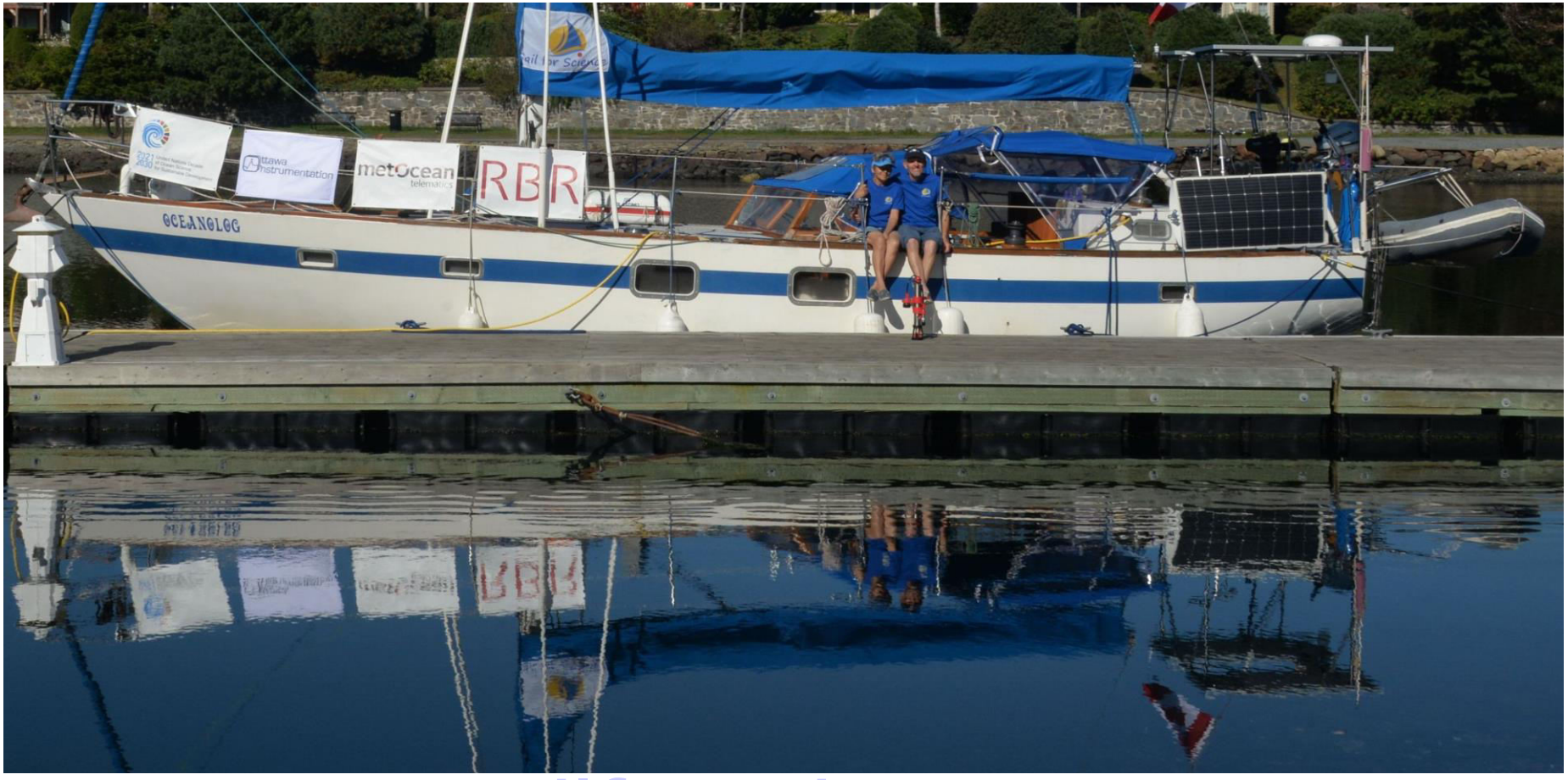
Sail for Science

How Sailors Can Help Science Collect Oceanographic Data

Igor Shkvorets

Presentation in the Shelter Bay Marina, 19 May, 2025

Non-profit project “Sail for Science”



www.sailforscience.com

Our mission:

1. Collecting low-cost high-quality oceanographic data using a sailboat, providing Quality Control (QC) and submitting these data to the World Ocean Database (WOD).

2. Developing a methodology for cruising sailors on how to use CTD measuring systems to collect oceanographic data.

The activity of the Sail for Science project was endorsed by the UN Decade of Ocean Science for Sustainable Development

SV Oceanolog

Built: 1964 by the Cheoy Lee Shipyard, Hong Kong
Design: Gulf 40 by William Garden
Rig: Long-keeled Bermuda sloop
Length: 40 feet
Breadth: 11.2 feet
Draft: 6 feet 3 Inches
Waterline Length: 35 feet
Weight: 12.66 tons gross, 9.66 net tons
Engine: Perkins 4.108 diesel
Accommodation: Sleeps 6 in three cabins.

Our Path from Ottawa to the Caribbean
July 2023 – May 2025

- 6790 nautical miles passed
- 250 CTD casts and moorings performed
- 80MB of data collected
- 1 ARGO float deployed
- Hurricane Beryl surveyed

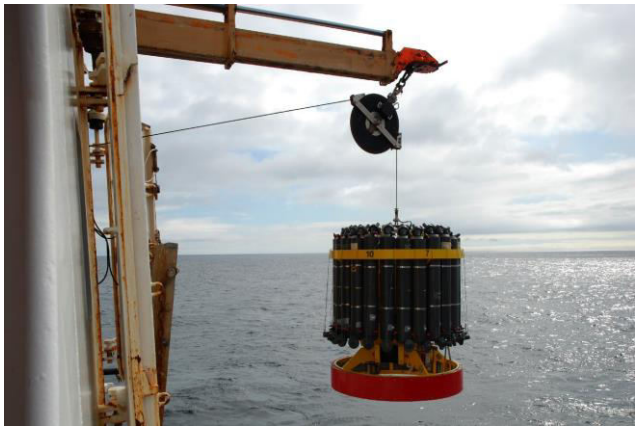
Why collecting Temperature and Salinity data in Oceanography is important?

Collecting temperature and salinity data in oceanography is important for several reasons:

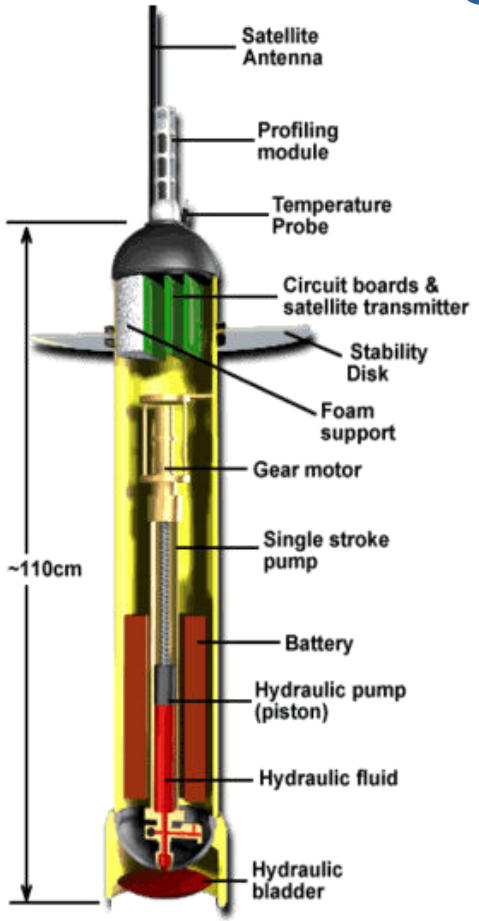
- **Understanding ocean circulation**: Temperature and salinity play a key role in determining the density of seawater, which affects ocean circulation patterns. Oceanographers can use these parameters to track the movement of water masses and understand how they are transported around the Oceans.
- **Studying climate change**: Temperature and salinity data can provide valuable information about how the world's oceans are changing over time. Changes in these parameters can affect the ocean's ability to absorb and transport heat, which can have significant impacts on climate patterns.
- **Monitoring marine ecosystems**: Many marine organisms are sensitive to changes in temperature and salinity, and these parameters can provide important information about the health of marine ecosystems. For example, changes in ocean temperature can affect the growth and distribution of phytoplankton, which form the base of the marine food web.
- **Improving weather forecasts**: Ocean temperature and salinity data are used to develop computer models that predict weather patterns and ocean conditions. Accurate data is essential for making these models as precise as possible.

In summary, collecting temperature and salinity data is essential for understanding the complex processes that govern the world's oceans and for predicting how they will change in the future.

