

2017 Oceanographic Conditions and Related Topics

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WHOI/CFRF

November 2, 2017

with help from Frank Bahr and Aubrey Ellertson

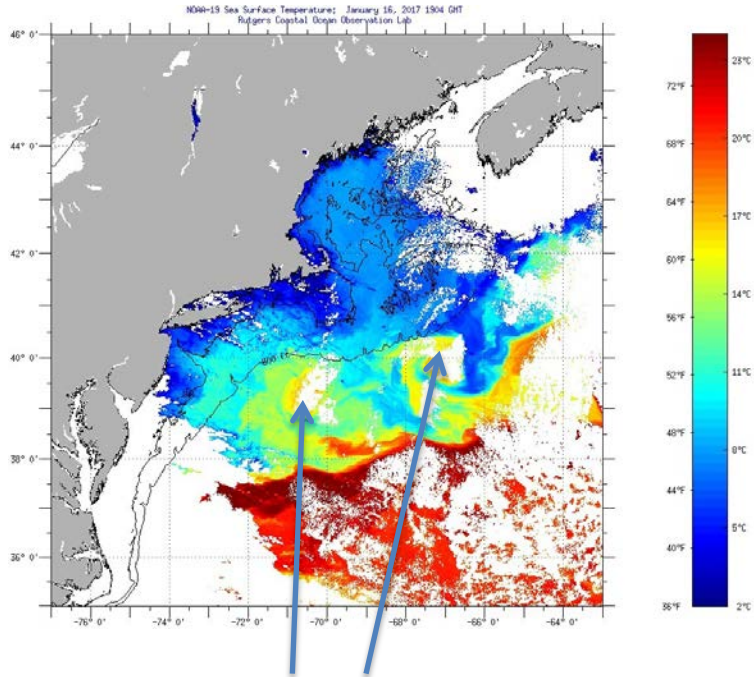


Outline

- Overview of 2017- A strange year oceanographically
- Seasonal forecasting - Last winter comparison and looking forward
- Recent proposals
- Technical update - Shelf Research Fleet

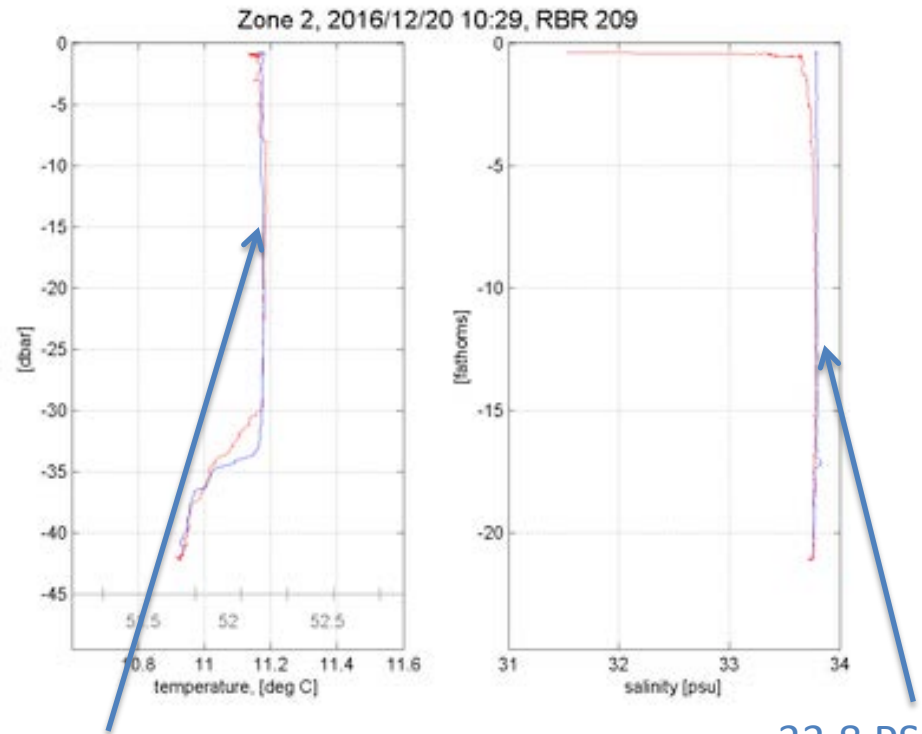
Gulf Stream Influence (December-January)

January 16, 2017



Warm Core Rings

December 20, 2016



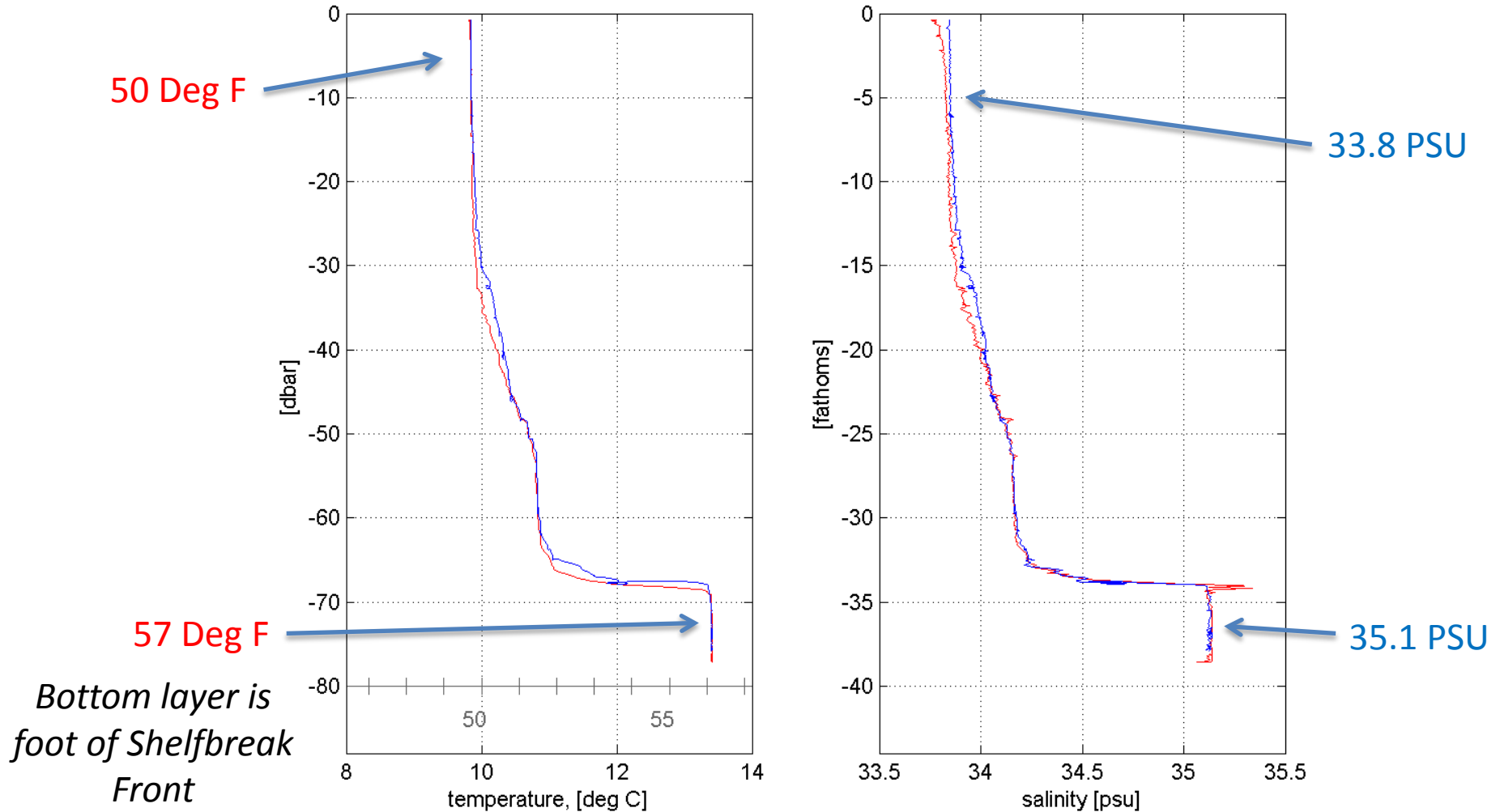
Temp 52 Deg. F (WARM!)

33.8 PSU
(SALTY!)

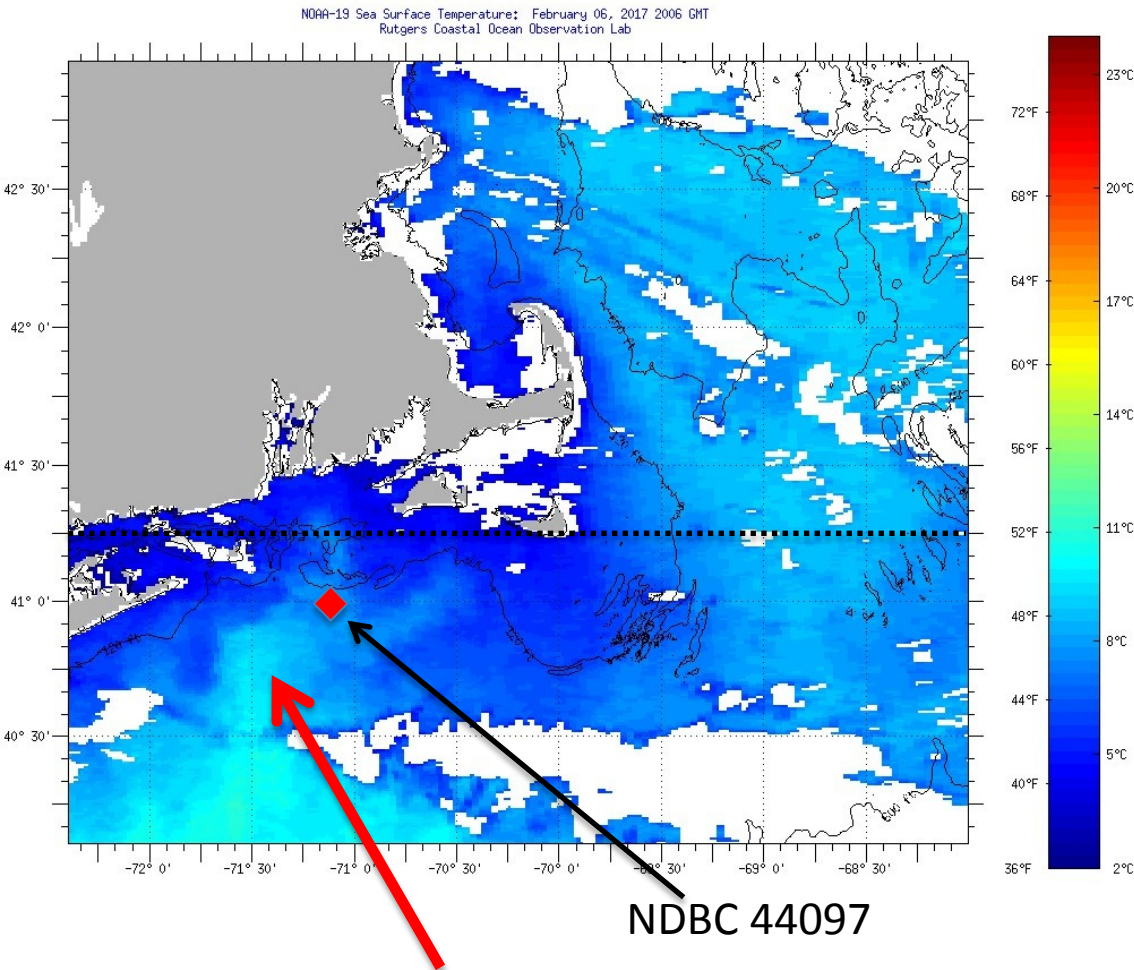
- Two **warm core rings** were present during the January/February
- The first drove a **large warm anomaly** across much of the continental shelf

