MINISTÉRIO DA CIÊNCIA, TECNOLOGIA, INOVAÇÕES E COMUNICAÇÕES

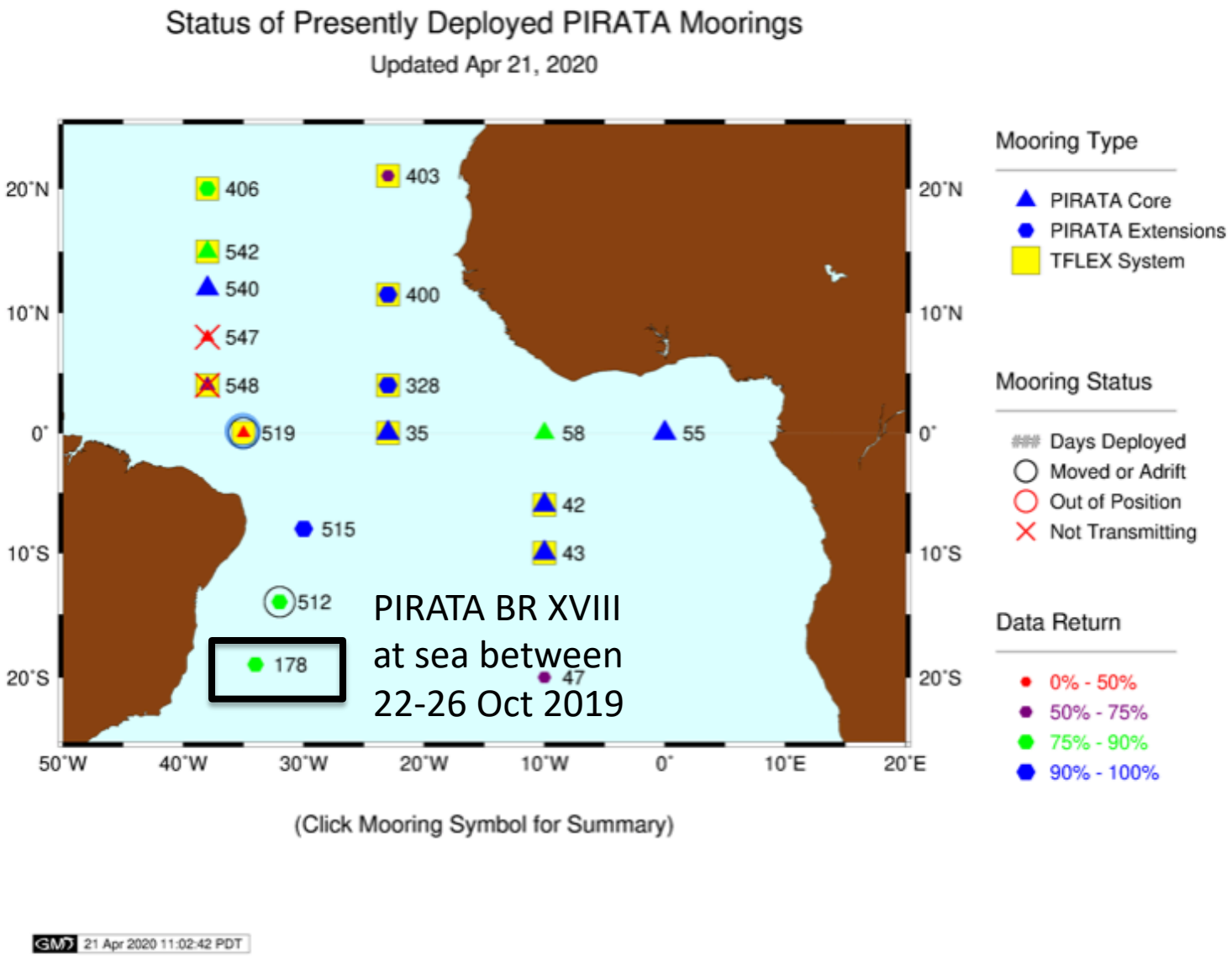
PÁTRIA AMADA BRASIL GOVERNO FEDERAL

Prediction and Research Moored Array in the Tropical Atlantic -- PIRATA Brazil 2019-20 Activities--

PIRATA Scientific Steering Group and PIRATA Resources Board Meeting
April 22, 2020

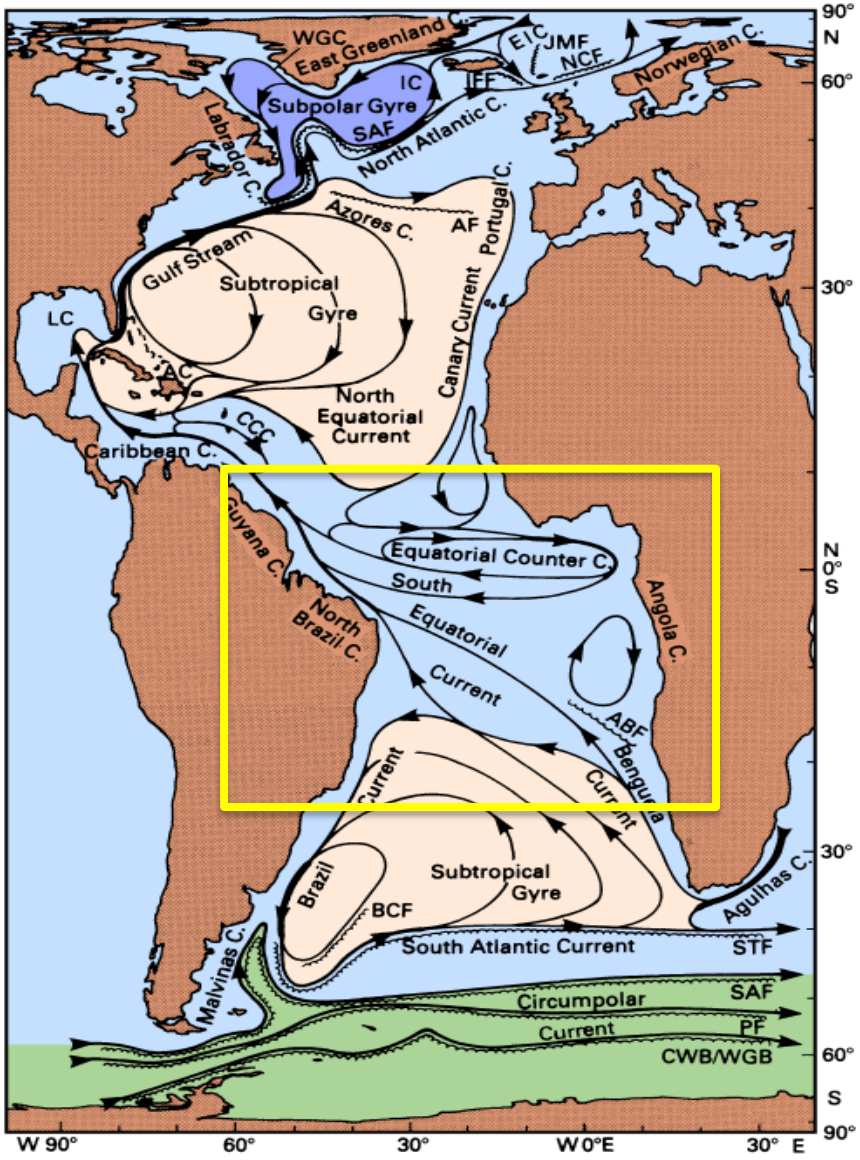
Dr. Ronald Buss de Souza
Senior Researcher, PIRATA's Brazilian Coordinator
Center for Weather Forecast and Climate Studies - CPTEC
National Institute for Space Research - INPE
ronald.buss@inpe.br