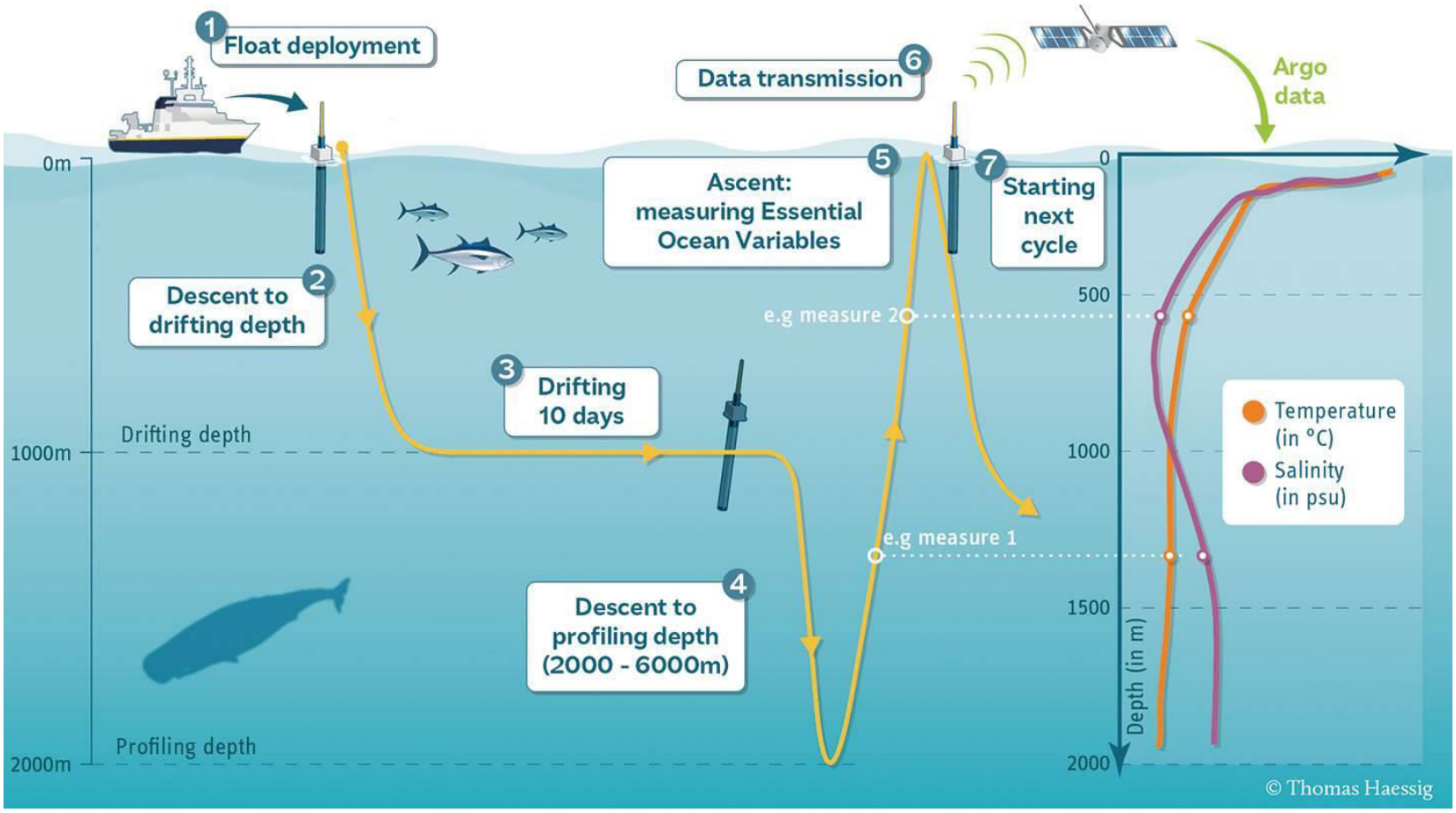
Research vessels with CTD-systems



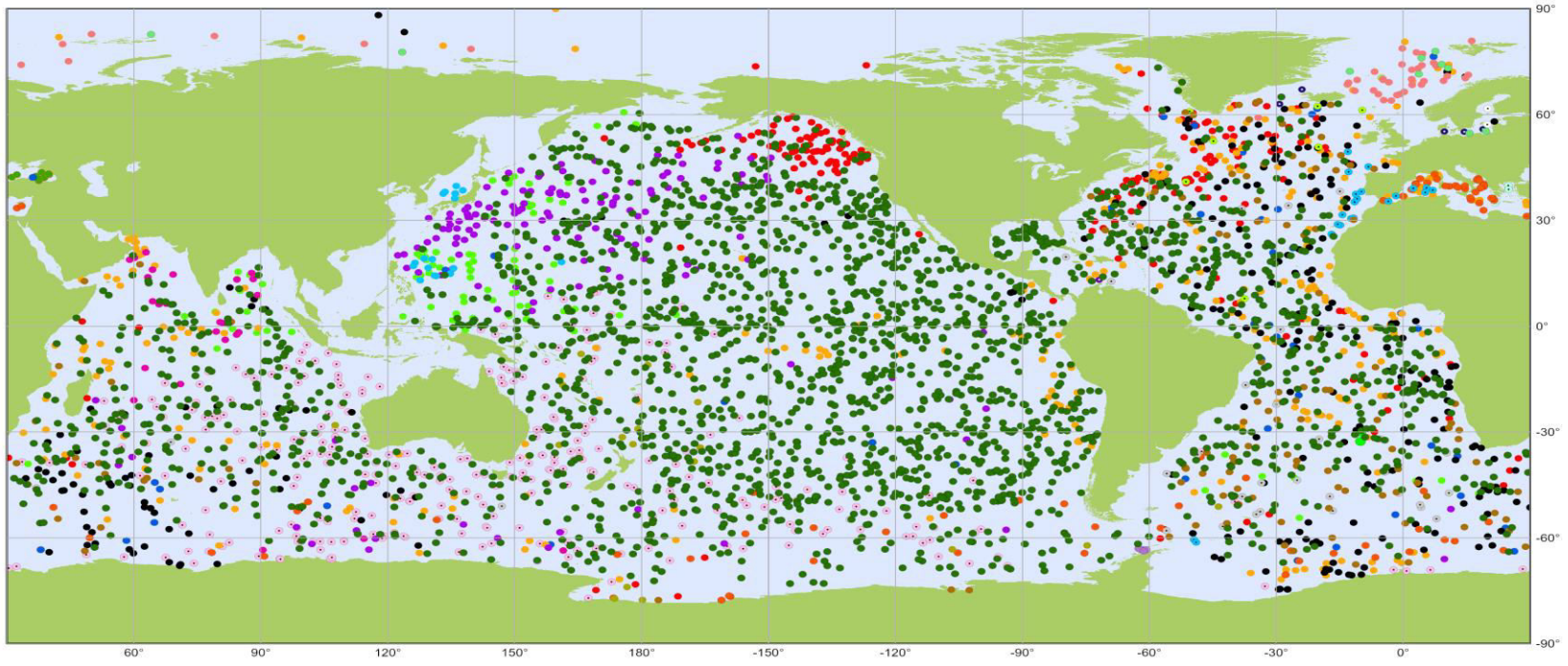
Argo floats – “Seahorses” of collecting oceanographic data



ARGO Float Mission



The global network of ARGO floats



Argo

National contributions- 4056 operational floats

Latest location of operational floats (data distributed within the last 30 days)

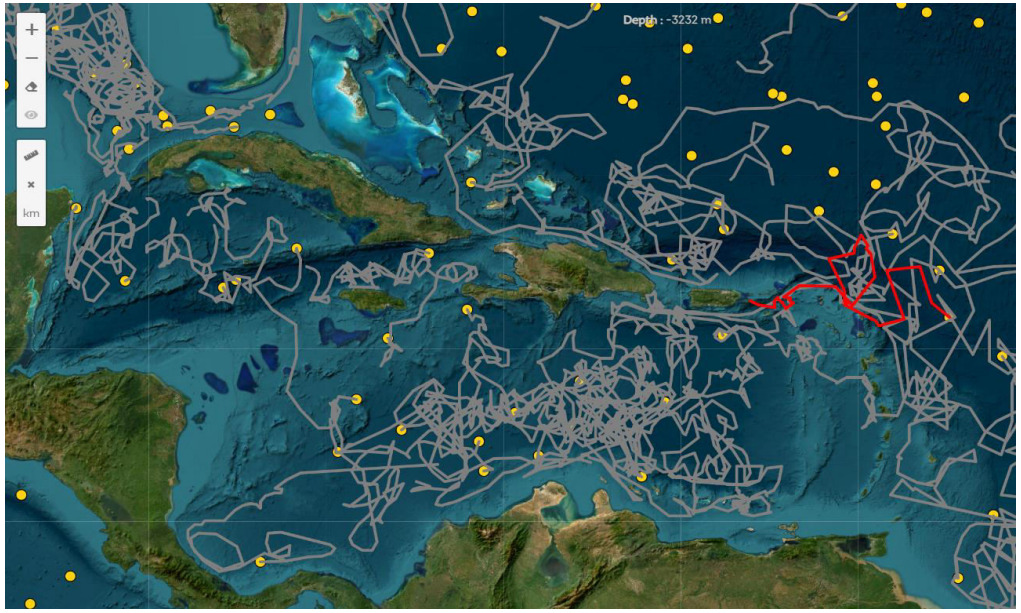
April 2025

AUSTRALIA (303)	DENMARK (5)	GREECE (6)	NETHERLANDS (35)	SPAIN (21)
BULGARIA (10)	EUROPE (46)	INDIA (25)	NEW ZEALAND (17)	UK (122)
CANADA (196)	FINLAND (2)	IRELAND (8)	NORWAY (41)	UKRAINE (5)
CHINA (88)	FRANCE (296)	ITALY (76)	POLAND (10)	USA (2300)
COLOMBIA (1)	GERMANY (271)	JAPAN (153)	KOREA, REPUBLIC OF (17)	OTHER (2)

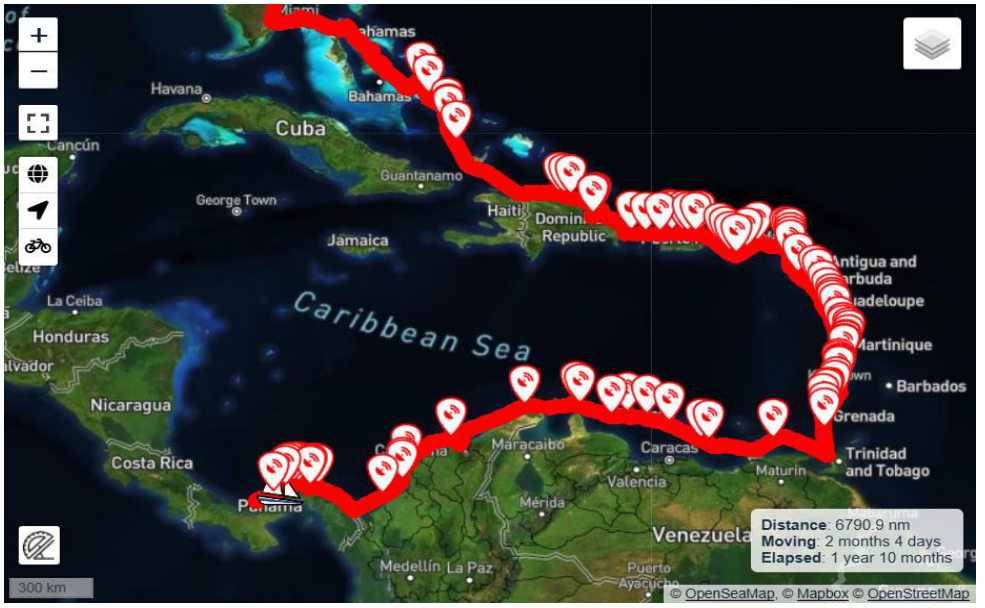
Generated by ocean-ops.org, 2025-05-06
Projection: Plate Carree (-150.0000)