Warm Water on Shelf (40 Fathoms)

Zone 4, 2017/01/29 17:27, RBR 207



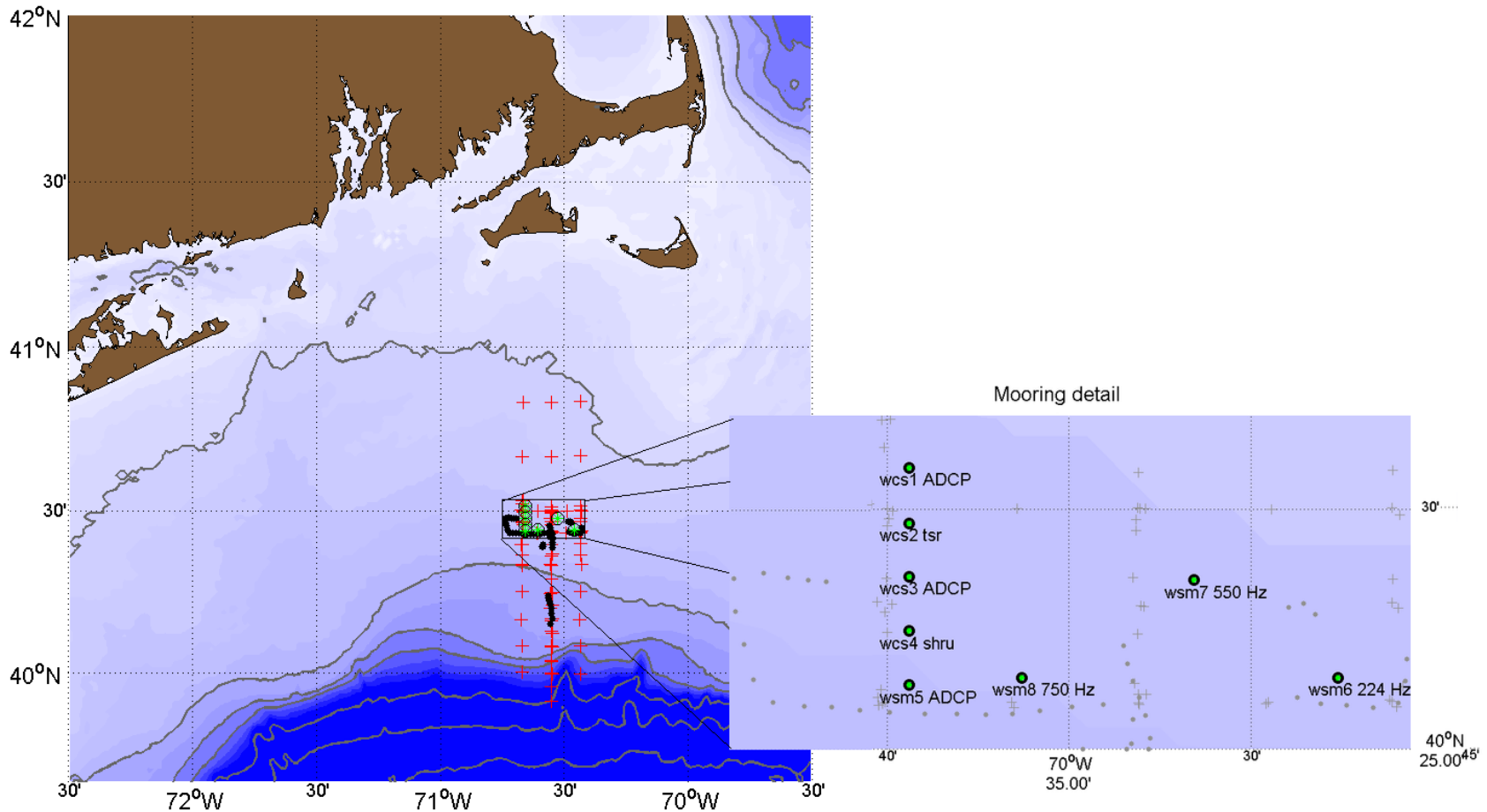
Warm Water on Shelf – February 6, 2017



- 50°F extended up to 40° 45' N
- 41°F at NDBC 44008 Buoy
- 41°F along Cape Cod line (Naomi Fleming Climatology)

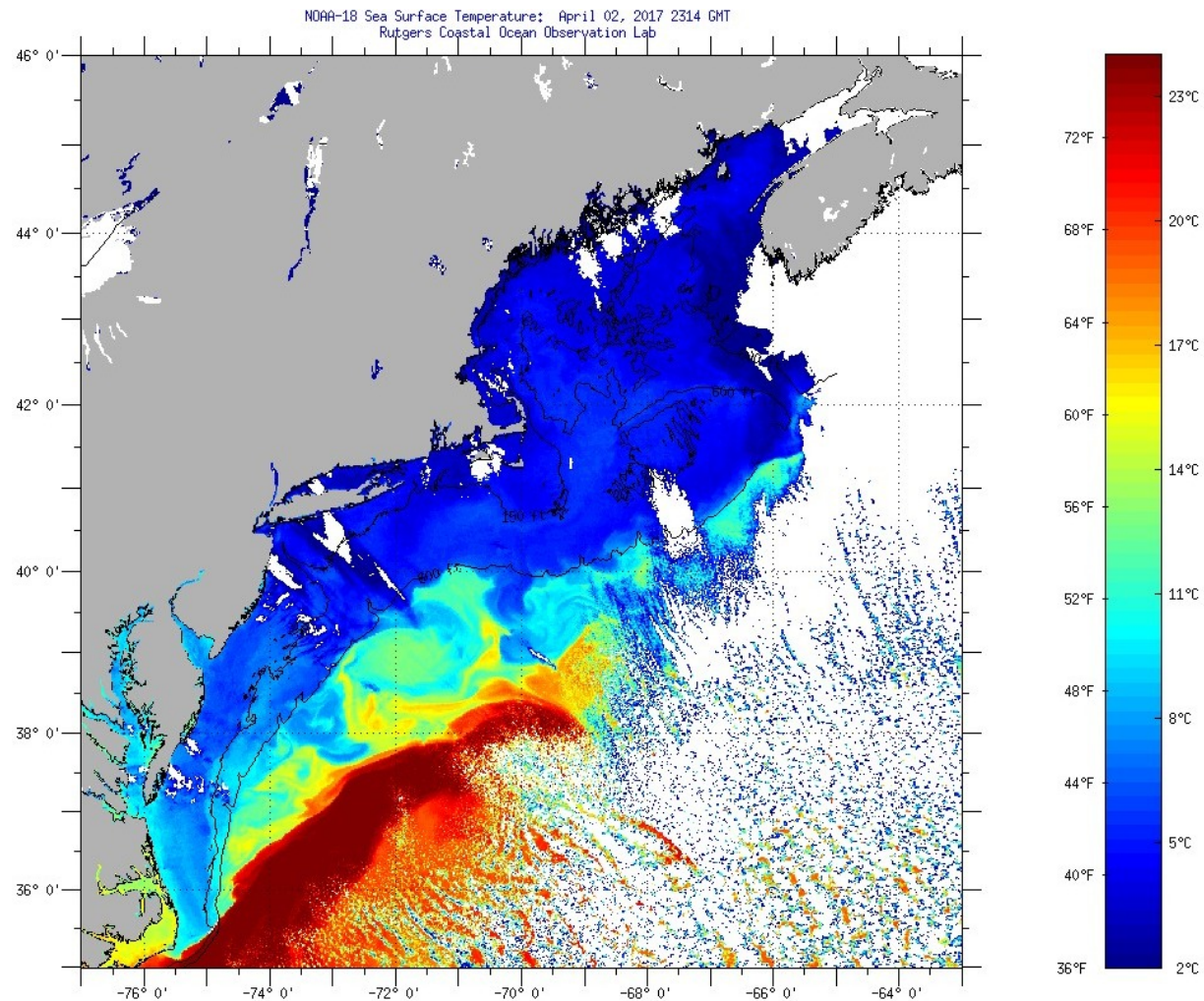
Warm surface water associated
with warm core ring (50°F)

Physical Oceanographic Sampling During SCE17- March/April 2017



- Cross-shelf array of 5 moorings with temperature probes and a few CTDs
- Shipboard CTD profiles (temperature, salinity, depth)
- Limited use of University of Delaware Scanfish