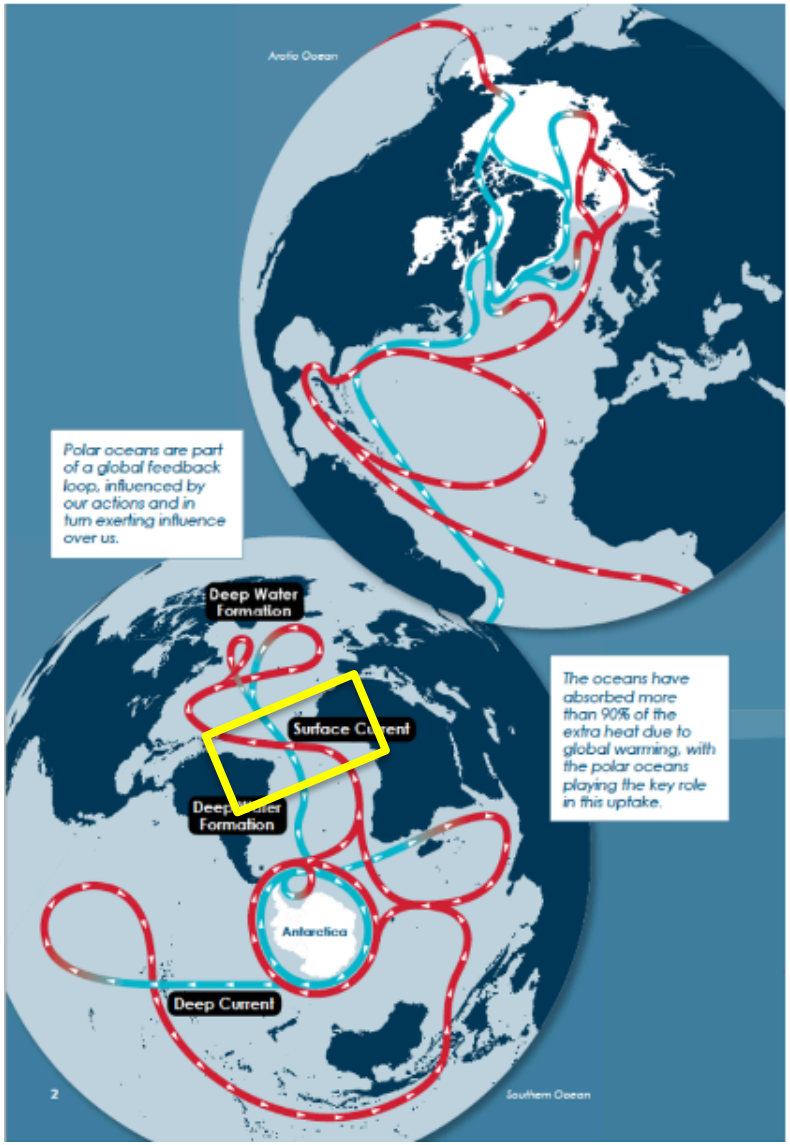
A project based on moored buoys



https://www.pmel.noaa.gov/tao/global/status/buoystat-pirata.html

Why there?


WGC
East Greenland
IC
Subpolar Gyre
SAF
Labrador C.
North Atlantic C.
ETC
JMF
NCF
FF
Norwegian C.
Azores C.
AF
Portugal C.
Gulf Stream
Subtropical
Gyre
LC
AC
Canary Current
North
Equatorial
Current
CCC
Caribbean C.
Guyana C.
Equatorial Counter C.
South
Equatorial
Current
North
Brazil C.
Angola C.
ABF
Benguela
Current
Brazil
Current
Subtropical
Gyre
BCF
Agulhas C.
South Atlantic Current
STF
Malvinas C.
Circumpolar
Current
SAF
PF
CWB/WGB
90° N
60°
30°
N 0° S
30°
60°
S 90°
W 90°
60°
30°
W 0°E
30° E


Arctic Ocean
Polar oceans are part of a global feedback loop, influenced by our actions and in turn exerting influence over us.
Deep Water Formation
Surface Current
Deep Water Formation
The oceans have absorbed more than 90% of the extra heat due to global warming, with the polar oceans playing the key role in this uptake.
Antarctica
Deep Current
2
Southern Ocean

A project based on moored buoys

ATLAS PI255A [Start Date 2018-11-23 21:43:00 :: 514 Days Deployed]

Data Return Summary:

	Total Deployment			Past 30 Days			Past 7 Days		
Sensor	Deployed	Data	%	Deployed	Data	%	Deployed	Data	%
SST	514	490	95.3	30	7	23.3	7	0	0.0
T20	514	513	99.8	30	30	100.0	7	7	100.0
T40	514	513	99.8	30	30	100.0	7	7	100.0
T60	514	513	99.8	30	30	100.0	7	7	100.0
T80	514	513	99.8	30	30	100.0	7	7	100.0
T100	514	513	99.8	30	30	100.0	7	7	100.0
T120	514	513	99.8	30	30	100.0	7	7	100.0
T140	514	513	99.8	30	30	100.0	7	7	100.0
T180	514	513	99.8	30	30	100.0	7	7	100.0
T300	514	513	99.8	30	30	100.0	7	7	100.0
T500	514	513	99.8	30	30	100.0	7	7	100.0
P300	514	513	99.8	30	30	100.0	7	7	100.0
P500	514	513	99.8	30	30	100.0	7	7	100.0
SSC	514	121	23.5	30	0	0.0	7	0	0.0
C20	514	513	99.8	30	30	100.0	7	7	100.0
C40	514	513	99.8	30	30	100.0	7	7	100.0
C120	514	513	99.8	30	30	100.0	7	7	100.0
WIND	514	513	99.8	30	30	100.0	7	7	100.0
AT	514	513	99.8	30	30	100.0	7	7	100.0
RH	514	513	99.8	30	30	100.0	7	7	100.0
RAIN	514	206	40.1	30	0	0.0	7	0	0.0
SWR	514	513	99.8	30	30	100.0	7	7	100.0
ALL	10280	9538	92.8	600	517	86.2	140	119	85.0

Summary Updated 21-Apr-2020 11:01 (2020/112)

A project based on moored buoys

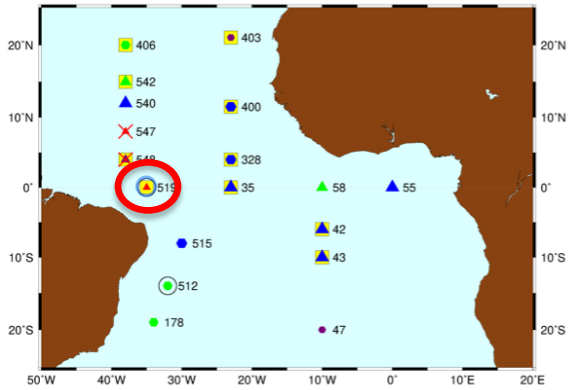
TFLEX PT026 [Start Date 2018-11-18 21:08:00 :: 519 Days Deployed]

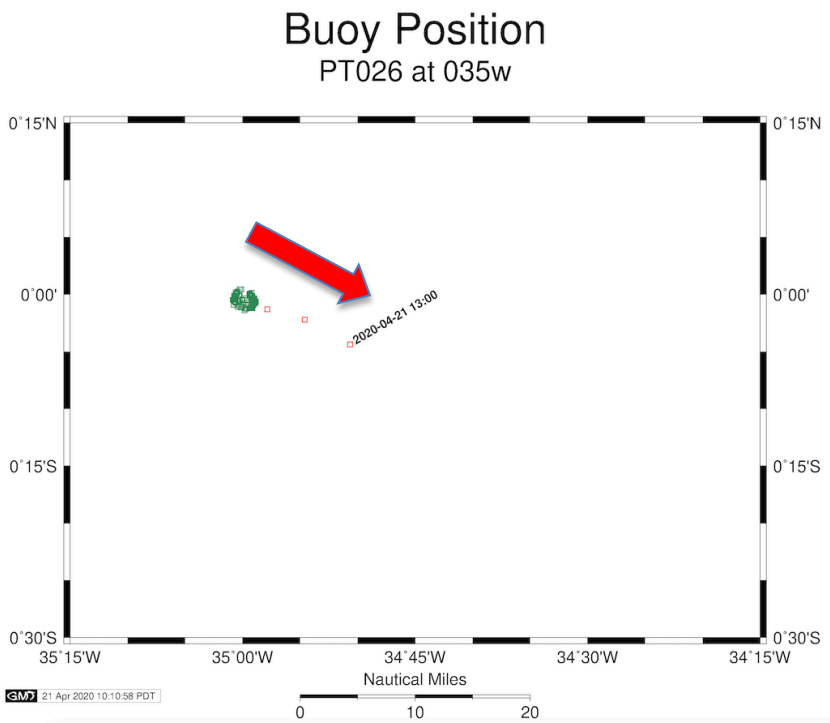
Buoy Moved or Adrift since 2020-04-21
Latest daily-averaged position (2020-04-21 12:00:00) 0.04S 34.91W
Distance from deployed position: 6.0 naut mi