Vendee Globe Race Argo program

SV Oceanolog and ARGO Floats Tracks Through the Caribbean Sea



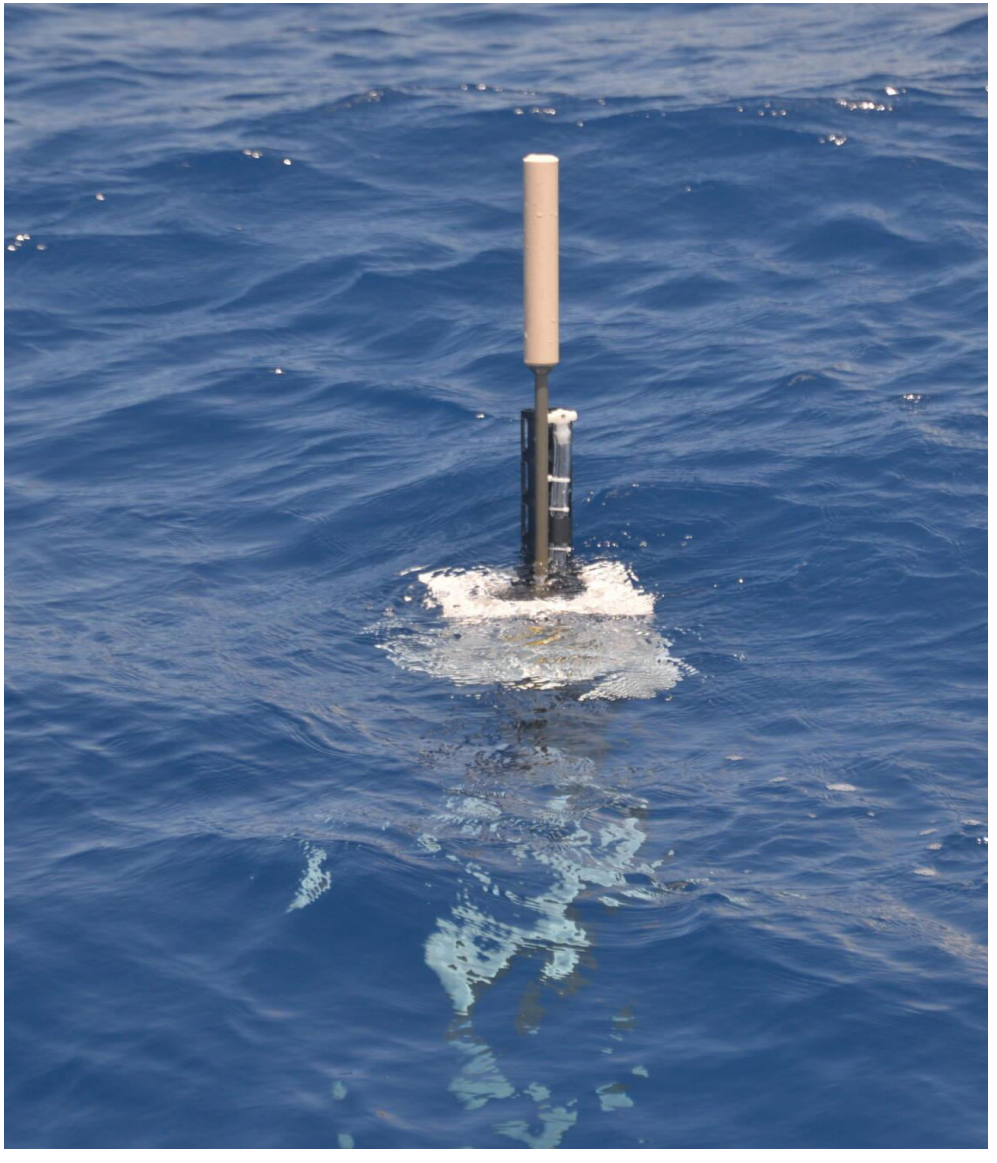
Plot of all tracks of ARGO floats around Caribbean Islands well show areas with gaps in ocean data, caused by limitation of parking (drifting) depth in 1000m, set for the floats. In red the track of ours deployed float



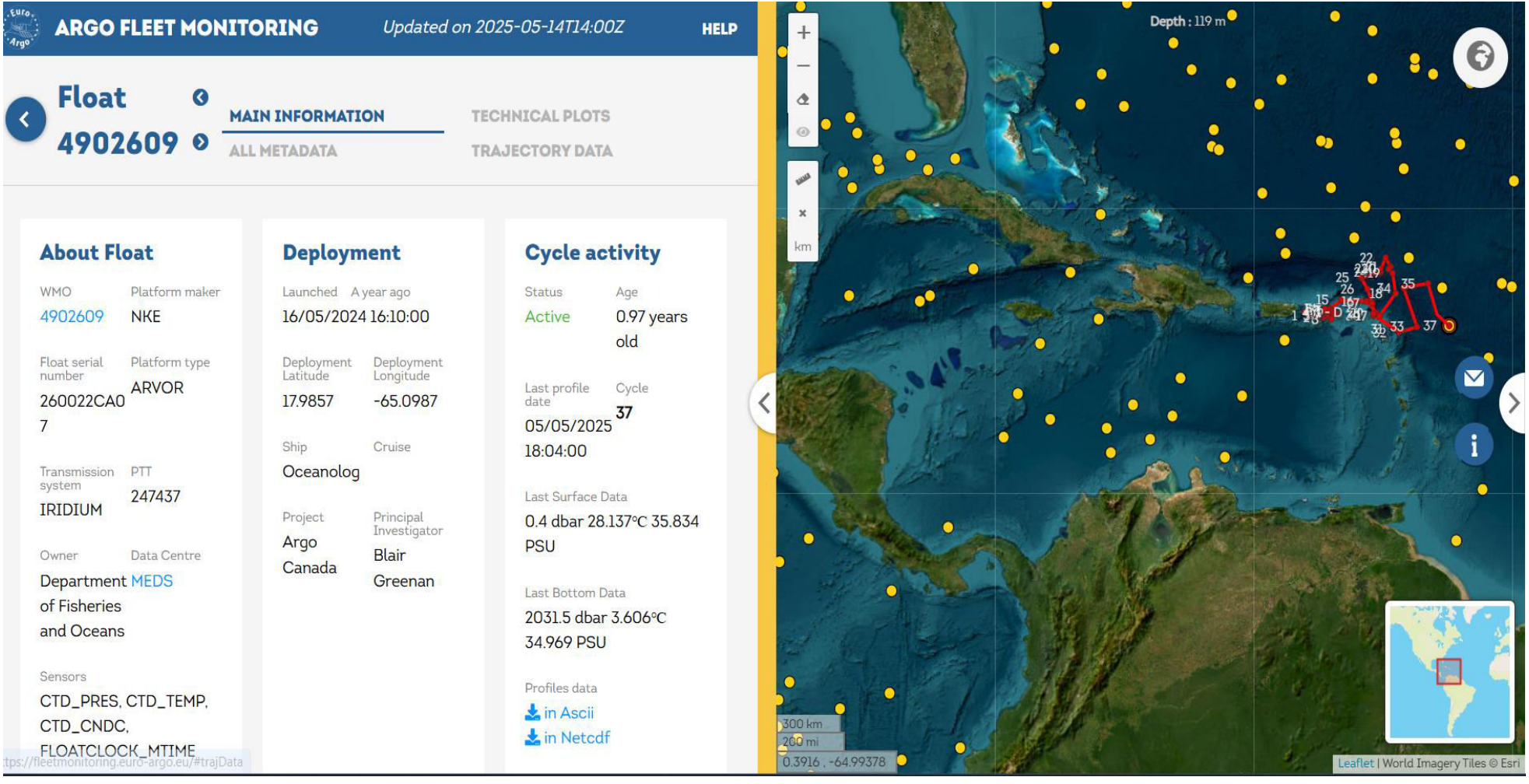
Plot of SV Oceanolog track through the Caribbean Islands with marked points of underway CTD casts to fill in gaps with ocean data.

