

Pioneer Array Update



CFRF
18 April 2018
Al Plueddemann, WHOI

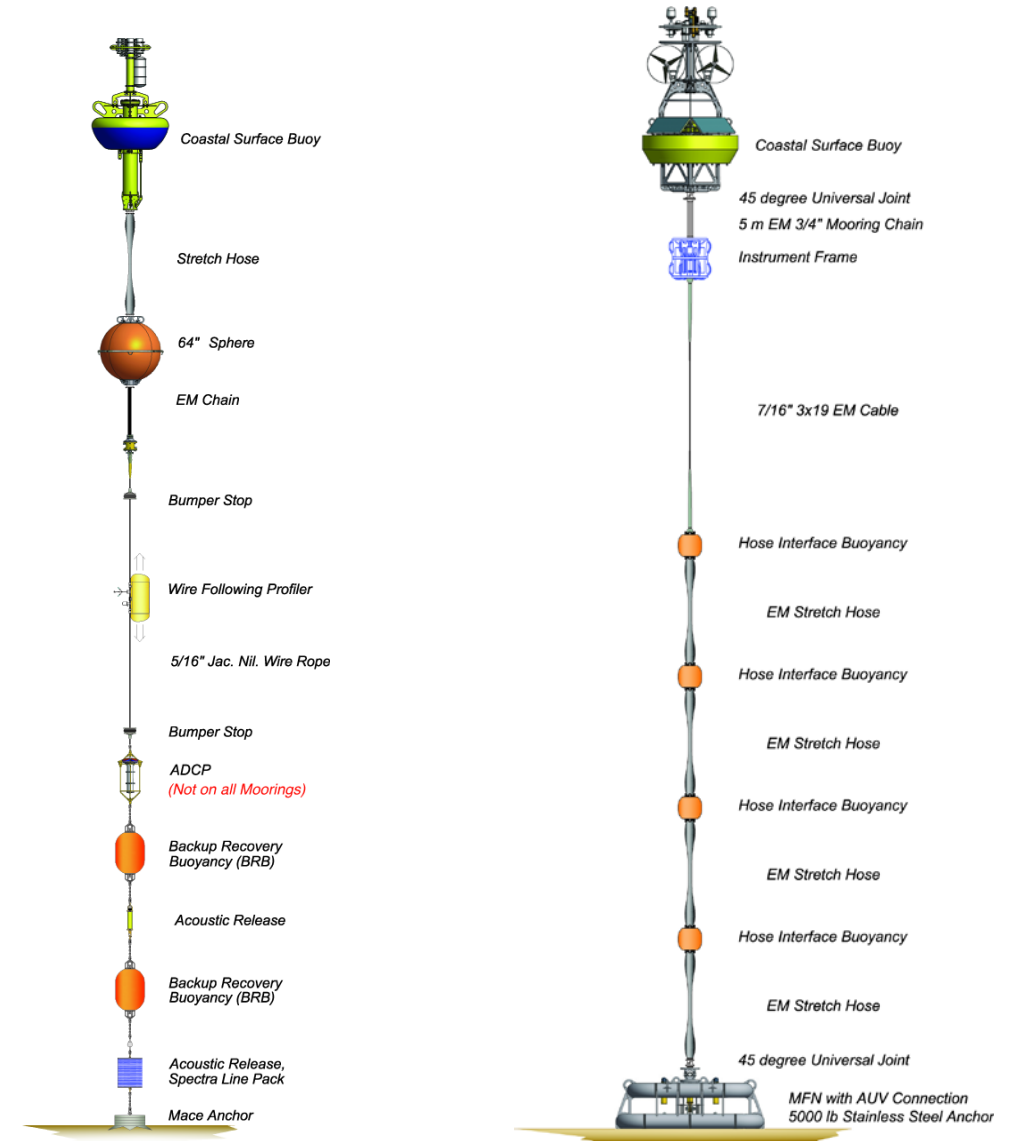
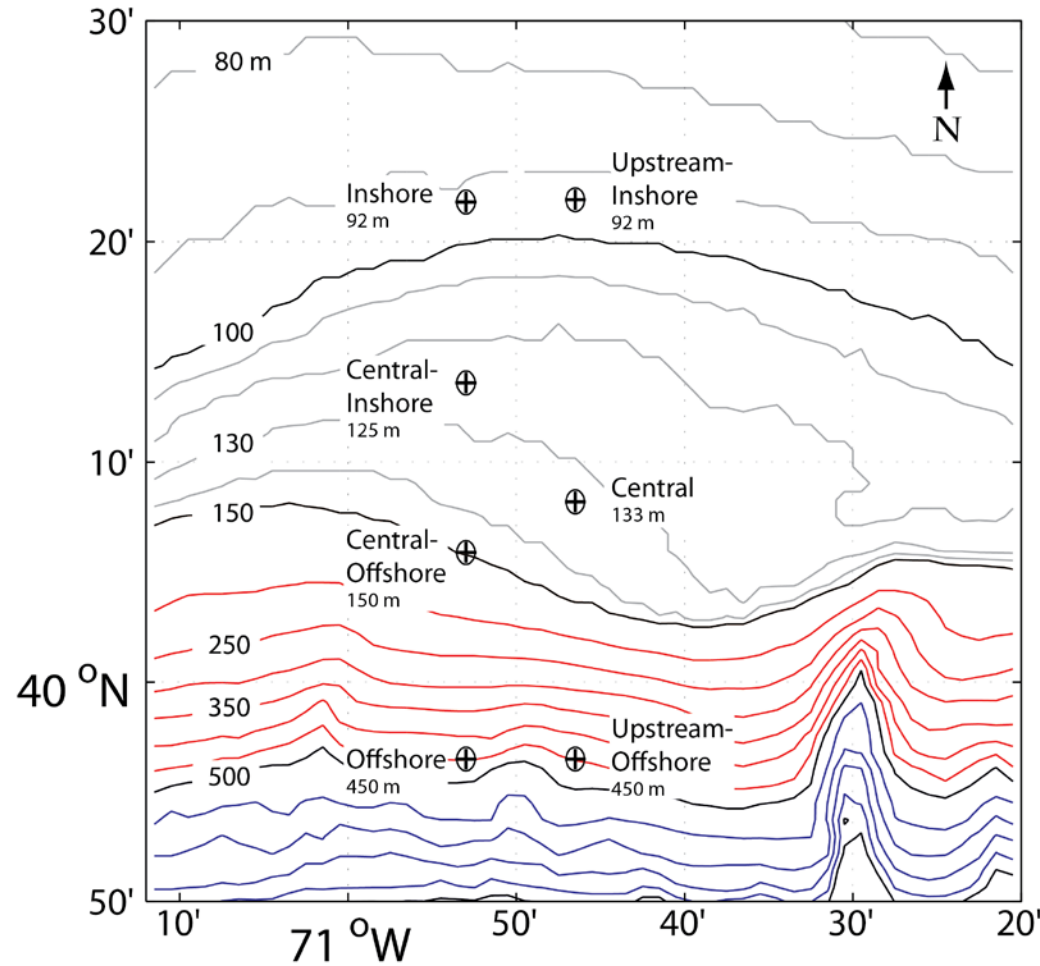


Outline

- Brief review of Pioneer Array elements
- Equipment and operations update
- Brief science summary
- Data access update and demo
- Open discussion



Moored Array Elements



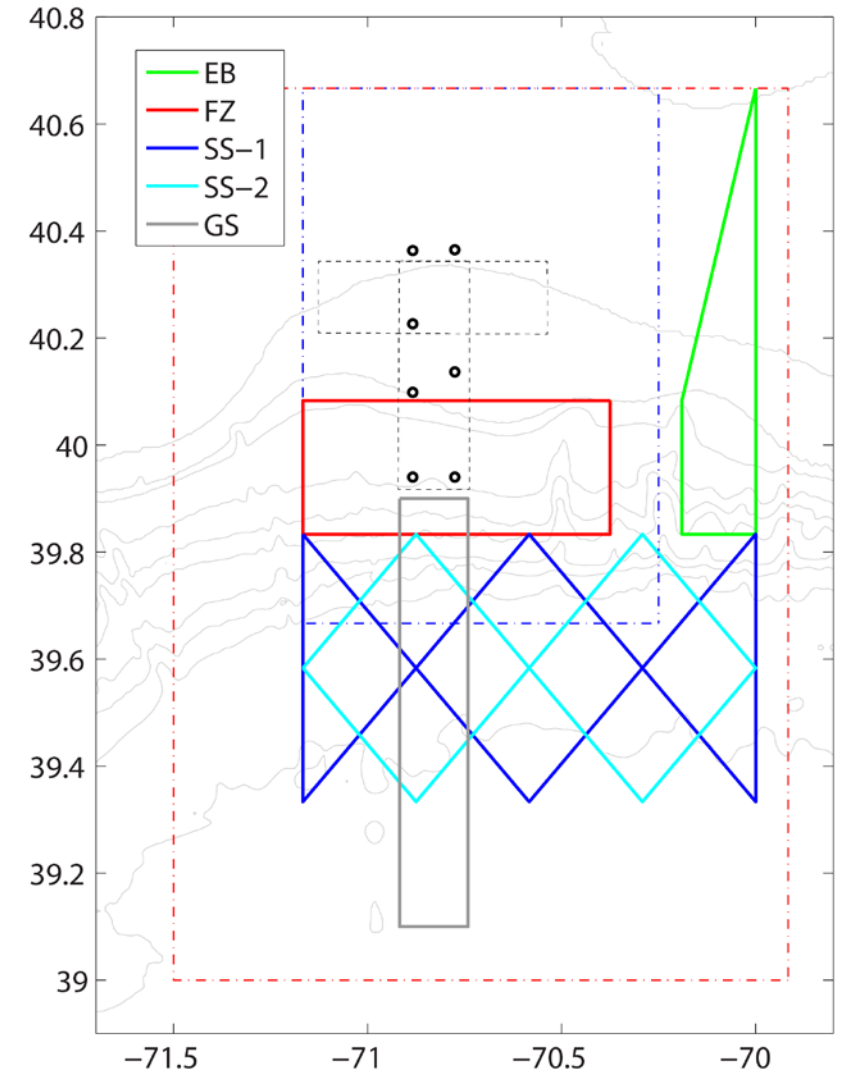
Gliders and AUVs

Gliders

- Each 7 ft long x 10" diam, 200 lb
- 6 gliders on 4 track lines (colored lines)
- Approx service interval 90 days