Data Return Summary:

	Total Deployment			Past 30 Days			Past 7 Days		
Sensor	Deployed	Data	%	Deployed	Data	%	Deployed	Data	%
SST	519	129	24.9	30	0	0.0	7	0	0.0
T 10	519	130	25.0	30	0	0.0	7	0	0.0
T 20	519	130	25.0	30	0	0.0	7	0	0.0
T 40	519	130	25.0	30	0	0.0	7	0	0.0
T 60	519	130	25.0	30	0	0.0	7	0	0.0
T 80	519	129	24.9	30	0	0.0	7	0	0.0
T100	519	130	25.0	30	0	0.0	7	0	0.0
T120	519	130	25.0	30	0	0.0	7	0	0.0
T140	519	130	25.0	30	0	0.0	7	0	0.0
T180	519	130	25.0	30	0	0.0	7	0	0.0
T300	519	130	25.0	30	0	0.0	7	0	0.0
T500	519	24	4.6	30	0	0.0	7	0	0.0
STDT	5709	1323	23.2	330	0	0.0	77	0	0.0
P300	519	130	25.0	30	0	0.0	7	0	0.0
P500	519	24	4.6	30	0	0.0	7	0	0.0
PRES	1038	154	14.8	60	0	0.0	14	0	0.0
SSC	519	129	24.9	30	0	0.0	7	0	0.0
C 10	519	130	25.0	30	0	0.0	7	0	0.0
C 20	519	130	25.0	30	0	0.0	7	0	0.0
C 40	519	130	25.0	30	0	0.0	7	0	0.0
C120	519	130	25.0	30	0	0.0	7	0	0.0
COND	2076	520	25.0	120	0	0.0	28	0	0.0
V 12	519	130	25.0	30	0	0.0	7	0	0.0
VEL	519	130	25.0	30	0	0.0	7	0	0.0
AT	519	519	100.0	30	30	100.0	7	7	100.0
RAIN	519	293	56.5	30	0	0.0	7	0	0.0
RH	519	519	100.0	30	30	100.0	7	7	100.0
SWR	519	432	83.2	30	0	0.0	7	0	0.0
WIND	519	465	89.6	30	0	0.0	7	0	0.0
ALL	12975	4613	35.6	750	60	8.0	175	14	8.0

Summary Updated 21-Apr-2020 11:01 (120/112)





The Intertropical Convergence Zone (ITCZ)

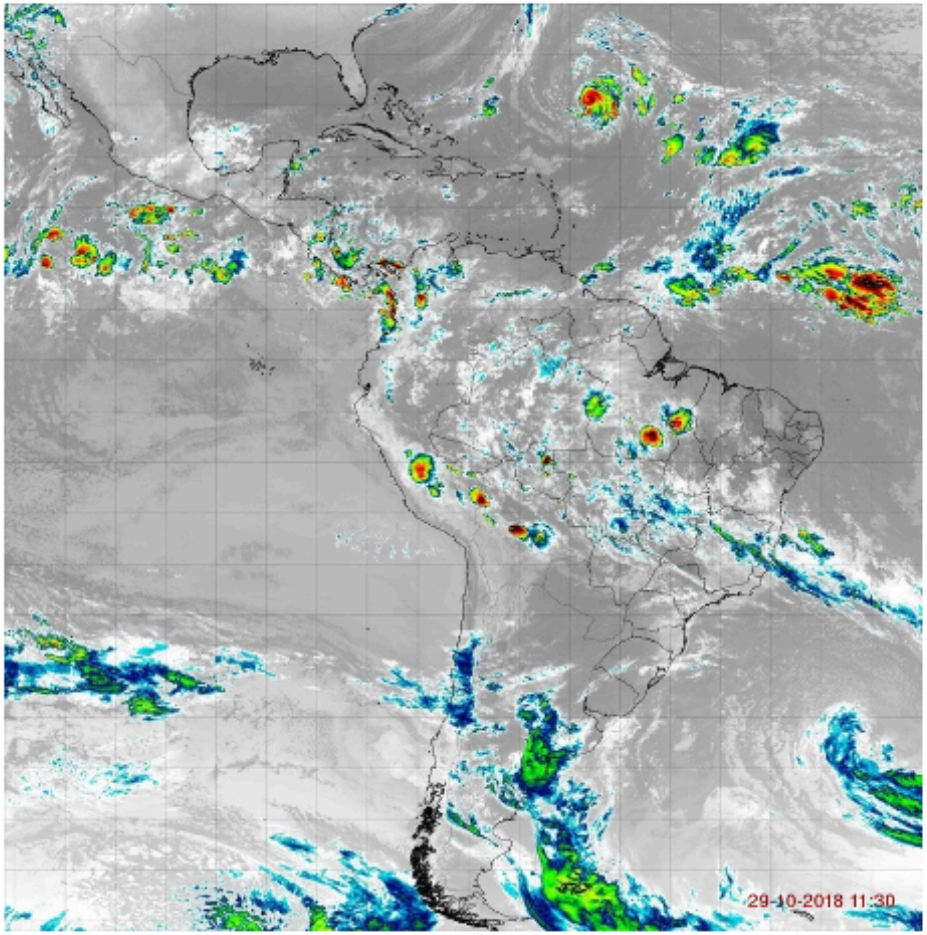
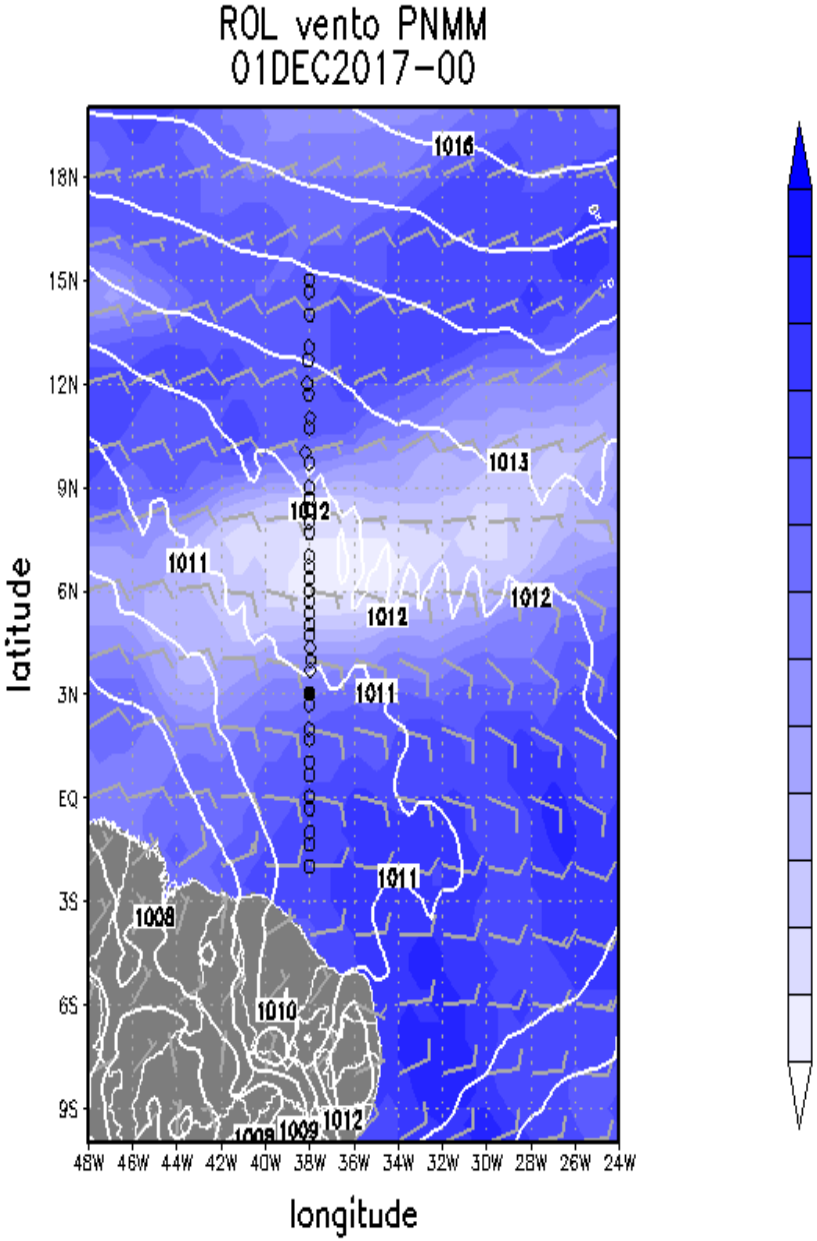
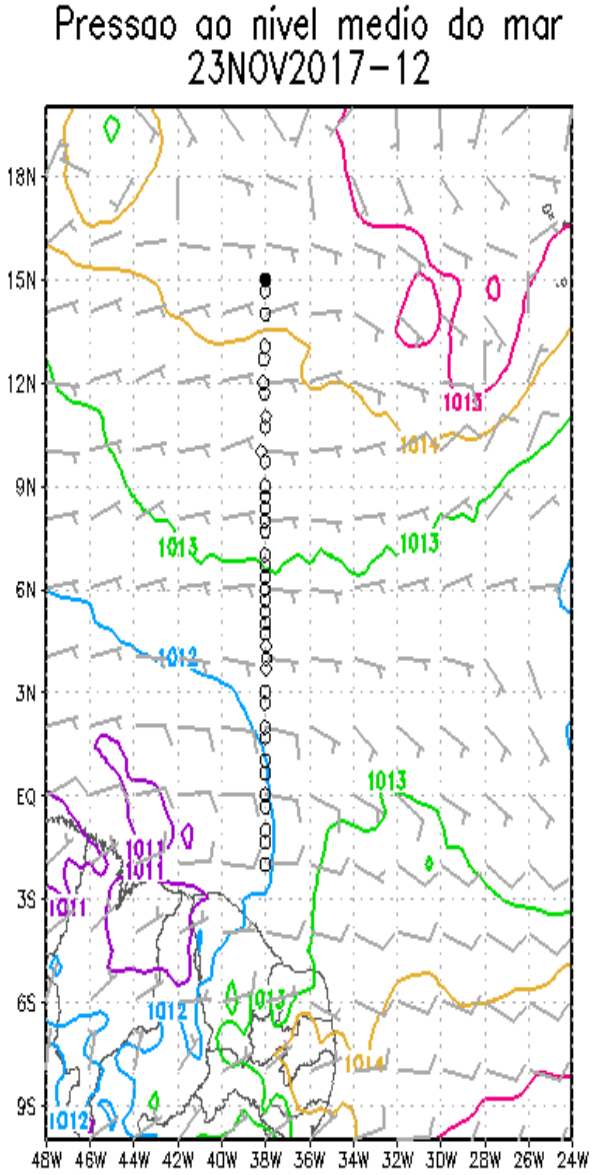


