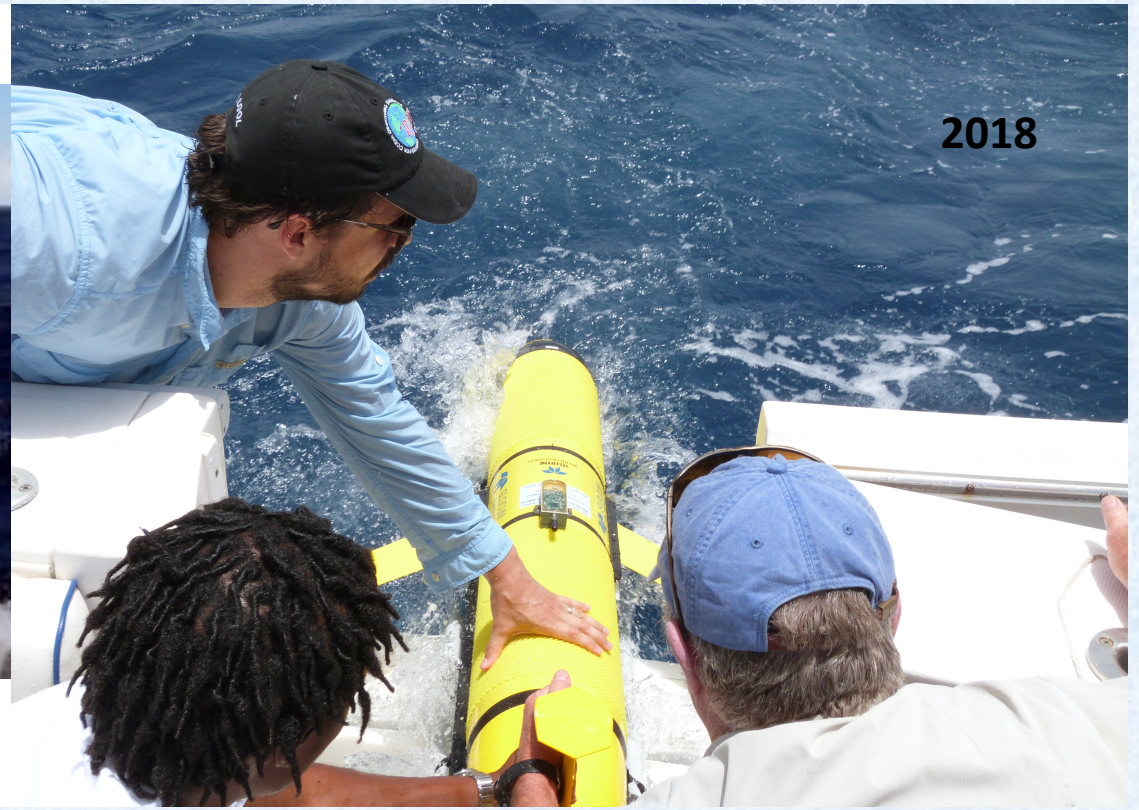
Glider Operations in the US Virgin Islands in 2018

8th EGO Meeting and International Glider Workshop
21 May 2019 Rutgers University NJ USA

Doug Wilson, Roy Watlington — CARICOOS – OCOVI
Travis Miles, Scott Glenn, Maria Aristizabal — Rutgers University



NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

University of the Virgin Islands

IOOS Integrated Ocean Observing System

RUTGERS THE STATE UNIVERSITY OF NEW JERSEY

OCOVI supporting CARICOOS in the Virgin Islands

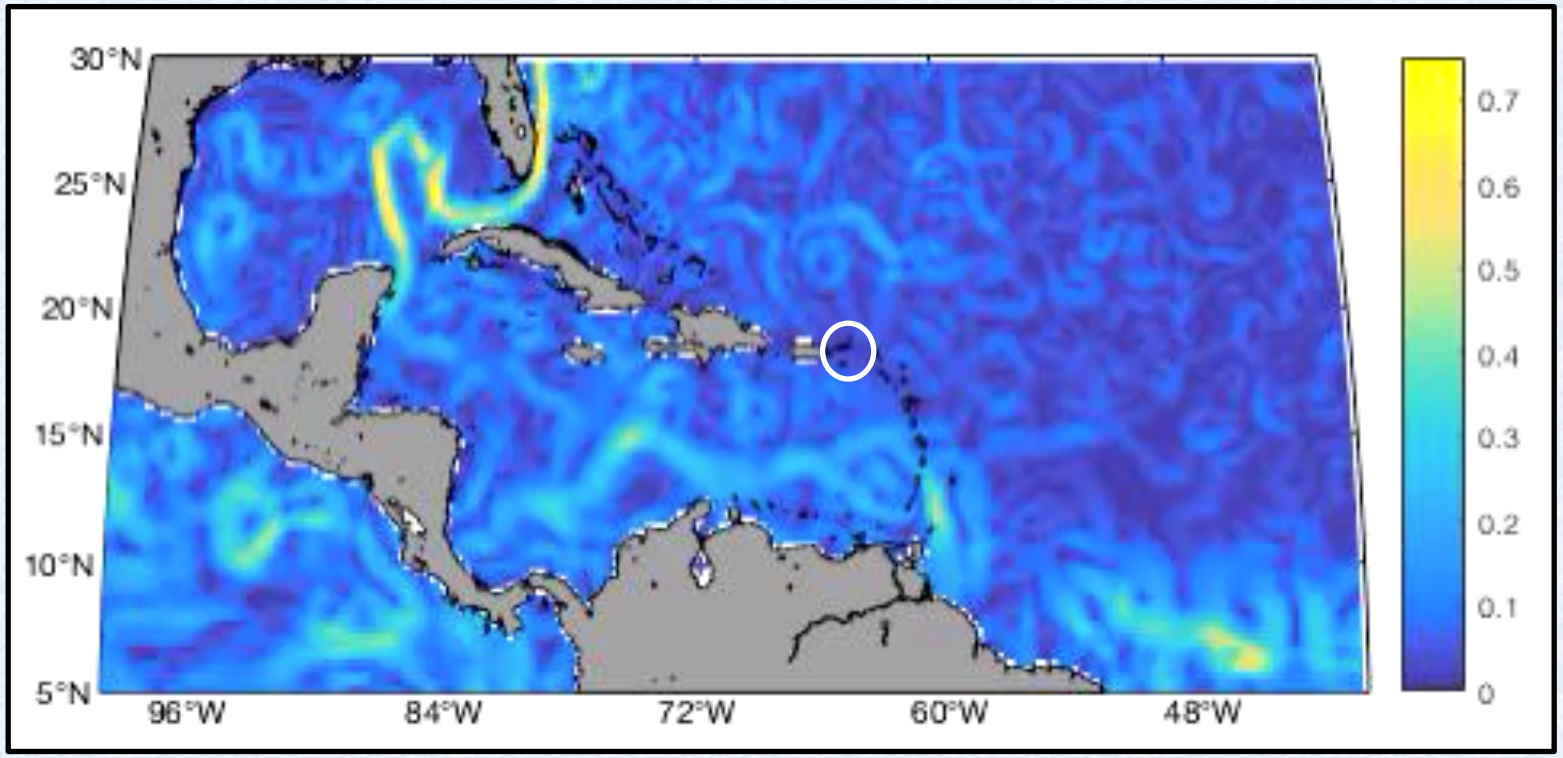
Naval Oceanographic Office

The US Virgin Islands lie in a significant location in the western tropical Atlantic Ocean. The region is:

Total Kinetic Energy from Satellite Altimetry

CMEMS SSALTO/DUACS MULTIMISSION ALTIMETER PRODUCT

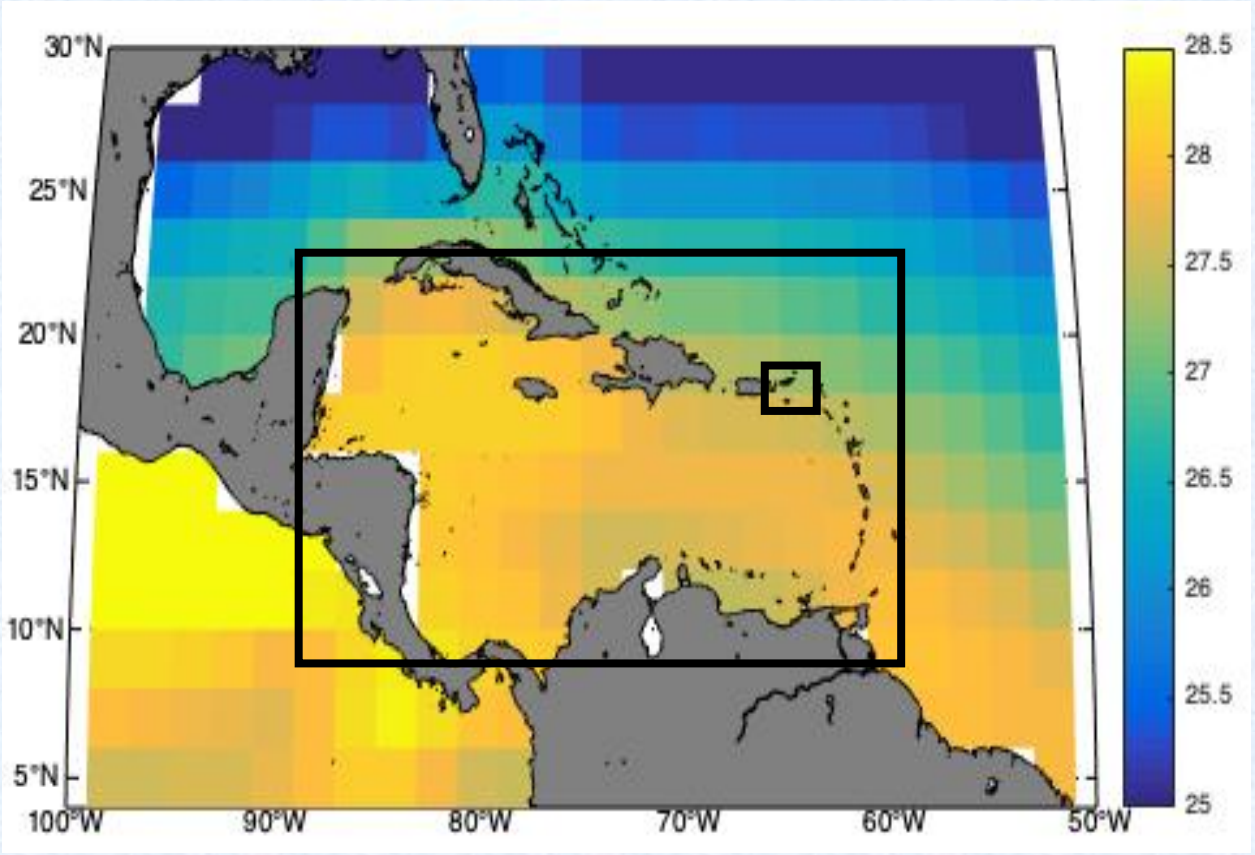
1993-PRESENT WEEKLY AVERAGES ¼ ° GRID



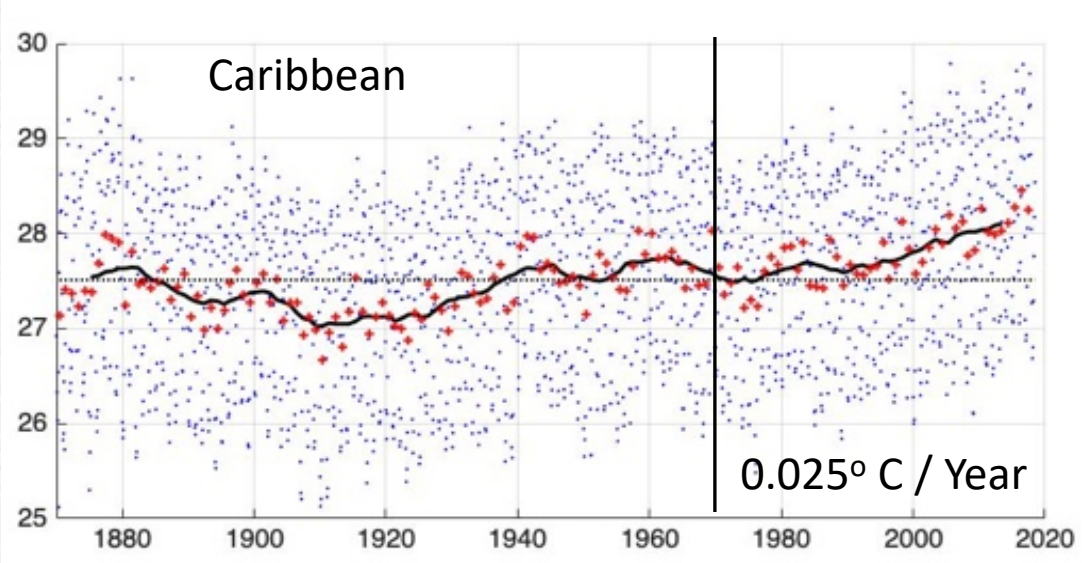
- **Typically included in the Atlantic Warm Pool, with accompanying connections to the Atlantic Multidecadal Oscillation and Atlantic hurricane activity;**
- **The approximate mean boundary between the Subtropical and Tropical Sverdrup gyres driven by the mean North Atlantic wind stress field, and so subject to inflow variability associated with shifts in North Atlantic wind fields and Atlantic Meridional Overturning Circulation strength.**
- **Historically undersampled by upper ocean T-S profiles, and…**
- **…thus potentially improperly represented by climatology in ocean models (particularly relevant in ocean models forcing hurricane forecasts).**