AUVs

- Each 14 ft long x 13" diam, 700 lb
- 2 AUVs on 2 track lines (dashed lines)
- Approx activity interval 60 days



Update: Equipment and Operations

- No AUV dock, no methanol fuel cells
 - Result: More frequent AUV support cruises
- No surface-piercing profiler moorings
 - Result: Wire following profiler moorings in winter, gliders in summer
- Fatigue, damage and some failures on mooring risers
 - Result: Stronger stretch hoses, re-designed electrical connections
- Interest in state of buoy, instruments, sea and sky during deployment
 - Result: Cameras on surface mooring buoys
 - Still photos once per 3 hr, not publicly available

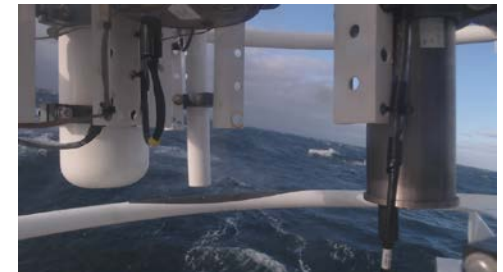
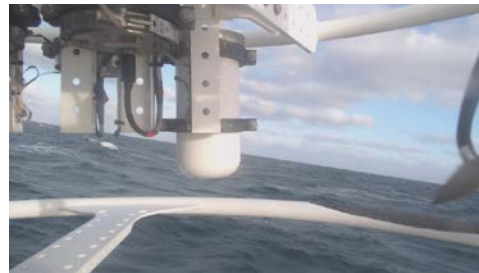


Camera Examples

Cloud Cam



Instrument
inspection

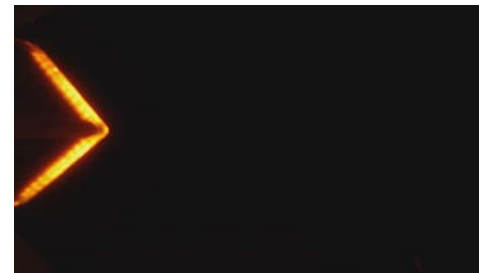
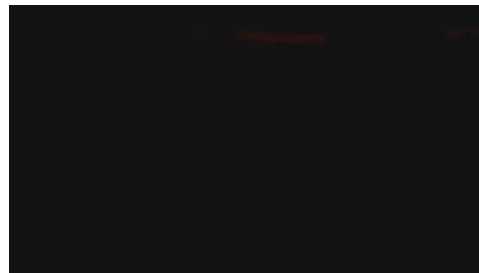


Camera Examples

Sea State

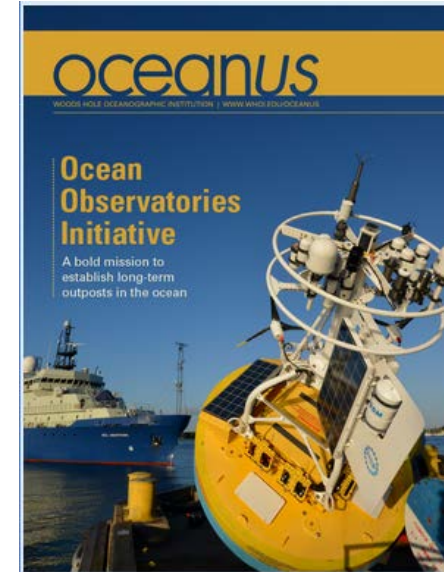


Night and
Day

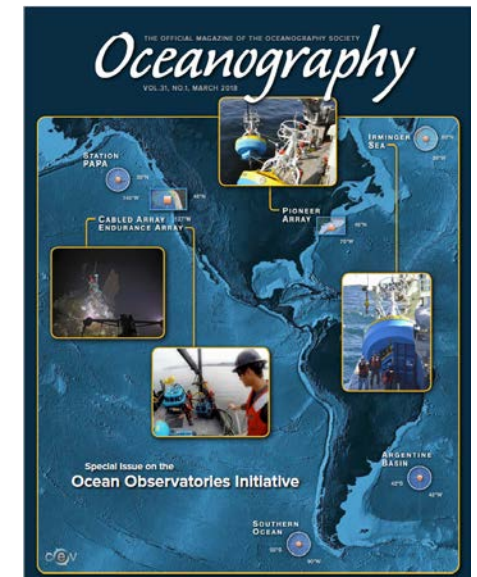


Science Results

- Southern Ocean air-sea flux and mixing
- Irminger Sea deep convection
- Irminger Sea upper ocean biology
- River influence offshore of Washington
- Earthquake monitoring off Oregon
- NE Pacific transient warming
- New Eng Shelfbreak front mean structure
- New Eng Shelf exchange processes
- New Eng Shelf air-sea flux and heating



WHOI
Oceanus
special issue



Oceanography
Magazine
special issue

Update: Data Access

- Real-Time data now available (“telemetered”)
 - <https://ooinet.oceanobservatories.org>, “Coastal Pioneer”
 - Typical sampling intervals 15 min to 1 hr, update rate 3 hr
 - Handout with “recipe” for data access and plotting
- Historical data also available (“recovered”)
 - More complete data sets due to internal recording
 - Delay of 6 months or more from time of deployment
- Future possibilities
 - Customized web page with selected plots
 - What variables are of interest?



Questions, Discussion, Other Topics

- Notification (e.g. Boatracs)
- Interactions/problems/complaints
- Variables of interest from real-time data server
- Any other topics of interest



Oceanographic Update

April 2018 - Shelf Research Fleet

Glen Gawarkiewicz- WHOI

Anna Malek Mercer- CFRF

With assistance from

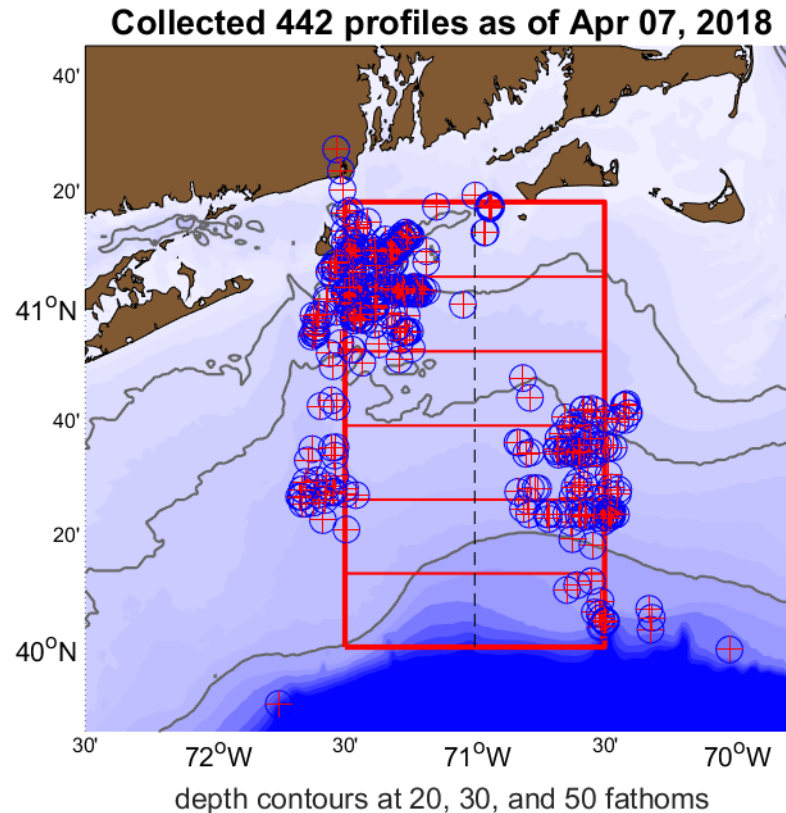
Frank Bahr- WHOI and Aubrey Ellertson-CFRF