Figura 9. Imagem do satélite GOES-16 do dia 29 de outubro de 2018 apresentando uma banda de nebulosidade no Oceano Atlântico Equatorial ao norte do Brasil característica da Zona de Convergência Intertropical (ZCIT). Fonte: CPTEC/INPE.

The Intertropical Convergence Zone (ITCZ)





Key components of the Tropical Atlantic variability

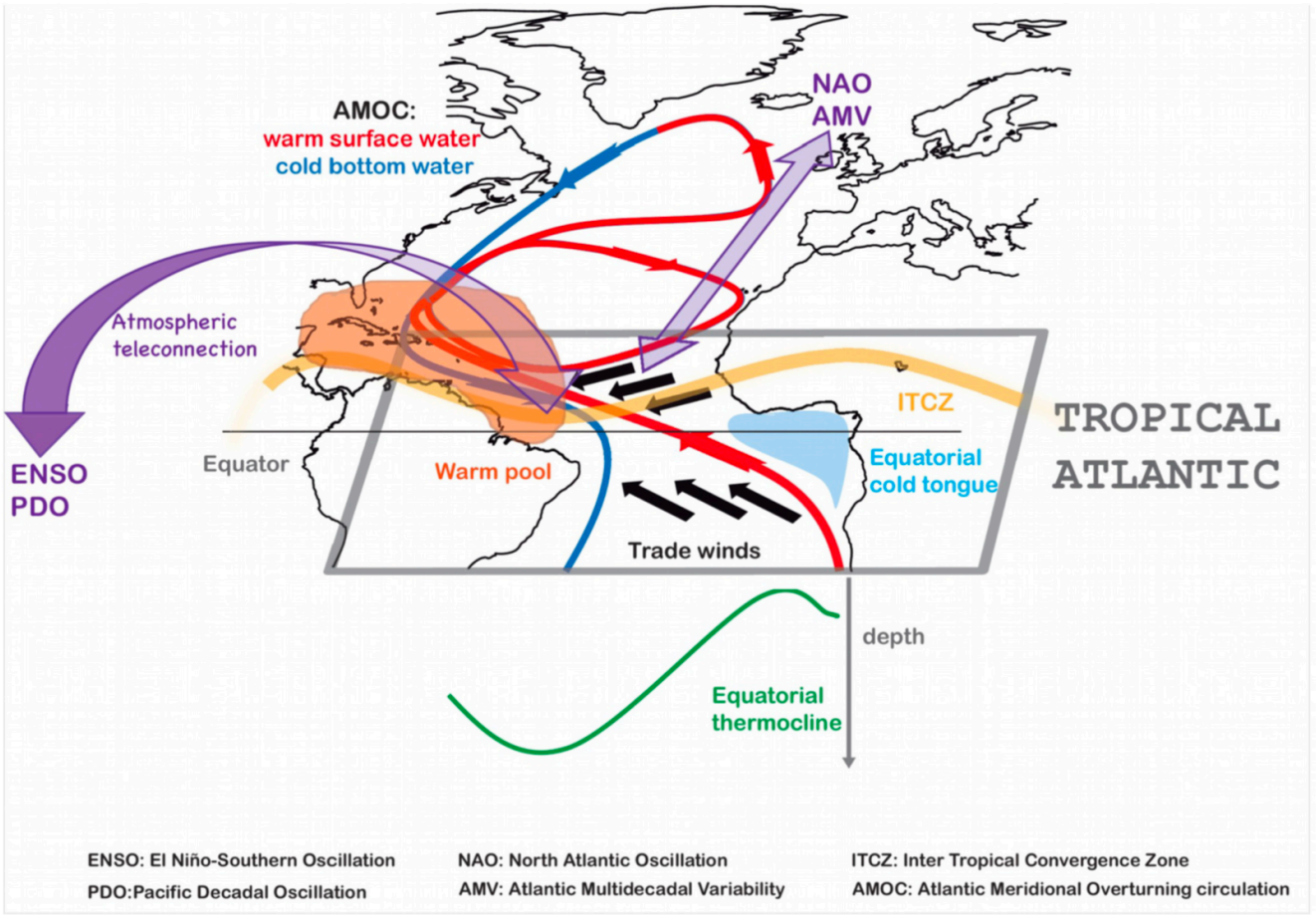
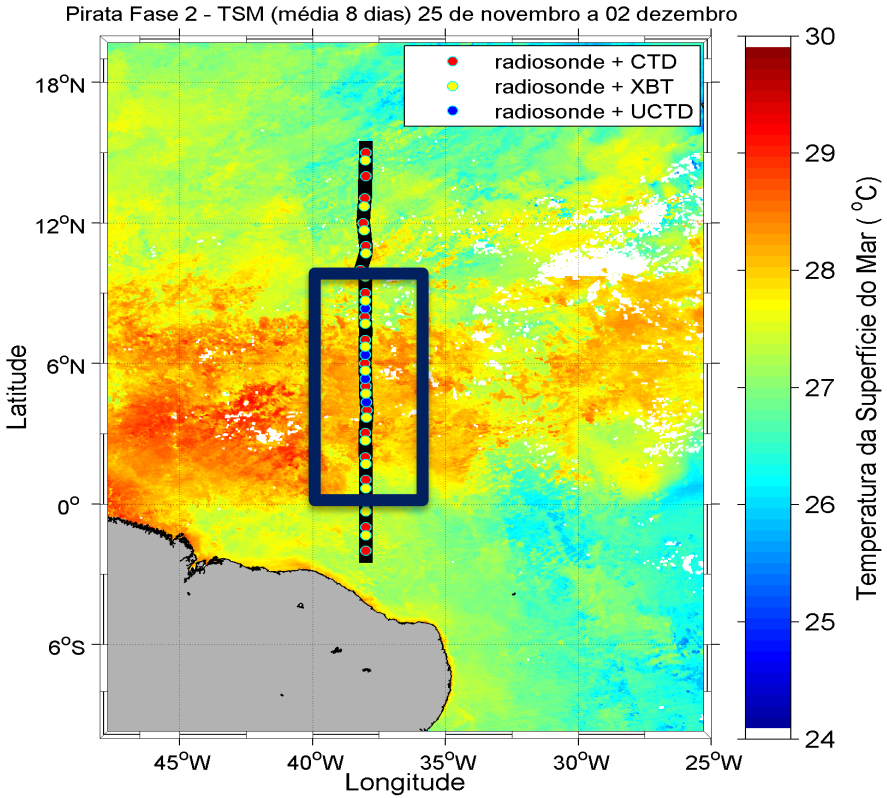
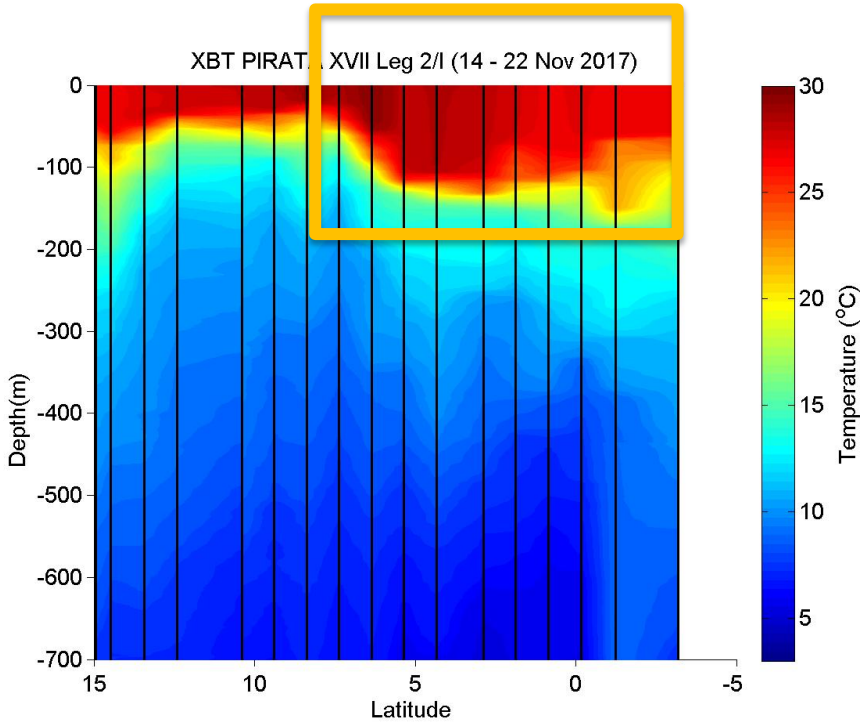