Recieving Argo float in Halifax, Canada

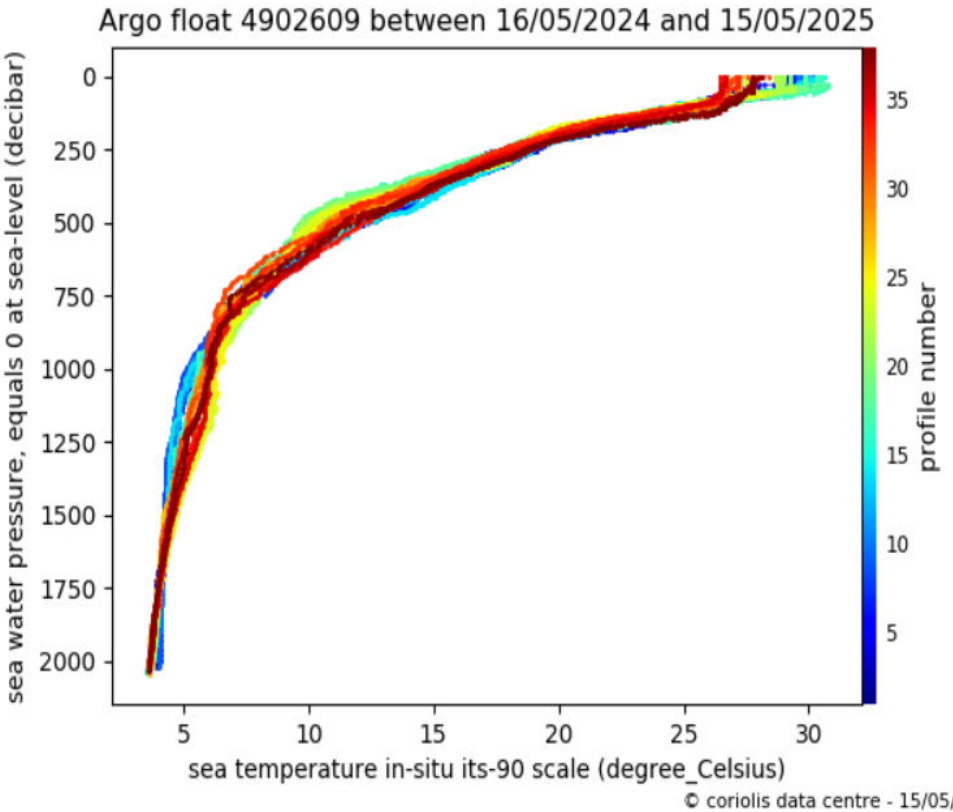
Deployment of ARGO float May,16th 2024

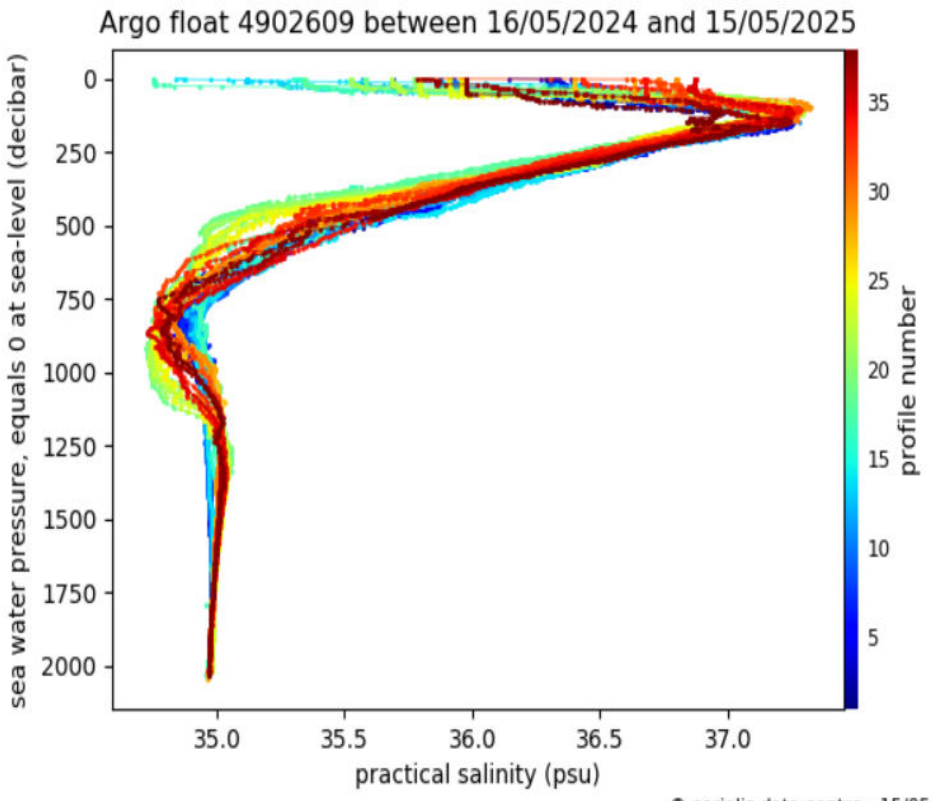


https://fleetmonitoring.euro-argo.eu/float/4902609



Temperature and Salinity Data from ARGO Float #4902609





RBR*concerto*^{3}CTD

Specifications:

Conductivity

Range	0-85mS/cm
Initial accuracy	±0.003mS/cm
Resolution	0.0001mS/cm
Typical stability	0.010mS/cm/year

Temperature

Range	-5°C to 35°C
Initial accuracy	±0.002°C
Resolution	0.00005°C
Typical stability	0.002°C/year

Pressure (Depth)

Range	0-2000 dbar
Initial accuracy	±1 dbar

Axillary sensors:

Dissolved Oxygen (RBRcodaODO)

Range: 0-500uM/L (0-120%)

Accuracy: ±8uM/L or ±5%

Backscatter (RBRtridente)

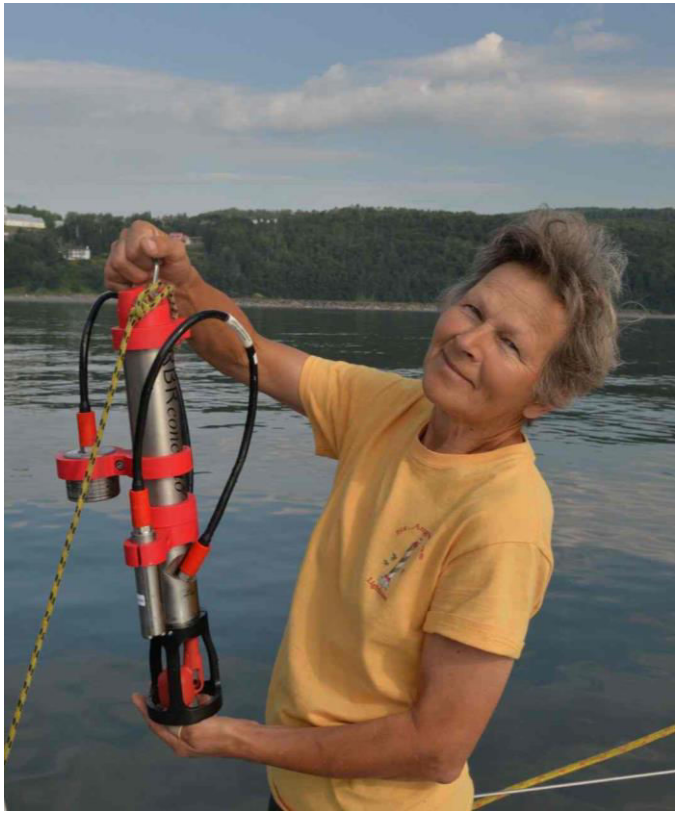
Range 0-.05 $m^{-1}sr^{-1}$

Chlorophyll *a* (RBRtridente)

Range 0-50ug/L

FDOM (RBRtridente)

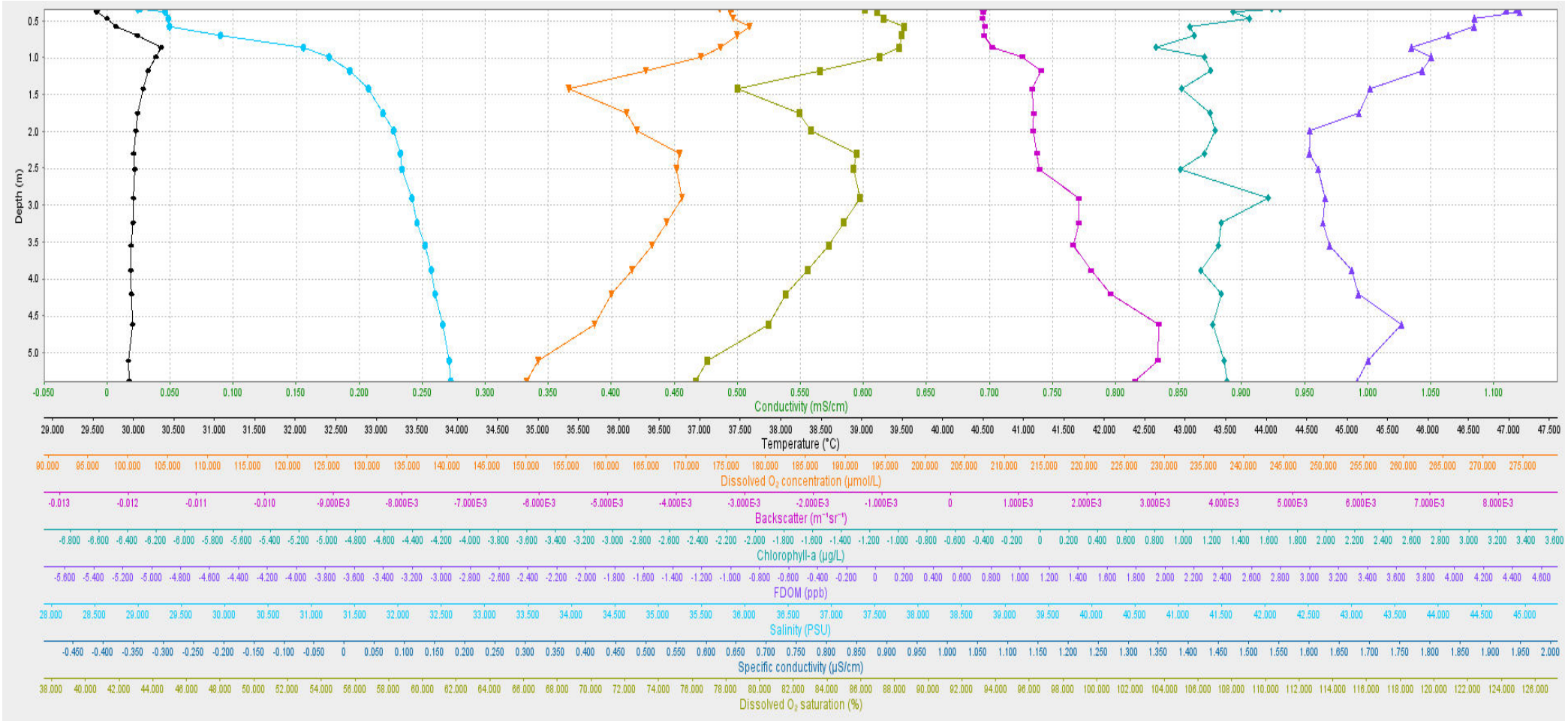
Range 0-500ppb



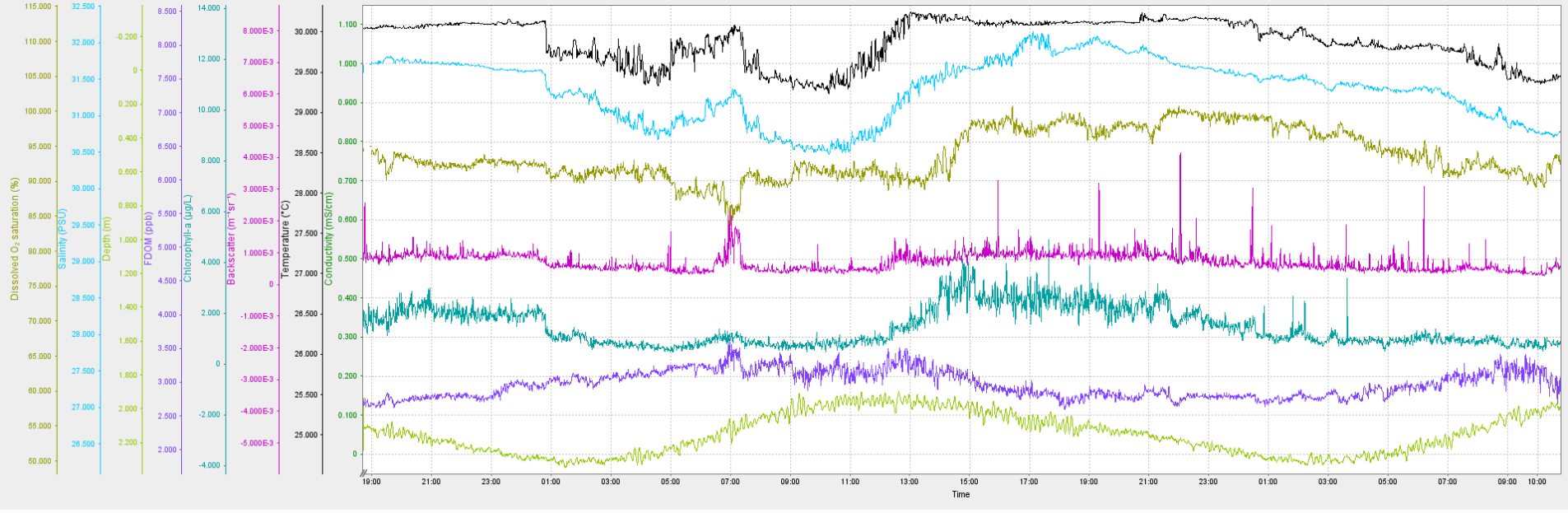
CTD casts on moorings

CTD cast in the Shelter Bay Marina

Plot of the CTD cast data in the Shelter Bay Marina(Dock E38)