Outline

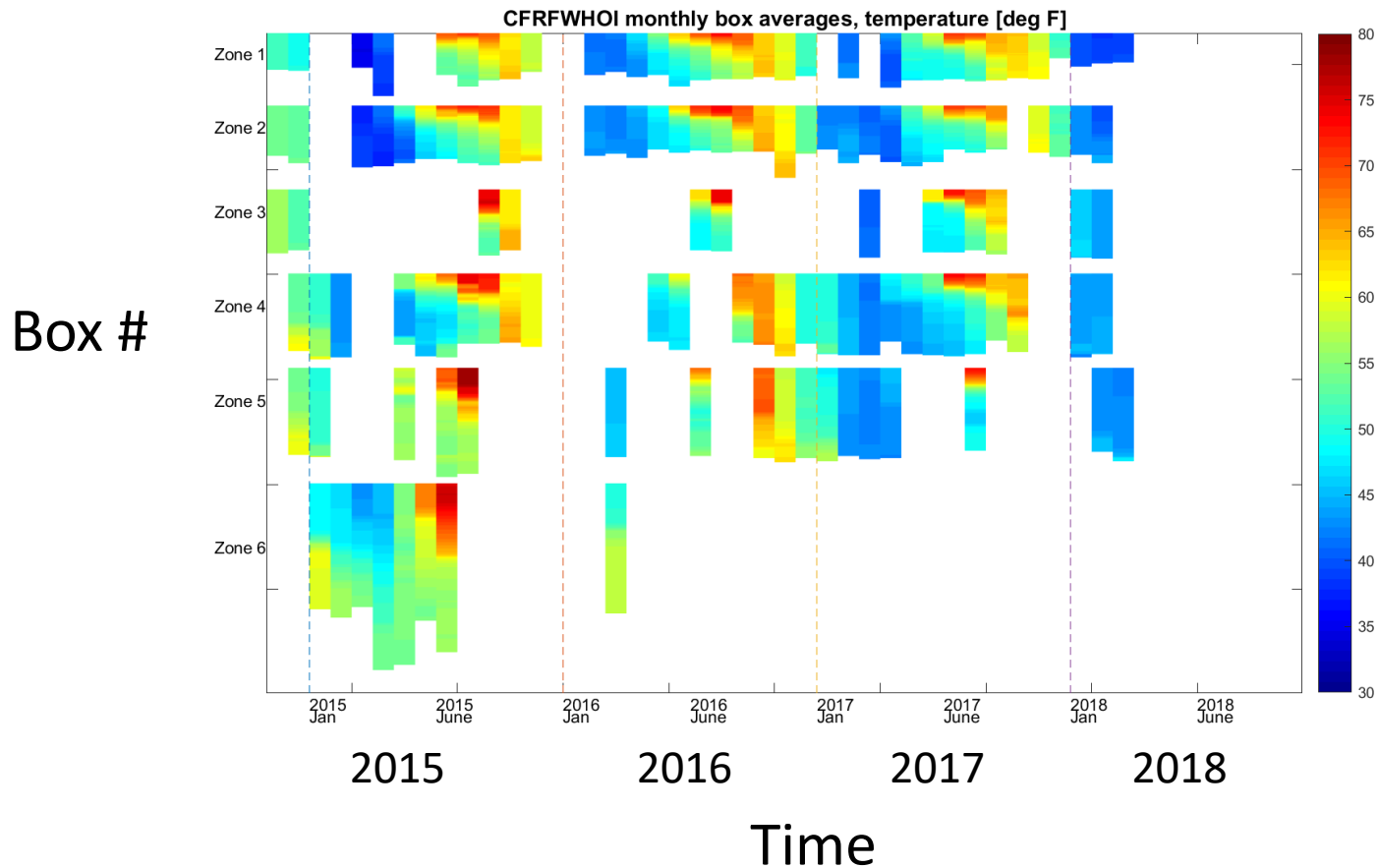
- Overall summary of Shelf Fleet data collected
- Publications- one paper out, one submitted
- Quick Review- 2017 Ring influence in January-February, no rings in May-June, rings in October
- Summary- 2018 south of New England- a remarkable storm and its causes
- Summary- 2018 south of Hudson Canyon- a remarkable Gulf Stream filament

Data Collected to April 7, 2018

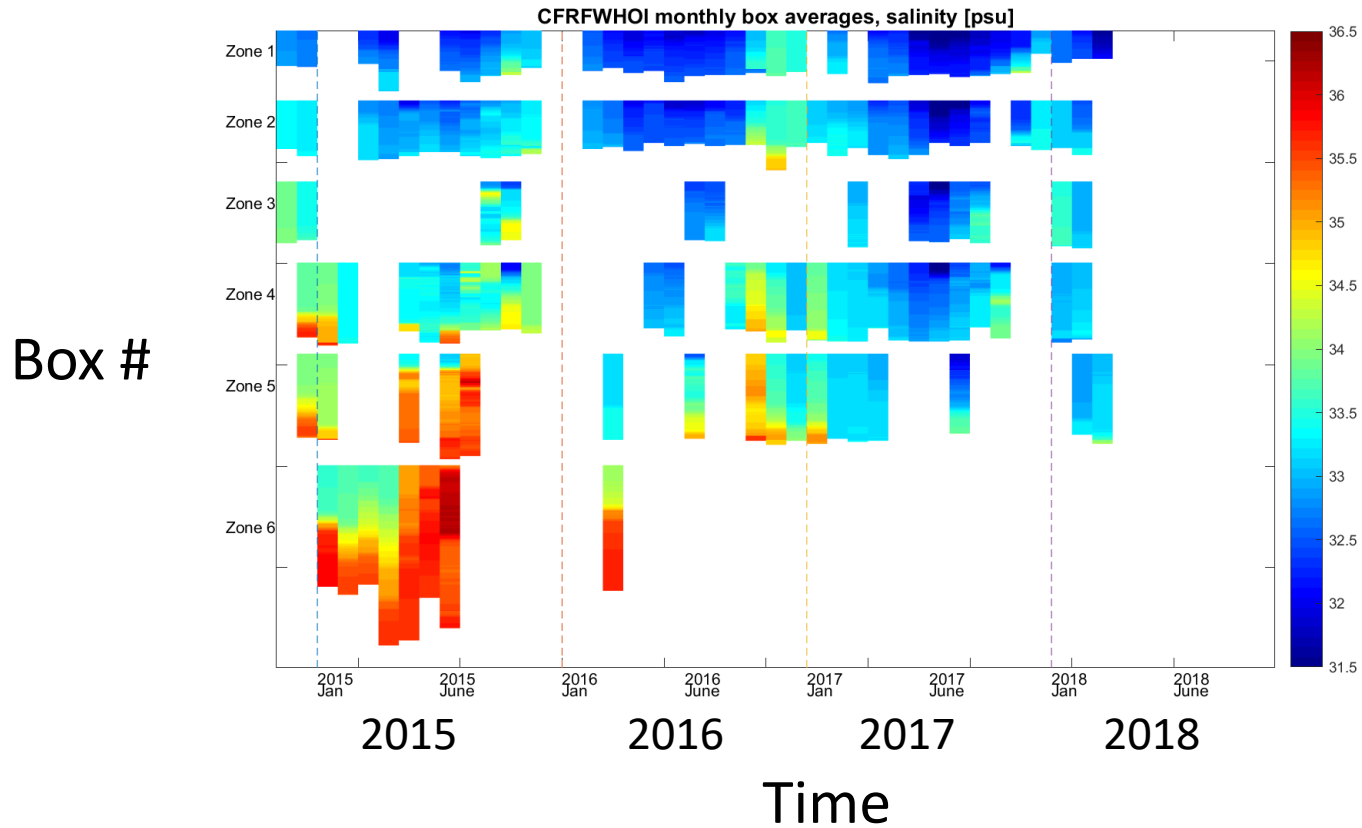


442 Profiles!!! Data collected from Nov. 2014 to present
Funding runs through Dec. 2018 for data collection

Temperature Data by month and box



Salinity Data by month and box



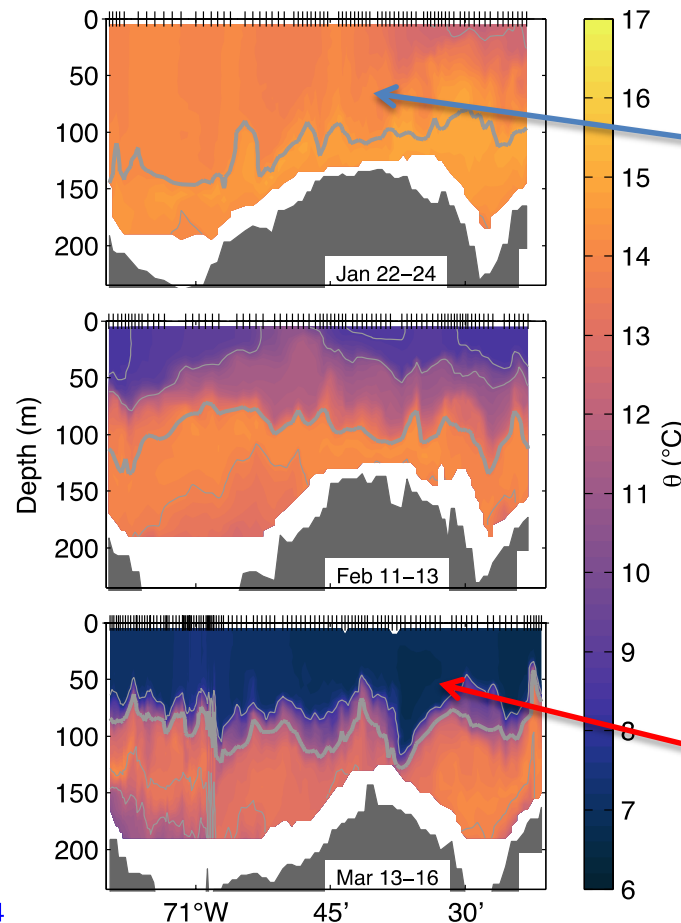
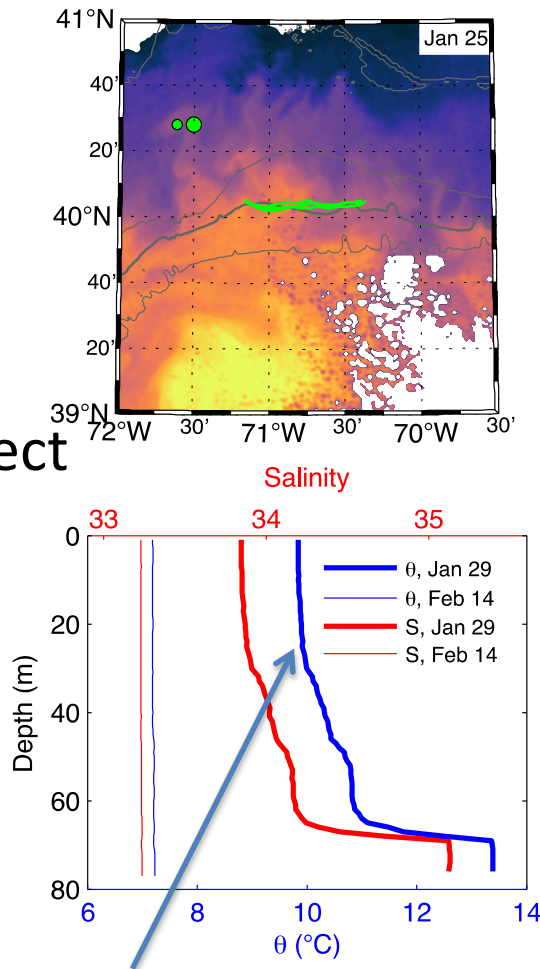
Publications