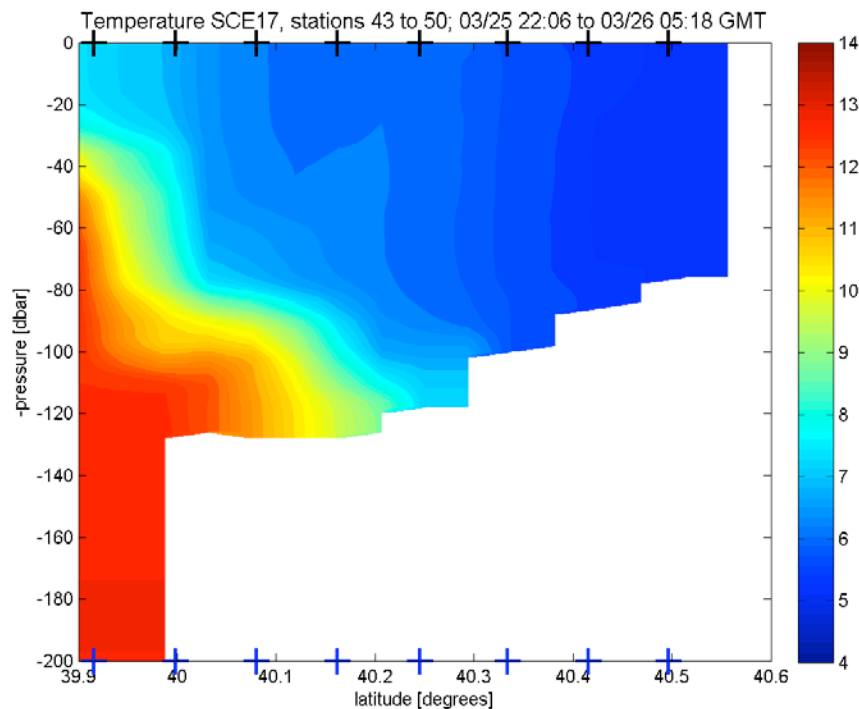
April 2, 2017: Sea Surface Temperature



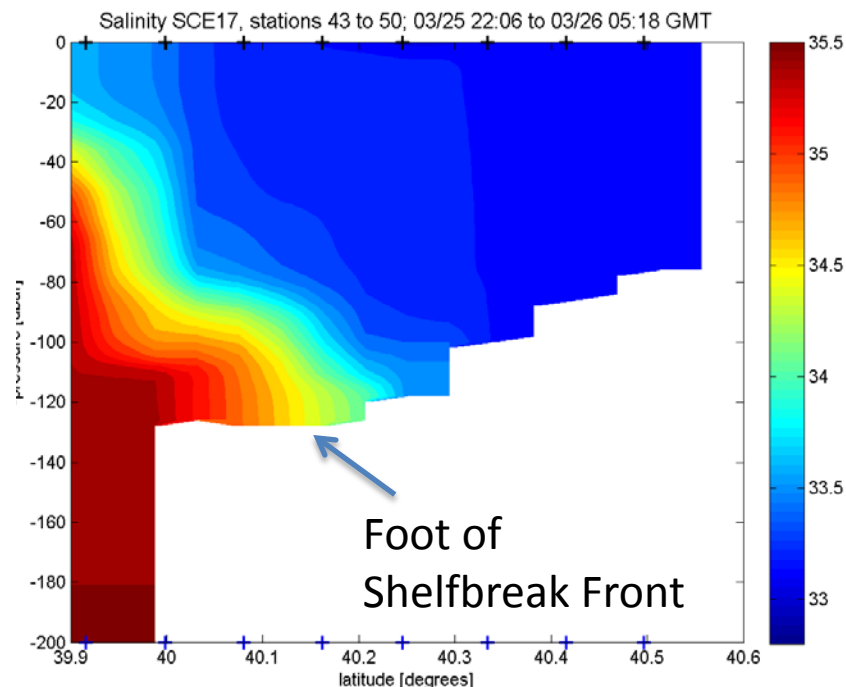
No intrusions of warm slope/Gulf Stream water onto Continental Shelf visible at surface

Cross-shelf Temperature and Salinity

March 25, 2017



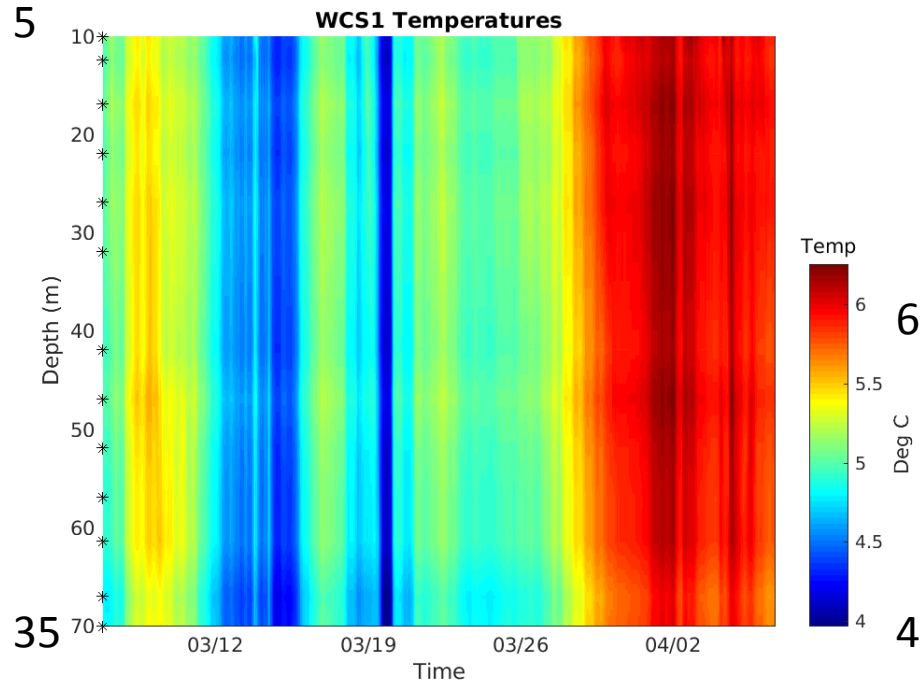
Deepest blue- 41 Deg F
Red- 55 Deg F



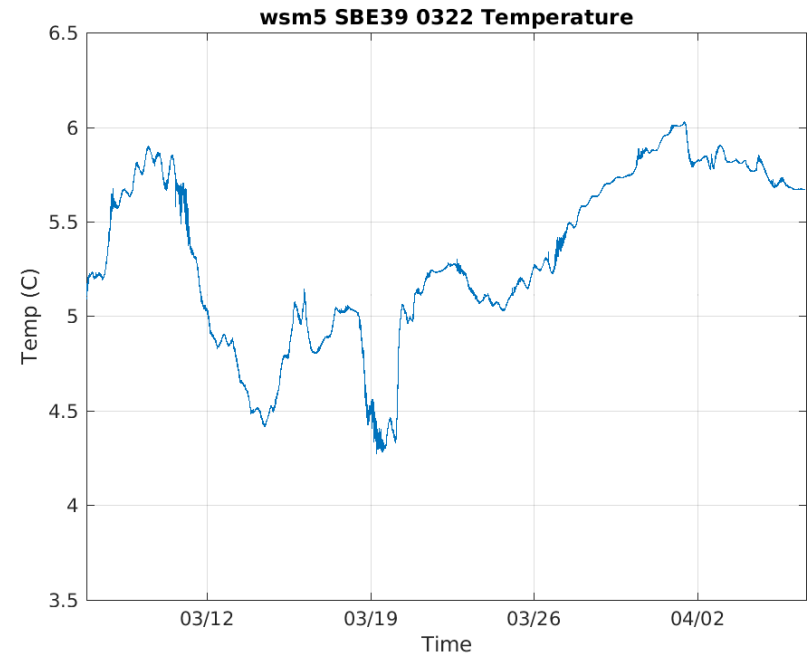
Shelf Salinity- 33.3 PSU
Offshore Salinity- 35.5 PSU

Shelf is well mixed vertically
Foot of Shelfbreak Front is at 60 fathoms

Mooring Temperature Data



Not significant thermal stratification
(from northern mooring WCS1 at 35
fathoms)

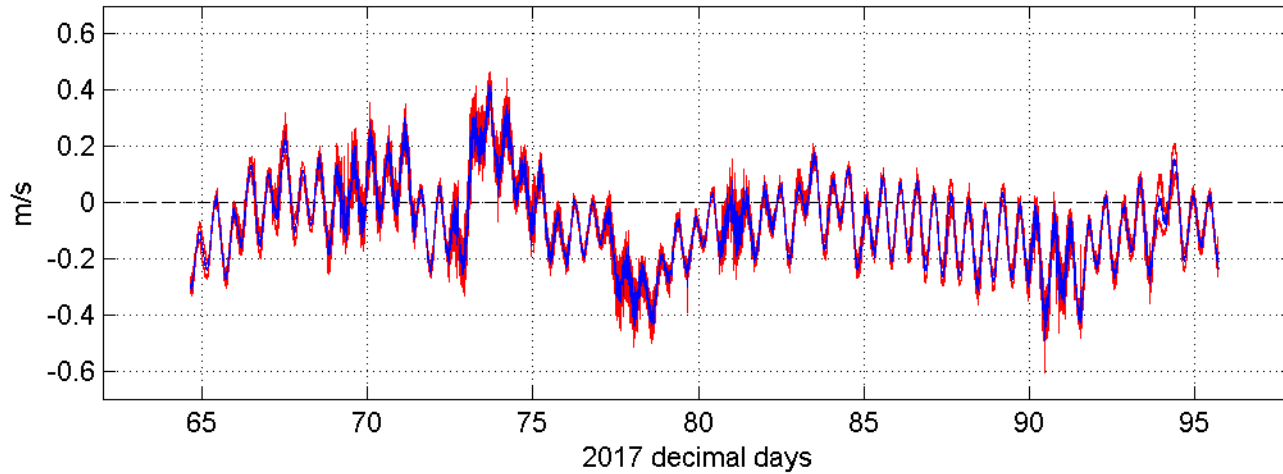


Temporal differences were in the
range of 3 Deg F (from WCS5
at 40 m fathoms)

