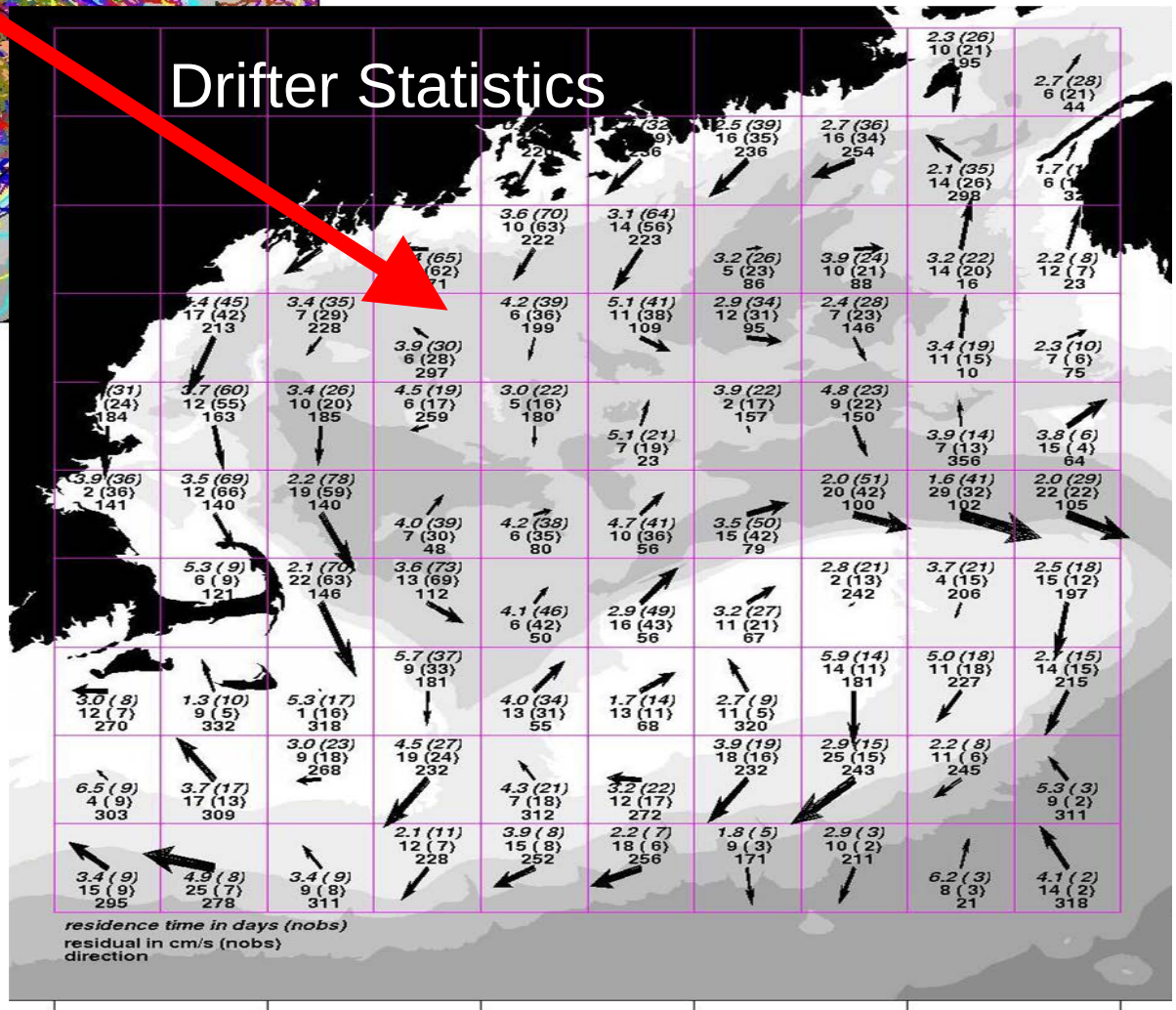


Drifters

- Like weather balloons
- ~150+ deployments per year >1300 total
- 50+ New England schools this year building eco-friendly