- “The Changing Nature of Shelfbreak Exchange revealed by the OOI Pioneer Array”- Oceanography Magazine, March 2018 GG and AMM co-authors (and others)
- “Partnering with Fishing Fleets to Monitor Ocean Conditions”- Annual Reviews in Marine Science- submitted GG and AMM co-authors
Invited review paper

January 2017- Major Ring Intrusion

Green Dots
CTD Profiles

Green Line
Glider transect

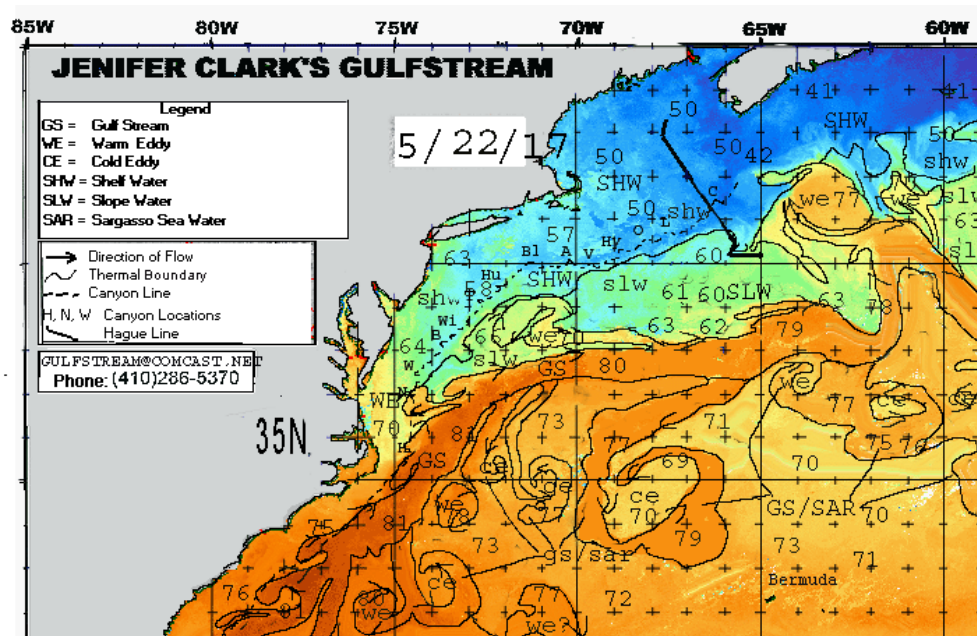


January
59 Deg F

March
44 Deg F

Warm Anomaly- 9 Deg. F

Gulf Stream configuration May 22 2017- Very Straight!!!

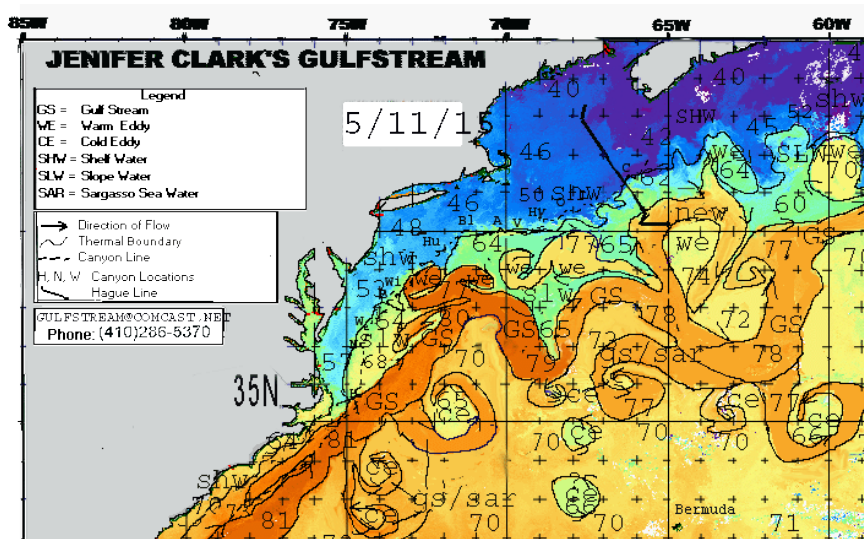


Gulf Stream is very straight between 70 and 65 Deg W

Little or no influence from Gulf Stream/Ring water on shelf in May/June

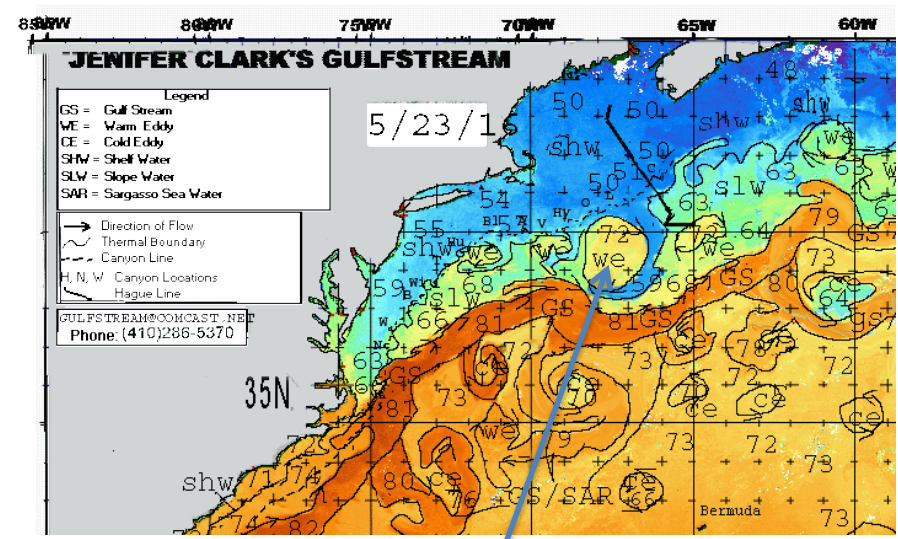
Examples of Gulf Stream interaction with shelf: May 2015 and 2016