Currents from WCS1

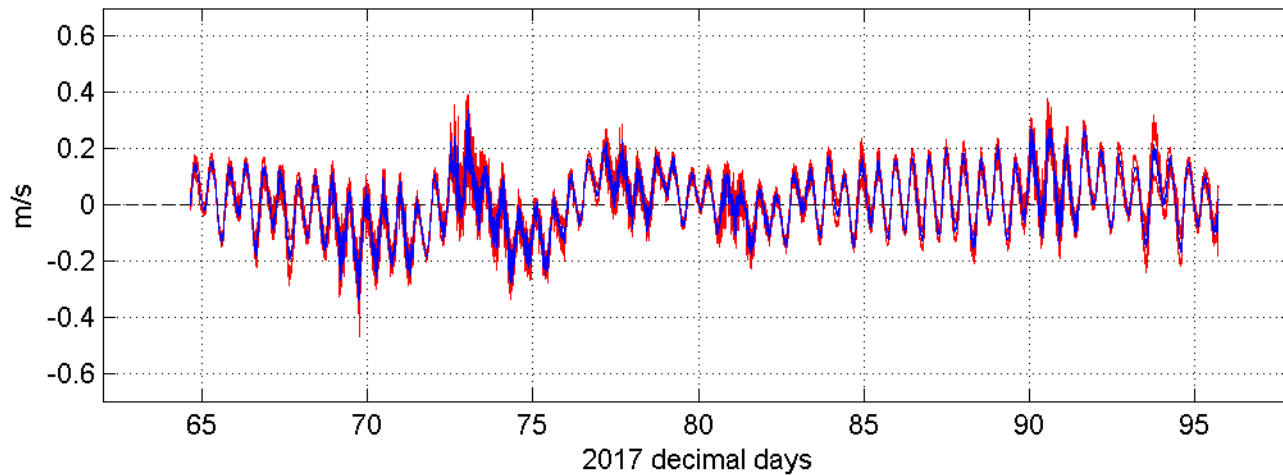
Geoac 2017 WCS1; vertical mean \pm std

Eastward
Velocity

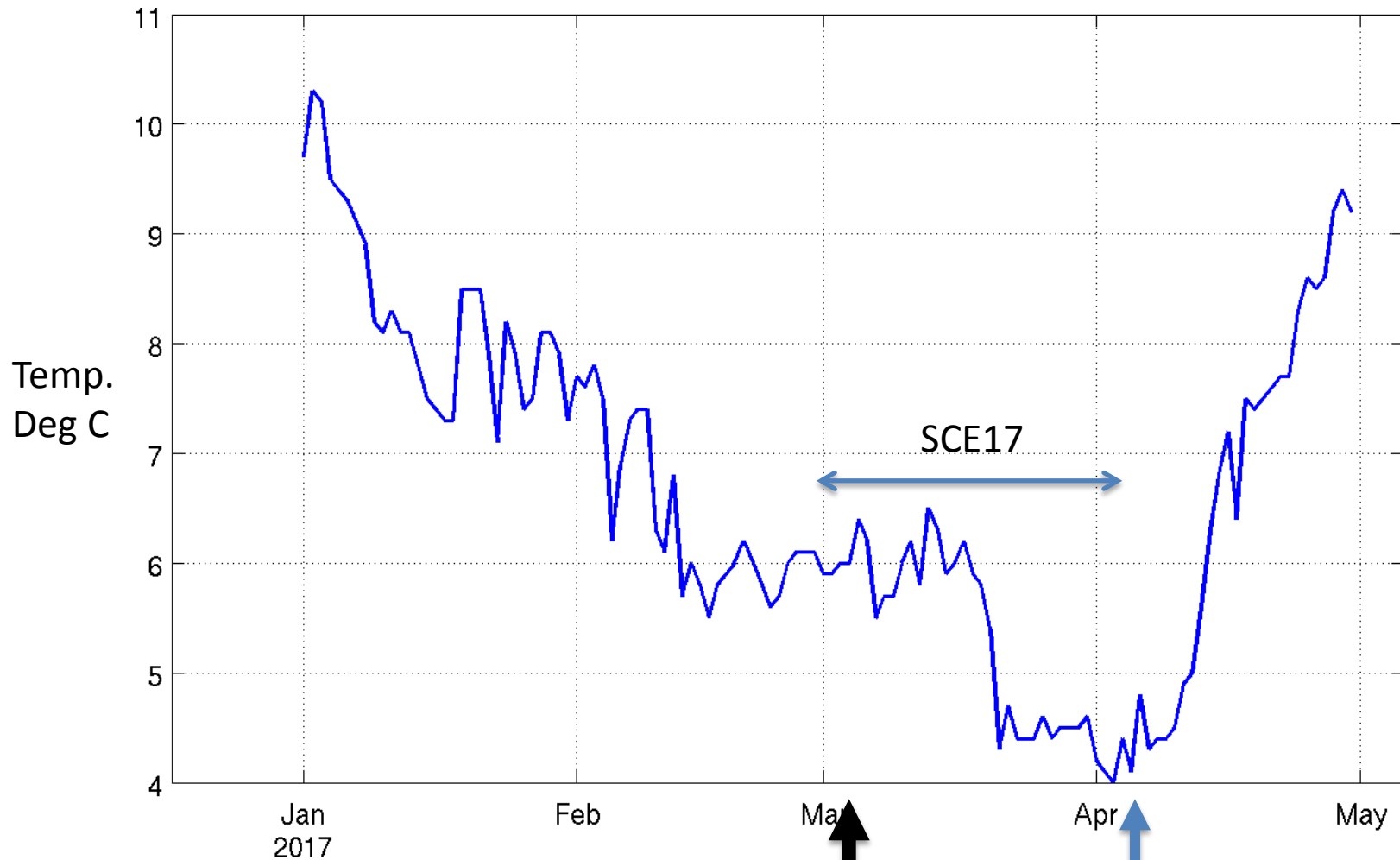


U (top) and V (bottom)

Northward
Velocity

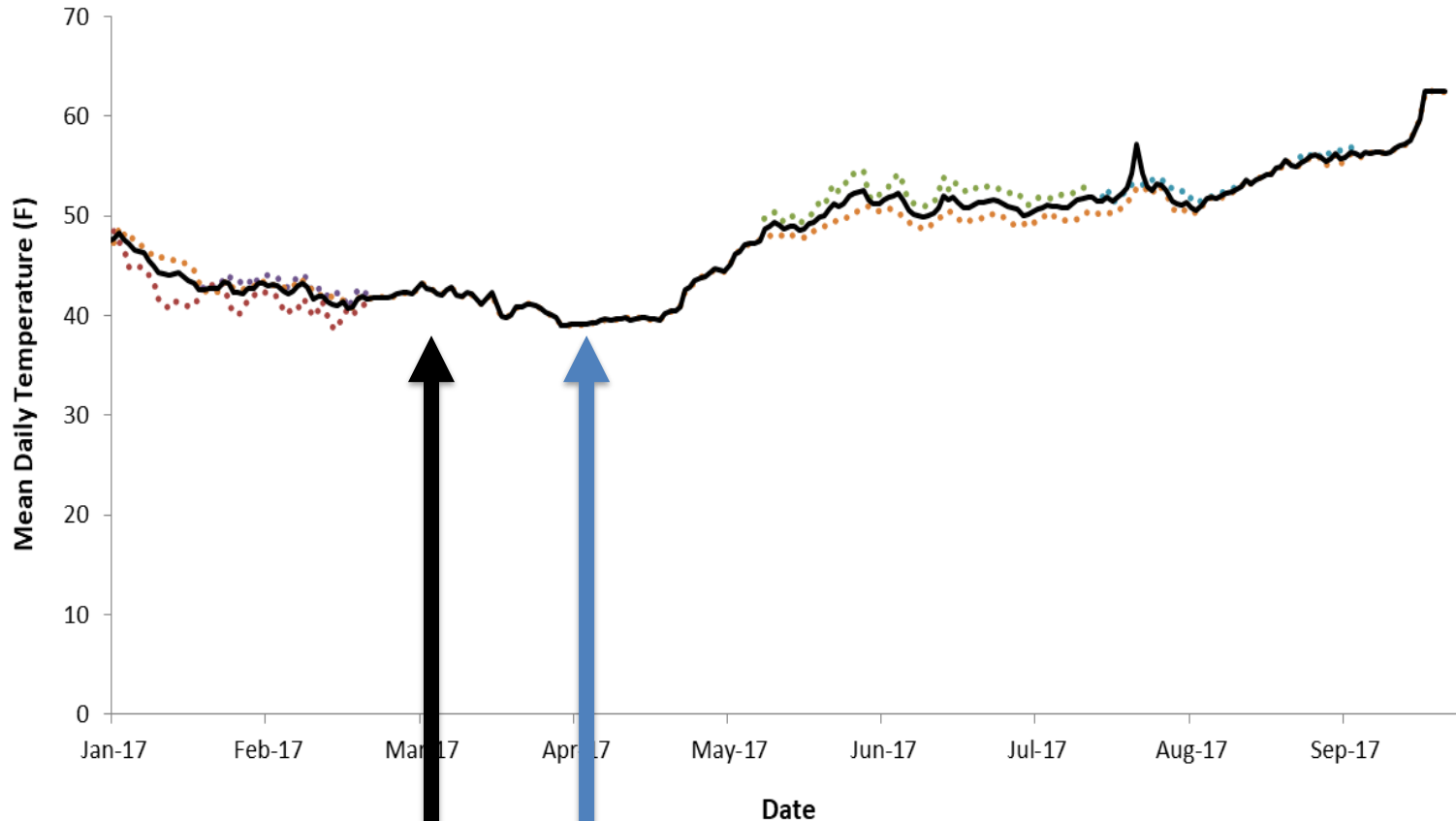


Surface Temperature - NDBC Buoy Rhode Island Sound



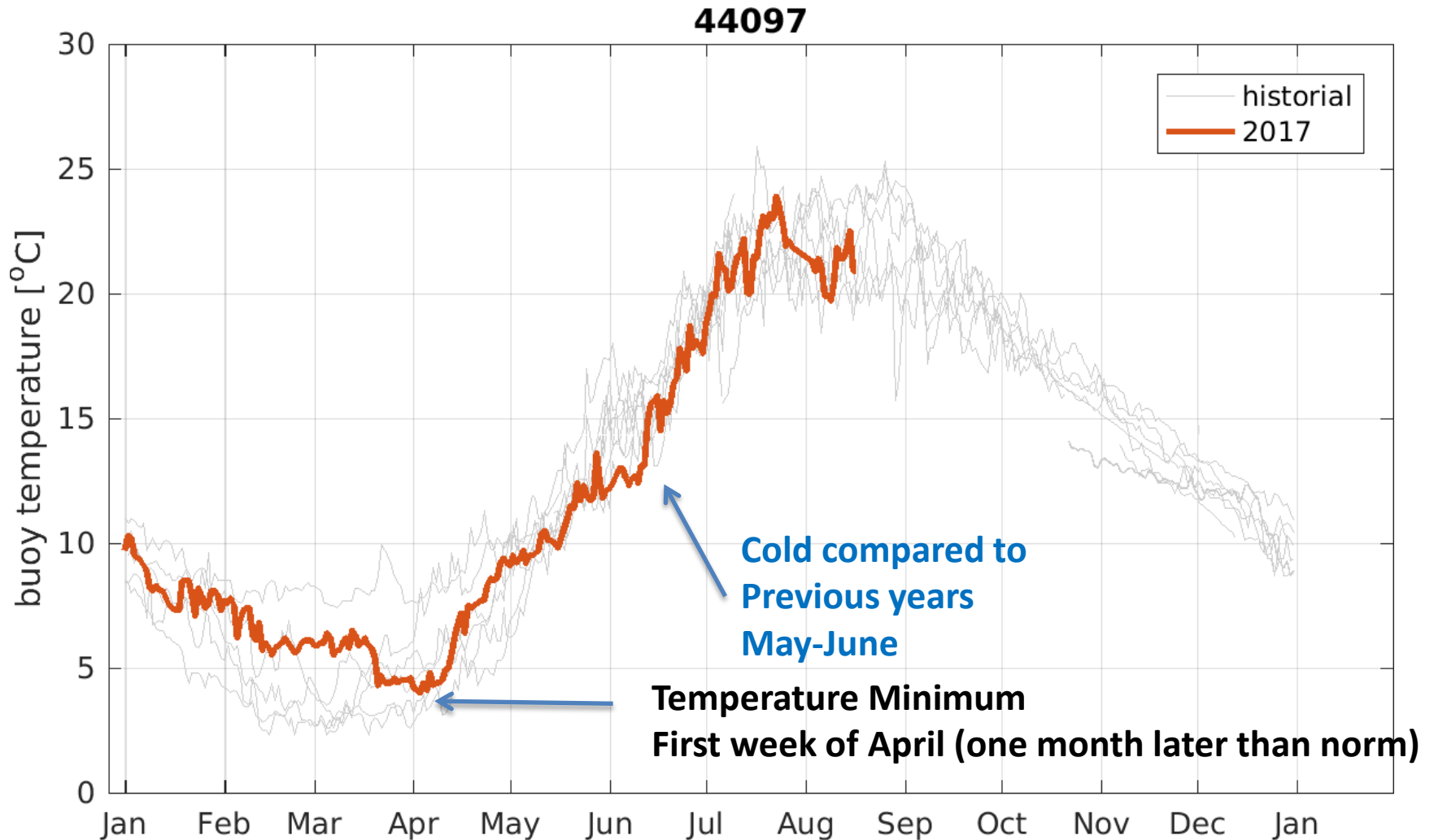
LATE Minimum Temperature: April 1
Normal Minimum: First week March