16-17May25 Plot of the CTD mooring data Shelter Bay Marina (Dock E38)

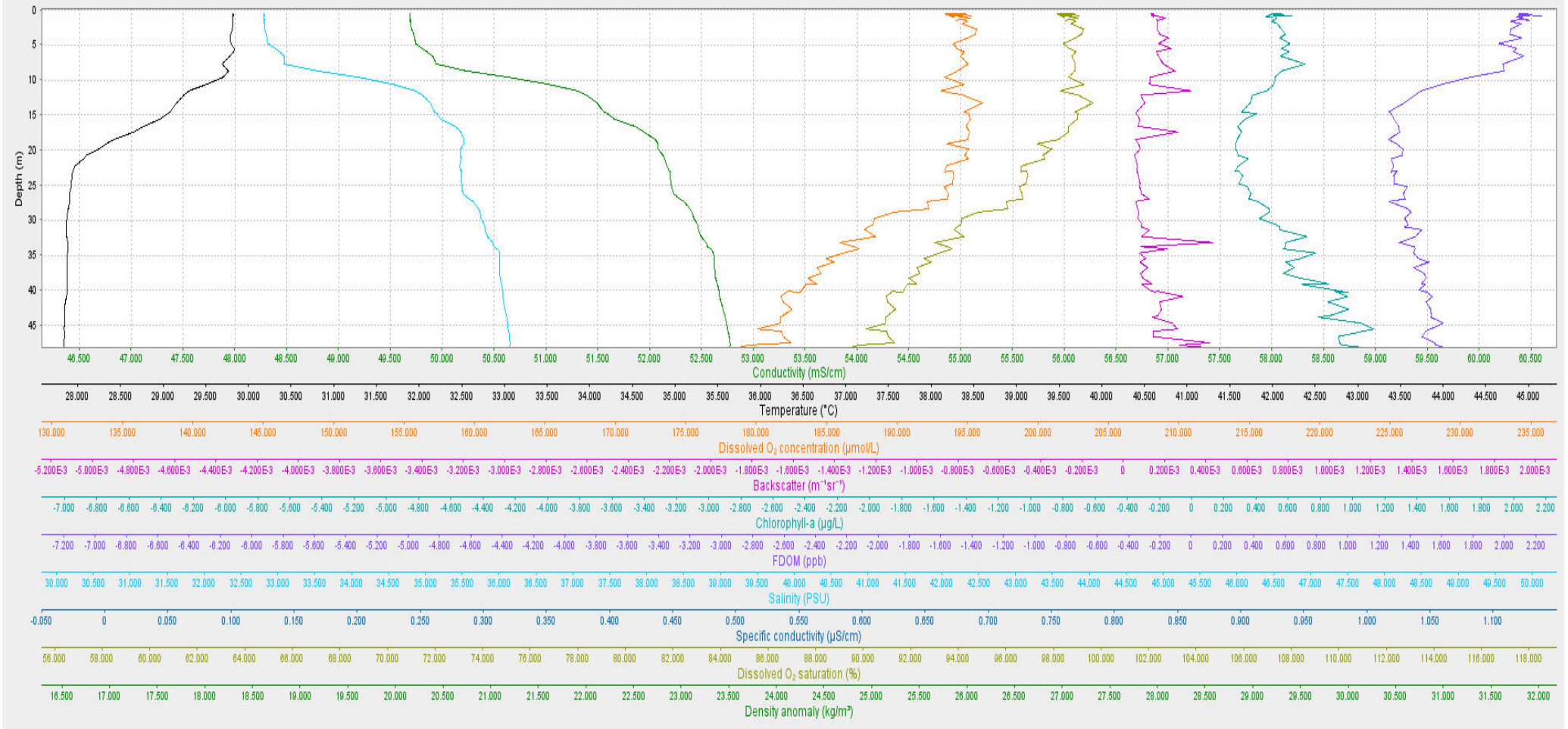


Underway “heaving to” CTD casts

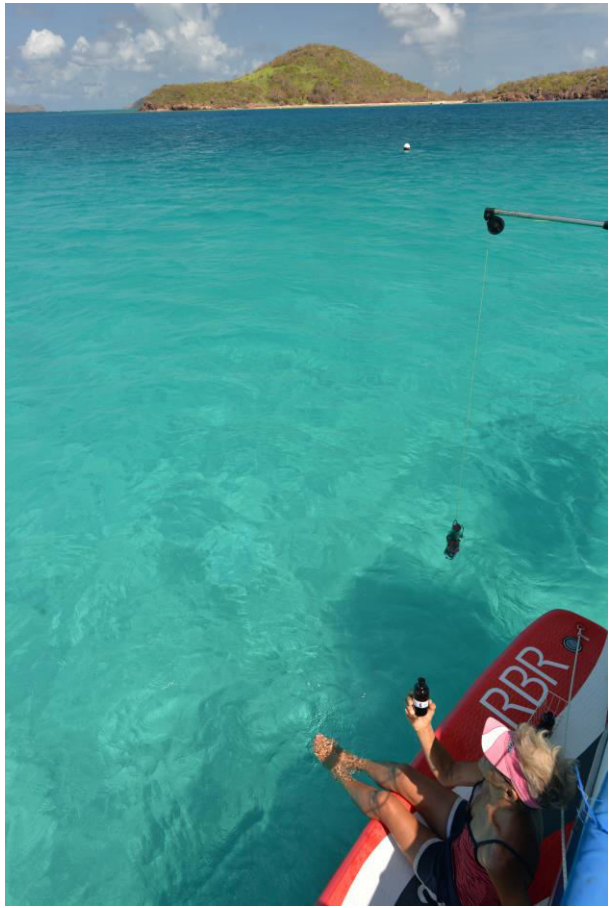

HONDA


HONDA

Underway CTD cast near Colon



Taking Reference Salinity Samples



Onboard Salinometry:QC of CTD data

Quality Control of *In situ* Temperature and Salinity Data

QC tests:

Group 1 *Required*	Test 1)	Gap Test
	Test 2)	Syntax Test
	Test 3)	Location Test
	Test 4)	Gross Range Test
	Test 5)	Climatological Test
Group 2 *Strongly Recommended*	Test 6)	Spike Test
	Test 7)	Rate of Change Test
	Test 8)	Flat Line Test
Group 3 *Suggested*	Test 9)	Multi-Variate Test
	Test 10)	Attenuated Signal Test
	Test 11)	Neighbor Test
	Test 12)	TS Curve/Space Test
	Test 13)	Density Inversion Test

IOOS Integrated Ocean Observing System

QARTOD Quality Assurance/Quality Control of Real-Time Oceanographic Data

Manual for

Real-Time Quality Control of In-situ Temperature and Salinity Data

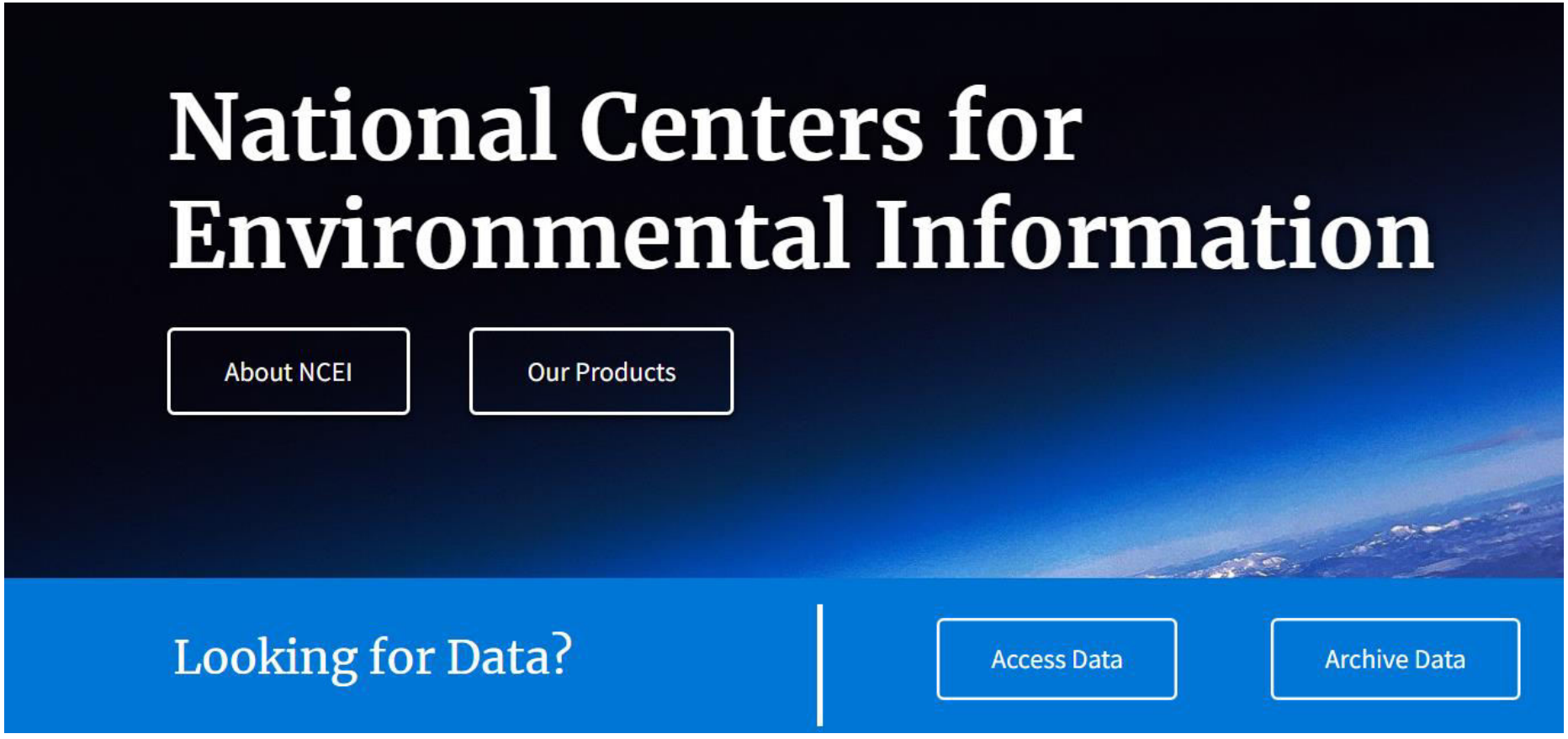
A Guide to Quality Control and Quality Assurance for In-situ Temperature and Salinity Observations