May 2015



Very contorted Gulf Stream

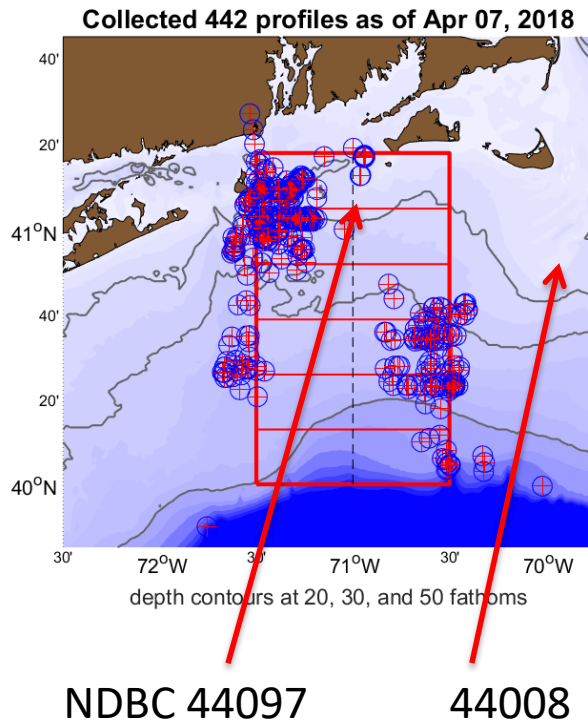
May 2016



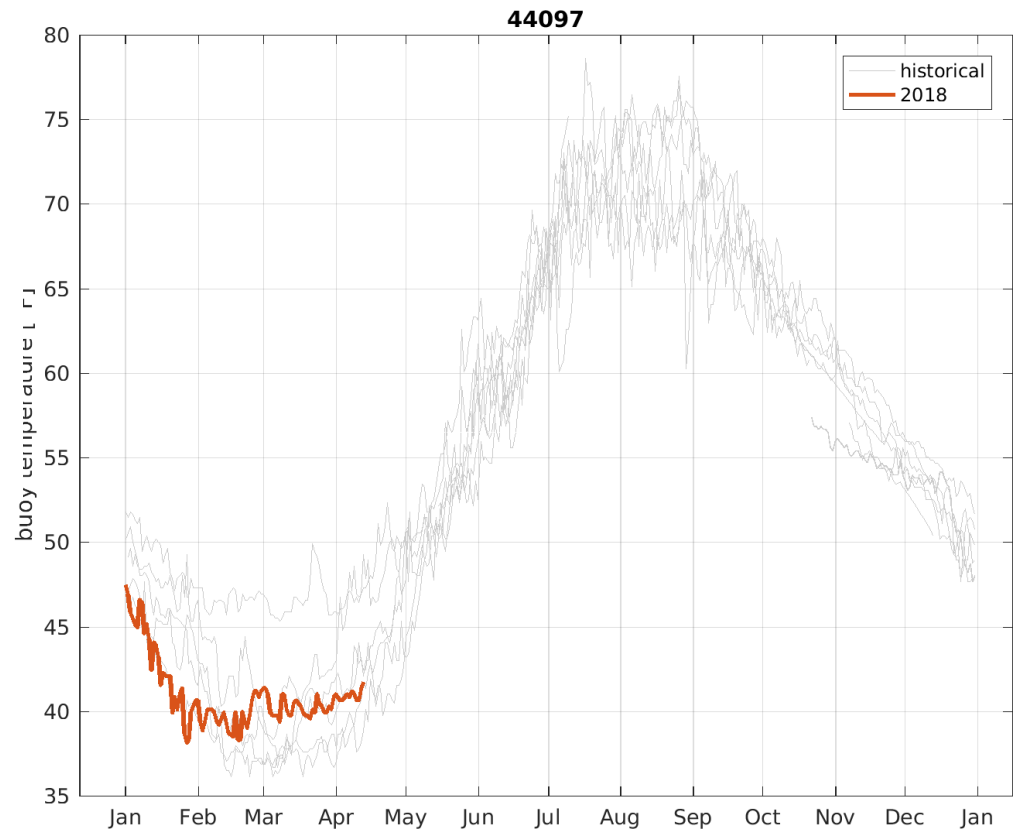
Big Warm Core Ring

Lots of interaction between Gulf Stream and shelf in May/June time frame

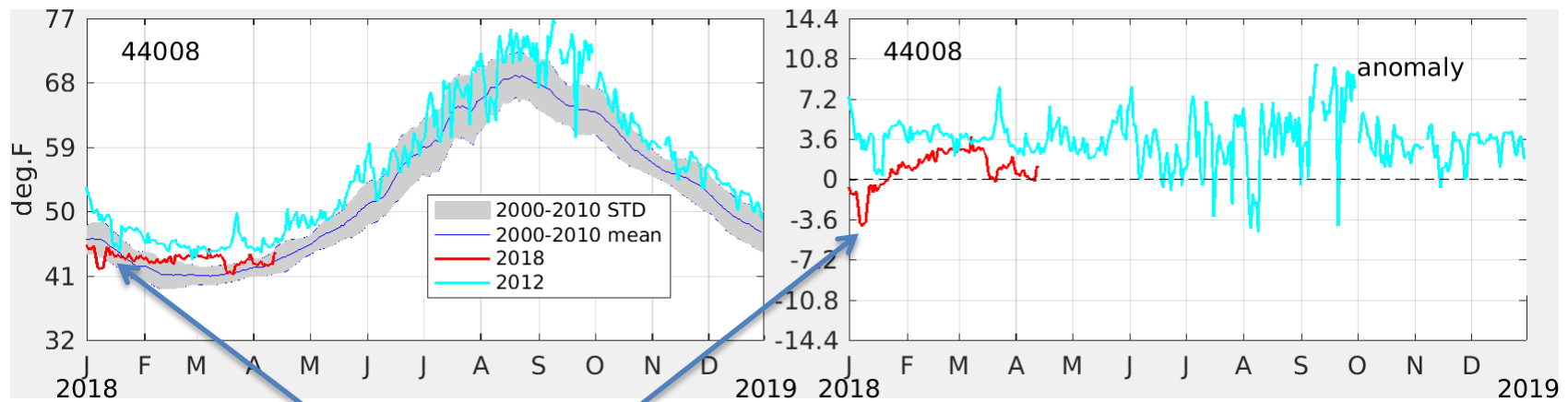
2018- NDBC 44097 Rhode Island Sound



This morning- 40.4 Deg F



2018- NDBC 44008 Nantucket Shoals

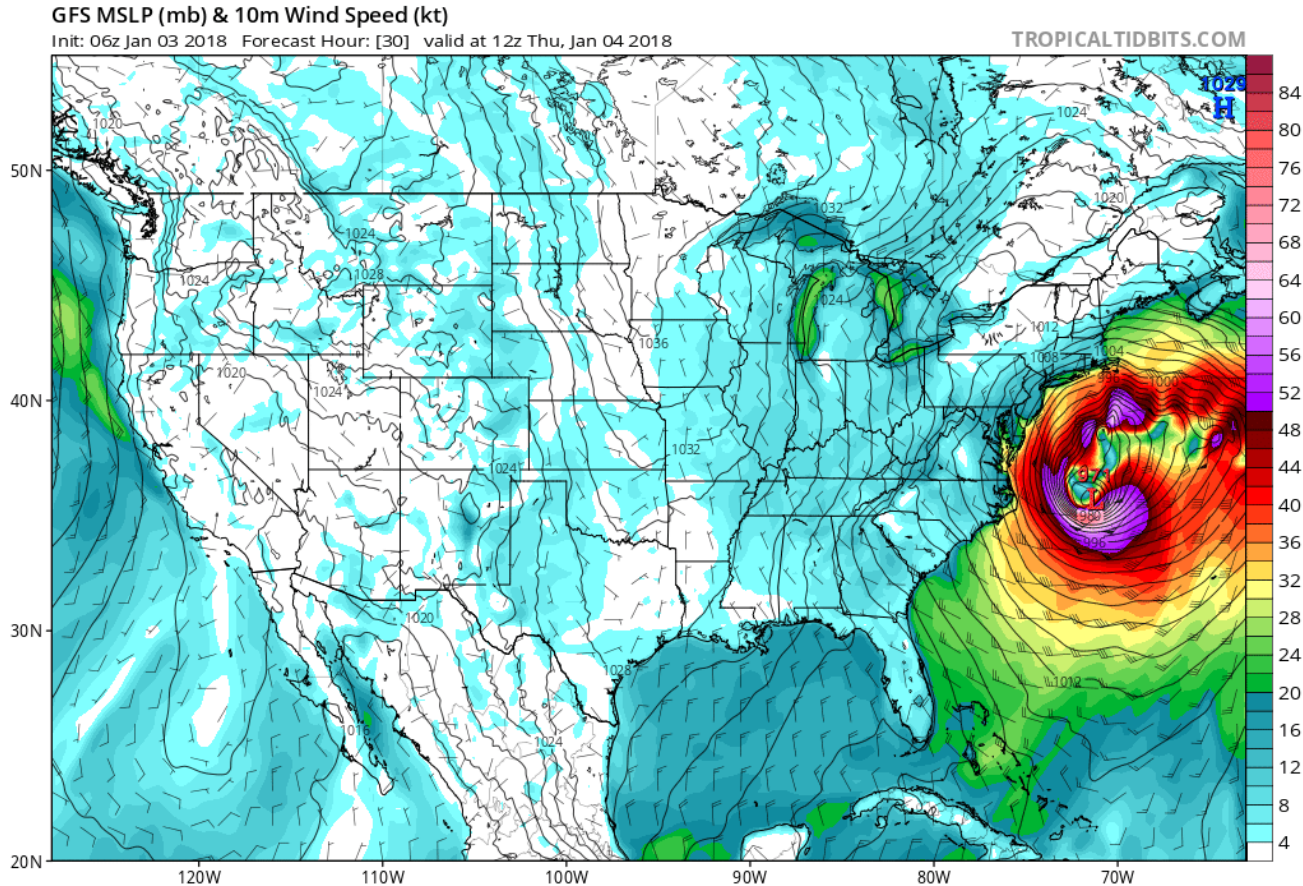


Major Bomb storm- **January 4**

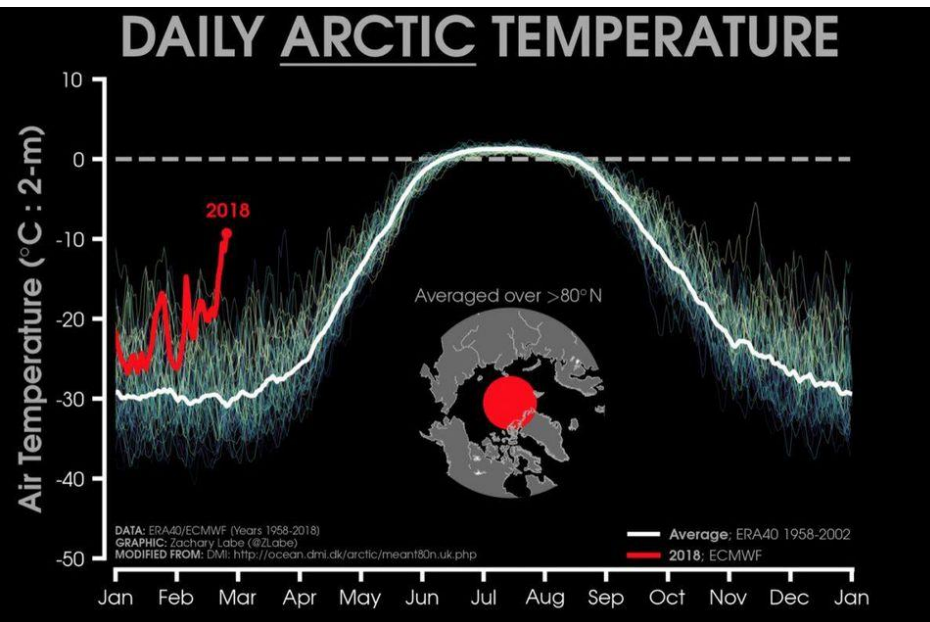
Cold Anomaly until late January
By mid-February have a 2 Deg F
warm anomaly

Temperatures close to 2000-2010
average at present- 43 Deg F
this morning

January 4 Bomb Storm



Why was the January 4 storm so strong?