FIGURE 3 | Schematic of the key components for understanding tropical Atlantic variability.

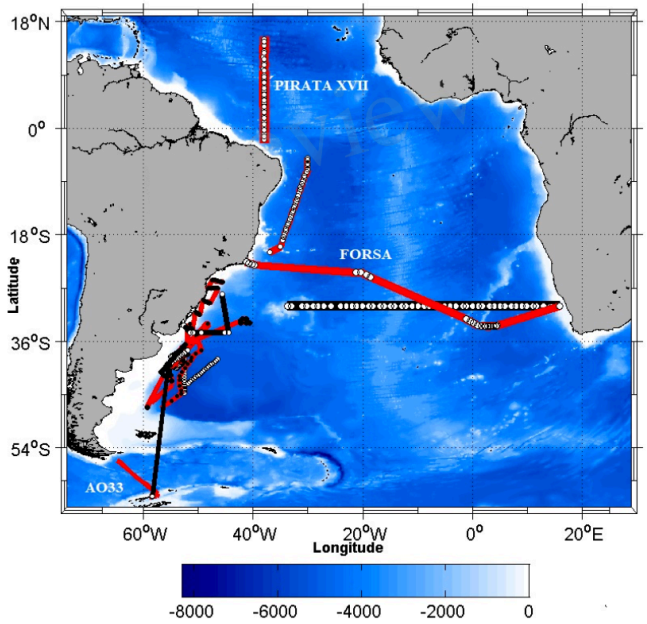
Brazilian Navy's Research Vessel Vital de Oliveira

Ocean-Atmosphere coupling at the synoptic scale





Ocean-Atmosphere coupling at the turbulent scale



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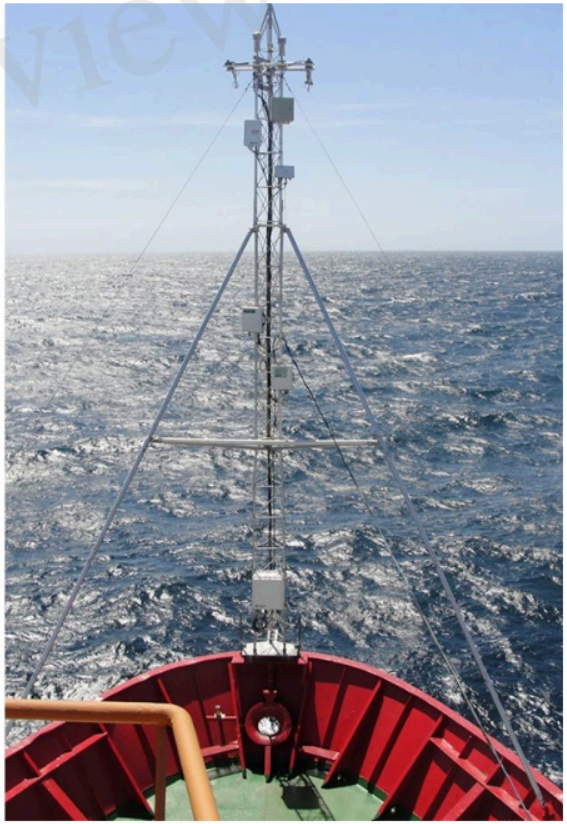