CFRF Bottom Temperature: Rhode Island Sound

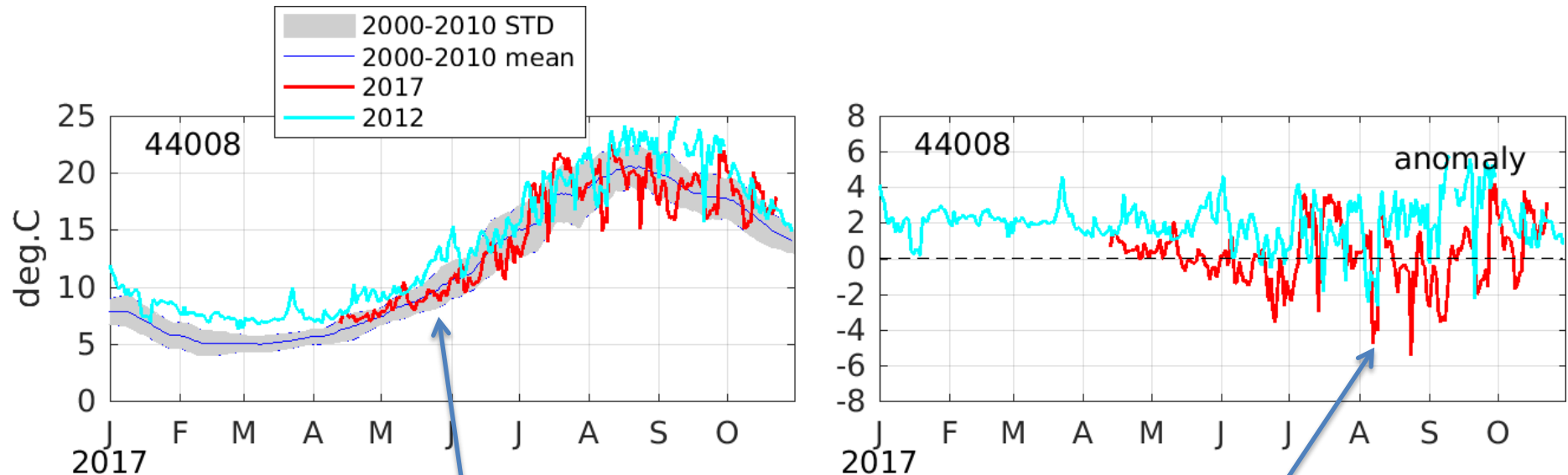


LATE Minimum Temperature: April 1
Normal Minimum: First week March

Surface Temperature: Rhode Island Sound Inter-annual Comparison

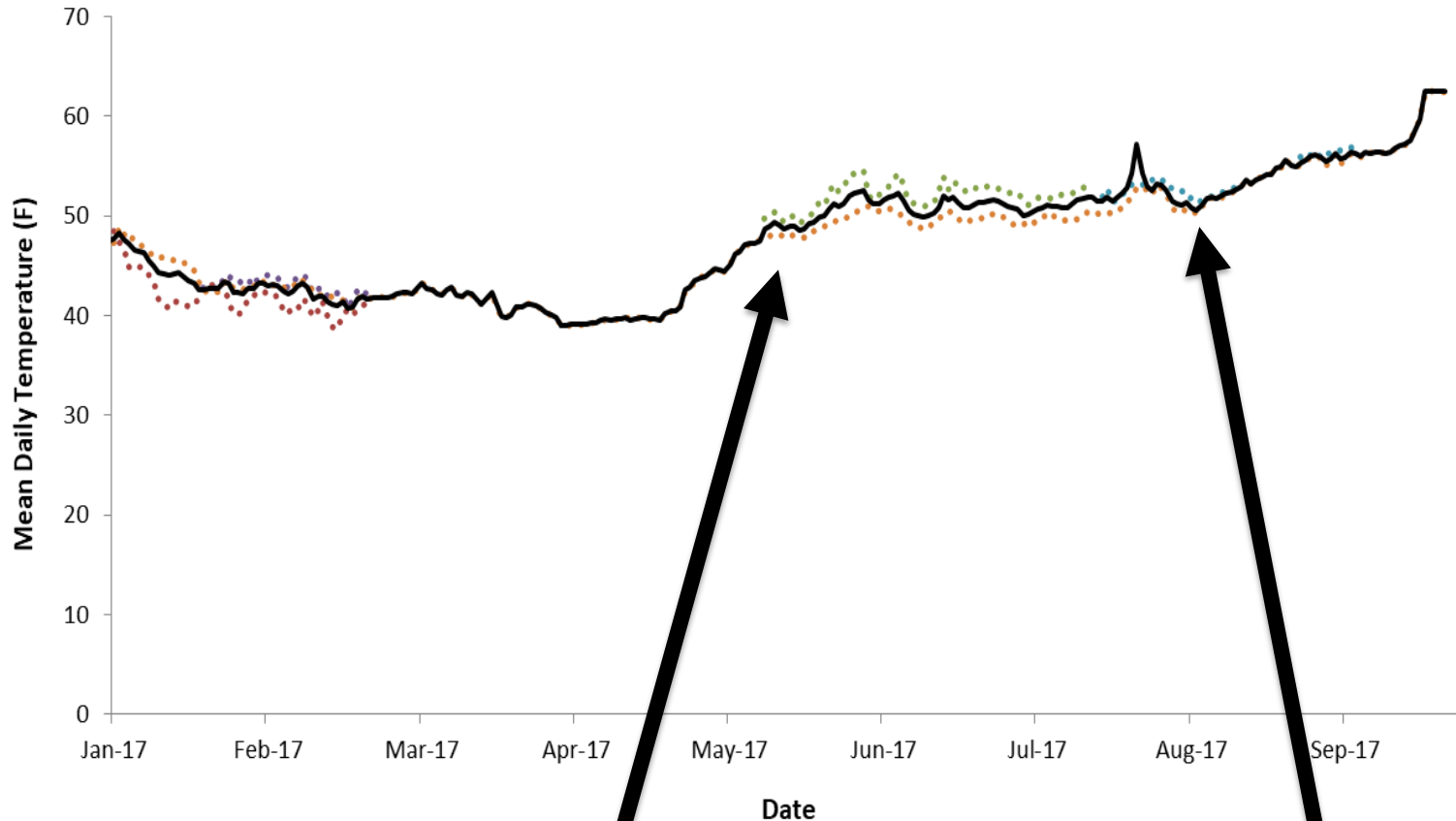


Surface Temperature: Nantucket Shoals Buoy



- Mid-May – July: **Cooler** than normal
- August: Wild temperature swings with **cold** temperature anomalies of up to 9°F

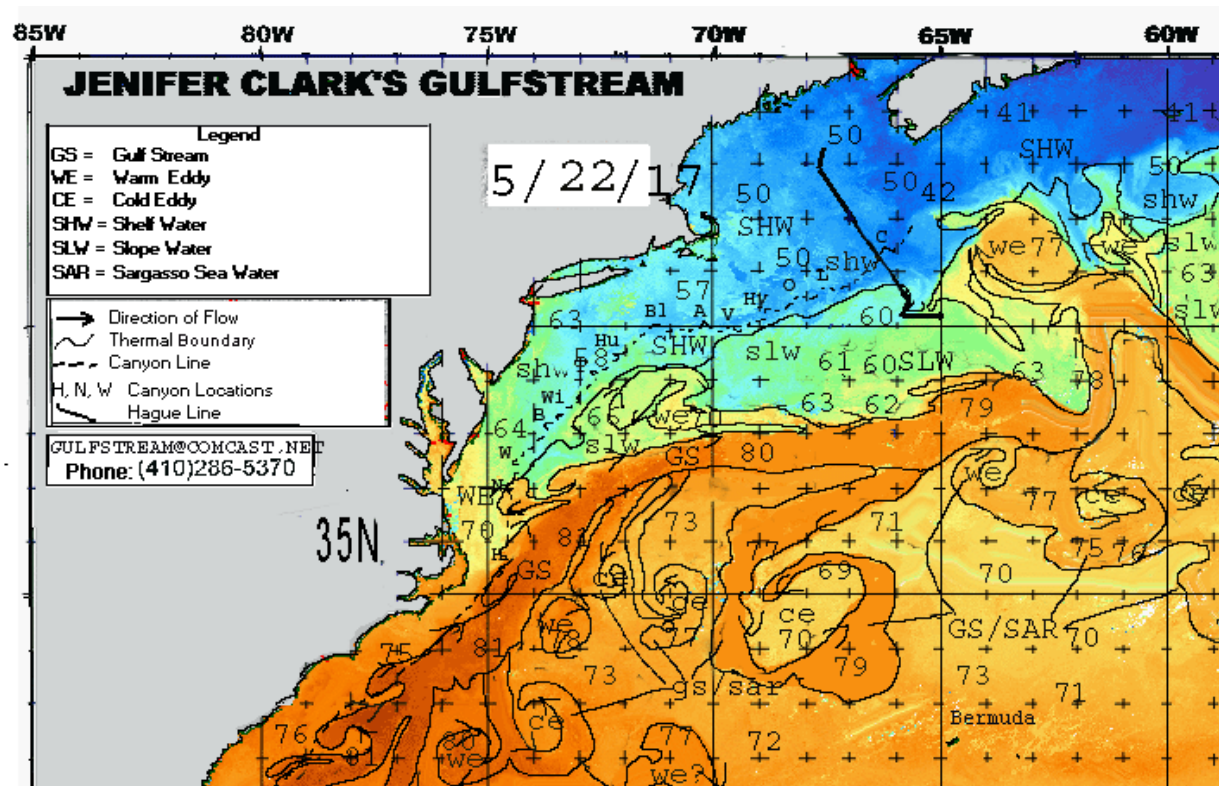
CFRF Bottom Temperature: Rhode Island Sound



- Mid-May – Early July: **Cooler** than normal (50°F)
- July/August: Warm peak (57°F) in late July, cooling to 51°F in August

Question: Why was there a cold anomaly in May-June 2017?