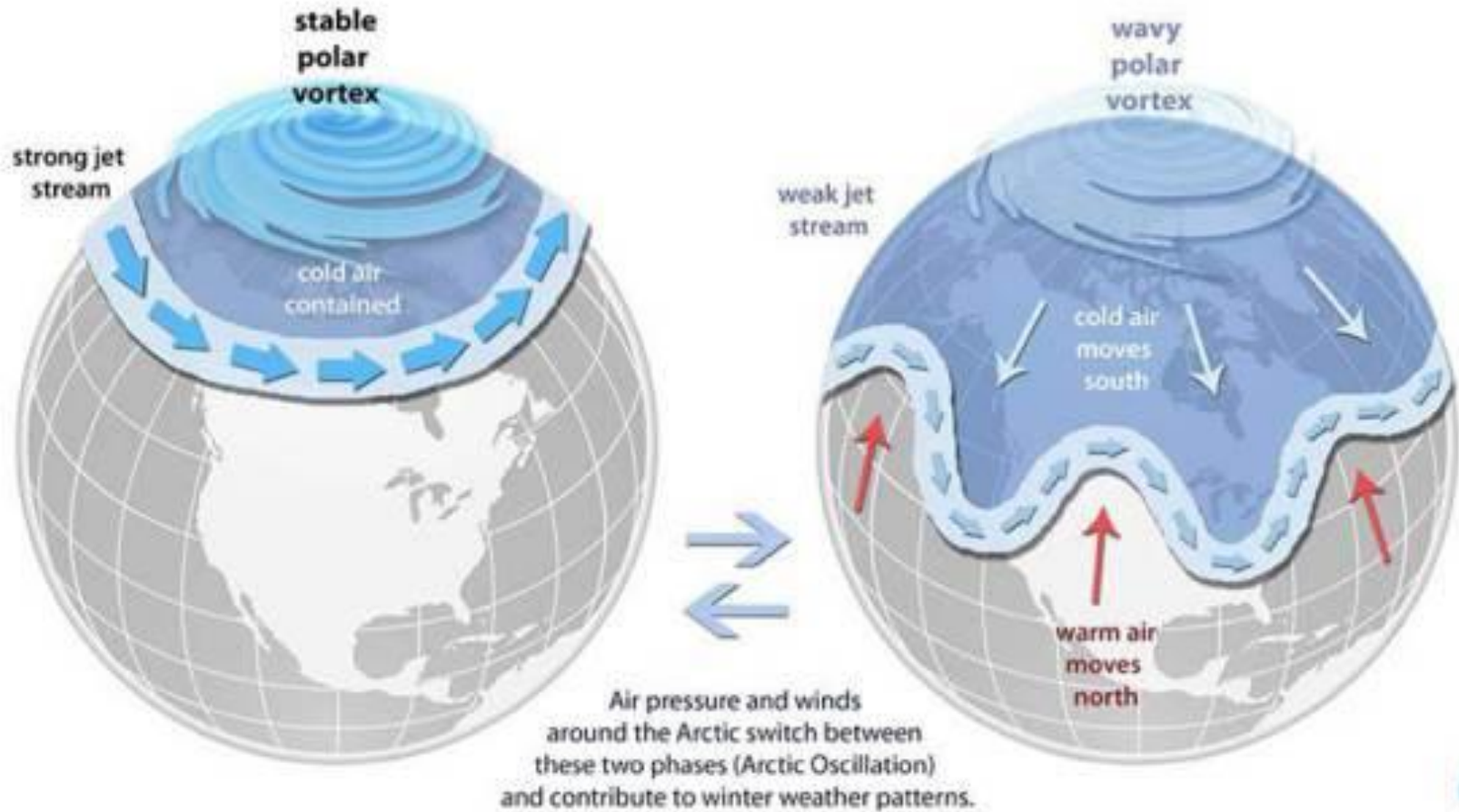


Incredible warming of high Arctic
45 Deg. F

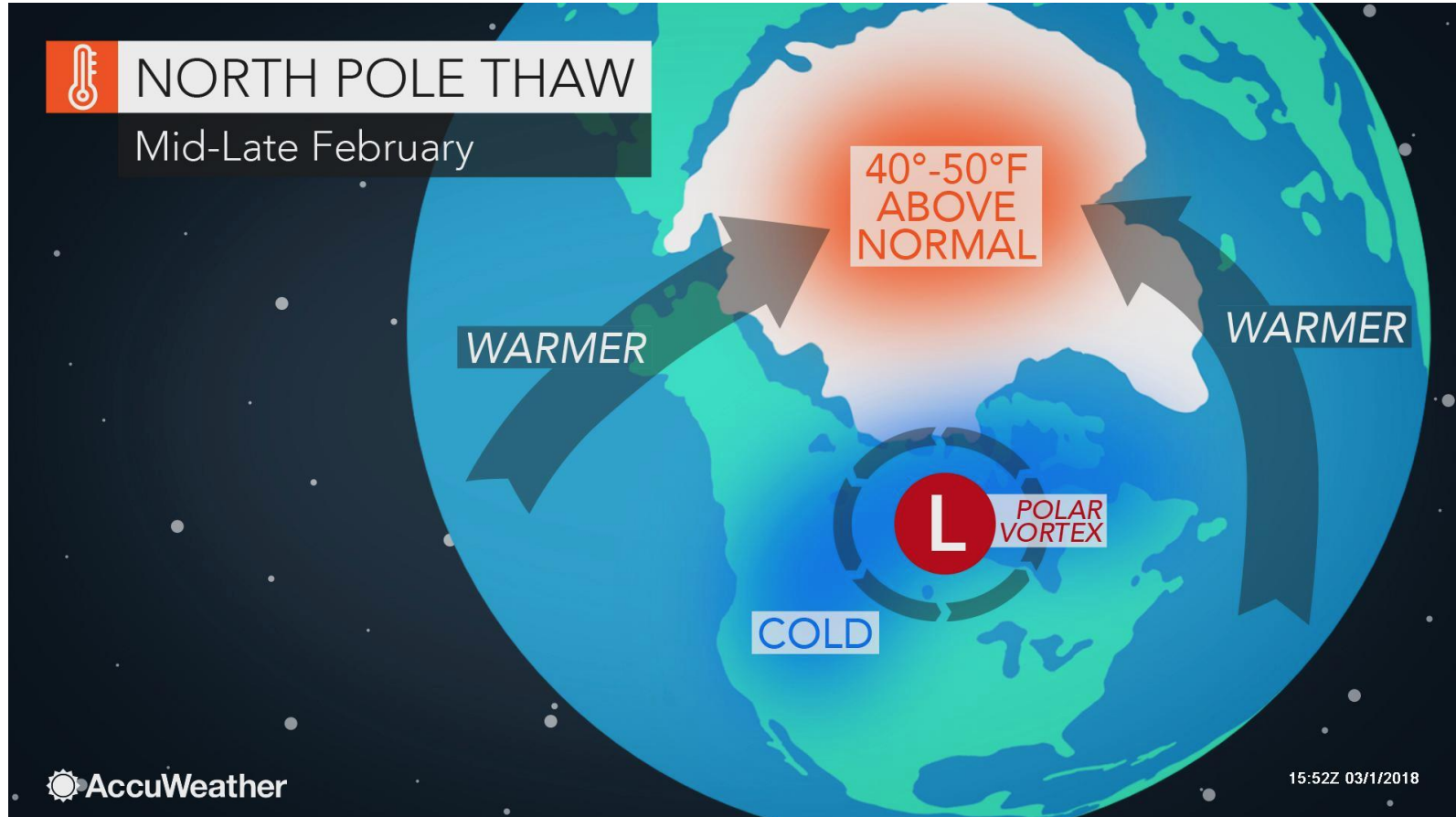


Weak Polar Vortex- Cold Air
extends very far South
Pattern began in mid-December
and is continuing to present