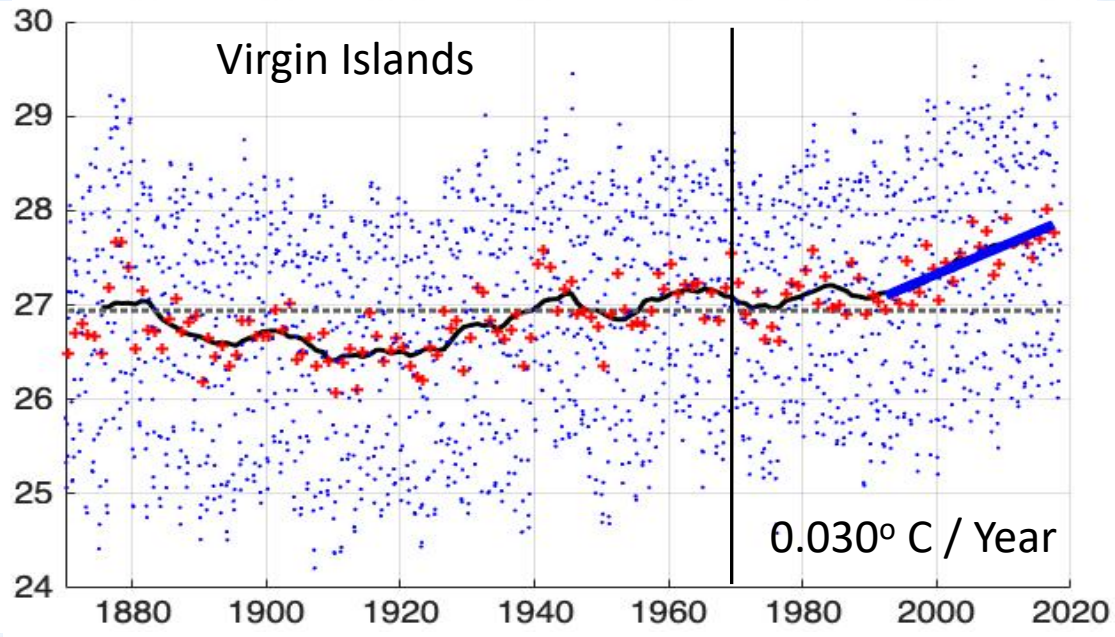
Mean SST

ERSST V4

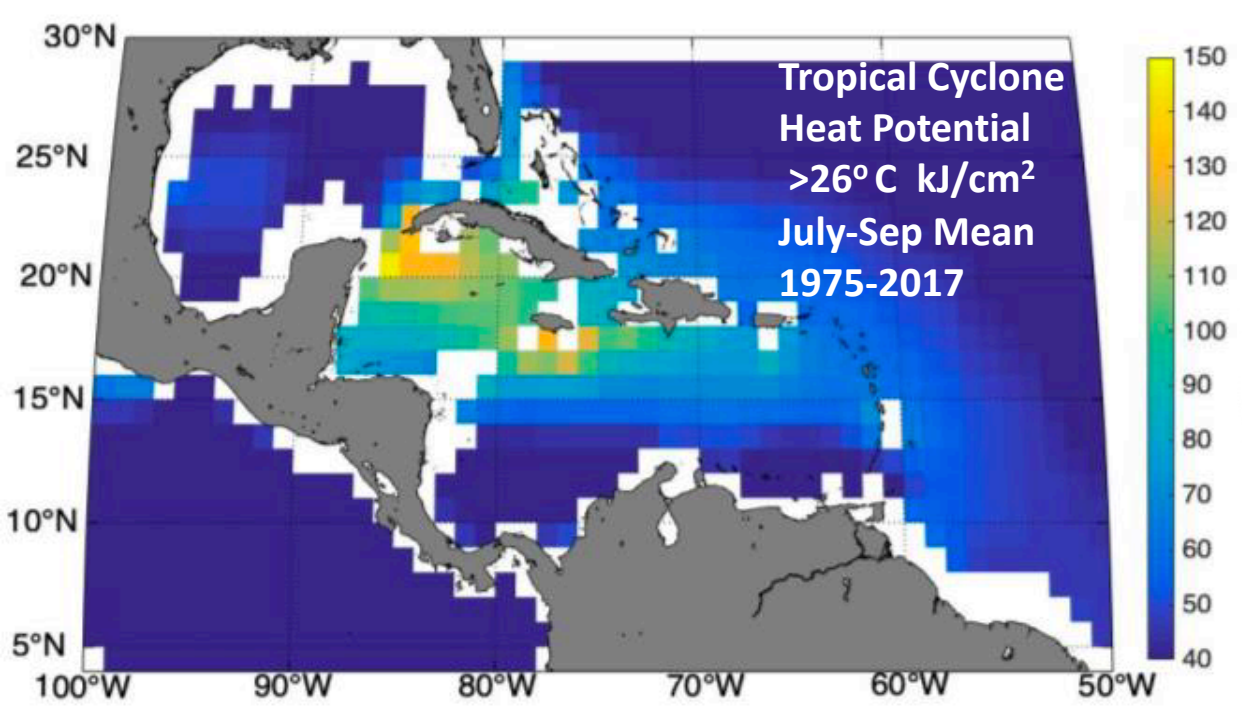


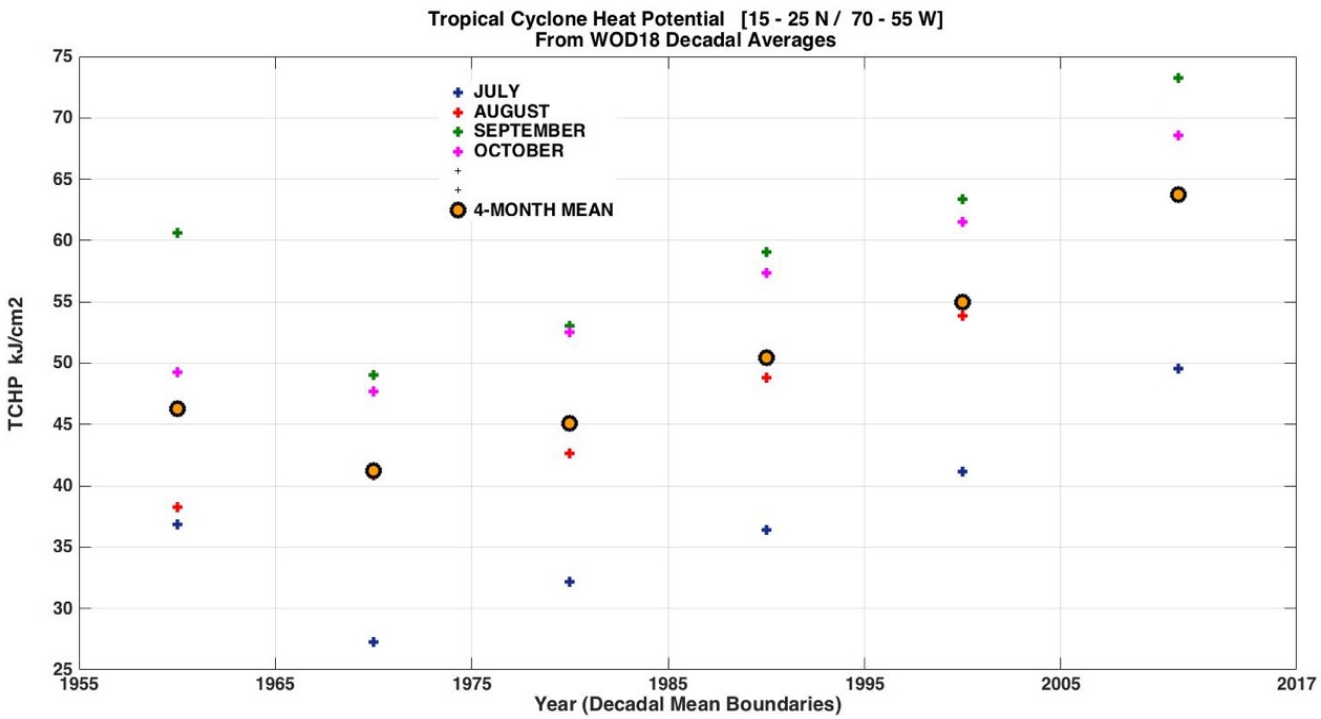
Mean Sea Surface Temperature for the North Atlantic Warm Pool. Based on Extended Reconstructed SST V4 (2 º x 2 º) resolution, monthly means. "Caribbean" (larger) and and "Virgin Islands" regions shown.