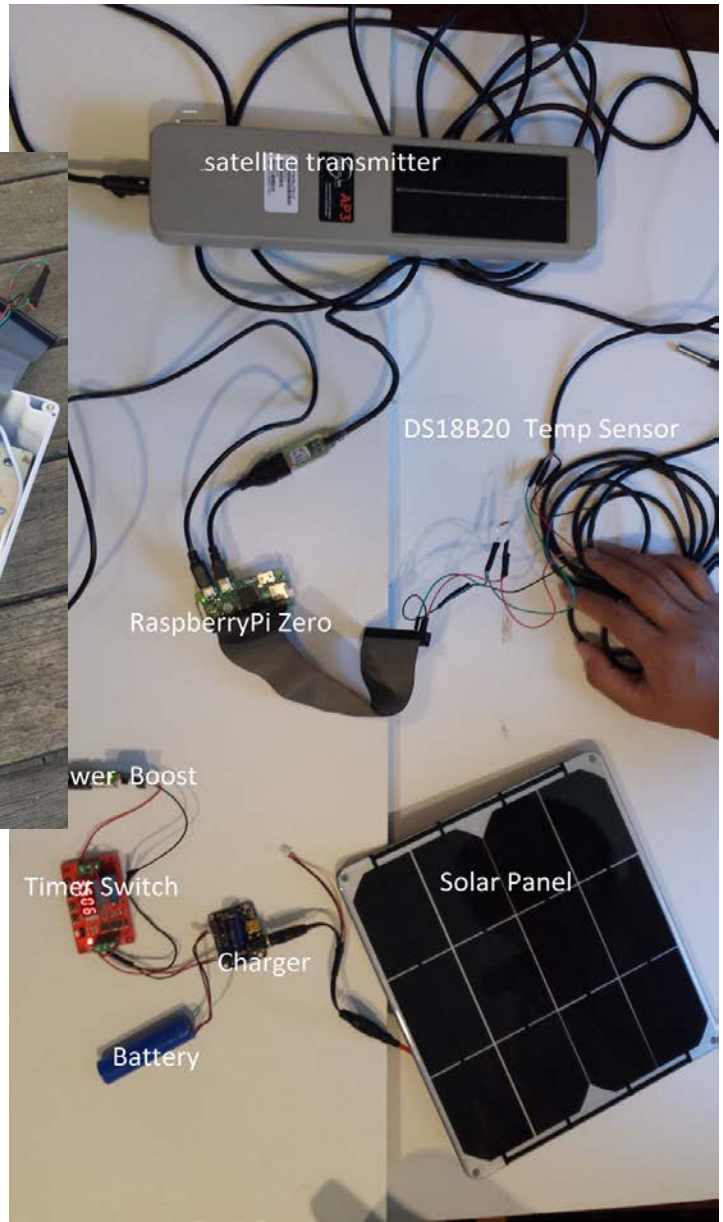
- Drifter workshops w/teachers
- Visualized in different ways
- studentdrifters.org for teachers & nefsc.noaa.gov/drifter for others





Student-built drifters resolving the flow fields of Gulf of Maine and beyond

Unmanned Sailboats w/Sensor Packages



- Educational Passages
- ~30+ boats have crossed Atlantic
- Sensor package now working!

Summary

- lobstermen collect bottom temperatures
- trawl fishermen telemeter real-time bottom temps & weather
- schools build drifters and sensor-laden unmanned sailboats
- all of the above can feed numerical models