Version 2.0
January 2016

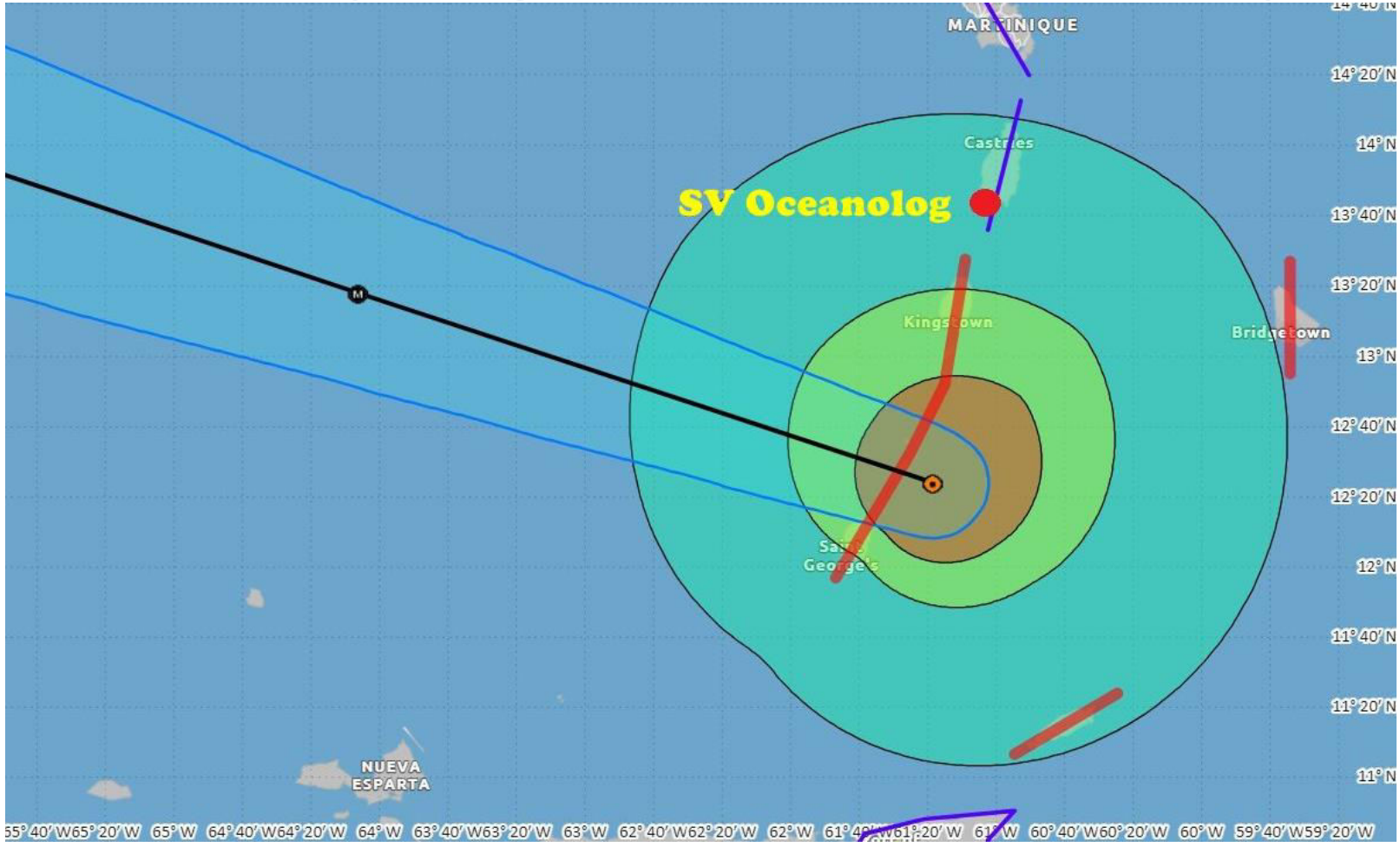
Quality Flagging

Flag	Description
Pass=1	Data have passed critical real-time quality control tests and are deemed adequate for use as preliminary data.
Not evaluated=2	Data have not been QC-tested, or the information on quality is not available.
Suspect or Of High Interest=3	Data are considered to be either suspect or of high interest to data providers and users. They are flagged suspect to draw further attention to them by operators.
Fail=4	Data are considered to have failed one or more critical real-time QC checks. If they are disseminated at all, it should be readily apparent that they are not of acceptable quality.
Missing data=9	Data are missing; used as a placeholder.

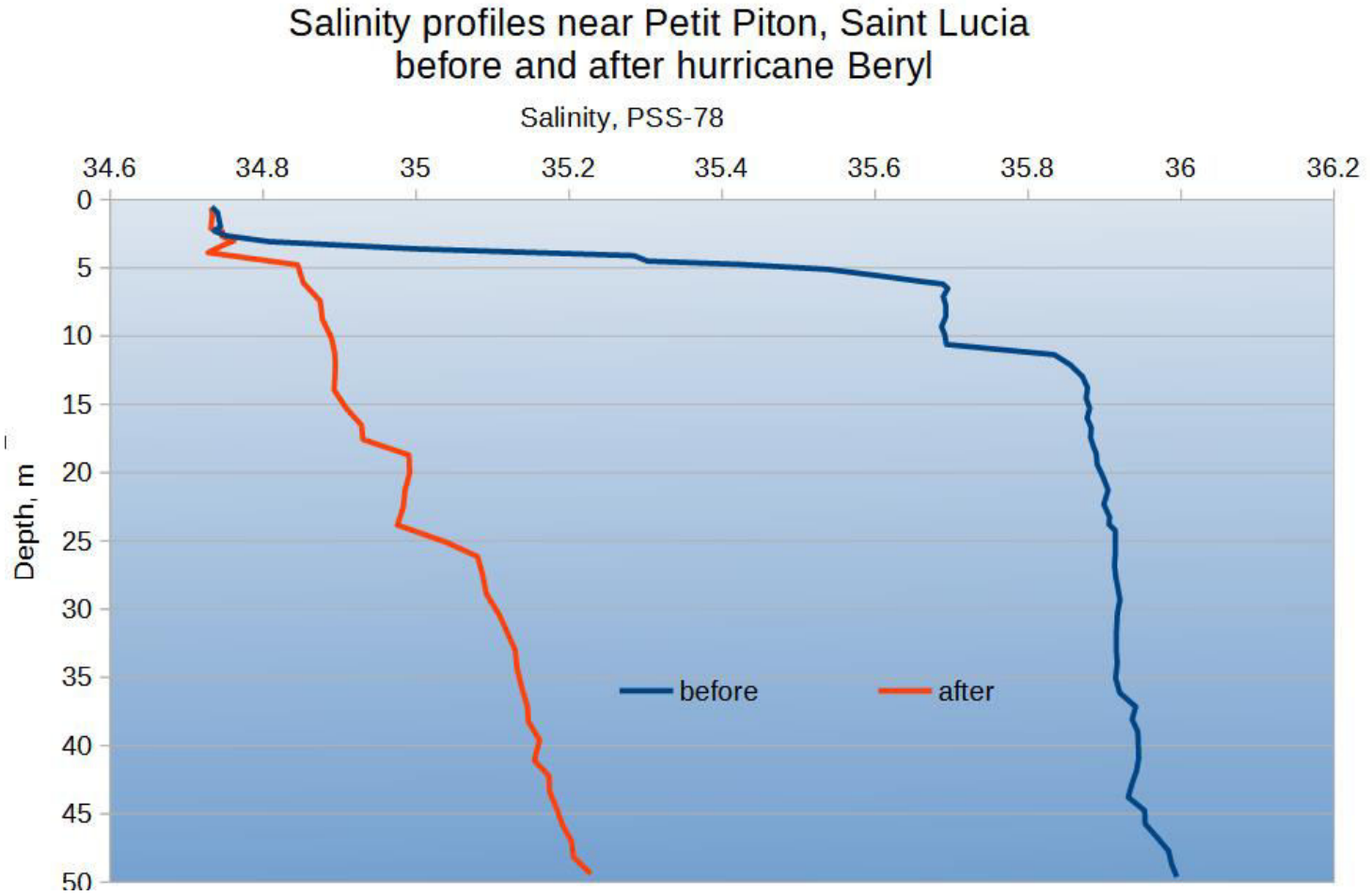
Submission of Data to the World Ocean Database (NCEI)