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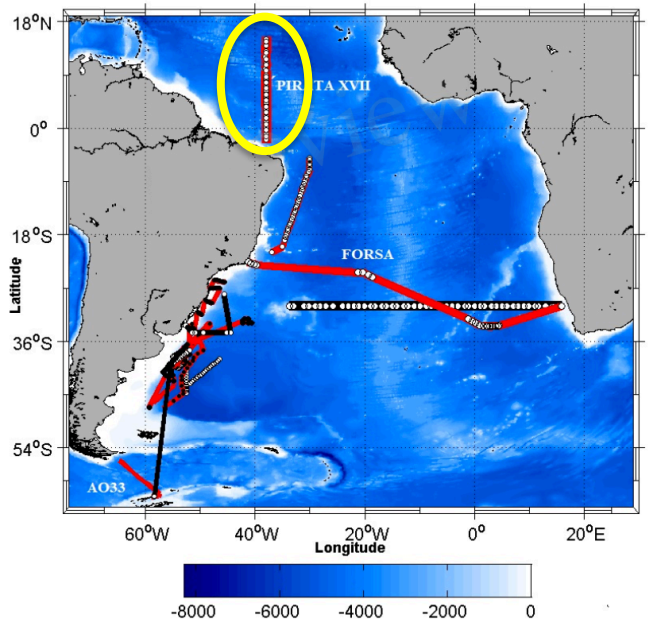
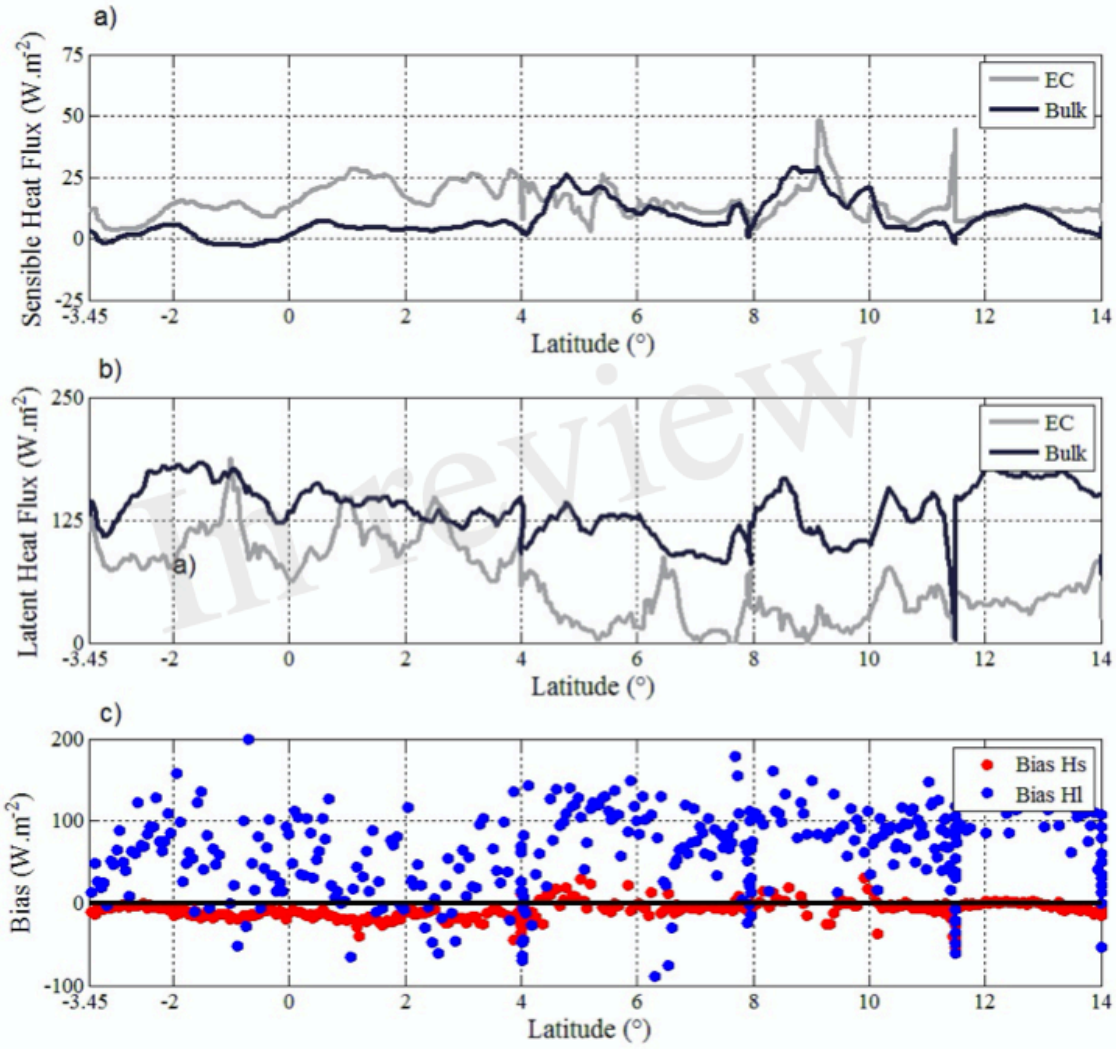
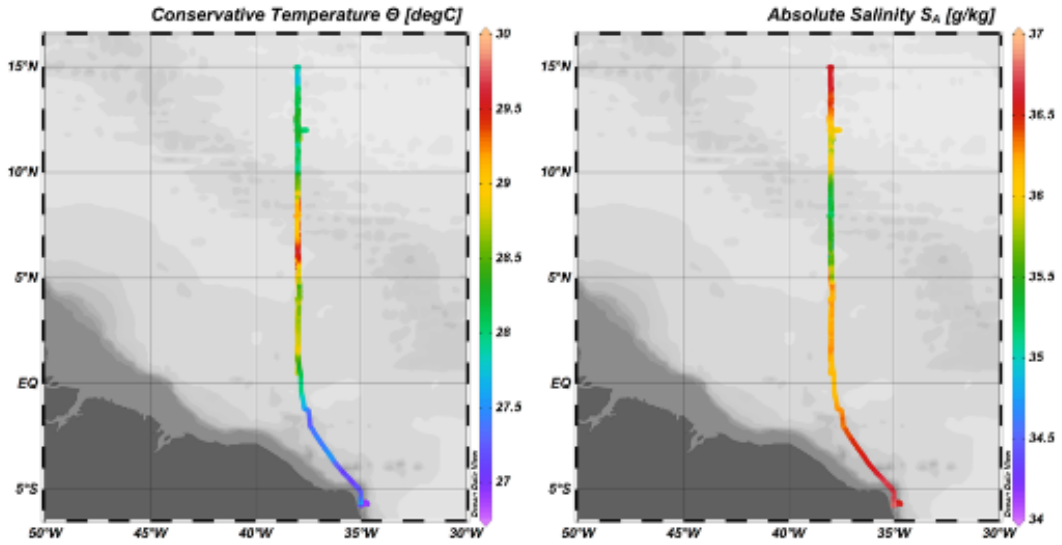
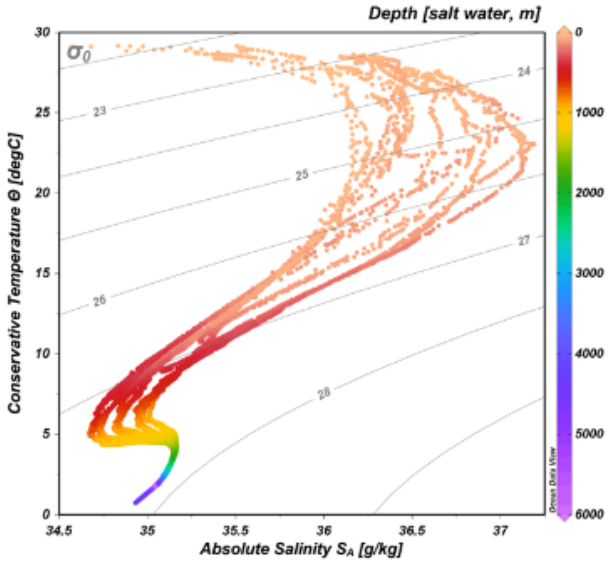
Ocean-Atmosphere coupling at the turbulent scale