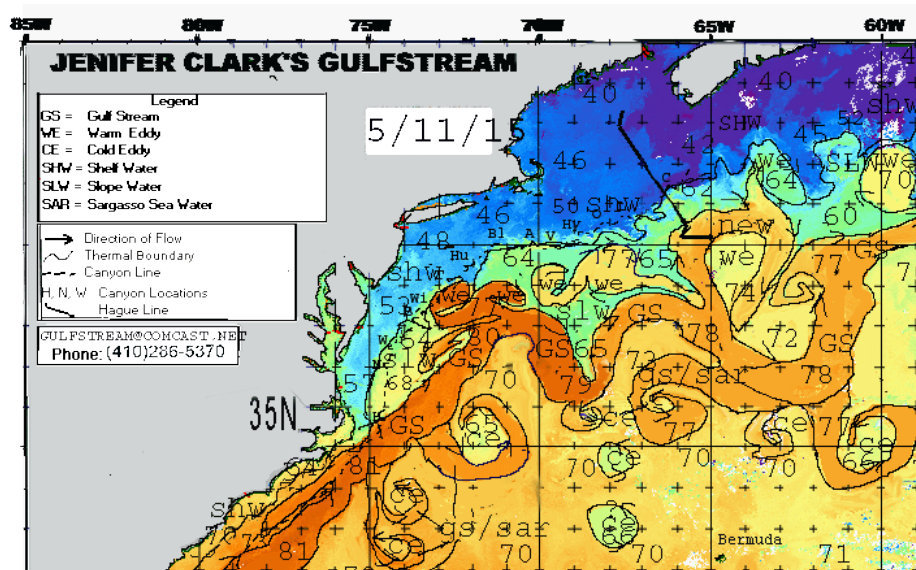
Answer: Gulf Stream configuration May 22, 2017



Very little influence of Gulf Stream on continental shelf for March, April, May – **COMPLETELY DIFFERENT than 2015 and 2016**

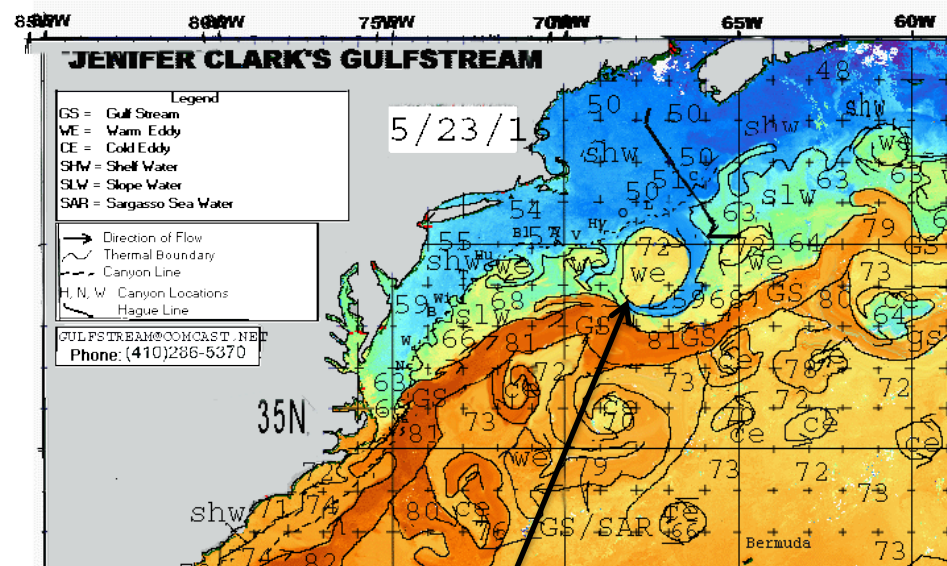
May 2015 and 2016: Strong Gulf Stream interaction with shelf

May 2015



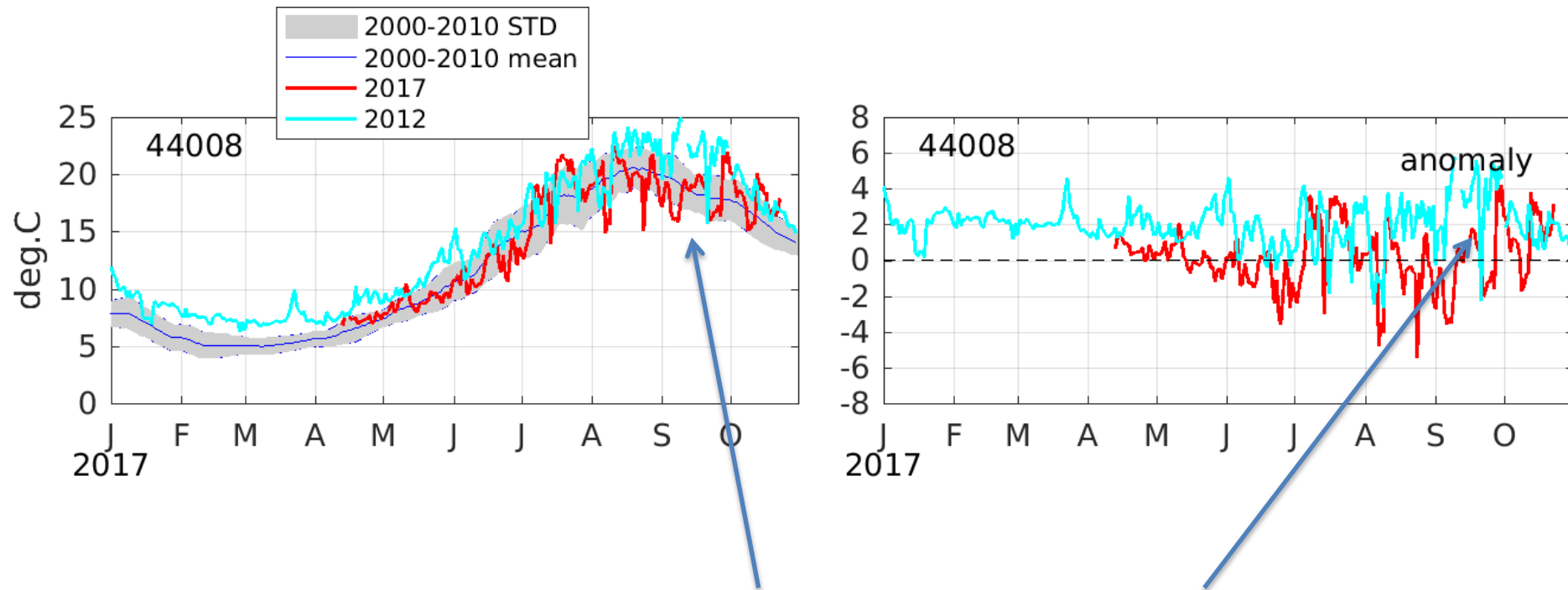
Very contorted Gulf Stream

May 2016



Big Warm Core Ring

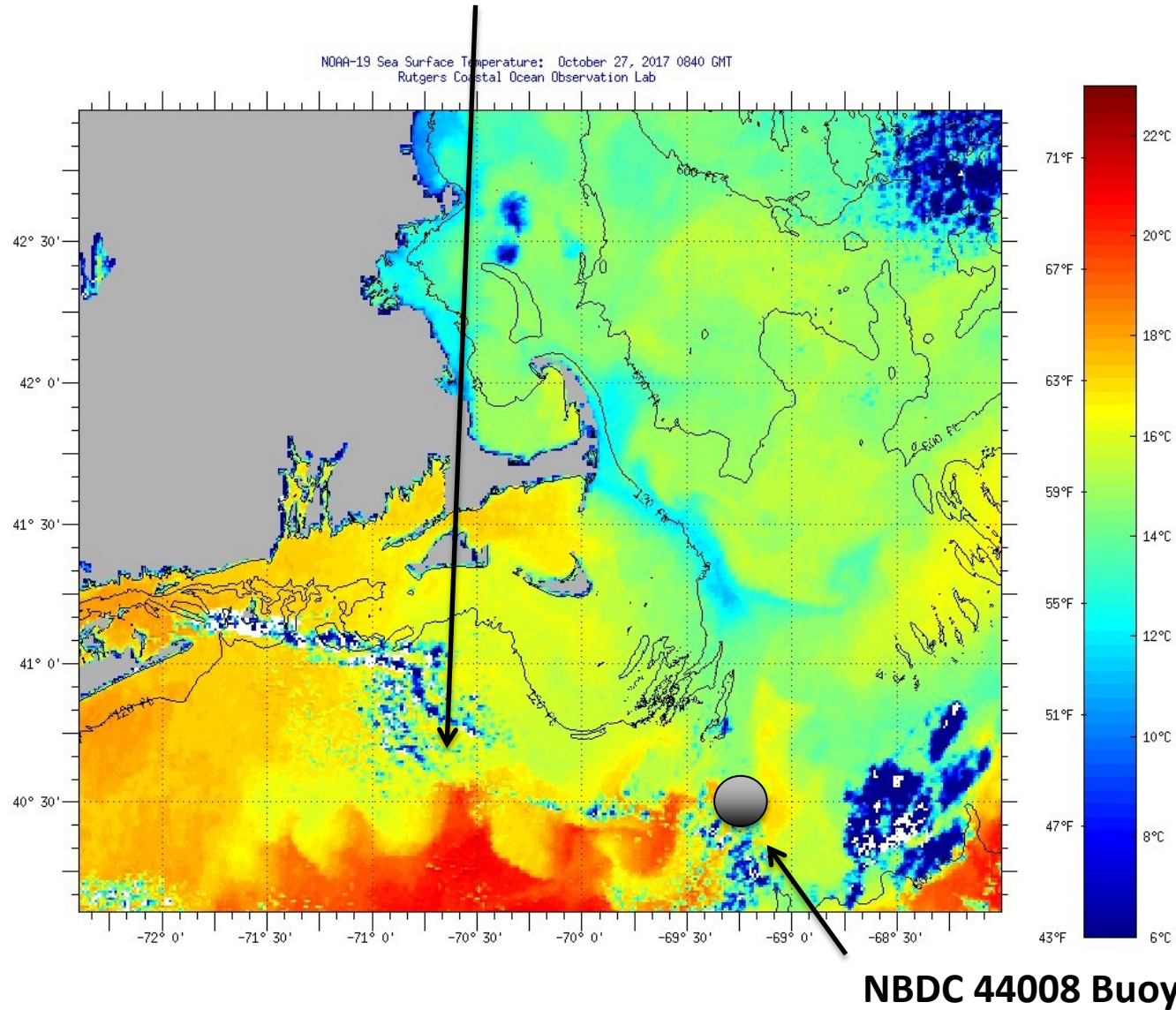
September/October Surface Temperature: Nantucket Shoals NDBC Buoy