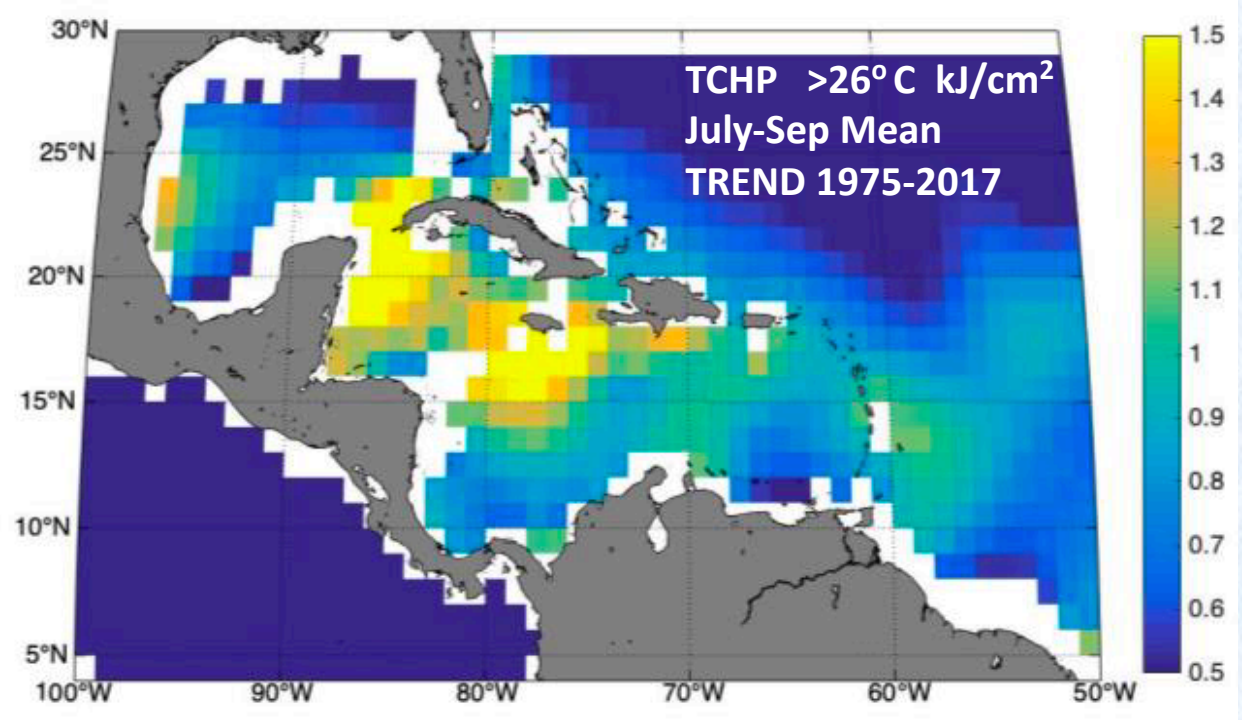


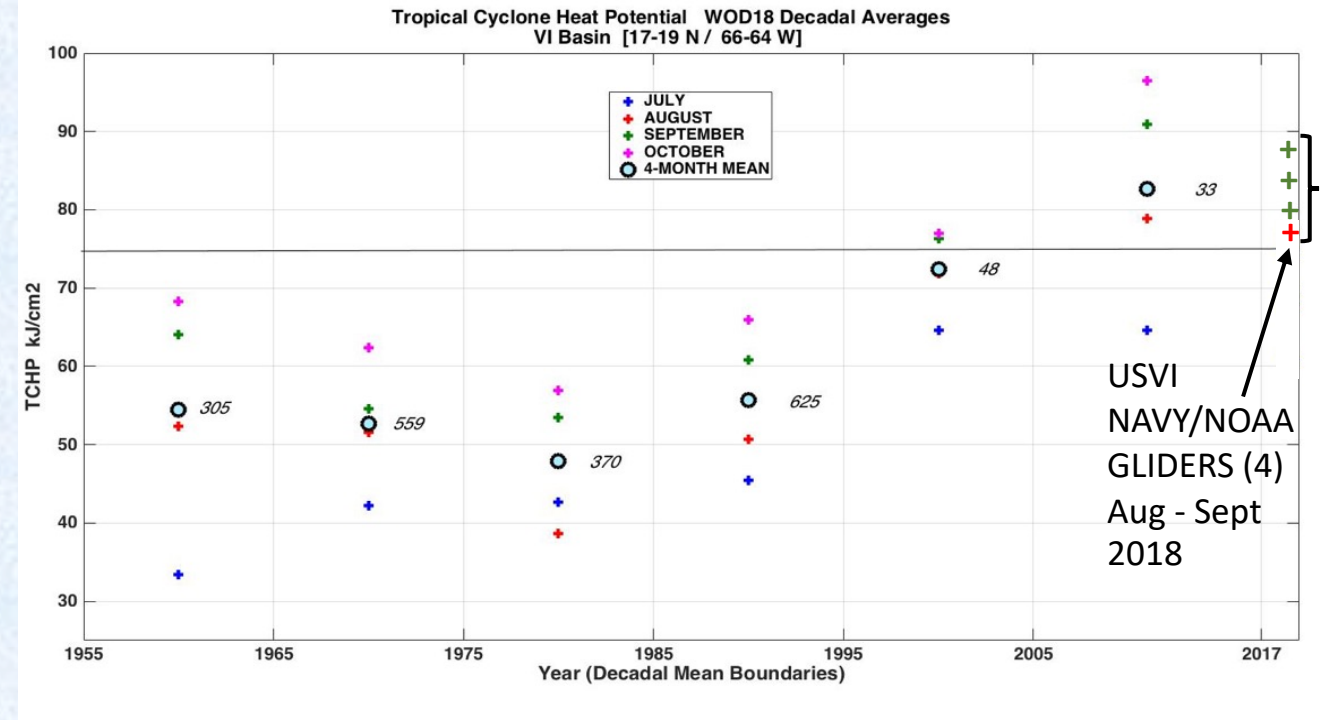


All ERSST V4 monthly mean values, averaged over a) the Caribbean and b) the Virgin Islands regions. Blue line in (b) is linear trend 1992 – 2017 (AMO increasing).

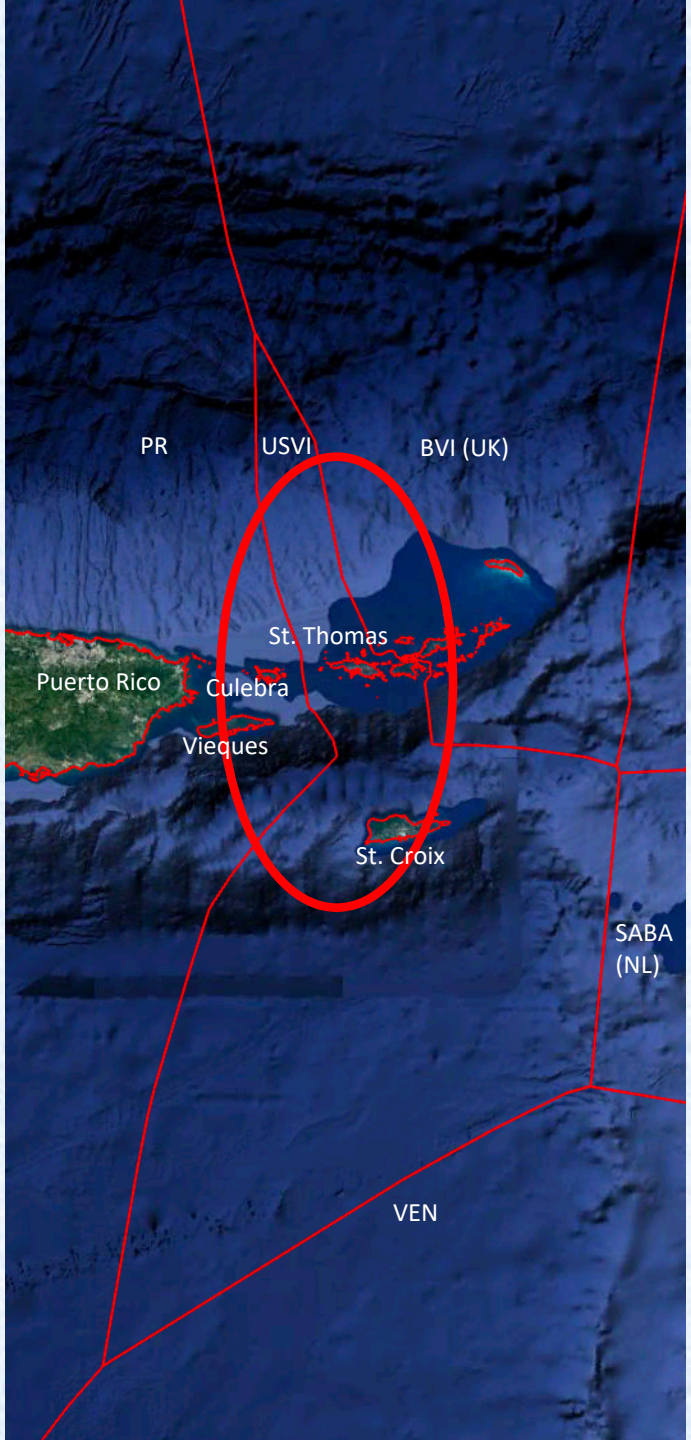

Tropical Cyclone
Heat Potential
>26° C kJ/cm²
July-Sep Mean
1975-2017
30°N
25°N
20°N
15°N
10°N
5°N
100°W
90°W
80°W
70°W
60°W
50°W
150
140
130
120
110
100
90
80
70
60
50
40

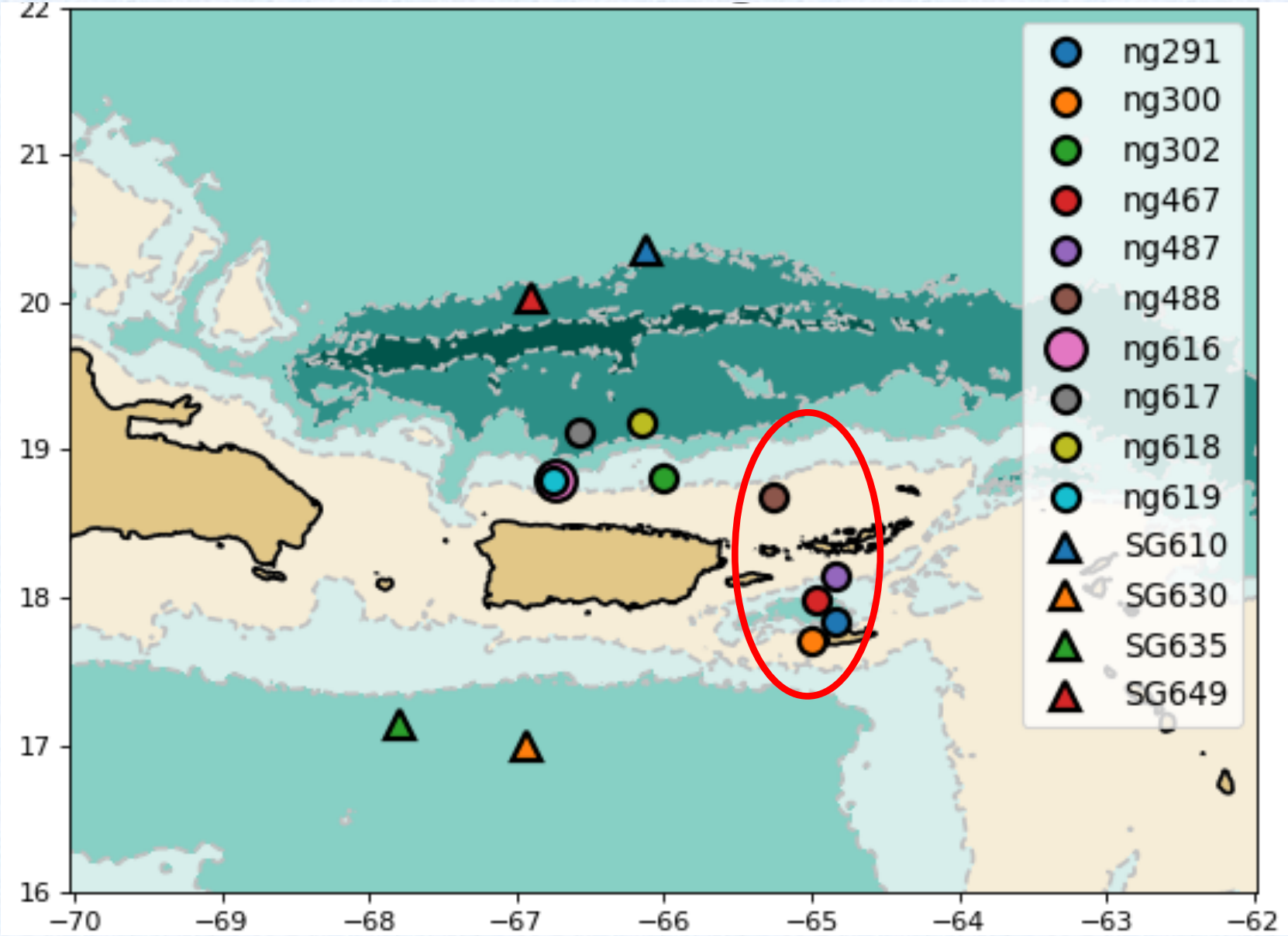

Tropical Cyclone Heat Potential [15 - 25 N / 70 - 55 W]
From WOD18 Decadal Averages
JULY
AUGUST
SEPTEMBER
OCTOBER
4-MONTH MEAN
TCHP kJ/cm2
Year (Decadal Mean Boundaries)
75
70
65
60
55
50
45
40
35
30
25
1955
1965
1975
1985
1995
2005
2017

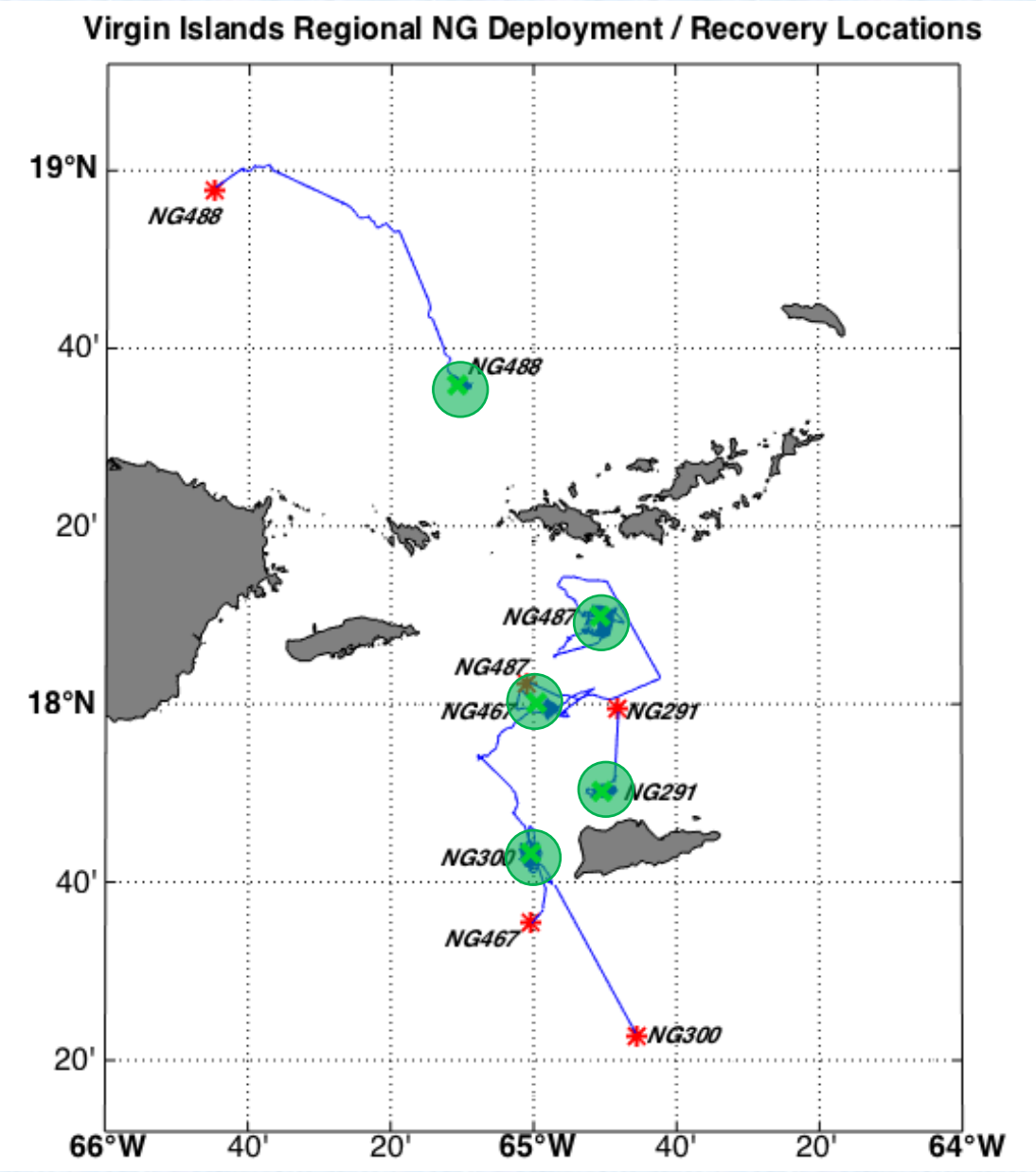

TCHP >26° C kJ/cm²
July-Sep Mean
TREND 1975-2017
30°N
25°N
20°N
15°N
10°N
5°N
100°W
90°W
80°W
70°W
60°W
50°W
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5