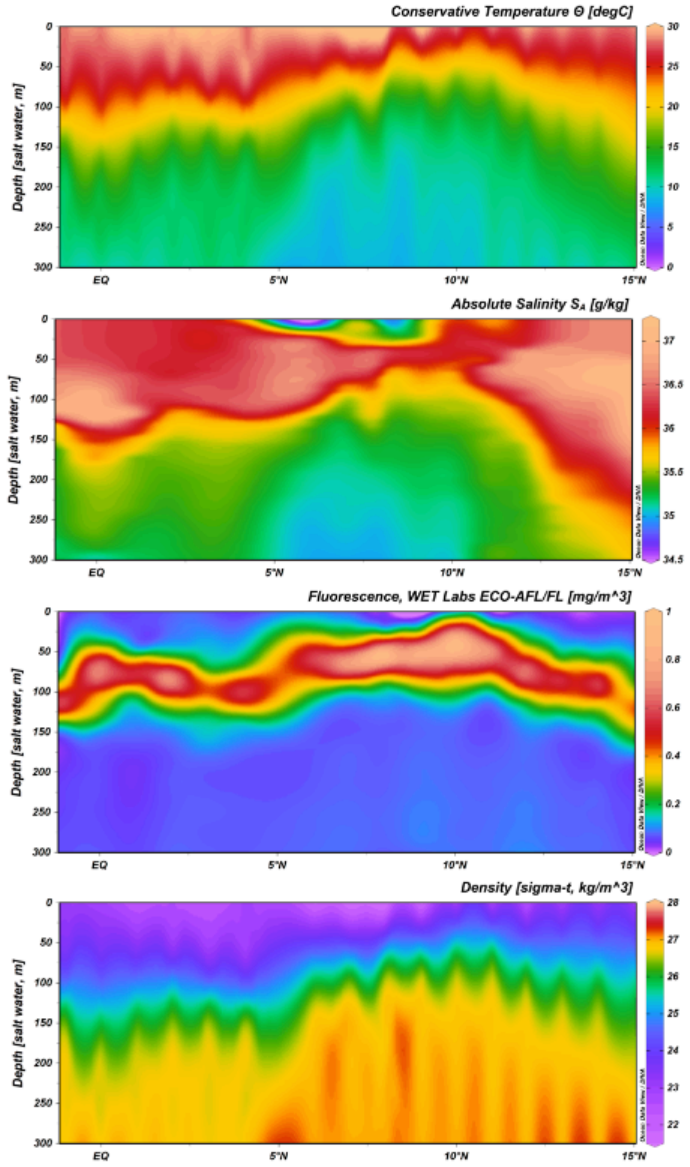
Oceanographic variables





Courtesy Dr. Leticia Cotrim – Rio de Janeiro State University (UERJ)

Oceanographic variables



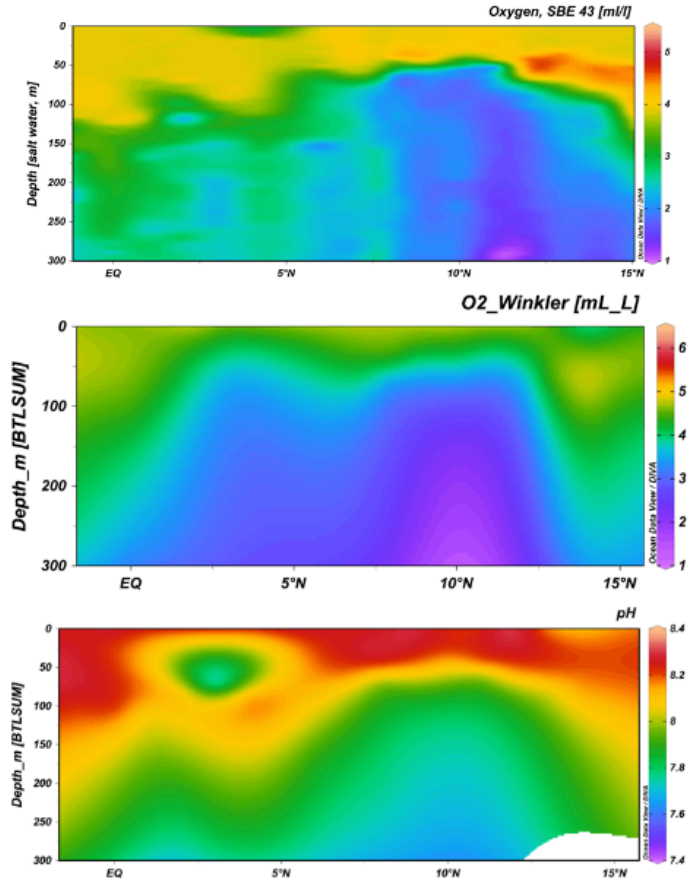


Figura 13. Perfis de temperatura, salinidade, oxigênio, fluorescência, densidade, oxigênio e pH do oceano superior (até 300 m) obtidos através do CTD ao longo do transecto 38□W durante a pernada 3 da Comissão PIRATA-BR XVIII.

Courtesy Dr. Letícia Cotrim – Rio de Janeiro State University (UERJ)

From PIRATA toward a more complete Tropical Observing System

frontiers in Marine Science

REVIEW
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The Tropical Atlantic Observing System

G. R. Foltz[1], P. Brandt[2,3], I. Richter[4], B. Rodríguez-Fonseca[5,6], F. Hernandez[7,8], M. Dengler[2], R. R. Rodrigues[9], J. O. Schmidt[10], L. Yu[11], N. Lefevre[12], L. Cotrim Da Cunha[13], M. J. McPhaden[14], M. Araujo[9], J. Karstensen[2], J. Hahn[2], M. Martín-Rey[15], C. M. Patricola[16], P. Poli[17], P. Zuidema[18], R. Hummels[2], R. C. Perez[1], V. Hatje[19], J. F. Lübbecke[2,3], I. Polo[5], R. Lumpkin[1], B. Bourlès[20], F. E. Asuquo[21], P. Lehodey[22], A. Conchon[22], P. Chang[23,24], P. Dandin[25], C. Schmid[1], A. Sutton[14], H. Giordani[25], Y. Xue[26], S. Illig[27,28], T. Losada[5], S. A. Grodsky[29], F. Gasparin[30], T. Lee[31], E. Mohino[5], P. Nobre[32], R. Wanninkhof[1], N. Keenlyside[33,34], V. Garcon[27], E. Sánchez-Gómez[15], H. C. Nnamchi[2], M. Drévillon[30], A. Storto[35,36], E. Remy[30], A. Lazar[37], S. Speich[38], M. Goes[1,39], T. Dorrington[40], W. E. Johns[18], J. N. Moum[41], C. Robinson[42], C. Perruche[30], R. B. de Souza[32], A. T. Gaye[43], J. López-Parages[5], P.-A. Monerie[44], P. Castellanos[45], N. U. Benson[46], M. N. Hounkonnou[47], J. Trotte Duhá[48], R. Laxenaire[38] and N. Reul[49]*