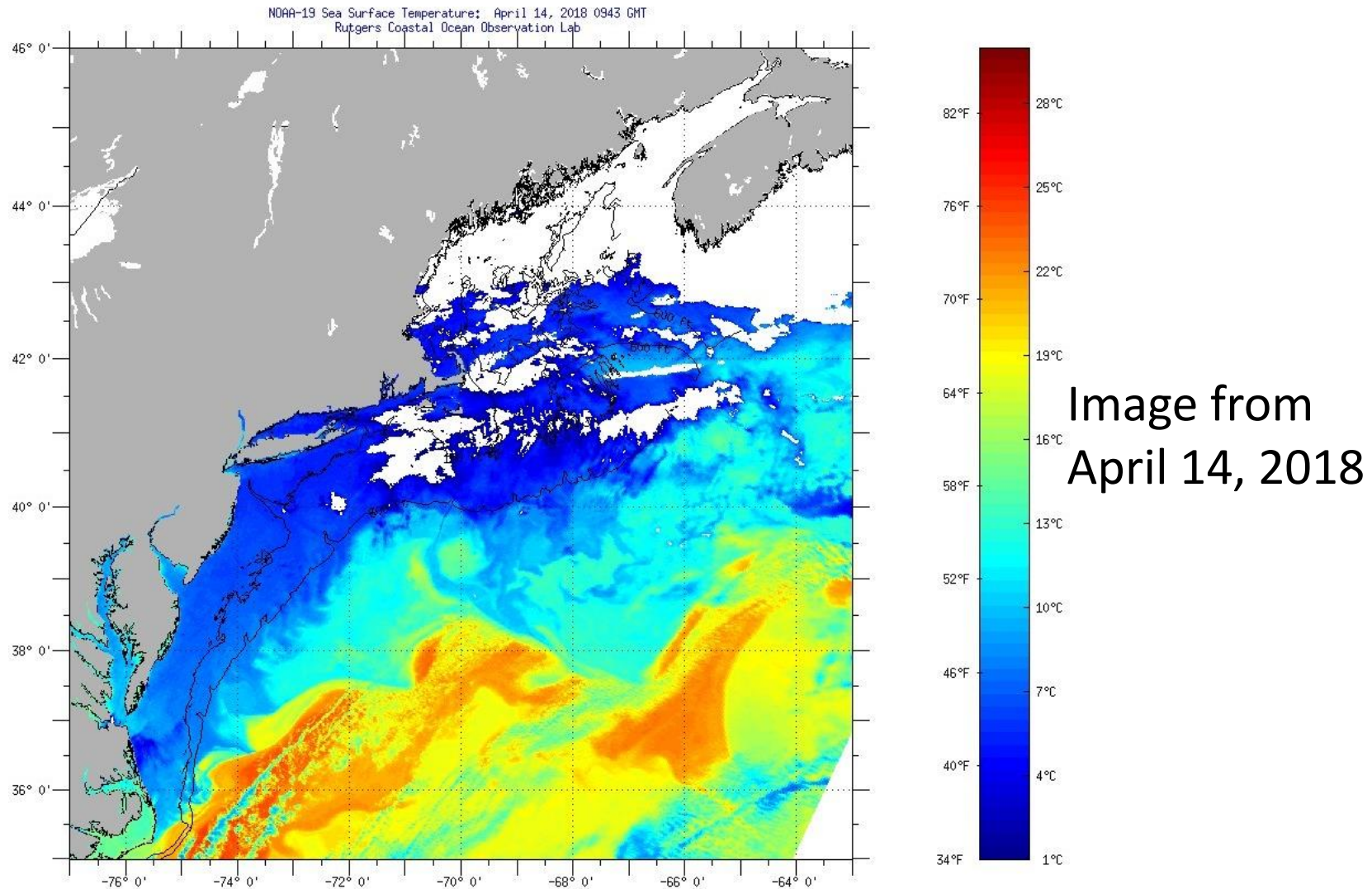
Polar Vortex



Mid-February- Massive warming of High Arctic

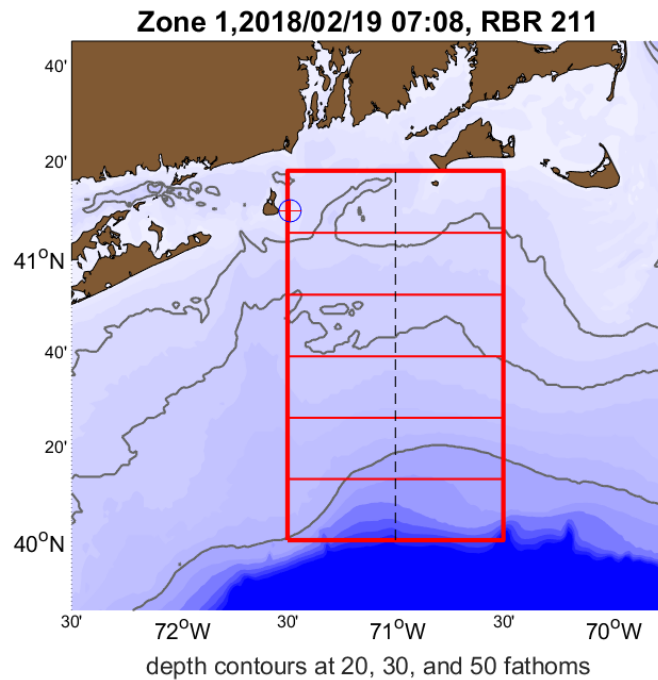


Shelf Conditions south of New England

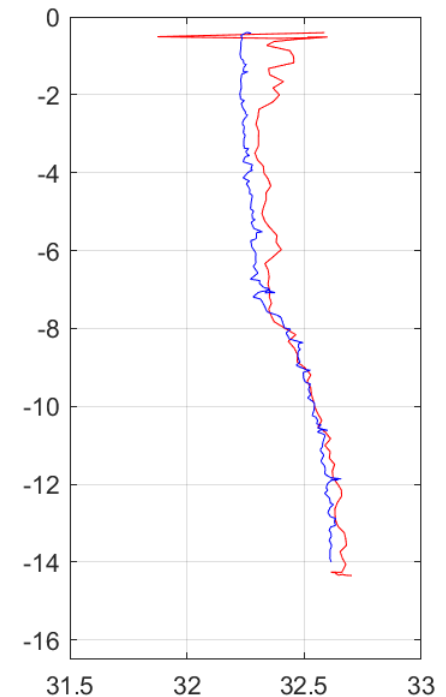
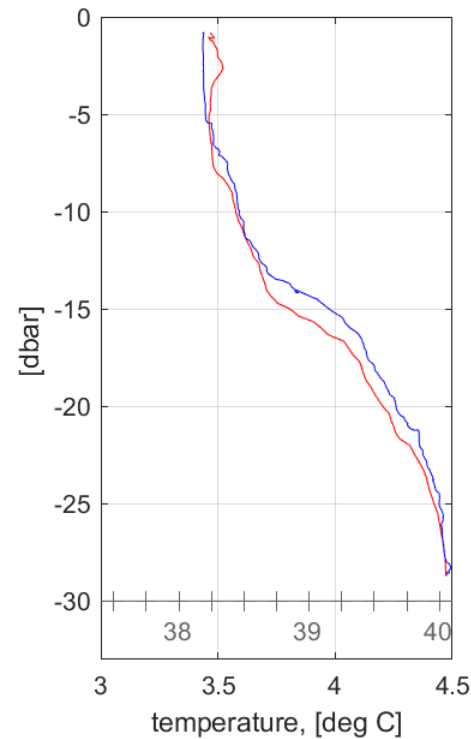


Shelf is cool and free of Gulf Stream/Warm Core Ring influences

Recent Profile- Box 1

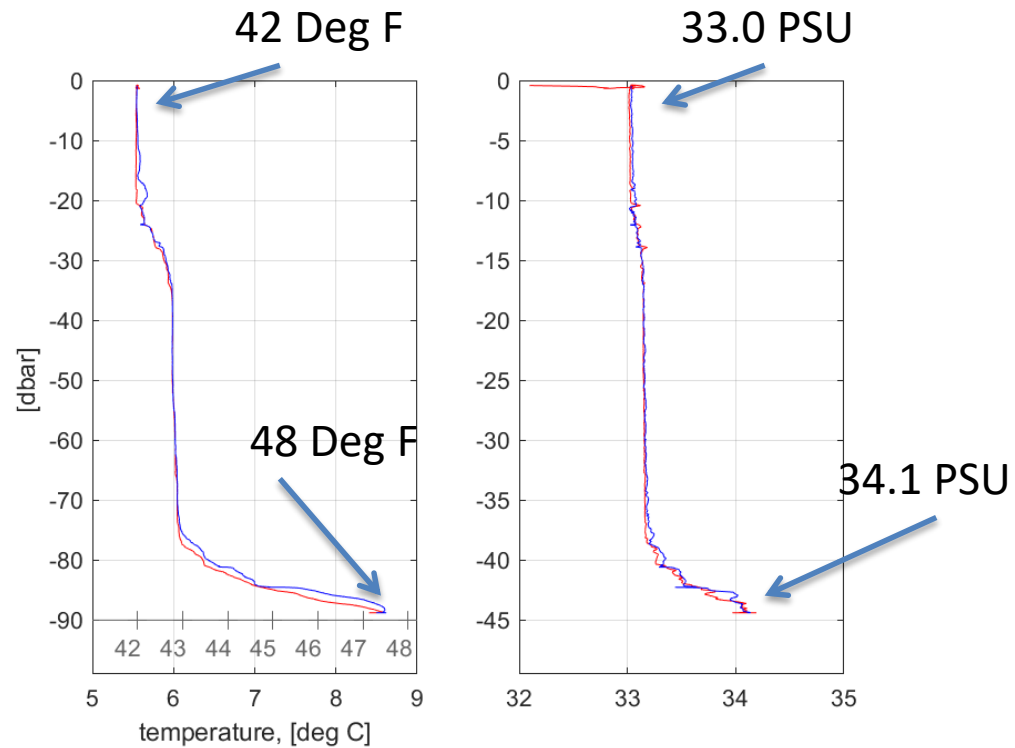
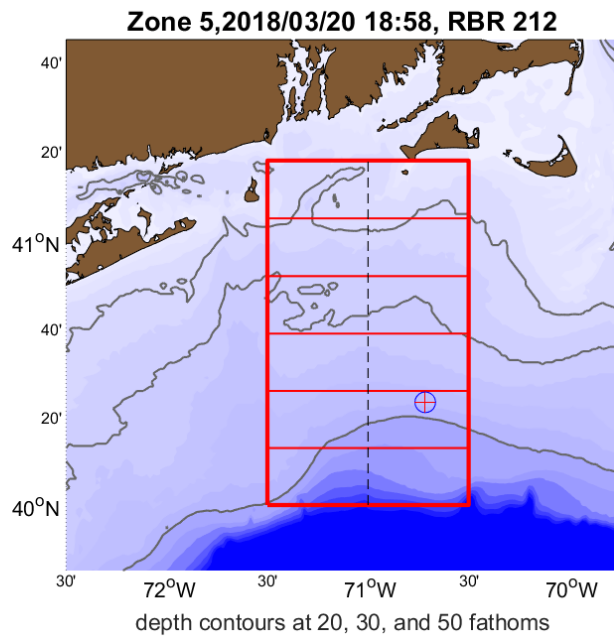


