

PIRATA-24a meeting report

(Virtual meeting via videoconference, April 22, 2020)

Since the last meeting PIRATA-23 in Marseille (October 2018), it was not possible to organize a PIRATA yearly meeting as usual, i) due to the OceanObs19 conference in late September 2019, then ii) due to the Covid-19 crisis and induced lockdowns from March 2020 in most countries around the world...

However, a limited meeting was held in Hawaii during the OceanObs19 meeting, with attendance of PIRATA SSG & PRB members. A report of this meeting (PIRATA-23b) has been distributed to all “pirates”, and added in the Annex 1 of this document.

The 24th PIRATA meeting, initially expected to be organized in Miami, was held via videoconference on April 22, 2020, and organized by Greg Foltz (NOAA/AOML). With the next in-person PIRATA-24 meeting being delayed, and hopefully occurring in May 2021 in Miami, this virtual one is named “PIRATA-24a”...

The agenda was as follows:

Wednesday, April 22 (all times EDT; GMT-4)

11:00-11:20 U.S./PMEL PIRATA update (Mike McPhaden)

11:20-11:40 France PIRATA update (Bernard Bourles)

11:40-12:00 Brazil PIRATA update (Ronald Buss de Souza, Paulo Nobre)

12:00-12:20 U.S./AOML PNE update (Greg Foltz)

12:20-12:40 PRB updates (David Legler, Jim Todd, Alex Ganachaud, Philippe Dandin, Janice Trotte)

12:40-13:00 Break

13:00-14:00+ Discussion, focusing on new MOU

Attendees for the SSG-PRB virtual session:

- SSG member participants:

Bernard Bourlès (IRD/LEGOS, France; co-chair); Moacyr Araujo (UFPE, Brazil; co-chair); Michael McPhaden (NOAA/PMEL, USA); Gregory Foltz (NOAA/AOML, USA); Paulo Nobre (INPE, Brazil), Hervé Giordani (Météo-France/CNRM, France), Fabrice Hernandez (IRD/LEGOS/Mercator Océan, France), Peter Brandt (GEOMAR, Germany), Leticia Cotrim (UERJ, Brazil), Christina Patricola (LBNL, USA), Regina Rodrigues (UFSC, Brazil), Adrienne Sutton (NOAA/PMEL, USA).

- PRB member participants:

David Legler (NOAA, USA, Chair); Janice Trotte-Duhá (DHN, Brazil); Alexandre Ganachaud (IRD/LEGOS, France); Philippe Dandin (Météo-France/CNRM, France); Ronald Guss de Souza (INPE, Brazil)

Also attended: James Todd (NOAA, USA), Katie Geddes (NOAA, USA), Renellys Perez (NOAA/AOML, USA), Kenneth Connell (NOAA/PMEL, USA), Jérôme Llido (IRD/LEGOS, France).