[1] NOAA/AOML, Miami, FL, United States, [2] GEOMAR Helmholtz Centre for Ocean Research Kiel, Kiel, Germany, [3] Kiel University, Kiel, Germany, [4] Application Laboratory, Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan, [5] Departamento de Física de la Tierra y Astrofísica, Universidad Complutense de Madrid, Madrid, Spain, [6] Instituto de Geociencias IGEO, UCM-CSIC, Madrid, Spain, [7] IRD, LEGOS, Mercator Océan, Ramonville-Saint-Agne, France, [8] Department of Oceanography, Federal University of Pernambuco, Recife, Brazil, [9] Department of Oceanography, Federal University of Santa Catarina, Florianópolis, Brazil, [10] Kiel Marine Science, Christian-Albrechts-Universität zu Kiel, Kiel, Germany, [11] Department of Physical Oceanography, Woods Hole Oceanographic Institution, Woods Hole, MA, United States, [12] LOCEAN-IPSL, Pierre and Marie Curie University, Paris, France, [13] Faculdade de Oceanografia, BrOA, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, Brazil, [14] NOAA/PMEL, Seattle, WA, United States, [15] UMR5318 CECI CNRS-CERFACS, Toulouse, France, [16] Climate and Ecosystem Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA, United States, [17] Center for Marine Meteorology, Météo-France, Brest, France, [18] Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL, United States, [19] CIEnAm, Departamento de Química Analítica, Universidade Federal da Bahia, Salvador, Brazil, [20] Centre IRD de Bretagne, Technopole Pointe du Diable, Plouzané, France, [21] Faculty of Oceanography, University of Calabar, Calabar, Nigeria, [22] Collecte Localisation Satellites, Ramonville-Saint-Agne, France, [23] Department of Oceanography and Atmospheric Sciences, Texas A&M University, College Station, TX, United States, [24] Physical Oceanography Laboratory, Qingdao Collaborative Innovation Center of Marine Science and Technology, Ocean University of China, Qingdao, China, [25] Direction de la Recherche, Météo-France, Toulouse, France, [26] NOAA/NCEP Climate Prediction Center, College Park, MD, United States, [27] LEGOS, CNRS/IRD/UT/CNES, Toulouse, France, [28] Department of Oceanography, University of Cape Town, Cape Town, South Africa, [29] Department of Atmospheric and Oceanic Science, University of Maryland, College Park, MD, United States, [30] Mercator Ocean, Ramonville-Saint-Agne, France, [31] JPL, NASA, Pasadena, CA, United States, [32] Center for Weather Forecast and Climate Studies – CPTEC, National Institute for Space Research (INPE), Cachoeira Paulista, Brazil, [33] Geophysical Institute, University of Bergen, Bergen, Norway, [34] Bjerknes Centre for Climate Research, Bergen, Norway, [35] Centro Euro-Mediterraneo sui Cambiamenti Climatici, Bologna, Italy, [36] Centre for Maritime Research and Experimentation (CMRE), La Spezia, Italy, [37] LOCEAN-IPSL, Sorbonne Universités (UPMC, Univ. Paris 06), CNRS/IRD/MNHN, Paris, France, [38] Laboratoire de Météorologie Dynamique, CNRS, ENS, UMR Ecole Polytech 8539, Paris, France, [39] CIMAS, University of Miami, Miami, FL, United States, [40] Department for Environment, Food and Rural Affairs (Defra), London, United Kingdom, [41] College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, Corvallis, OR, United States, [42] School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom, [43] ESP, University Cheikh Anta Diop (UCAD), Laboratoire de Physique de l'Atmosphère et de l'Océan Siméon Fongang, Dakar, Senegal, [44] National Centre for Atmospheric Science (NCAS), Department of Meteorology, University of Reading, Reading, United Kingdom, [45] MARE, Marine and Environmental Sciences Centre, University of Lisbon, Lisbon, Portugal, [46] Department of Chemistry, Covenant University, Ota, Nigeria, [47] Research Laboratory of Mathematics and Mathematical Physics, University of Abomey-Calavi, Cotonou, Benin, [48] Directorate General for Science, Technology and Nuclear Development of the Brazilian Navy, Rio de Janeiro, Brazil, [49] Laboratoire d'Océanographie Physique et Spatiale (LOPS), Université de Bretagne Occidentale, CNRS, Ifremer, IRD, Brest, France

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Edited by:
Gilles Reverdin,
Centre National de la Recherche Scientifique (CNRS), France

Reviewed by:
Sophie E. Cravatte,
Institut de Recherche pour le Développement (IRD), France
Laurent Coppola,
UMR7093 Laboratoire d'Océanographie de Villefranche (LOV), France

***Correspondence:**
G. R. Foltz
gregory.foltz@noaa.gov

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The tropical Atlantic is home to multiple coupled climate variations covering a wide range of timescales and impacting societally relevant phenomena such as continental rainfall, Atlantic hurricane activity, oceanic biological productivity, and atmospheric circulation in the equatorial Pacific. The tropical Atlantic also connects the southern

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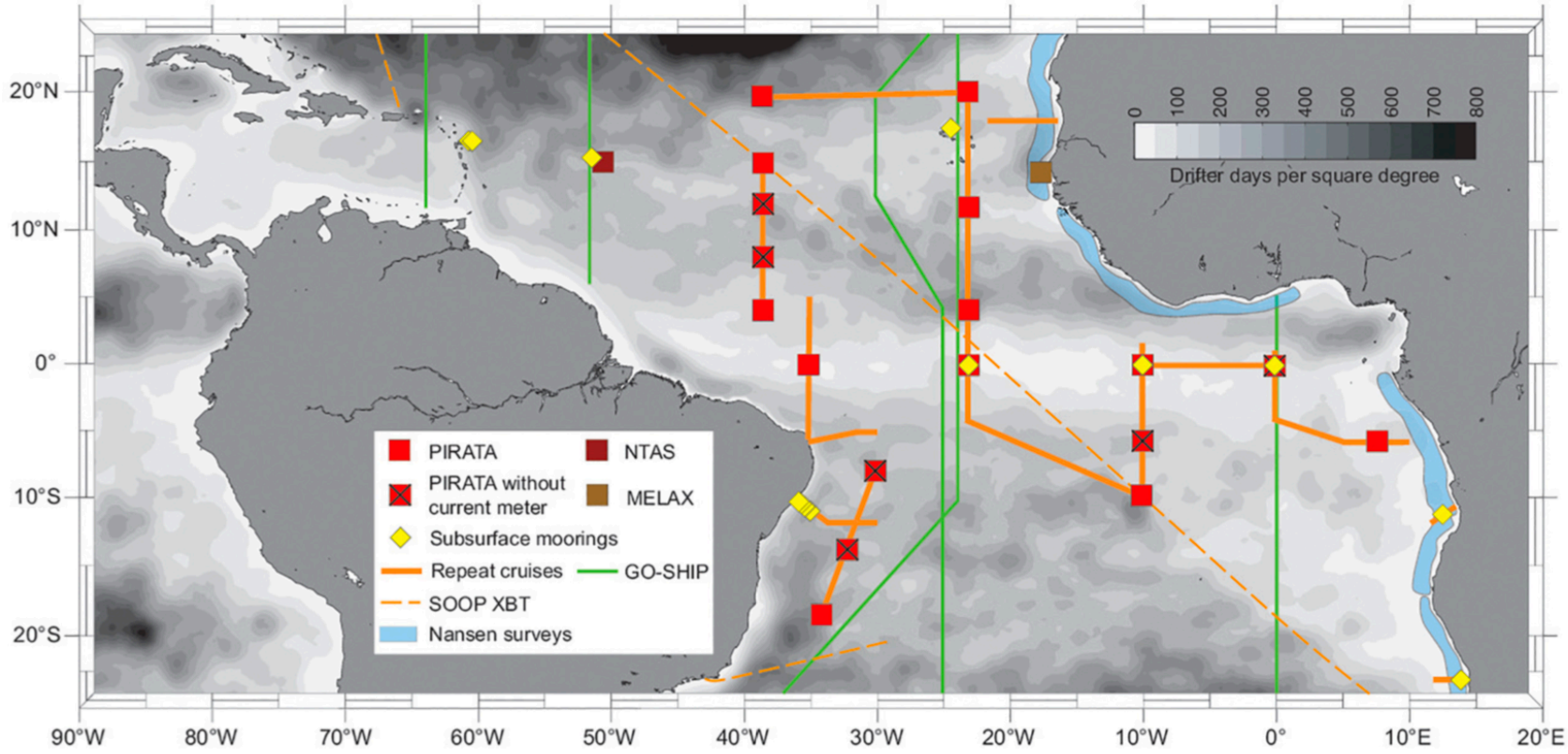

FIGURE 10 | The tropical Atlantic observing system as implemented for the study of ocean circulation and upwelling. Shading indicates total number of days any surface drifter was in each 1° × 1° box through February 2018. Surface drifter measurements in the tropical Atlantic began in 1997. Solid orange lines show repeat cruise tracks, mainly for servicing moorings, dashed orange lines show XBT lines, blue shading indicate regions where Nansen surveys (near-coastal physical, chemical, and biological sampling from a research vessel) have been conducted, and green lines show full-depth repeat hydrography cruise tracks (GO-SHIP). The brown square shows the location of the coastal air-sea buoy Melax, yellow diamonds indicate where subsurface velocity and hydrographic moorings have been deployed, and other symbols are as in **Figure 6**.

PIRATA: next steps

- A new MoU is being set between Brazil – USA and France;
- As well as maintaining the current observational set up, we want to improve the number of on going, automatic and discrete observations along the ship's tracks when at sea supporting PIRATA;
- A better scheme for meteorological and oceanographic instrument calibration and for data validation is needed, as well as a common site for data distribution;
- PIRATA should be the core program supporting the new Tropical Ocean Observing System;
- New data should be collected to support studies in several scales from turbulent to climate.

Acknowledgements

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