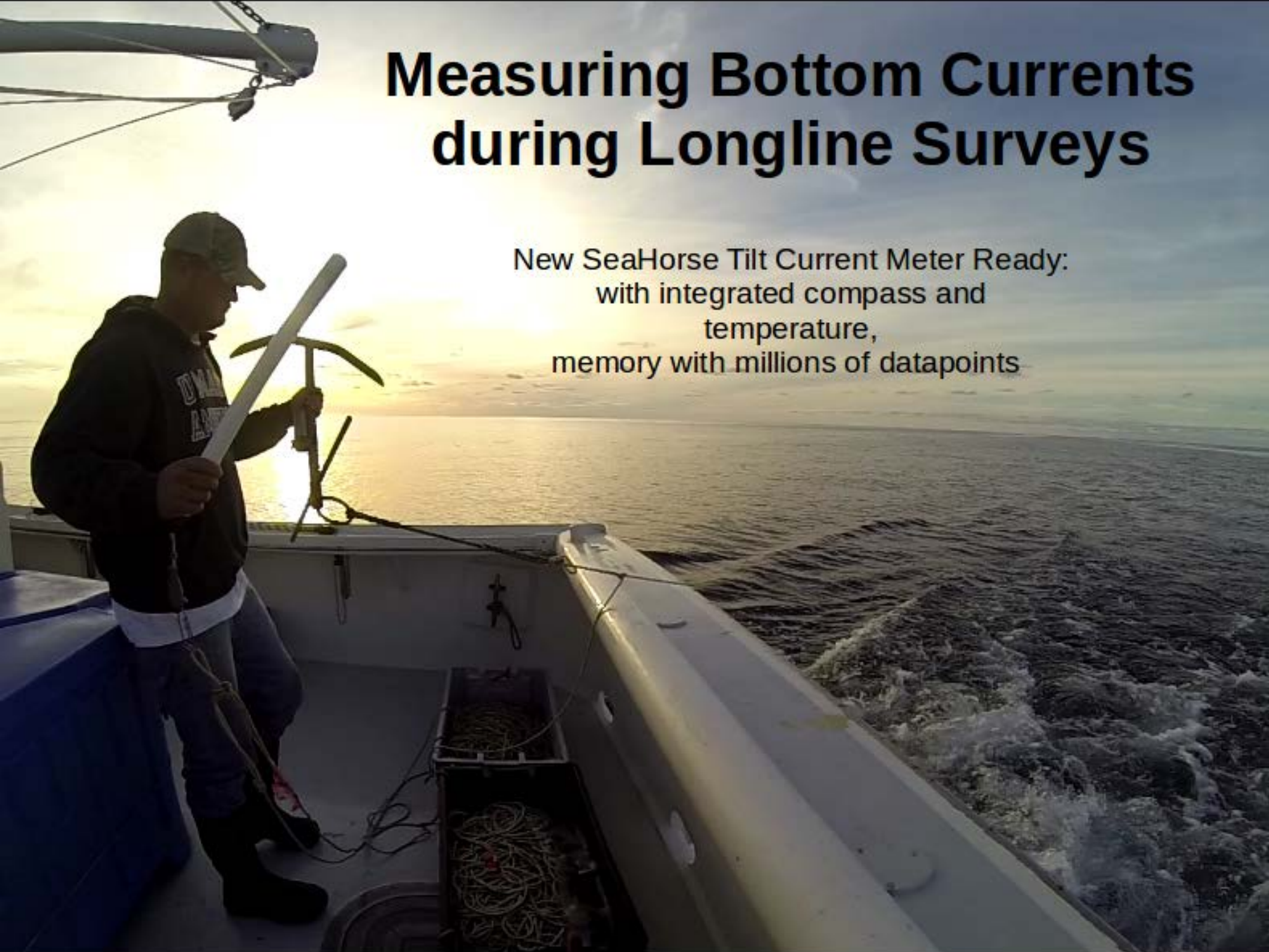
Just in the last 48 hours…

- Miniboats & drifters discovered:
  - on the rocks in England
  - on small Turk & Caicos Island
  - taken out of the water by Mass Bay fisherman
- Proposal accepted to extend operations to Canada
- We are asked to work with Canada’s DFO
- Rutgers scientist offers to extend our operations to the south

Extra slides given time

- Leaflets display of recent bottom temperatures
- Leaflets display of animated drifters
- Googlemap display of drifters