Tropical Cyclone Heat Potential WOD18 Decadal Averages
VI Basin [17-19 N / 66-64 W]
JULY
AUGUST
SEPTEMBER
OCTOBER
4-MONTH MEAN
305
559
370
625
48
33
TCHP kJ/cm2
Year (Decadal Mean Boundaries)
100
90
80
70
60
50
40
30
1955
1965
1975
1985
1995
2005
2017
USVI
NAVY/NOAA
GLIDERS (4)
Aug - Sept
2018

ALL NOAA/CARICOOS/NAVY 2018 Deployment Locations
NG=Navy Slocum G2 Gliders SG=AOML SeaGliders

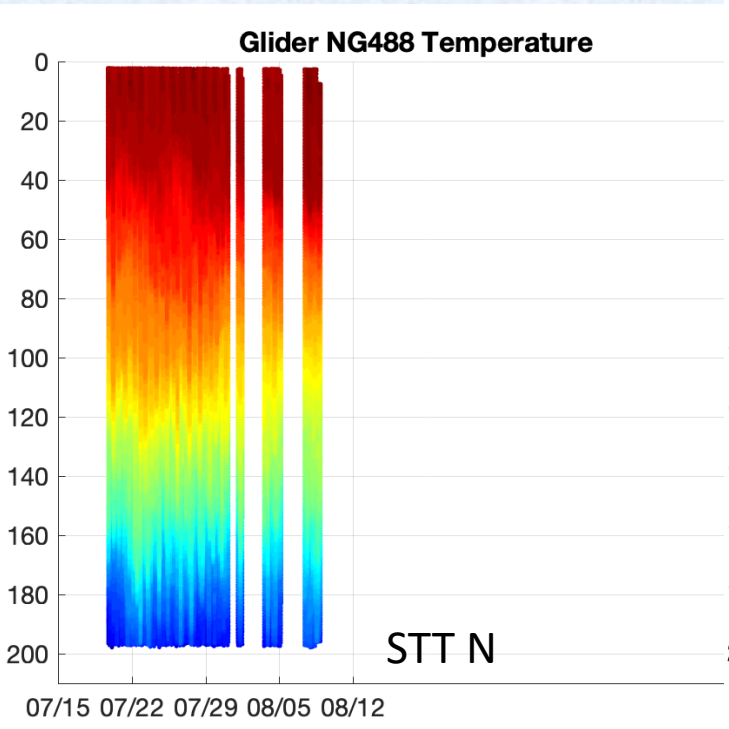


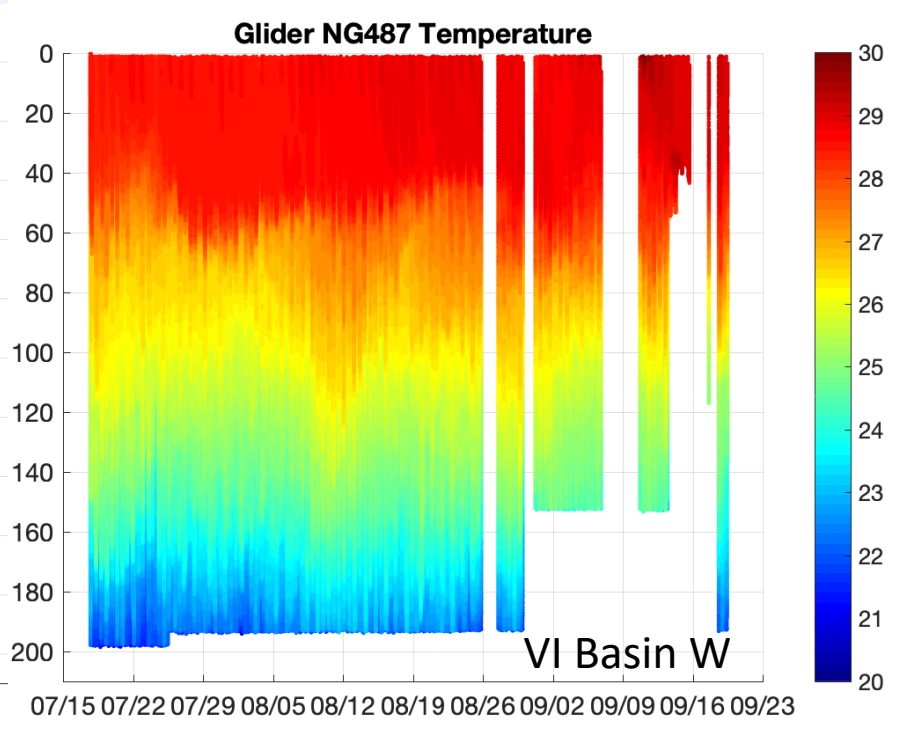


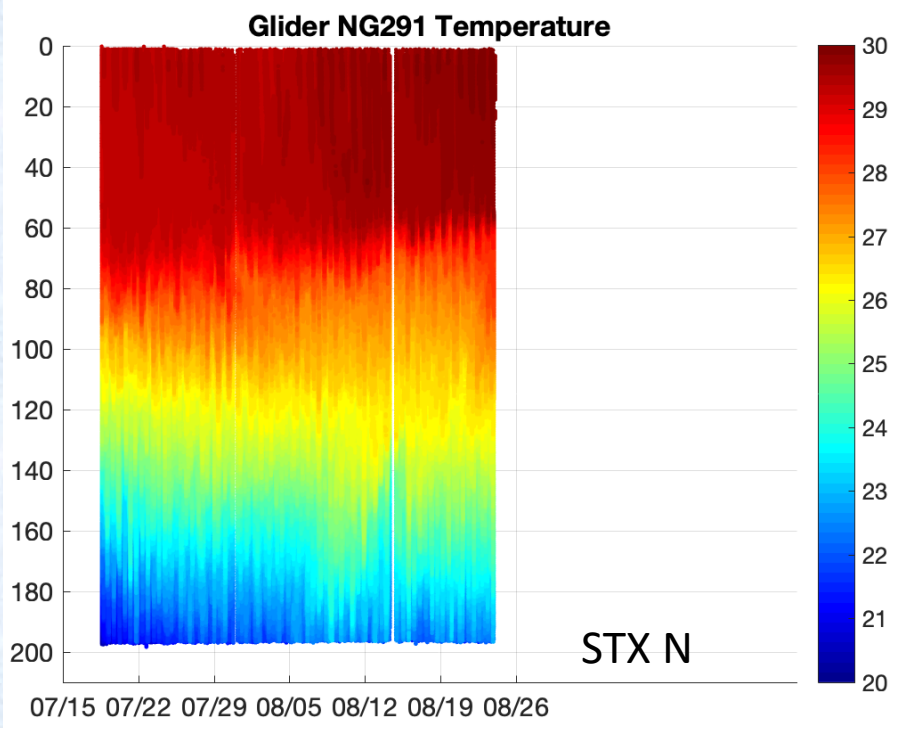


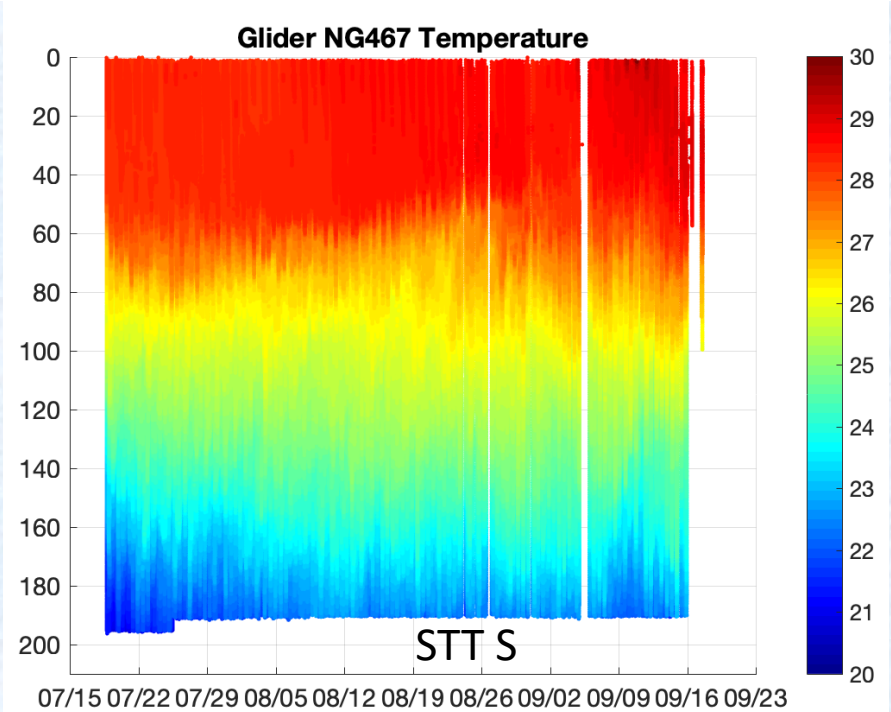
VI Glider Tracklines

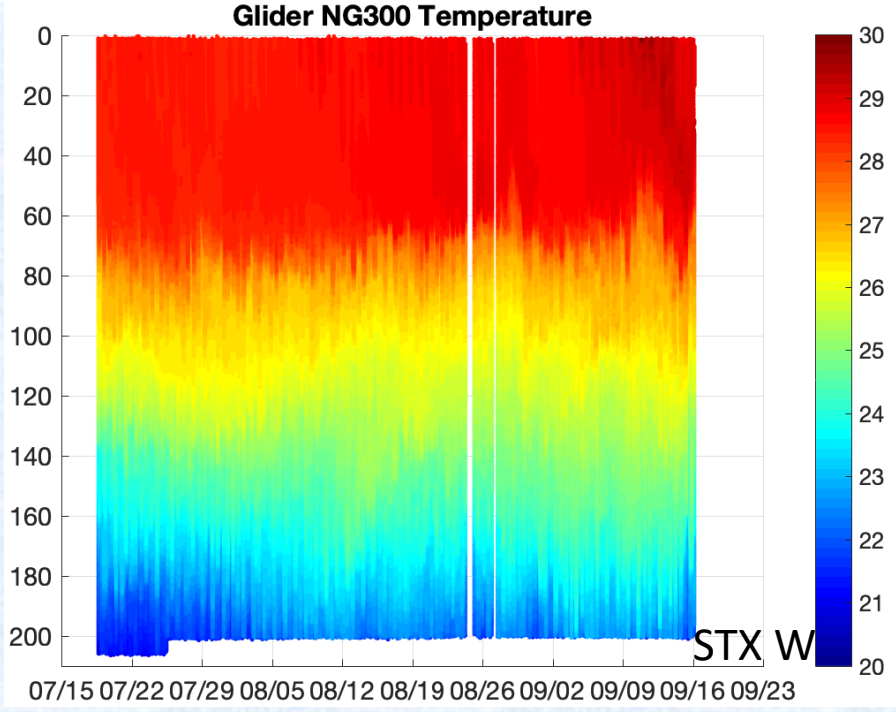
- Glider ID:
  - NG488-STT North 22 d 958 prof
  - NG487-STT South 64 d 3097 prof
  - NG467-VI Basin West 61 d 2840 prof
  - NG291-STX North 42 d 1965 prof
  - NG300-STX West 61 d 2961 prof
- Green X = Glider Deployment Site
- Red * = Glider Recovery Site
- Total profiles in USVI = 11,821