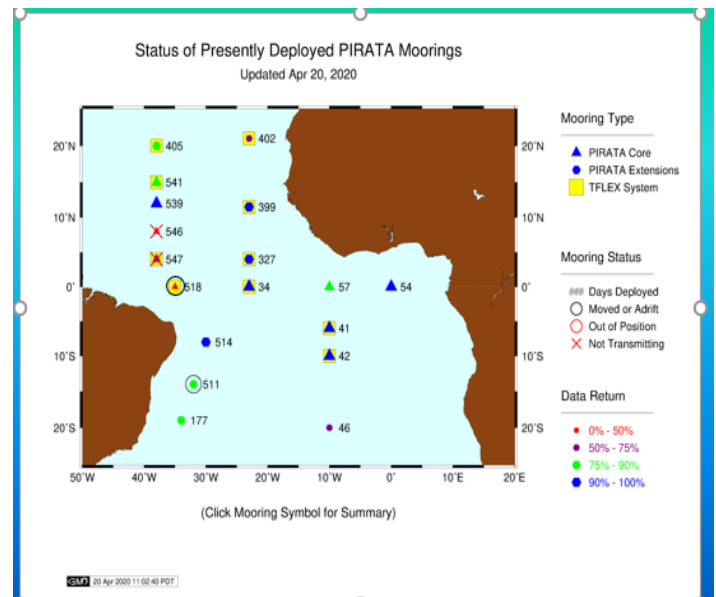
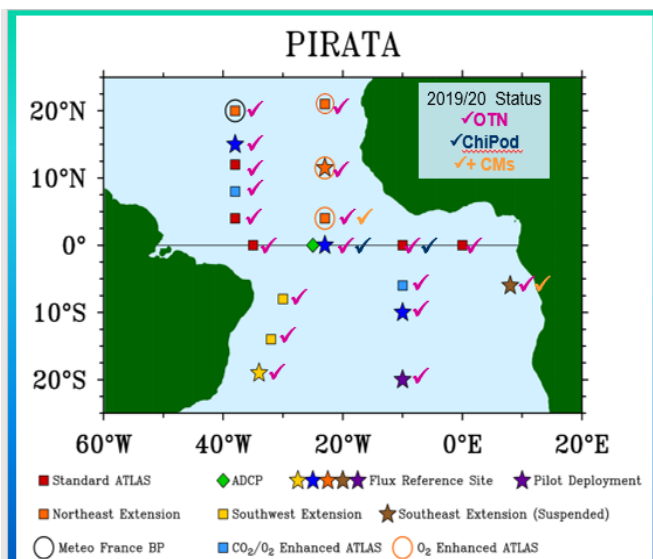
PIRATA global and national status:

1) NOAA/PMEL PIRATA overall report (Mike McPhaden)

Mike McPhaden (MM) presented the current flavor of the PIRATA buoy network (see figures below), progress from the last PIRATA-23 meeting, and plans for 2020.

Ocean Tracking Network (OTN: acoustic sensors) are installed on all air-sea interactions buoys from 2013; five Chipods (at 21m, 35m, 50m, 65m and 81m) are installed at 23°W-0°N & 10°W-0°N from 2016; sub-surface current meters (CMs) are installed at 23°W-4°N and 8°E-6°S; 8 IFM/GEOMAR subsurface O₂ sensors are also installed, with 6 reporting real-time data in 2019 at 23°W-11.5°N (80m, 300m, & 500m), 23°W-20°N (80m, 150m, & 300m), and an additional two with onboard data only at 23°W-4°N (300m & 500m). The status of presently deployed moorings indicates long periods, up to 547 days in the west and up to 405 in the north, without any servicing. Two buoys (at 4°N and 8°N along 38°W) are not transmitting. Also, we learned one day ago (April 21st) that the buoy at 35°W-0°N went adrift... In the east, the 8°E-6°S buoy also went adrift on August 8th 2019 (2nd year in a row...). It was decided in Hawaii (see Annex) that this buoy should not be maintained anymore for some time, and possibly replaced at 10°W-20°S (following recommendations by AtlantOS, TAOS etc... see Annex). Thus, a buoy was deployed at 10°W-20°S during the recent PIRATA-FR30 cruise, but it has not been transmitting any subsurface data since March 22nd (for unexplained reason...it was deployed on March 5th and worked properly until this date!).

The next PNE-US cruise was planned in May/June 2020 but has been postponed. The last BR cruise in October 2019 could only service the southernmost buoy on October 26, just before the cruise was diverted due to an oil spill off the Brazilian coast. The BR cruise was thus postponed.



MM showed and detailed the most recent 12 month real-time data return (from October 2018 to September 2019). The moorings with less than 80% total data return are:

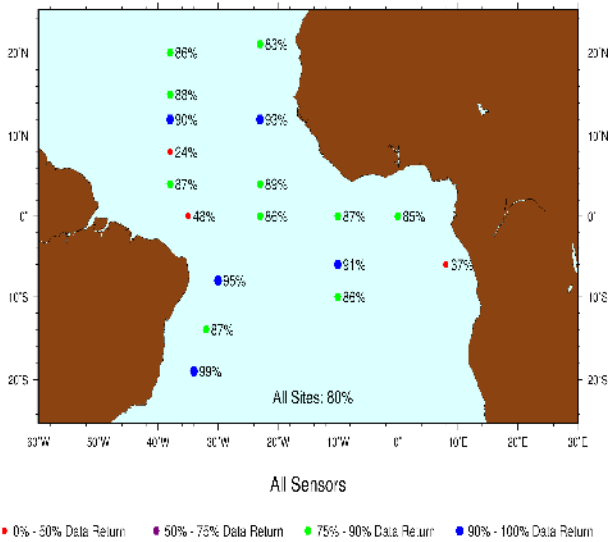
- 6°S-8°E : 37% (adrift on 8 Aug 2019 and loss of all subsurface instruments).
- 0°N-35°W : 48% (all subsurface failed after 130 days. Rain failed after 293 days. SWR failed after 432 days. Went adrift on April 21 2020 ...).
- 8°N-38°W : 24% (stopped transmitting after 83 days ; no data transmissions since 2019-01-15).
- 4°N-38°W : 87% for FY2019.....but no longer transmitting (stopped transmitting after 331 days ; no data transmissions since 2019-09-16)

MM reminded us of the fishing trends off Brazil, as detailed in a paper by Da Silva et al, 2018, indicating increasing fishing pressure around the PIRATA buoys! Such a phenomenon could induce some vandalism acts...

(Note: about this fishing pressure, see some important inputs in Annex 2 provided by Bernard Boulrès).

Despite major issues, the PIRATA mooring data return for the whole period October 2018-September 2019 is 80%, varying from 66% to 91% for individual sensors.

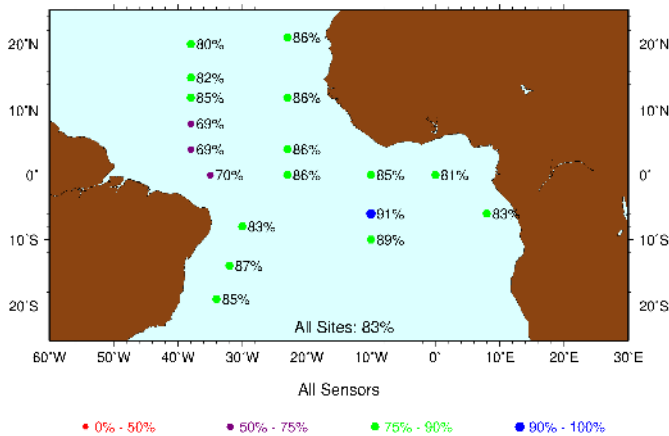
PIRATA Mooring Real-Time Data Return
October 2018 - September 2019



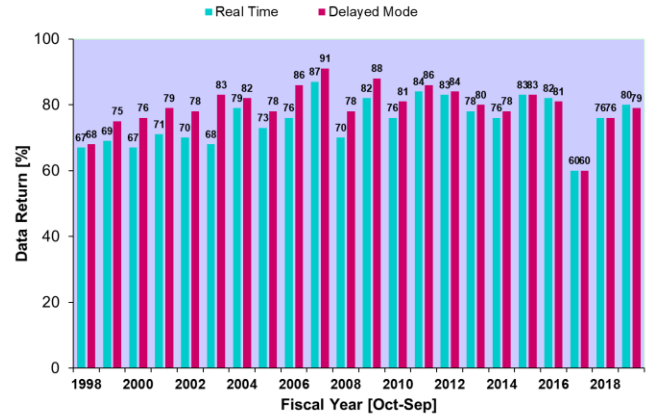
	Air T	SST/SSC	T(Z)	Wind
% Data Return	85	71/66	83	91
	RH	Rain	SWR	Salinity
% Data Return	79	77	88	75
	Currents (11 sites)	LWR (6 sites)	Atm Pres (7 sites)	All Sensors
% Data Return	78	90	86	80

Also, despite the buoys lost, both the Real Time (RT) and Delayed Mode (DM) data return during Oct 2004 - Sept 2019 was 83% for all sites. The RT and DM time evolution from 2008 indicates that the annual data return and number of moorings operating have returned to typical levels following a significant dip in 2017.