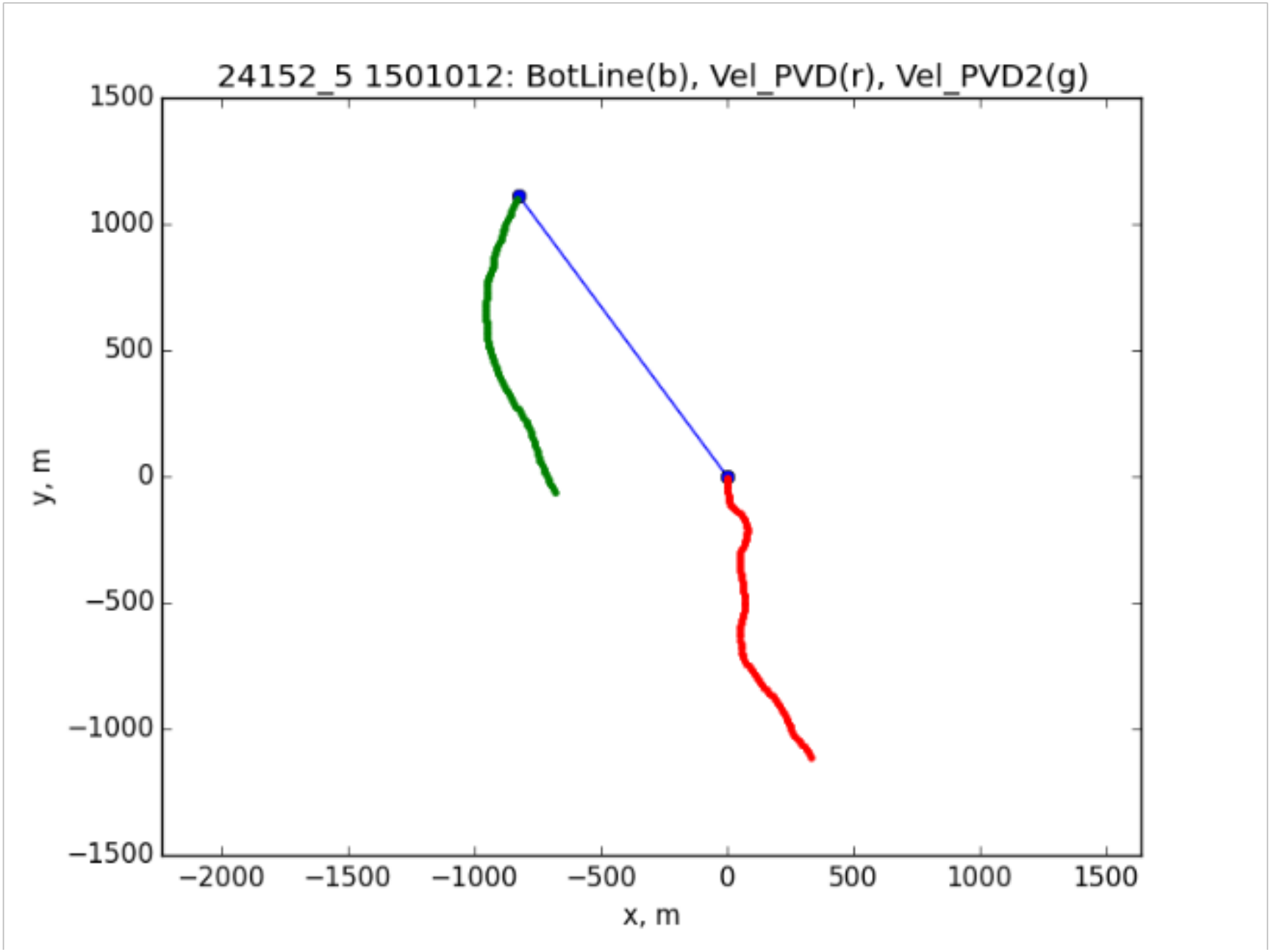
Measuring Bottom Currents during Longline Surveys



New SeaHorse Tilt Current Meter Ready:
with integrated compass and temperature,
memory with millions of datapoints

Go!

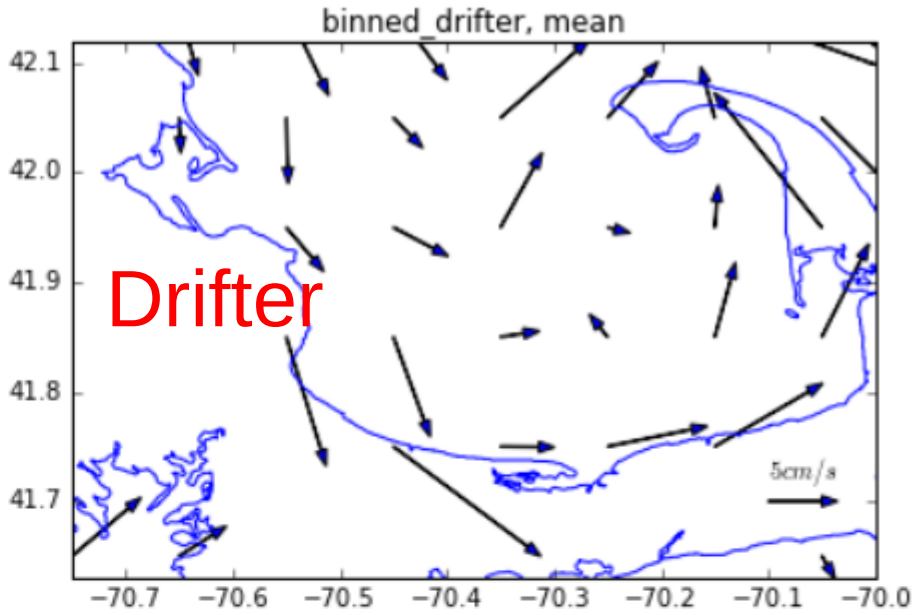
Water tracks at two ends of a Longline from two current meters