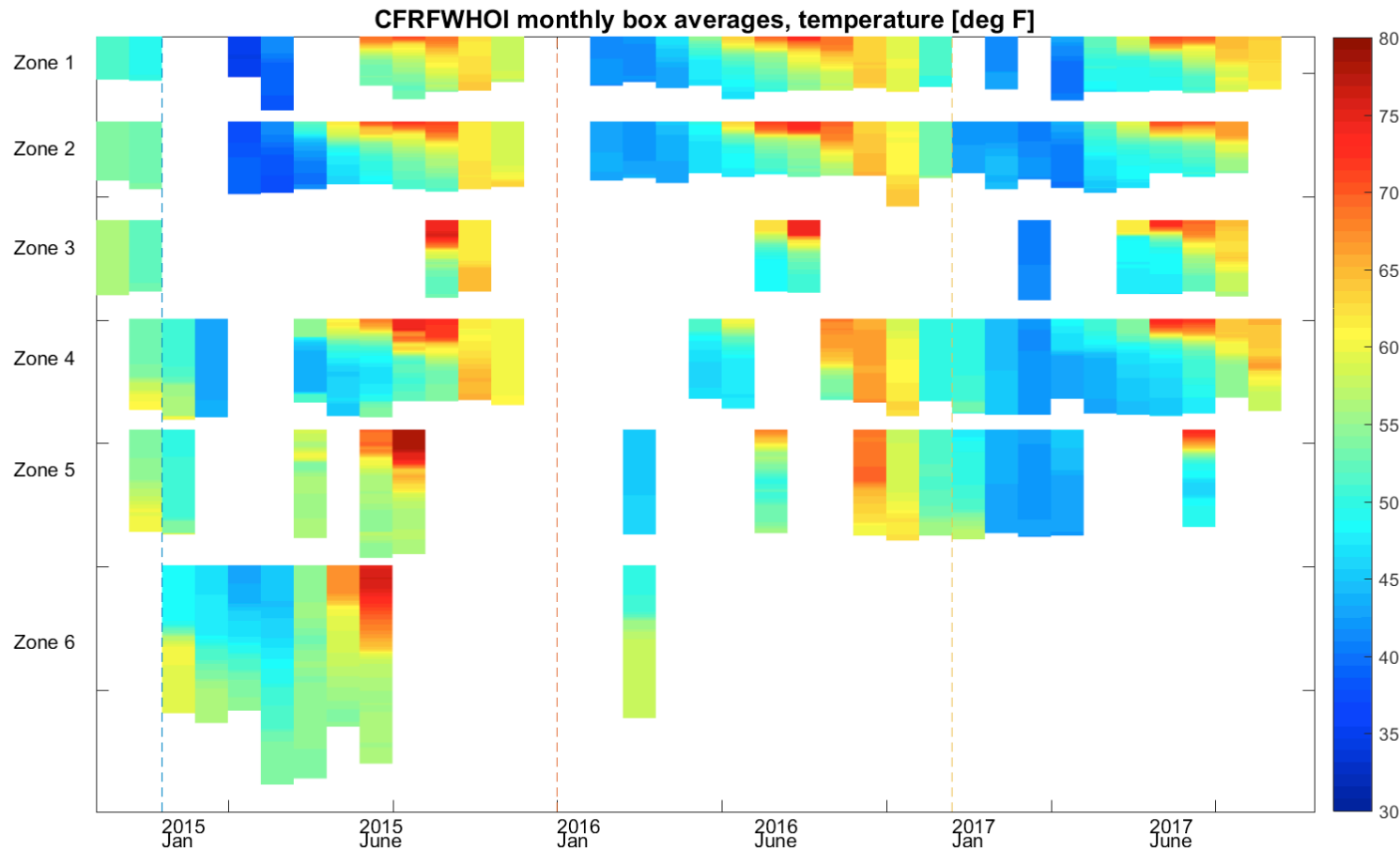
- September: Reversal from **cool** anomalies to **warm** anomalies
- October: **Warm** anomalies (similar to 2012!)

October 27, 2017

Frontal Meanders at 35 Fathoms

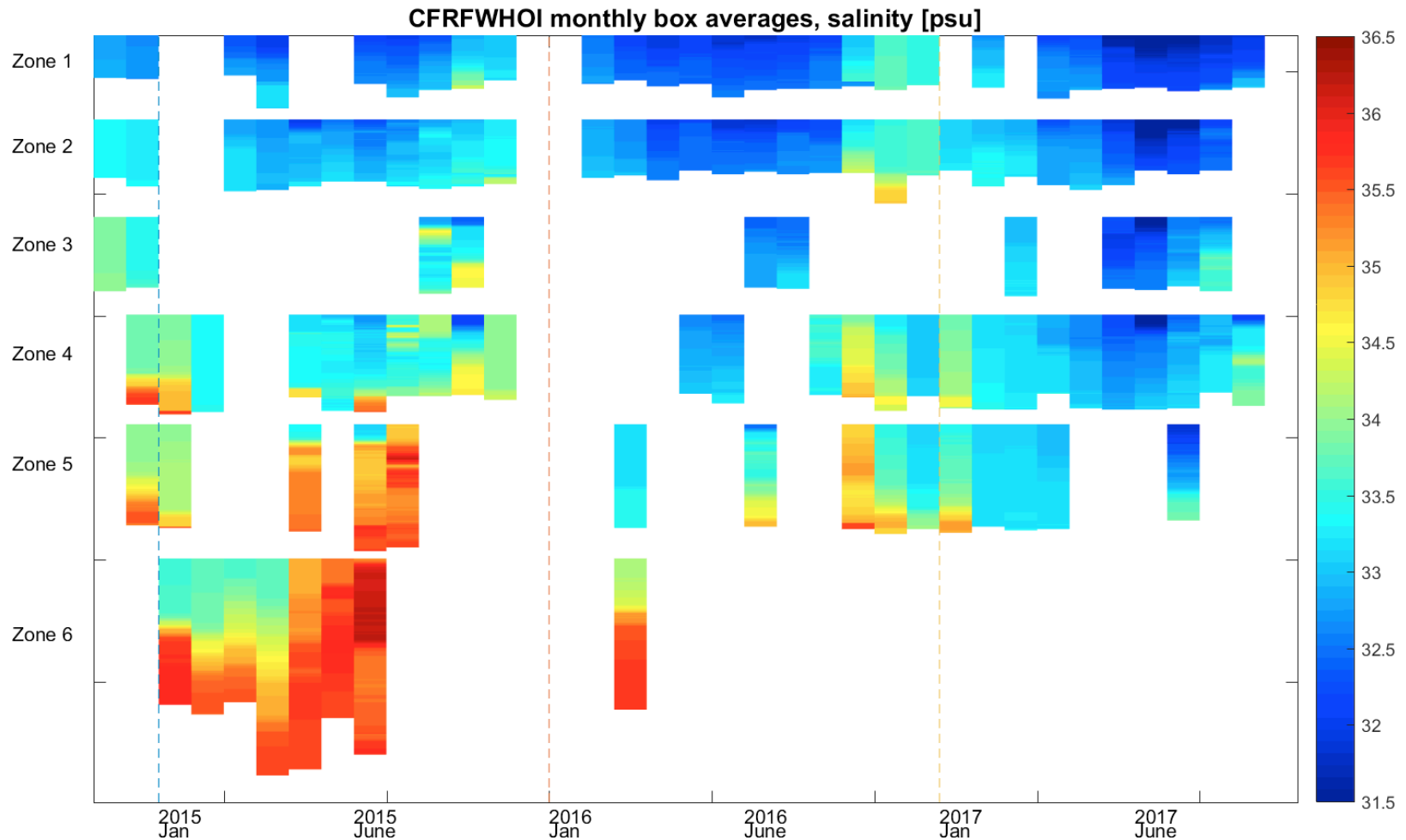


Water Column Temperature: Year to Year Comparisons



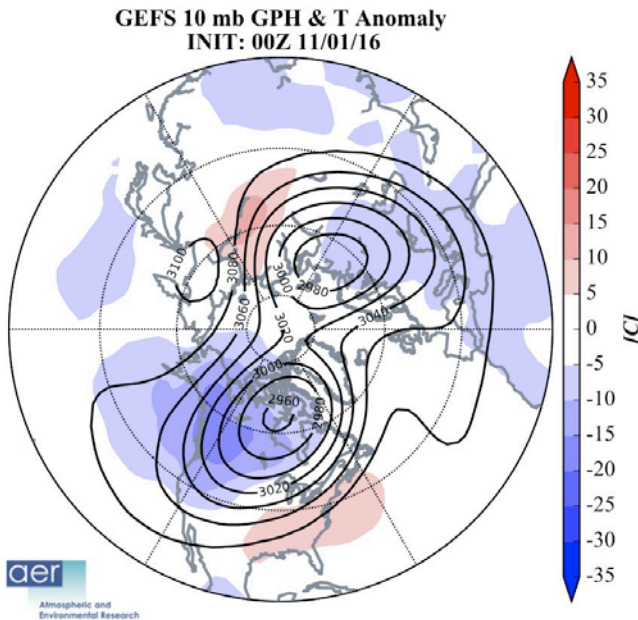
- **2015: Cooler winter, Early spring warming, warm summer/fall (Gulf Stream shape)**
- **2016: Warm winter, Early spring warming, Highly variable summer/fall (WCRs)**
- **2017: Warmer winter (WCRs), Later spring warming, Cooler summer, Warmer fall**