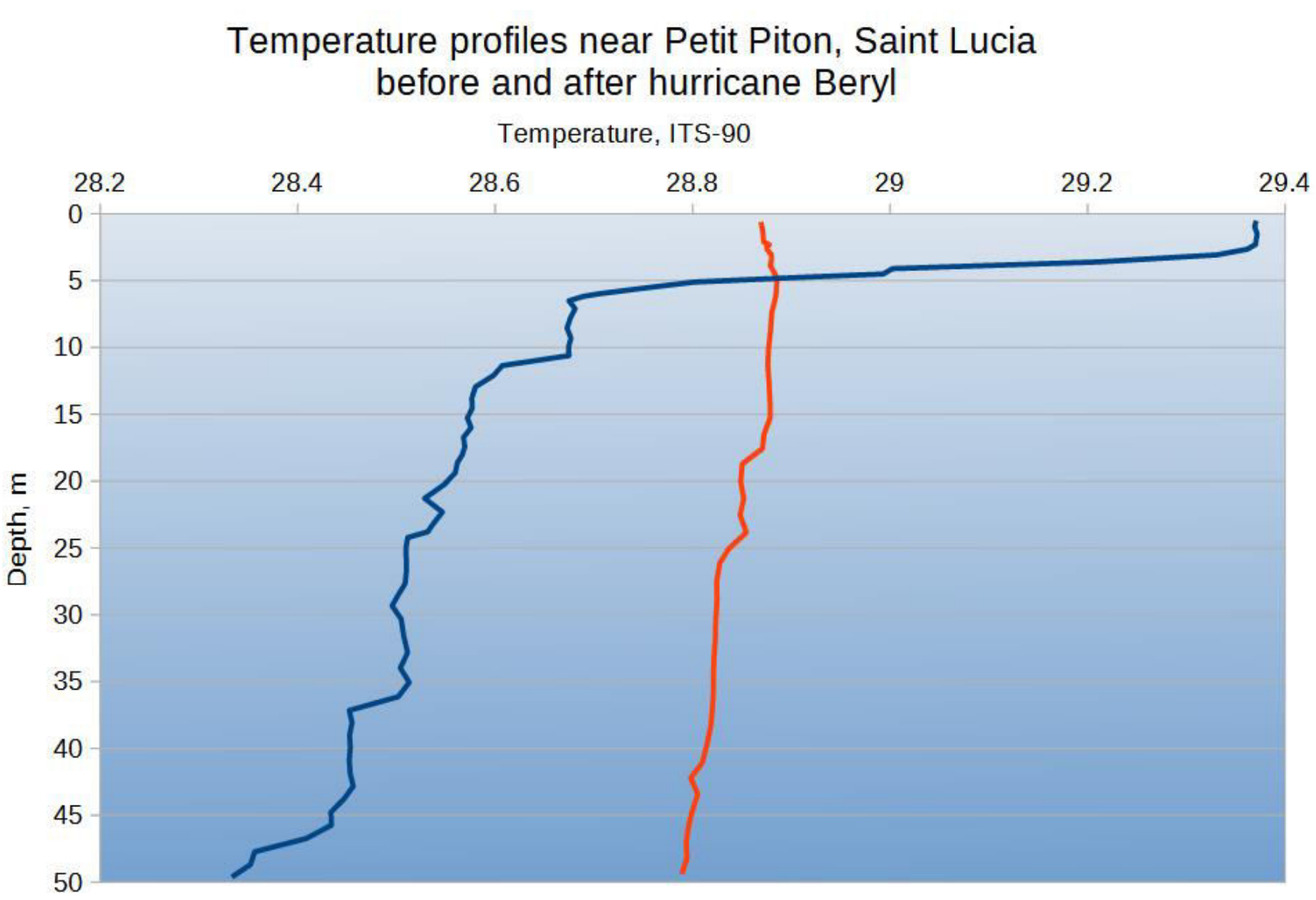


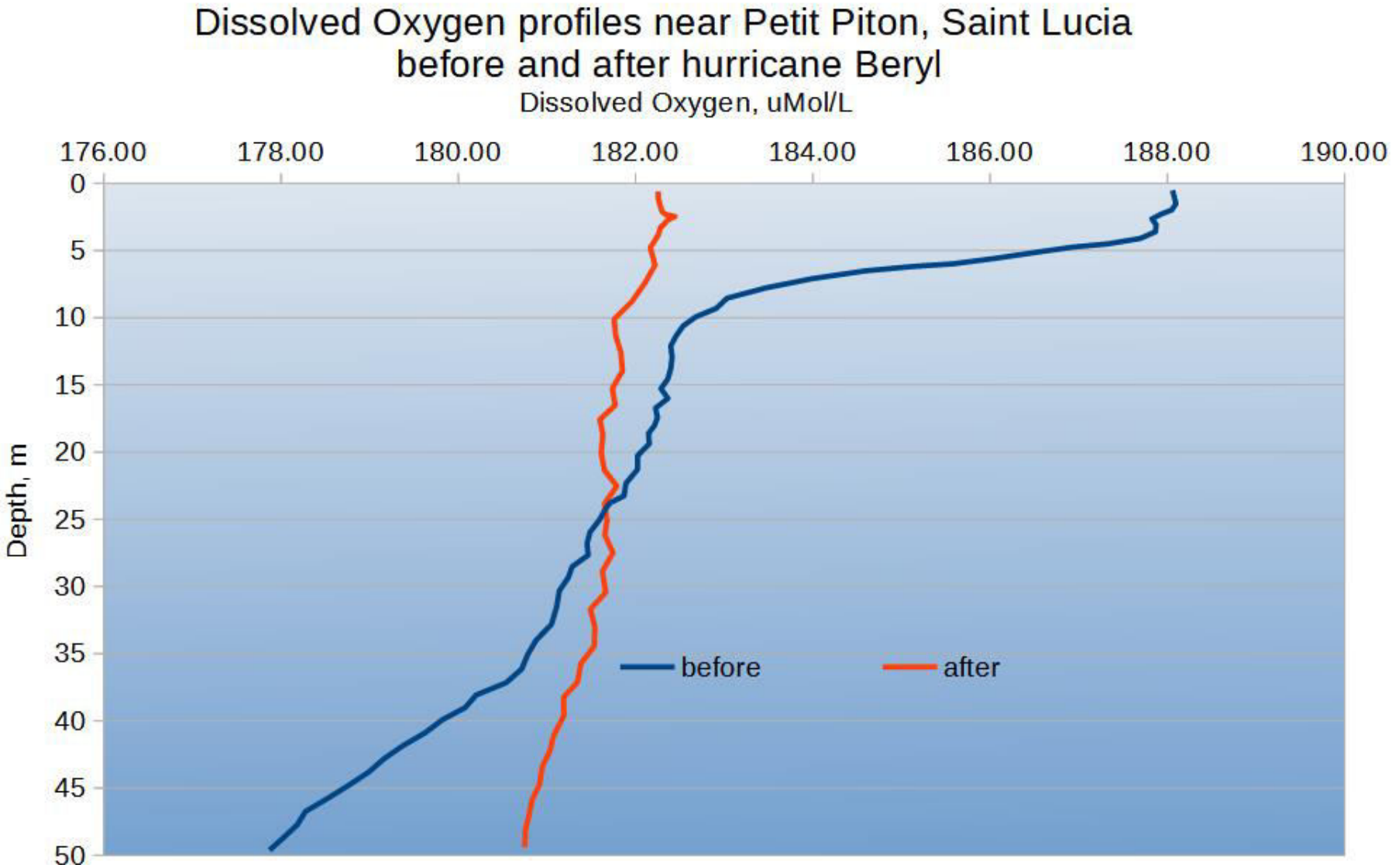
Surveying Hurricane Beryl

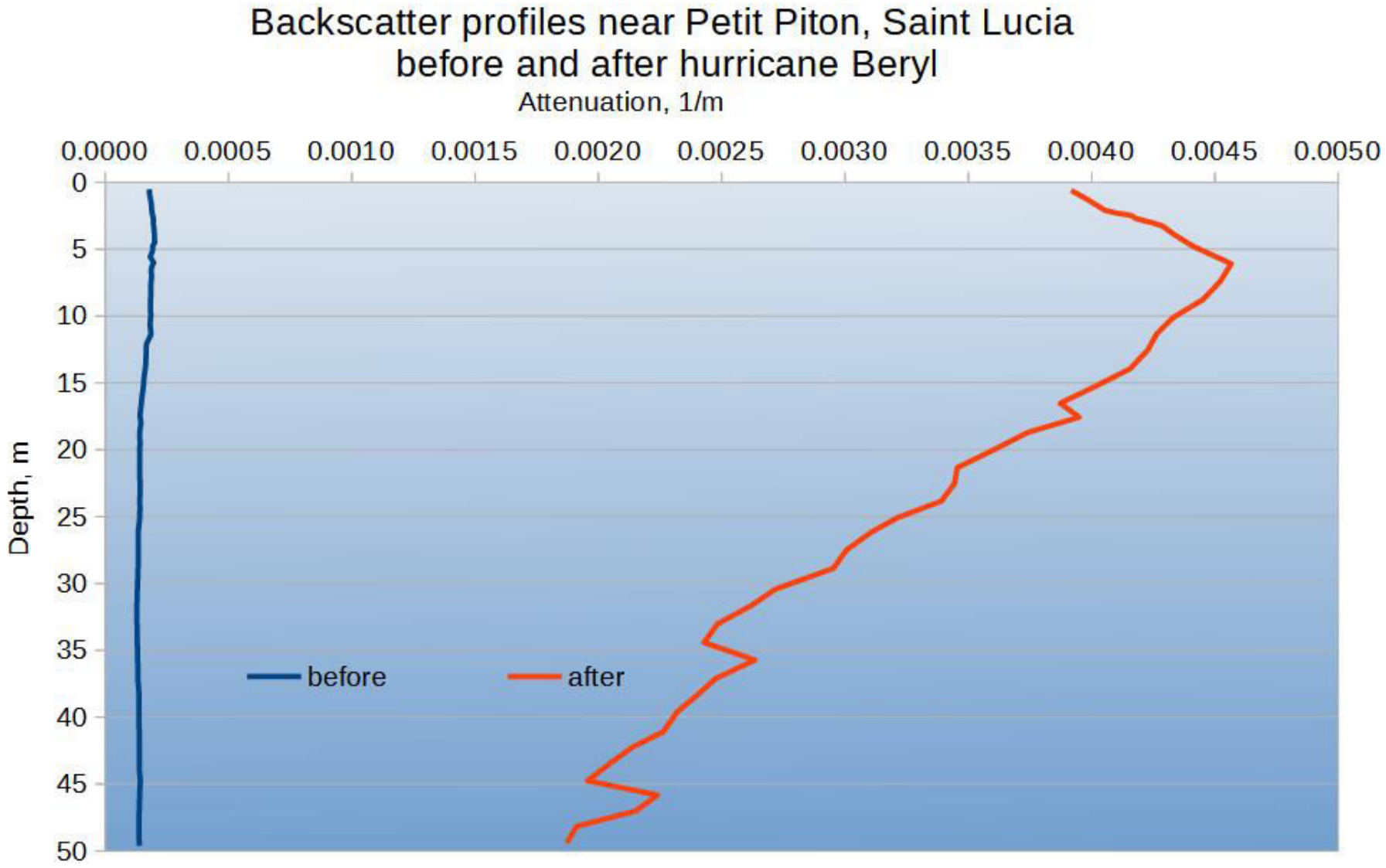


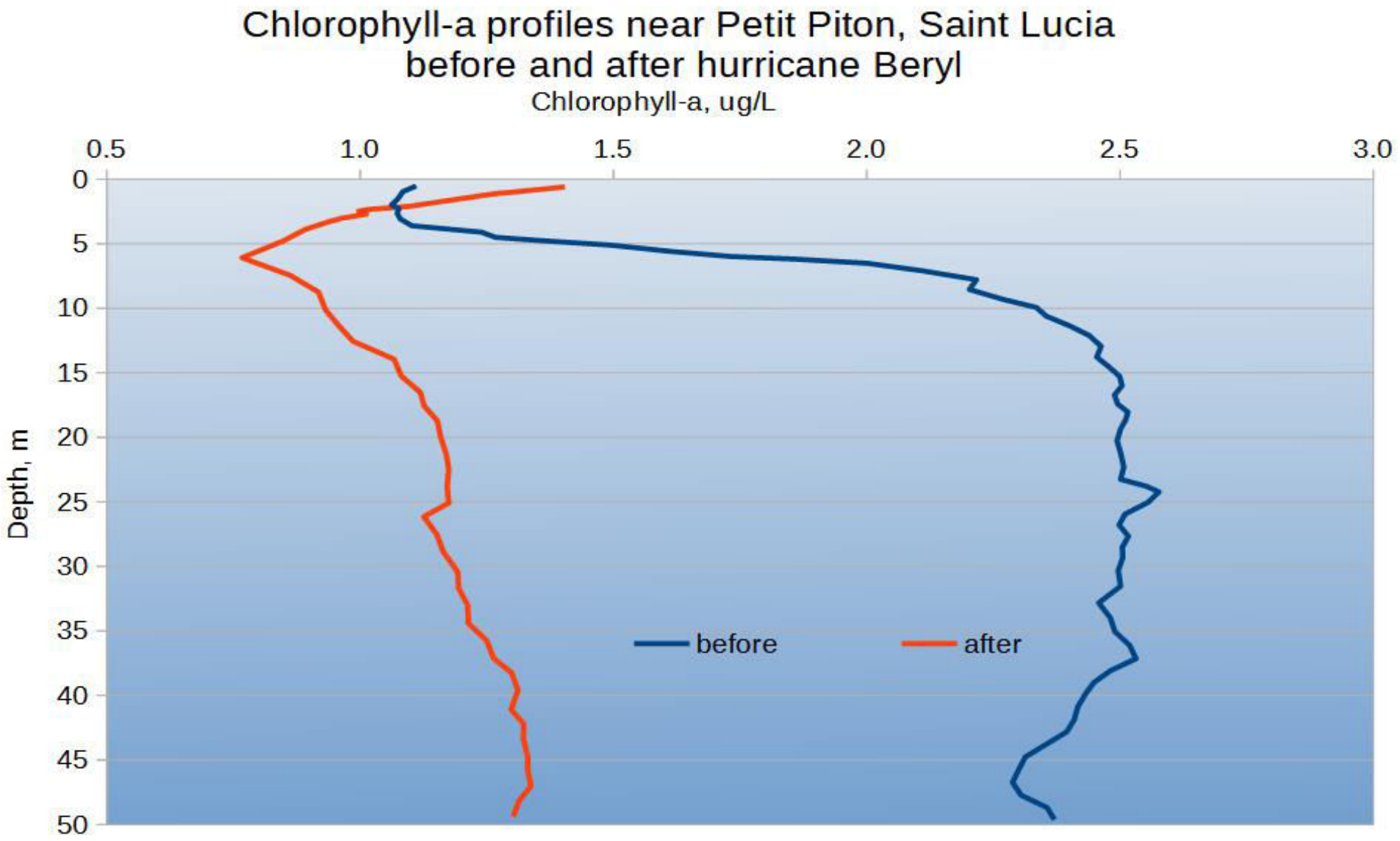
CTD cast near Petit Piton, Saint Lucia before and after passing Hurricane Beryl

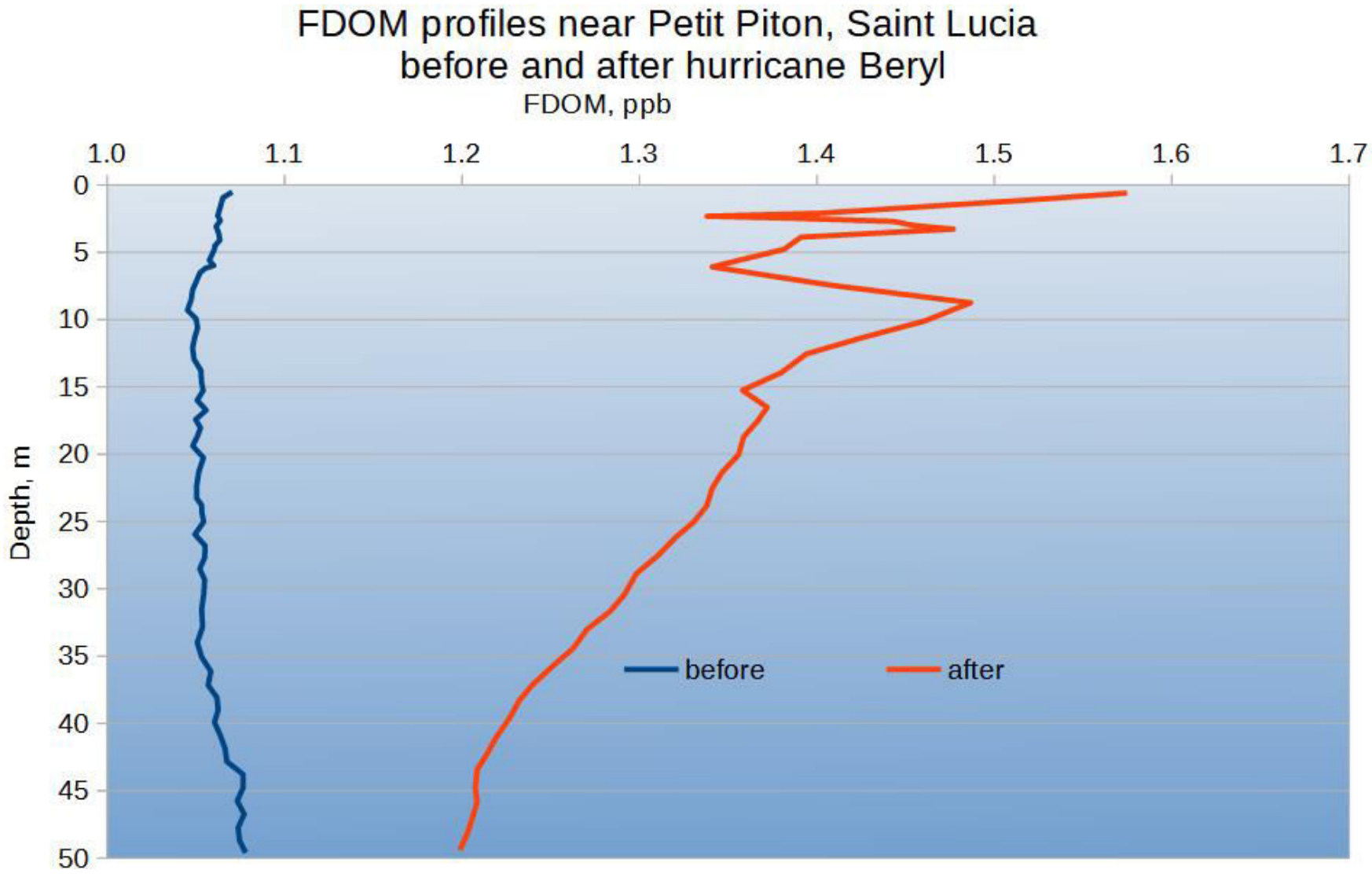



Temperature profiles near Petit Piton, Saint Lucia
before and after hurricane Beryl
Temperature, ITS-90
28.2
28.4
28.6
28.8
29
29.2
29.4
Depth, m
0
5
10
15
20
25
30
35
40
45
50


Dissolved Oxygen profiles near Petit Piton, Saint Lucia
before and after hurricane Beryl
Dissolved Oxygen, uMol/L
176.00
178.00
180.00
182.00
184.00
186.00
188.00
190.00
Depth, m
0
5
10
15
20
25
30
35
40
45
50
before
after


Backscatter profiles near Petit Piton, Saint Lucia
before and after hurricane Beryl
Attenuation, 1/m
0.0000
0.0005
0.0010
0.0015
0.0020
0.0025
0.0030
0.0035
0.0040
0.0045
0.0050
Depth, m
0
5
10
15
20
25
30
35
40
45
50
before
after


Chlorophyll-a profiles near Petit Piton, Saint Lucia
before and after hurricane Beryl
Chlorophyll-a, ug/L
0.5
1.0
1.5
2.0
2.5
3.0
Depth, m
0
5
10
15
20
25
30
35
40
45
50
before
after


FDOM profiles near Petit Piton, Saint Lucia
before and after hurricane Beryl
FDOM, ppb
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
Depth, m
0
5
10
15
20
25
30
35
40
45
50
before
after

Aftermath of Hurricane Beryl at Carriacou Island, Grenada

Introduction CTD-system to Sailors

Sailors Citizen Science programs:

1. Secchi Disk Study: www.secchidisk.org
2. Marine Debris Tracker: www.debristracker.org
3. The Globe Program: www.globe.gov
4. eOceans: www.eoceans.org
5. Sailors for the Sea: www.sailorsforthesea.org
6. Citizens of the Sea: www.citizensofthesea.org
7. Sailing4Science: www.sailing4science.org
8. The International SeaKeepers Society:www.seakeepers.org
9. Oceano-vox program: www.oceano-vox.com
10. Seabed-2030 program: www.seabed2030.org

Thank you!
Any questions?