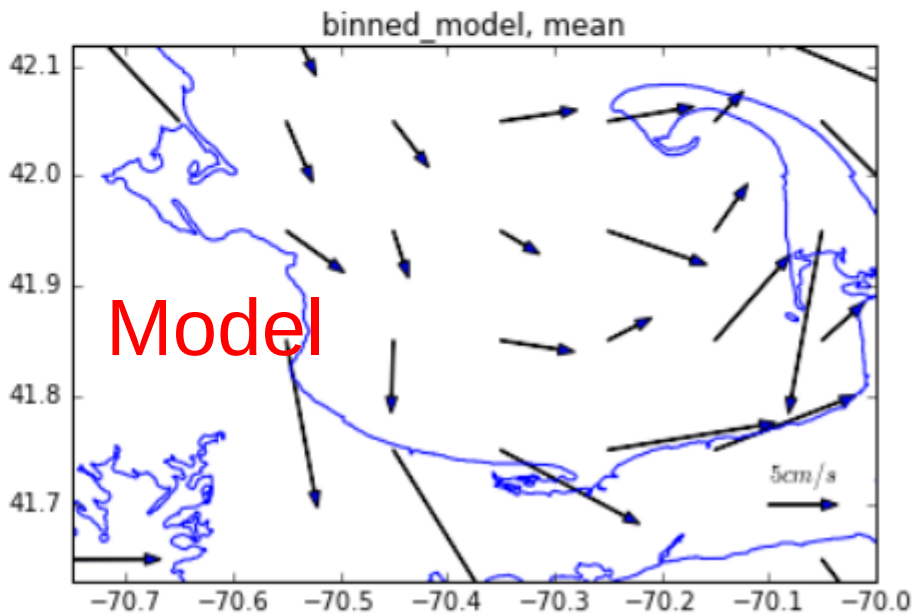


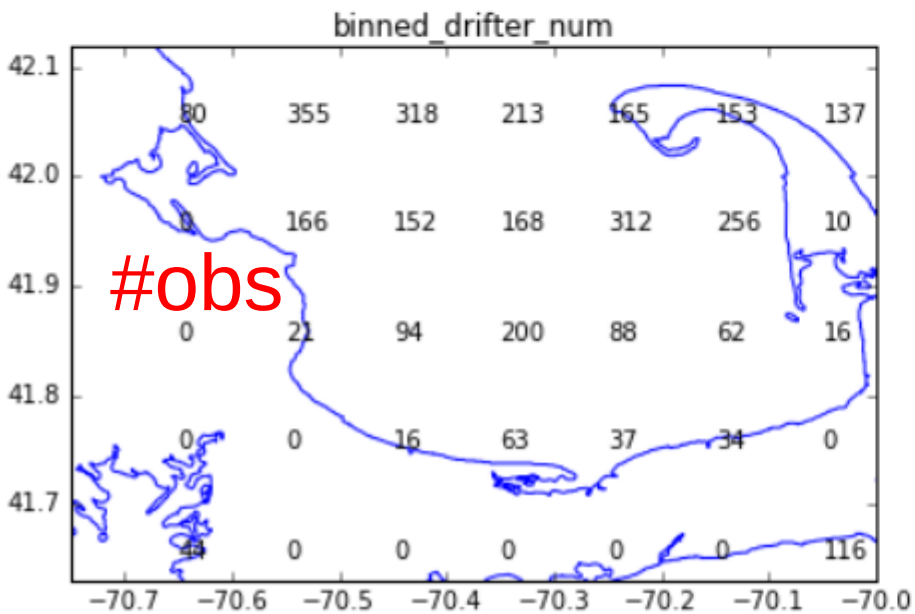
Cape Cod Bay Average Currents

Bin-averaged flow fields: drifter vs model

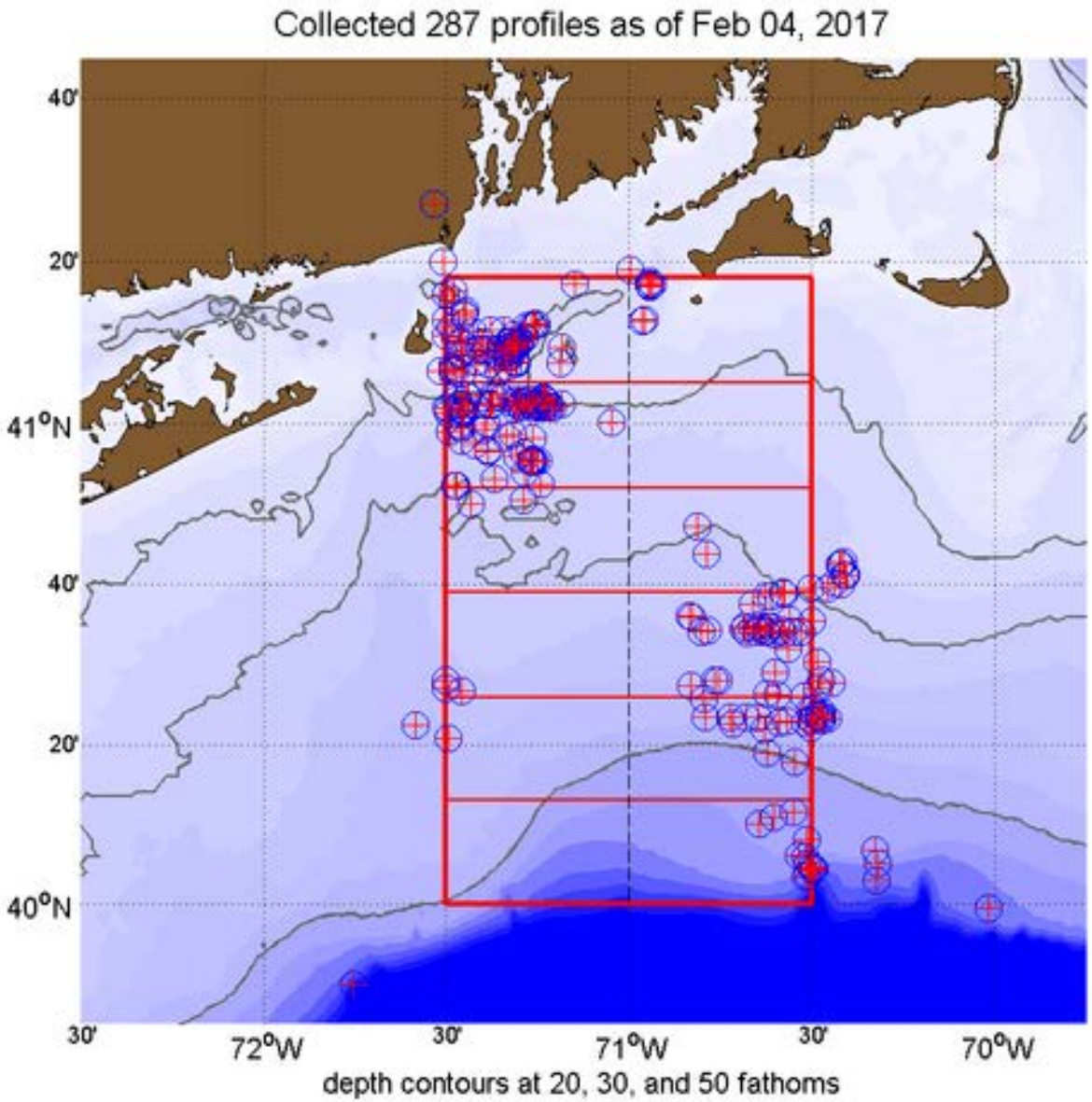
Given some preliminary analysis of the historical drifter data from previous years (1988-2015), we can derive a “bin average” flow field for Cape Cod Bay as in the figure below. The figure with numbers posted depicts how many observations went into the mean flow fields. We can see, for example, that a few hundred observations of surface velocity have been recorded for the bins at the northern edge of the bay while most in the southern half of the bay have less than one hundred. It will be interesting to see how these statistics change after the extensive 2016 tracks are added to the archive.