Water Column Salinity: Year to Year Comparisons

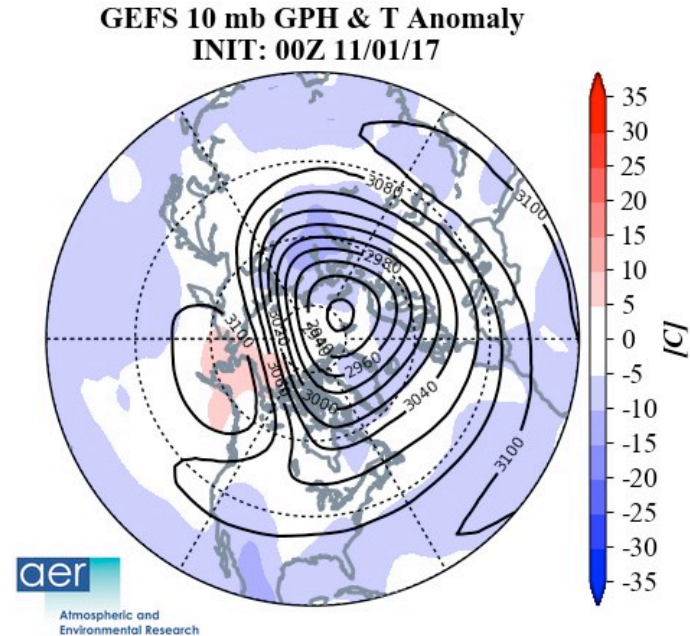


- **2015: High salinities due to penetration of Gulf Stream water**
- **2016: High salinities due to WCRs, but constrained farther offshore than in 2015**
- **2017: Lower salinities across shelf due to limited Gulf Stream interactions**

Winter Forecast for 2016-2017



November 1, 2016

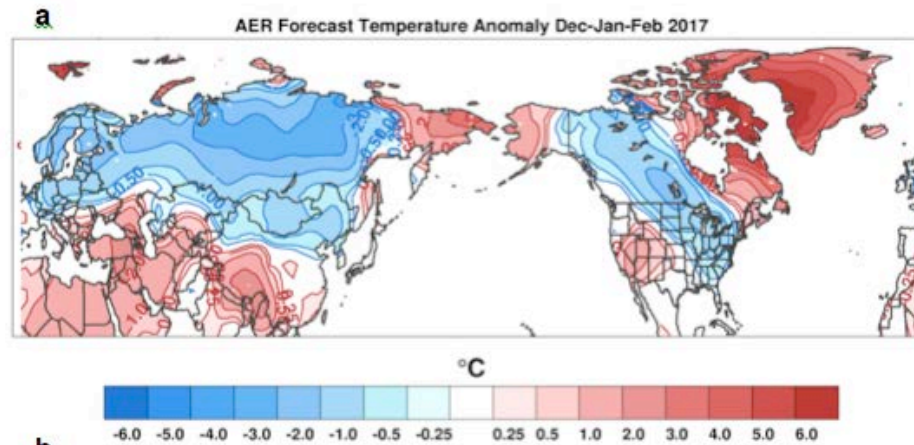


November 1, 2017

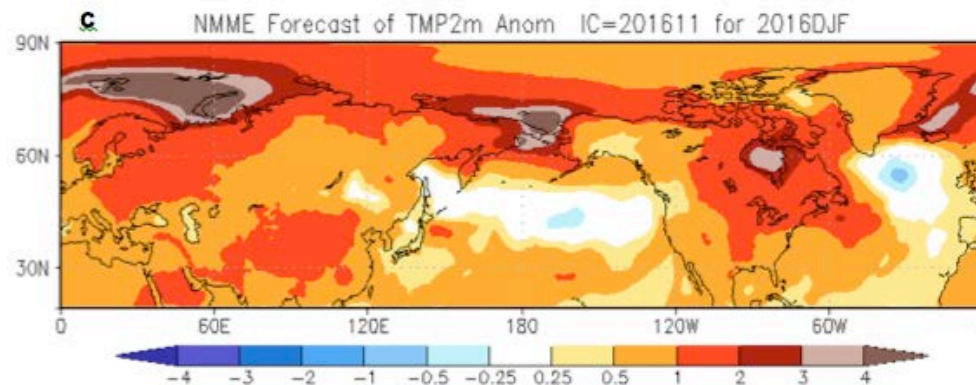
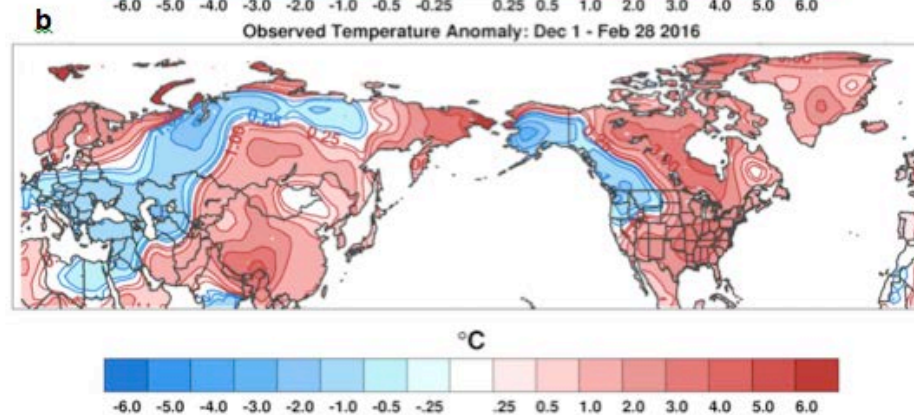
- Breakup of Polar Vortex occurred very early last winter (2016/17)
- Winter forecast based on Siberian snow fall being heavy
- strongly affected by **early breakup of Polar Vortex**

Forecast for Winter 2016-2017 vs. Observations

*AER Predicted
Temperature
Dec-Jan-Feb*



*Observed
Temperature
Dec-Jan-Feb*



View Oceanographic Conditions On Demand!

Shelf Research Fleet (Data & Presentations):

<http://www.cfrfoundation.org/shelf-research-fleet/>

<http://science.whoi.edu/users/seasoar/cfrfwho/>

NOAA CoastWatch (Satellite Imagery):

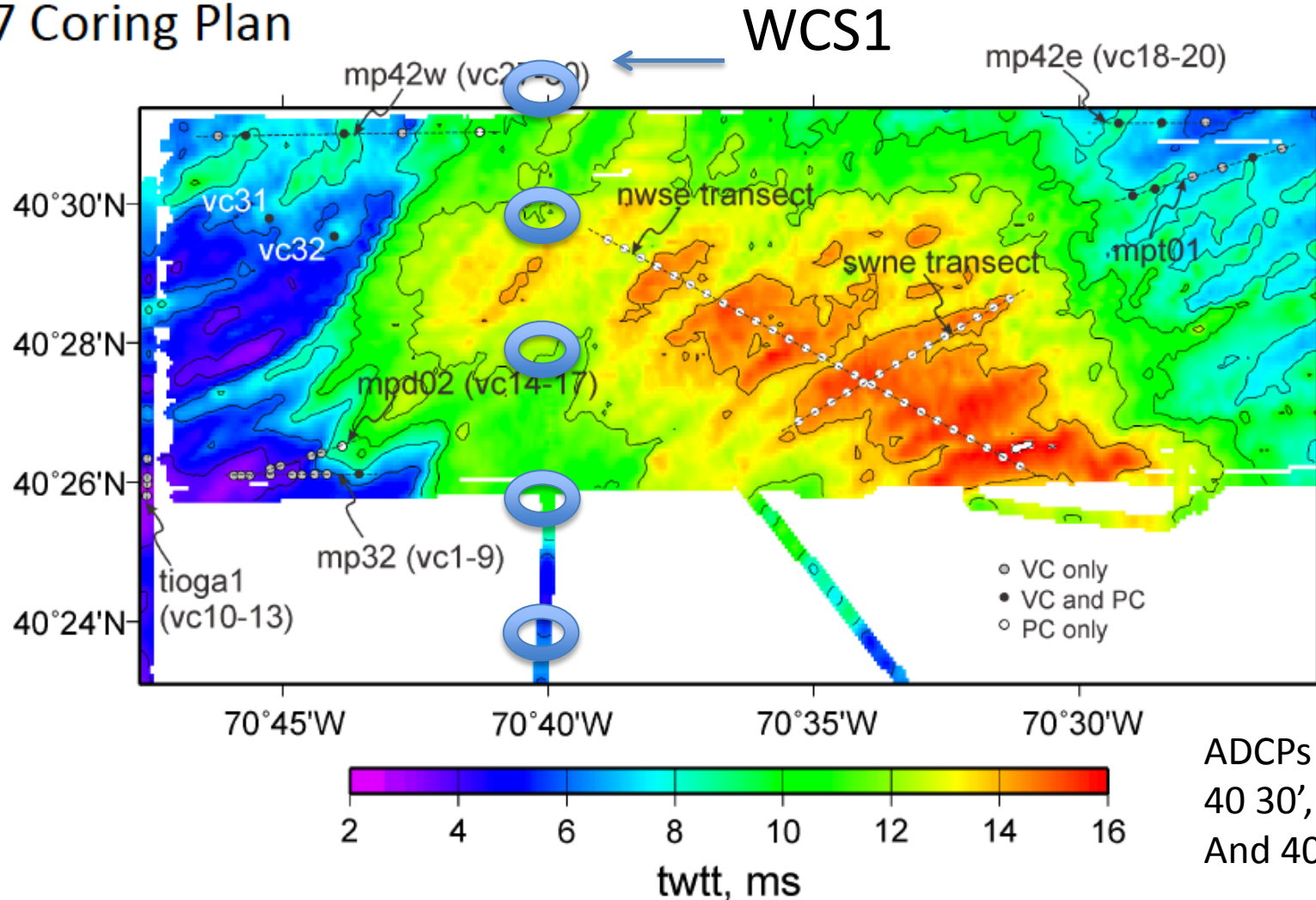
https://coastwatch.noaa.gov/cw_html/index.html

New Projects/Proposals (WHOI & CFRF Collaborations)

- Young-Oh Kwon is leading a WHOI-NEFSC-Stony Brook project on **forecasting shelf temperatures 3-24 months in advance** (use sea level, PDO, NAO)
- Pre-proposal to Saltonstall-Kennedy to examine **link between Gulf Stream warm core rings and long-finned squid** using historical data
- Pre-proposal to National Ocean Partners Program to put sonars on Autonomous Underwater Vehicles to **map squid movements onto continental shelf**

Physical Oceanography Moorings

EN577 Coring Plan



ADCPs at
40°30', 40°28',
And 40°24'