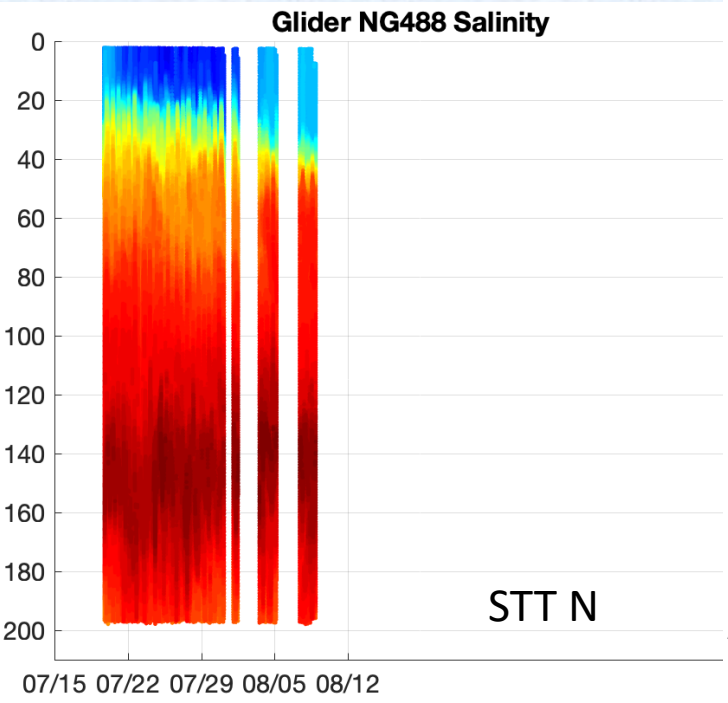

Glider NG488 Temperature
0
20
40
60
80
100
120
140
160
180
200
STT N
07/15 07/22 07/29 08/05 08/12

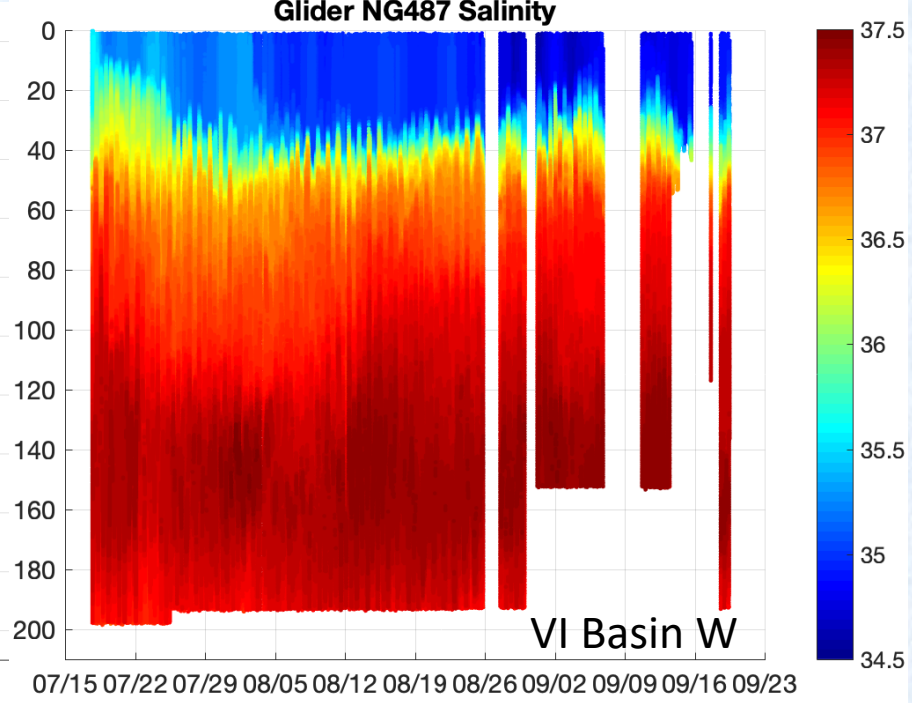

Glider NG487 Temperature
0
20
40
60
80
100
120
140
160
180
200
VI Basin W
07/15 07/22 07/29 08/05 08/12 08/19 08/26 09/02 09/09 09/16 09/23
30
29
28
27
26
25
24
23
22
21
20

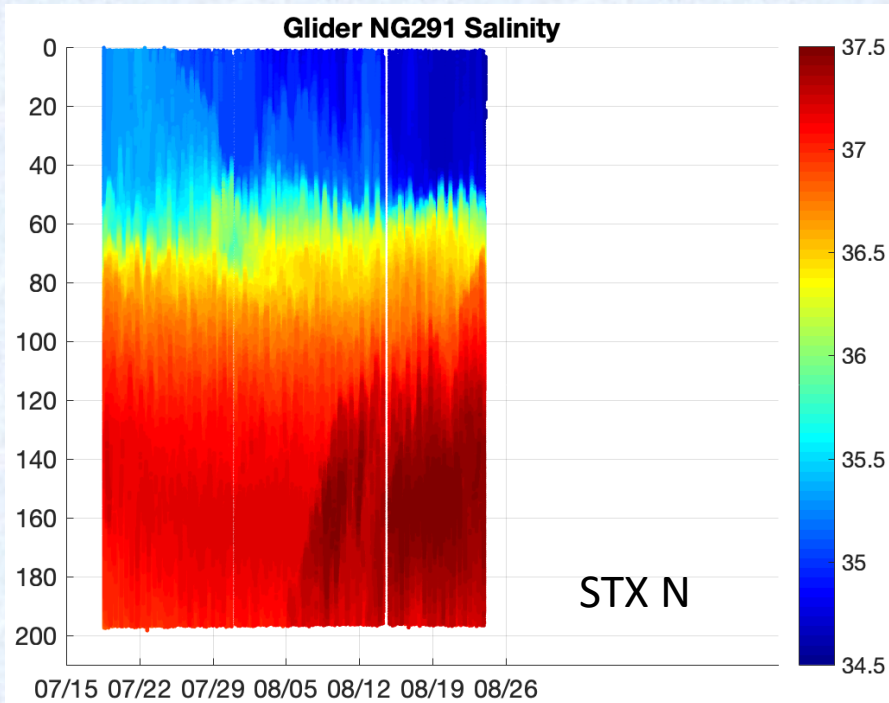

Glider NG291 Temperature
0
20
40
60
80
100
120
140
160
180
200
STX N
07/15 07/22 07/29 08/05 08/12 08/19 08/26
30
29
28
27
26
25
24
23
22
21
20

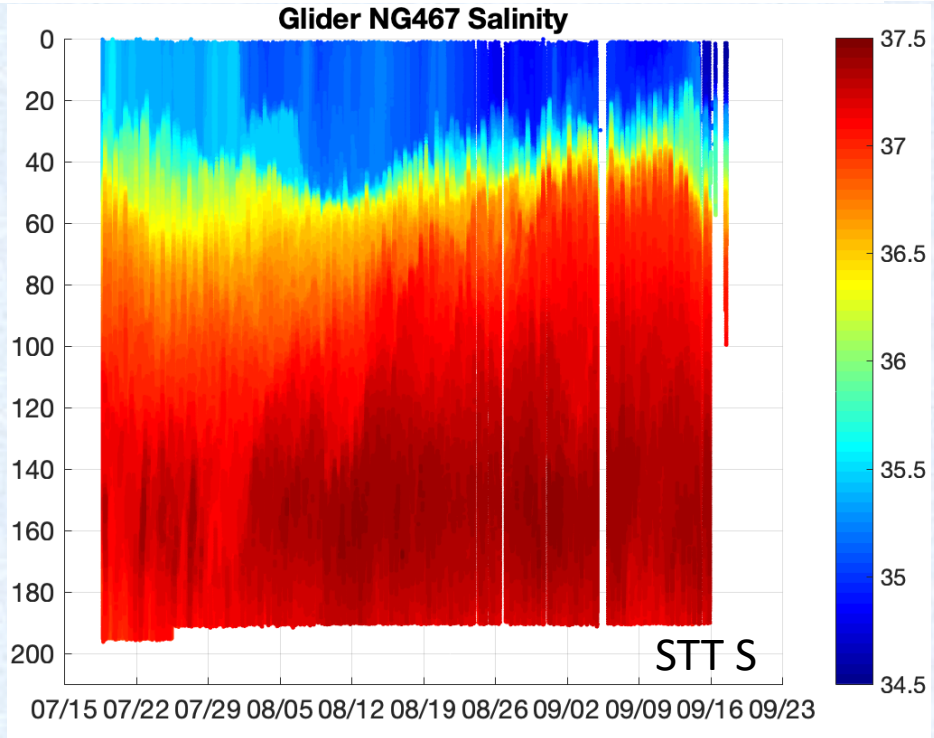

Glider NG467 Temperature
0
20
40
60
80
100
120
140
160
180
200
STT S
07/15 07/22 07/29 08/05 08/12 08/19 08/26 09/02 09/09 09/16 09/23
30
29
28
27
26
25
24
23
22
21
20

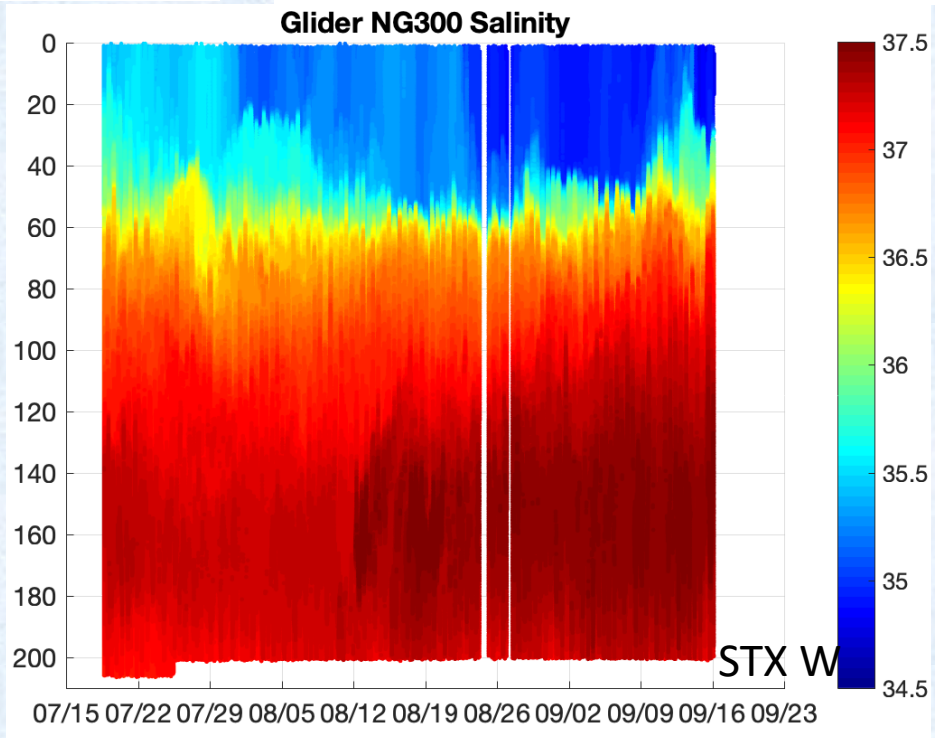

Glider NG300 Temperature
0
20
40
60
80
100
120
140
160
180
200
STX W
07/15 07/22 07/29 08/05 08/12 08/19 08/26 09/02 09/09 09/16 09/23
30
29
28
27
26
25
24
23
22
21
20

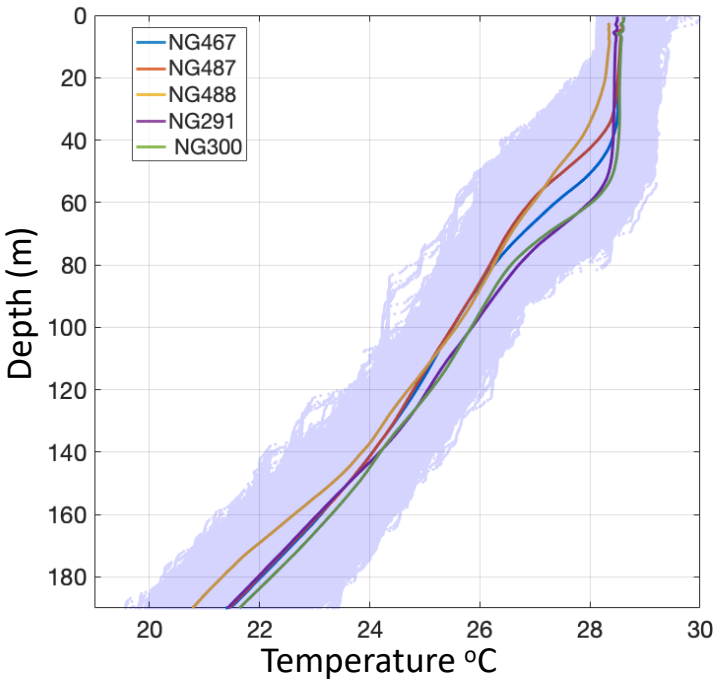

Glider NG488 Salinity
0
20
40
60
80
100
120
140
160
180
200
07/15 07/22 07/29 08/05 08/12
STT N