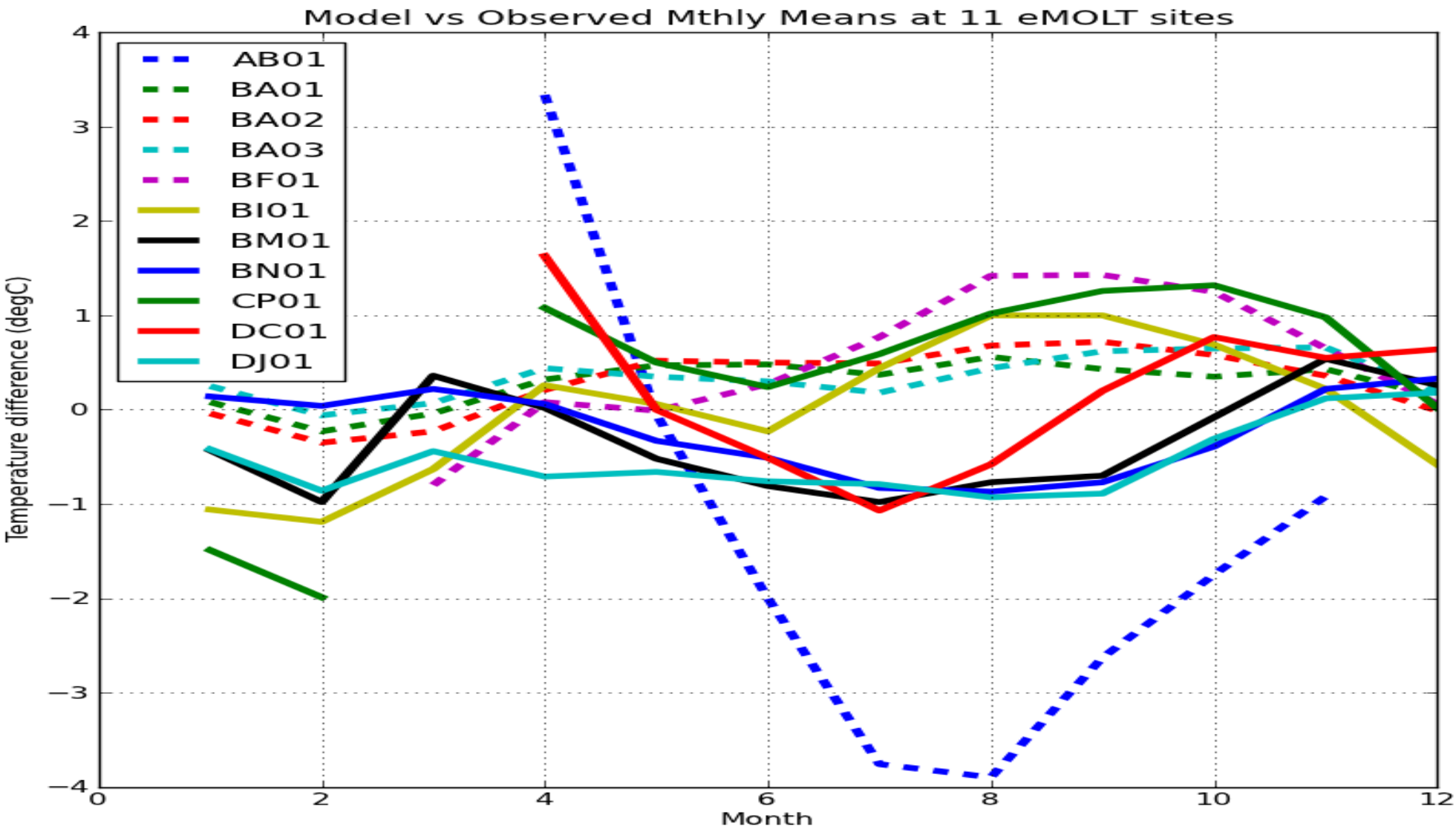




CFRF Shelf Fleet Project



How well can the models estimate the monthly mean bottom temperature at any location?



Manning, Wang, and Sheremet, in prep.