Profile from March 24
Box 1 near Block Island



Surface Temperature 38.2 Deg. F
Bottom Temperature 40.0 Deg. F

Recent Profile- Box 5



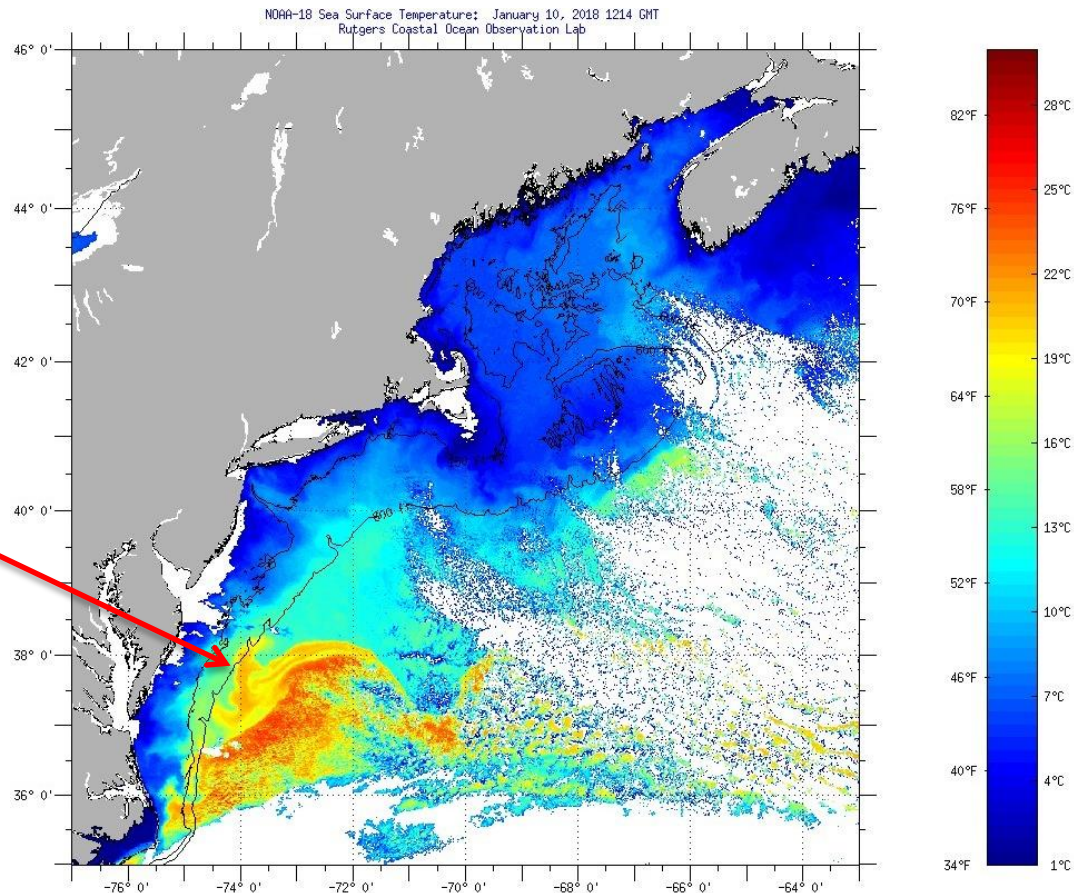
Surface Temperature- 42 Deg. F

Bottom Temperature- 48 Deg. F

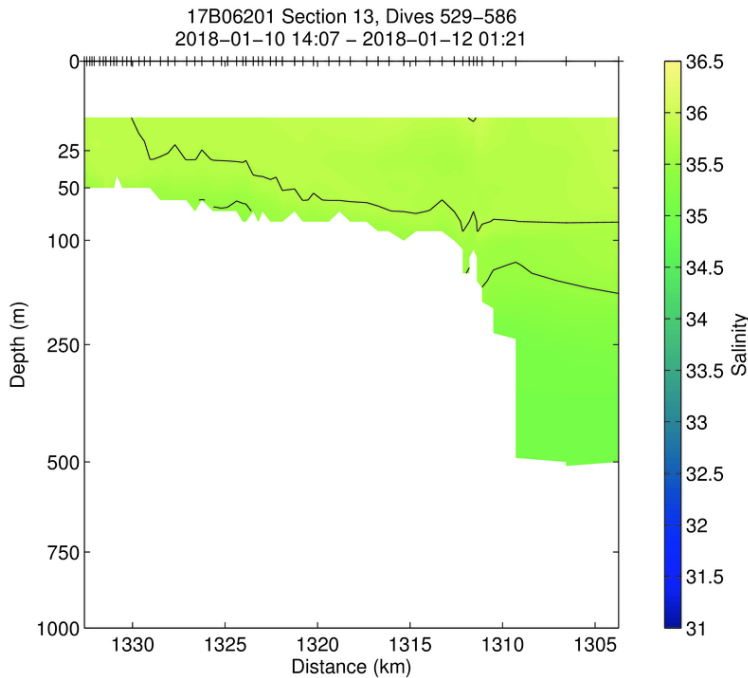
Foot of Shelfbreak Front is at **45 fathoms**

South of Hudson Canyon- Gulf Stream filament extends well north of Cape Hatteras

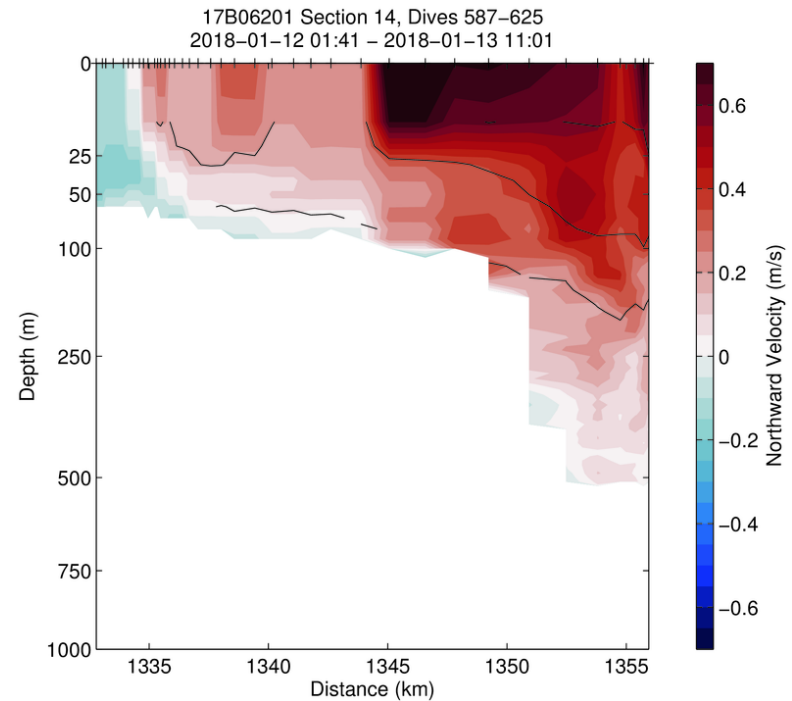
Warm filament
runs north
along shelfbreak
Extends 200 NM
North of Cape
Hatteras



Glider data from near Norfolk Canyon



Salinity > 35.5 PSU
Should be < 34 PSU,
more typically 33 PSU



Flow is to the north at the shelfbreak
Instead of to the south (Shelfbreak Jet)

Flow is greater than 1 knot to north

Summary of Conditions south of Hudson Canyon

- Gulf Stream filament started early December with warm salty water heading north along shelfbreak
- Lasted until early April
- What happened to shelf water that normally extends out to 50 fathoms? All Gulf Stream water to 25 fathoms
- Is the northward flow along the shelfbreak linked to the shelf water being pushed offshore south of New England?

Things to Watch For

- Will Gulf Stream have any influence on shelf in critical May/June time period?
- What caused the strong northward flows to extend so far north of Cape Hatteras from December to March?
- Eastward supply of shelf water into Gulf Stream was cut off for three months- does this affect Gulf Stream motions?