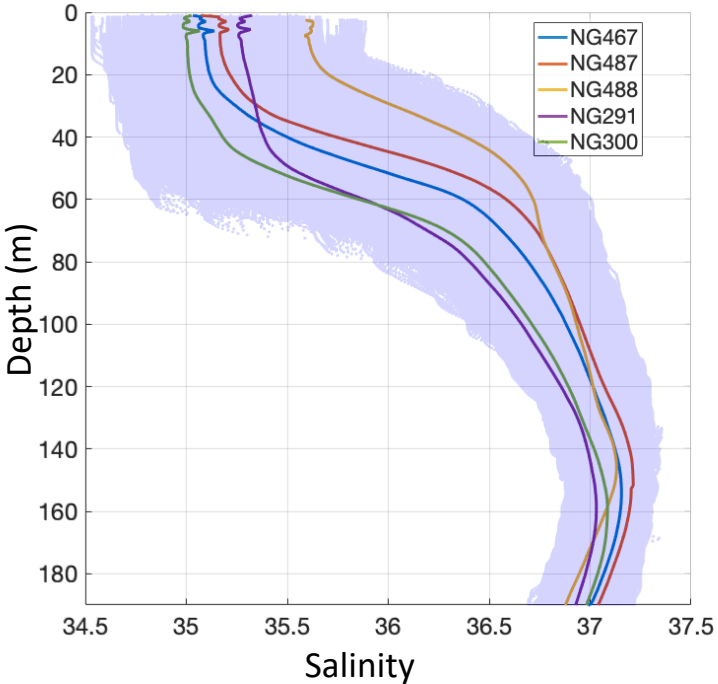

Glider NG487 Salinity
0
20
40
60
80
100
120
140
160
180
200
07/15 07/22 07/29 08/05 08/12 08/19 08/26 09/02 09/09 09/16 09/23
VI Basin W
37.5
37
36.5
36
35.5
35
34.5

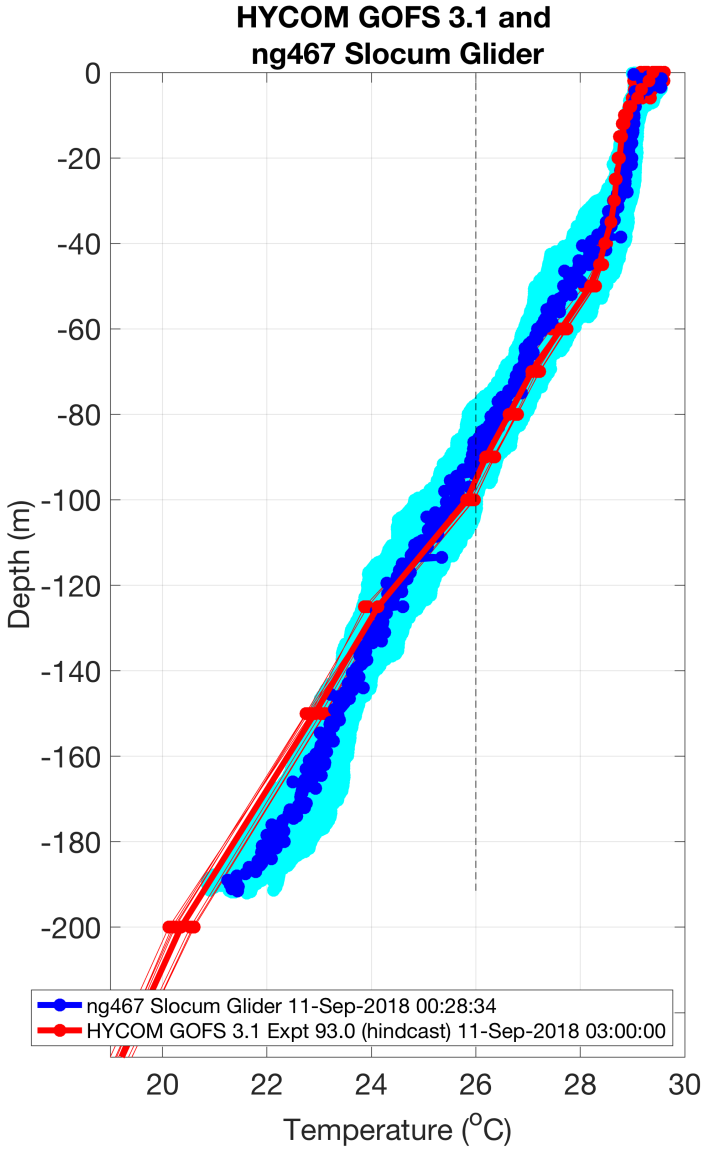

Glider NG291 Salinity
0
20
40
60
80
100
120
140
160
180
200
07/15 07/22 07/29 08/05 08/12 08/19 08/26
STX N
37.5
37
36.5
36
35.5
35
34.5

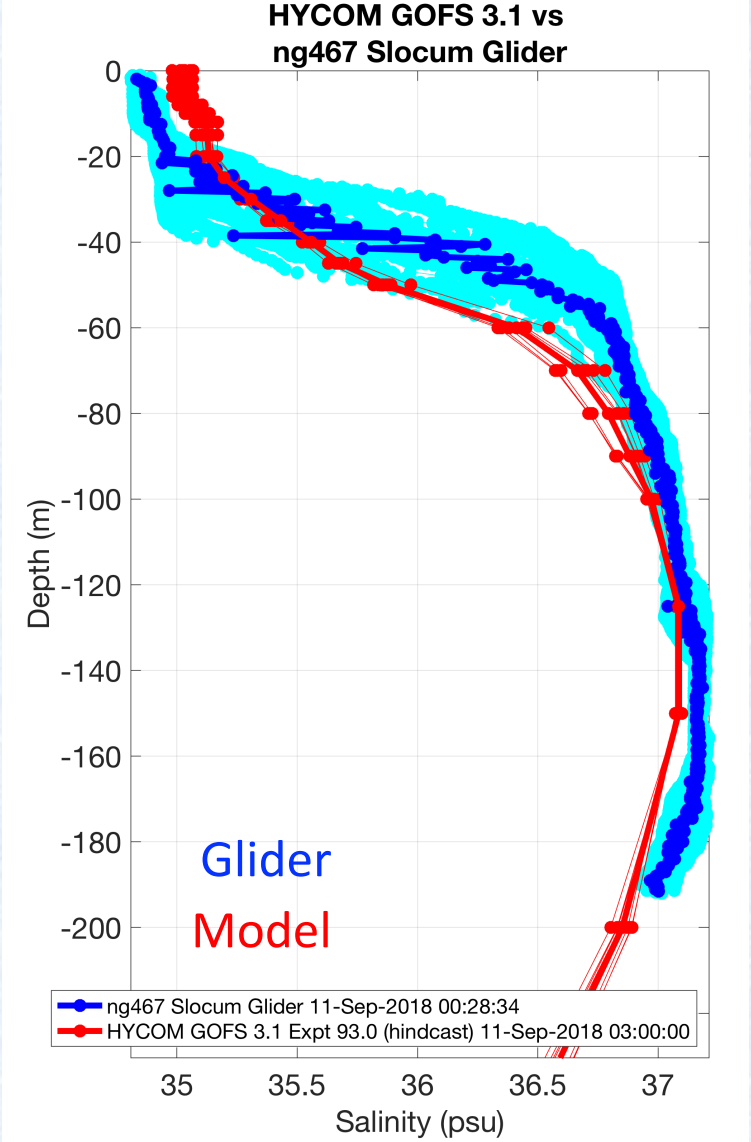

Glider NG467 Salinity
0
20
40
60
80
100
120
140
160
180
200
07/15 07/22 07/29 08/05 08/12 08/19 08/26 09/02 09/09 09/16 09/23
STT S
37.5
37
36.5
36
35.5
35
34.5


Glider NG300 Salinity
0
20
40
60
80
100
120
140
160
180
200
07/15 07/22 07/29 08/05 08/12 08/19 08/26 09/02 09/09 09/16 09/23
STX W
37.5
37
36.5
36
35.5
35
34.5

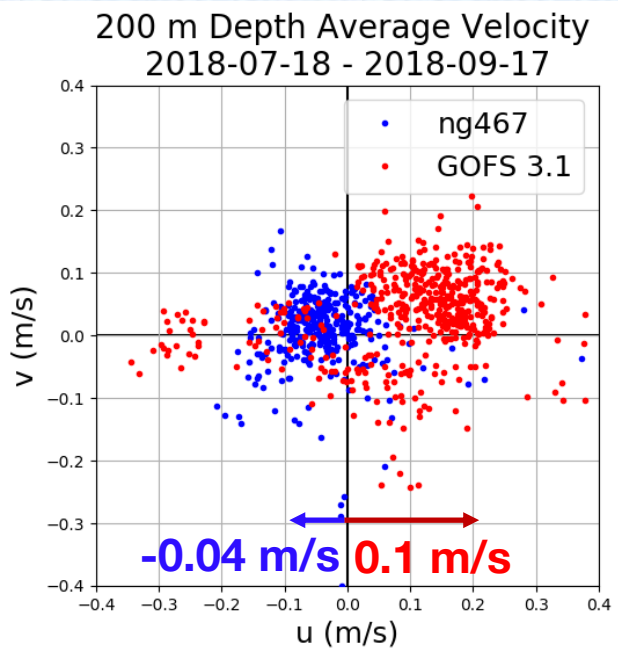

NG467
NG487
NG488
NG291
NG300
Depth (m)
Temperature °C

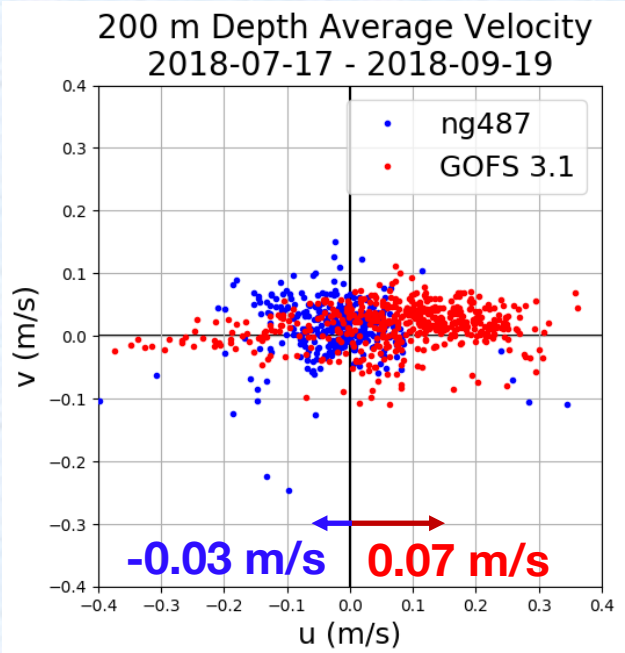

NG467
NG487
NG488
NG291
NG300
Depth (m)
Salinity

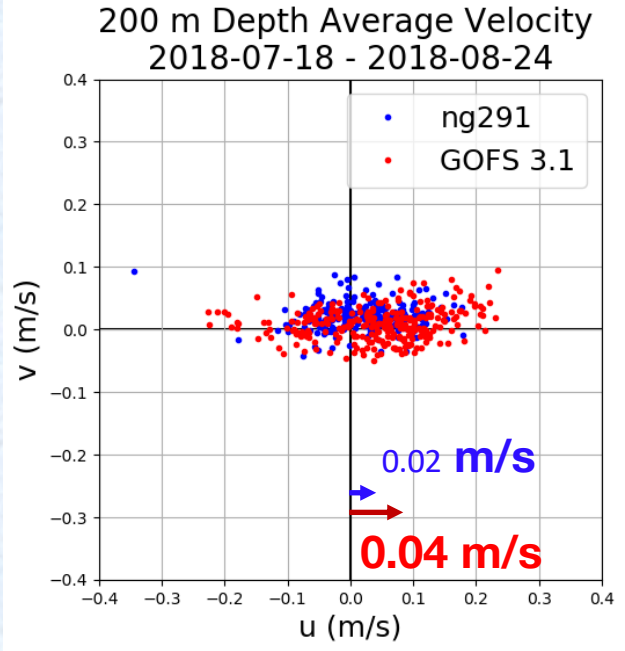

HYCOM GOFS 3.1 and
ng467 Slocum Glider
Depth (m)
ng467 Slocum Glider 11-Sep-2018 00:28:34
HYCOM GOFS 3.1 Expt 93.0 (hindcast) 11-Sep-2018 03:00:00
Temperature (°C)

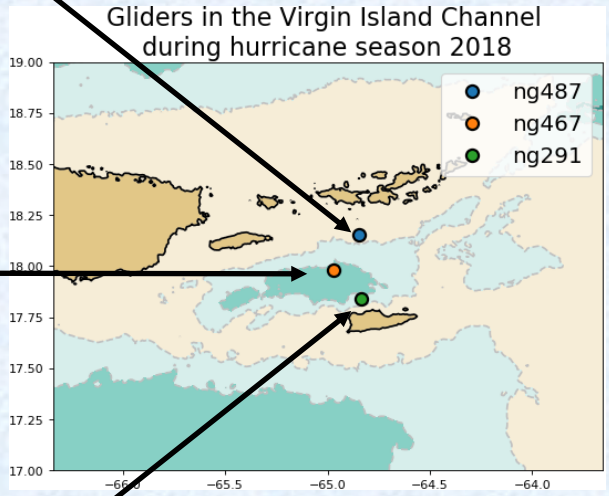

HYCOM GOFS 3.1 vs
ng467 Slocum Glider
Depth (m)
Glider
Model
ng467 Slocum Glider 11-Sep-2018 00:28:34
HYCOM GOFS 3.1 Expt 93.0 (hindcast) 11-Sep-2018 03:00:00
Salinity (psu)

Caribbean: 200 M Depth Average Velocity 18 July -17 Sep

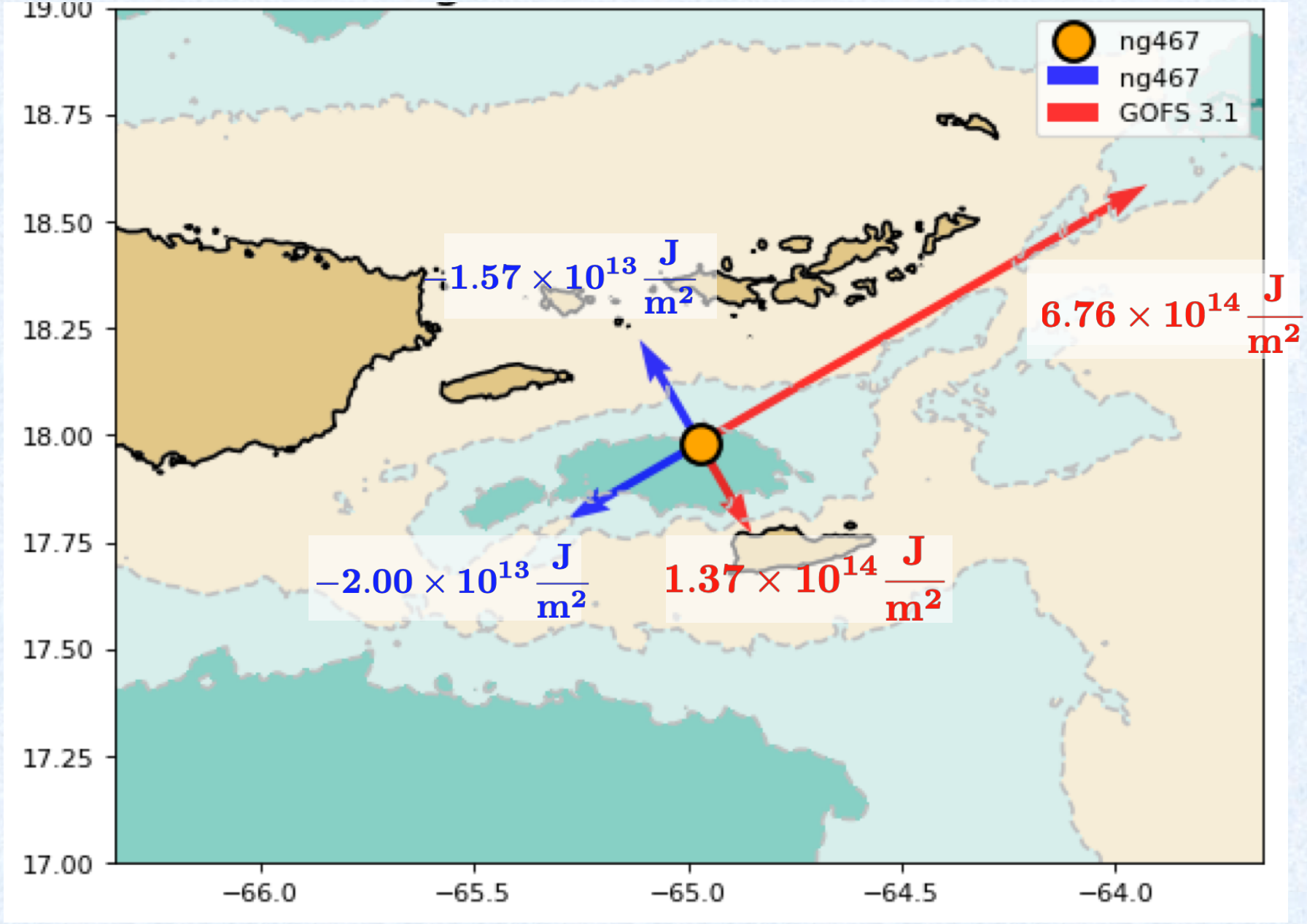






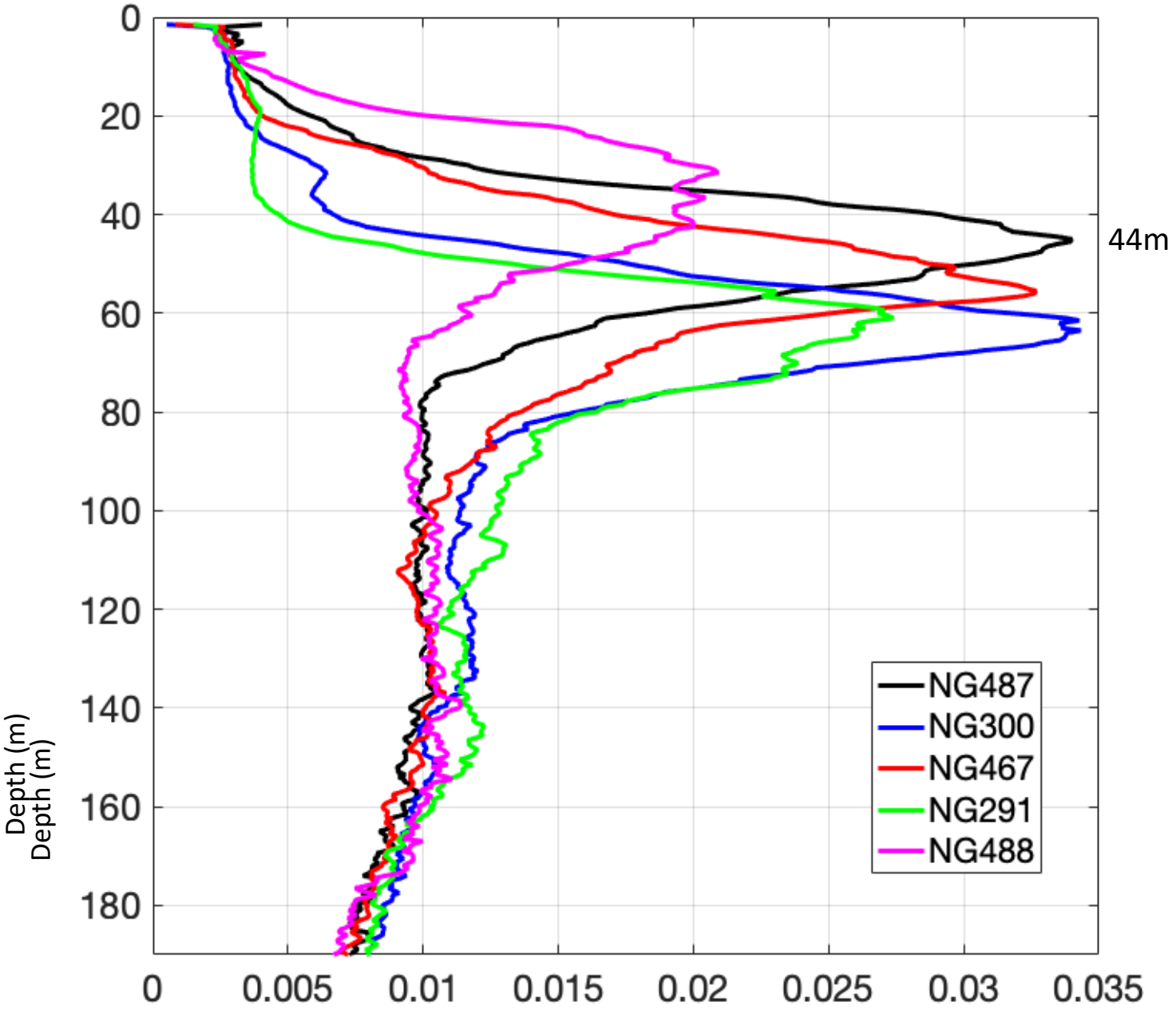


Cumulative Depth Averaged Heat Transport



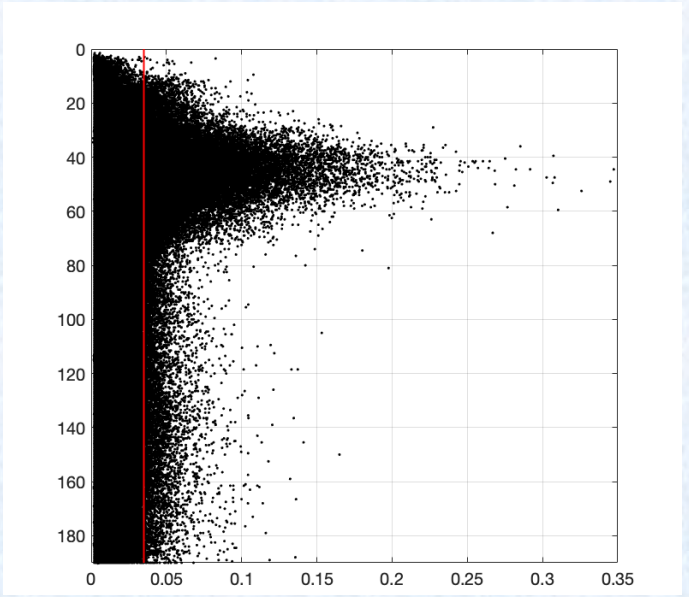
Supported more broadly by thermal wind calculations…

Mean Density Gradient kg/m^4

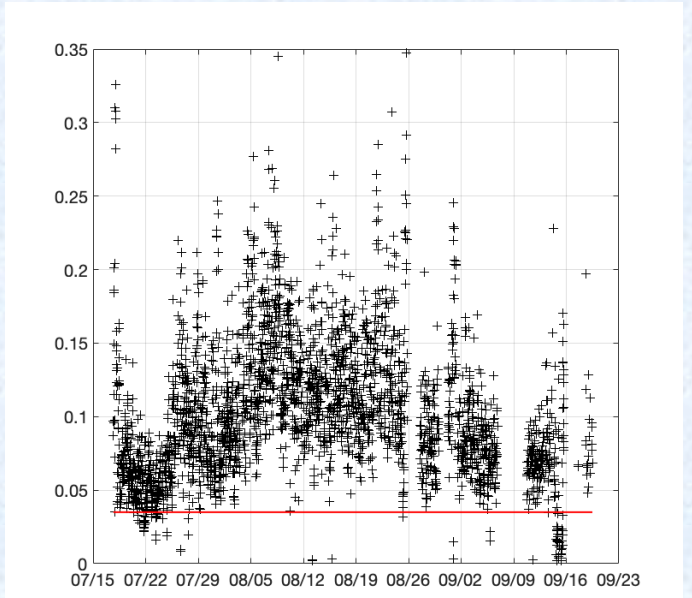


44m

NG487 Density Gradient
All Profiles kg/m^4



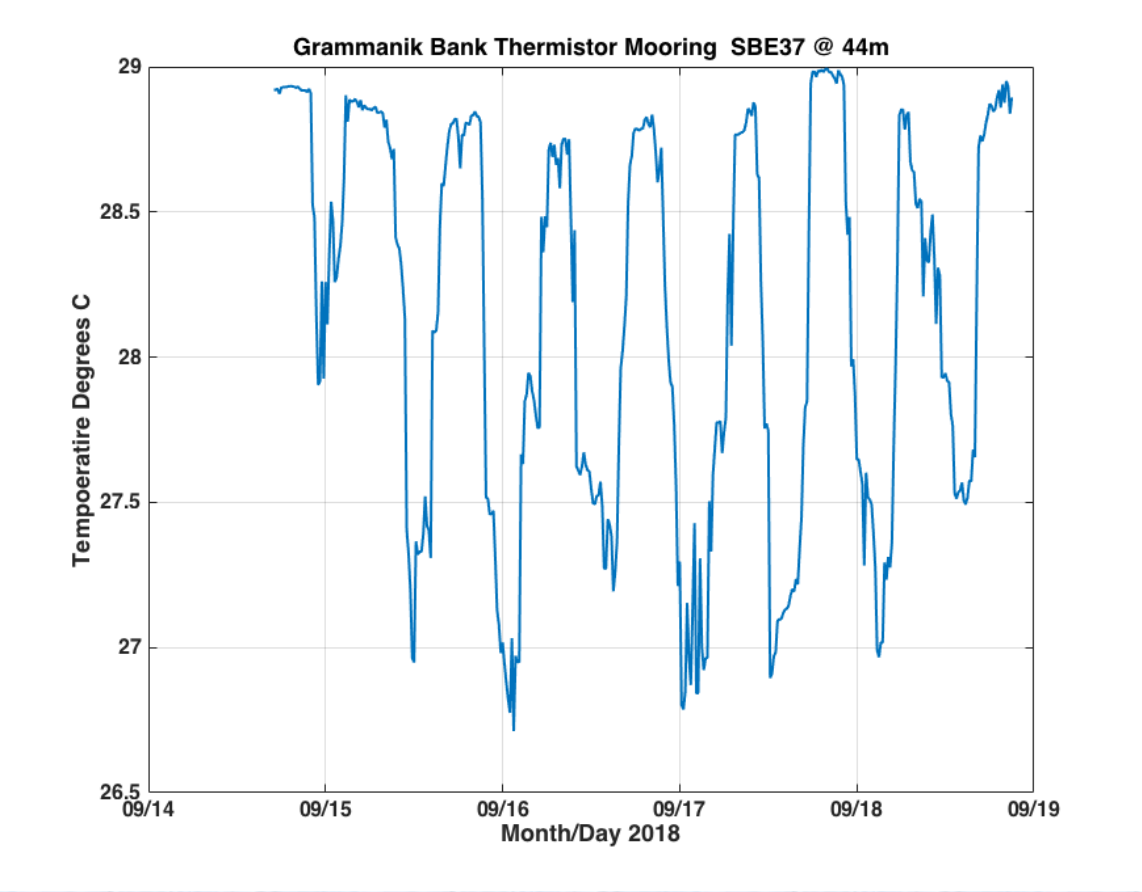
NG487 Density Gradient @Max value
All Profiles kg/m^4

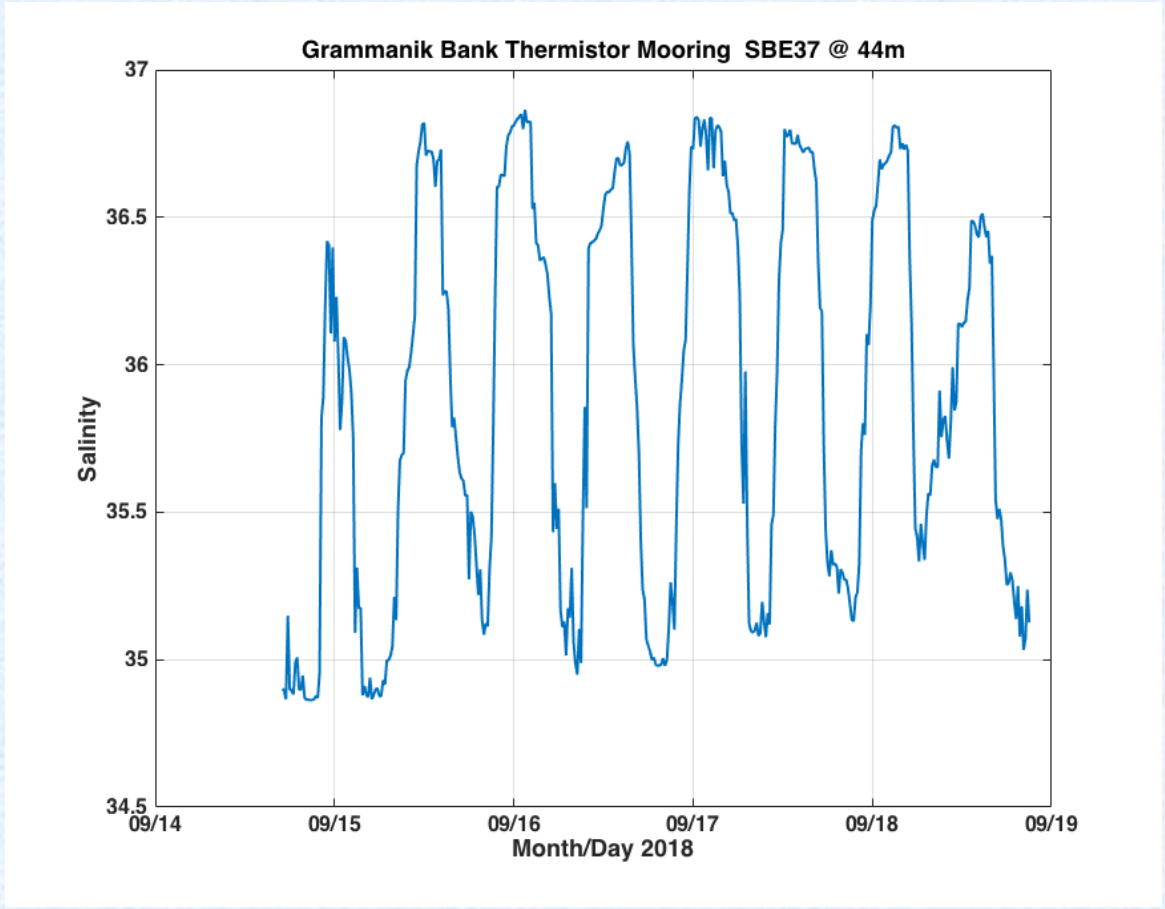


Grammanik Bank Inductive Thermistor String

Ongoing Research Project on Coral Reefs and Fish Spawning

UVI EPSCoR– CARICOOS – Caribbean Wind



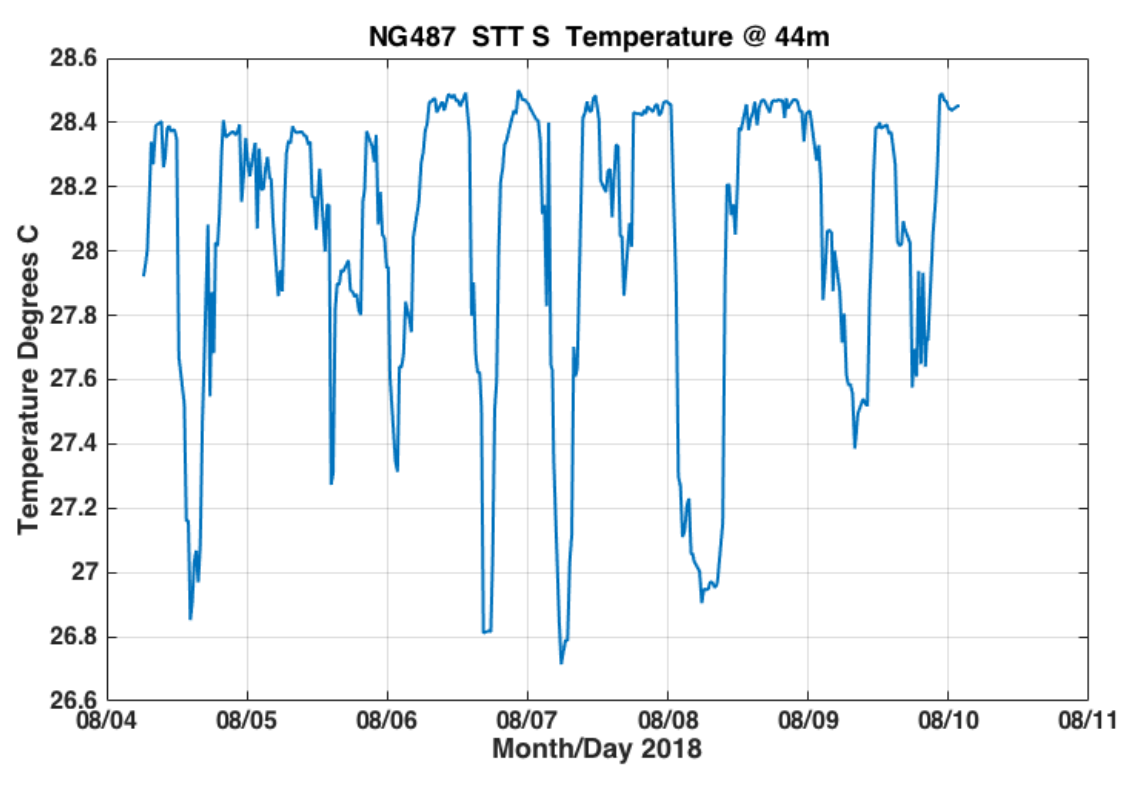


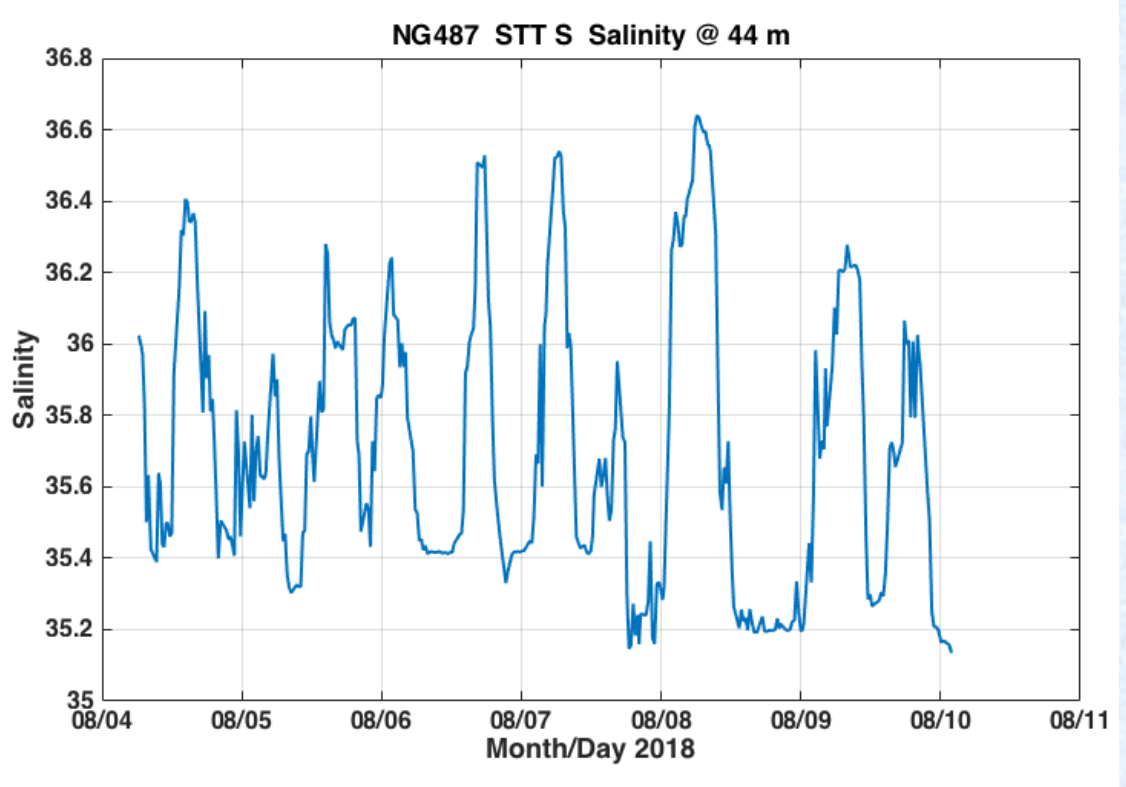
Typical 5-day sample shows strong semidiurnal T-S variability at 44 m at shelf break

Grammanik Bank Inductive Thermistor String

Ongoing Research Project on Coral Reefs and Fish Spawning

UVI EPSCoR– CARICOOS – Caribbean Wind





Contemporaneous glider profile data (NG487, just south of St Thomas and Grammanik Bank shelf break, shows strong semidiurnal internal tides (shown here at 44 m, density gradient maximum and depth at shelf break.

VI Glider Deployment Participants

- CARICOOS OCO-VI
  - Roy Watlington
  - W. Douglas Wilson
- Rutgers University
  - Travis Miles
  - Scott Glenn
- NAVOCEANO
  - GOC, Stennis SC MS
- NOAA IOOS
- IOOS Glider DAC
- University of the Virgin Islands
  - Paul Jobsis
  - Sennai Habtes
  - Vanessa McKague
  - Marc Boumedine
  - Student Interns (8)
- Capt. Matt Driscoll
  - *Double Header*
  - *Family Ties*
- Capt. Benjy Schwartz
  - *Morgan II*