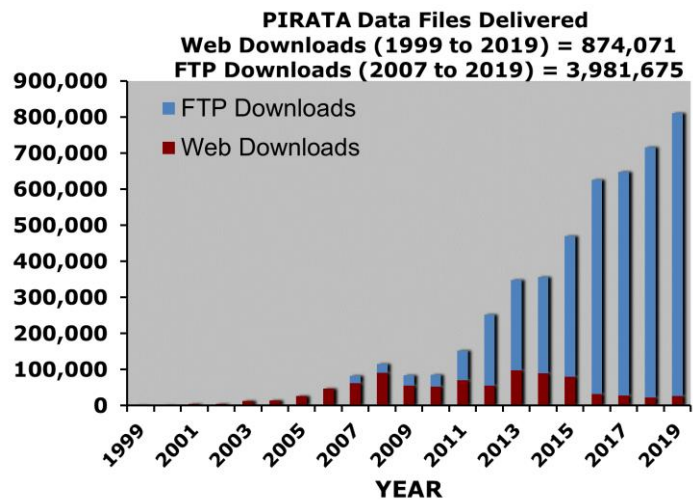
PIRATA Mooring Data Return
October 2004 - September 2019



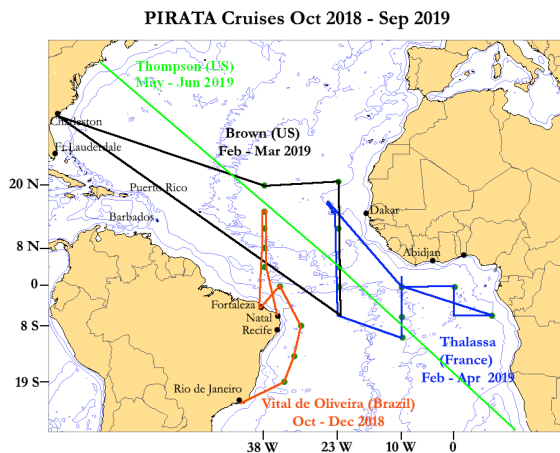
PIRATA Data Return



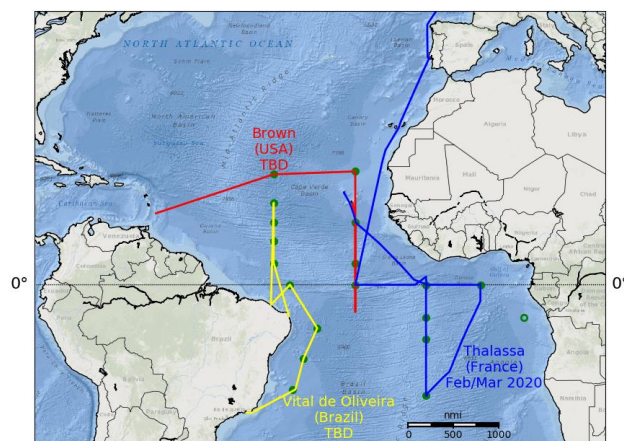
Data files delivered through the web strongly decreased from 2013 but were offset by a very large increase in ftp file downloads (more than 800,000 during the last US fiscal year). A grand total of 874,071 files were delivered from 1999 to 2019 through the website, compared to 3,981,675 through ftp from 2007.



Field work from Oct 2018 to Sept 2019 involved 135 days at sea across US, BR and FR partners. 18 buoys were deployed: 7 ATLAS and 11 T-Flex during the cruises: BR VITAL DE OLIVEIRA (in 2 legs: 47 days: 16 Oct - 10 Nov 2018; 15 Nov - 5 Dec 2018); US RON BROWN (29 days: 1 Mar - 29 Mar 2019); during this cruise a medical evacuation required a second NOAA cruise to service 4N, 23W in May/June); FR THALASSA (35 days: 1 Mar - 4 Apr 2019) and US THOMPSON (24 days: 17 May - 9 Jun 2019 to service 4N, 23W). PMEL sent persons to sea for 106 days.



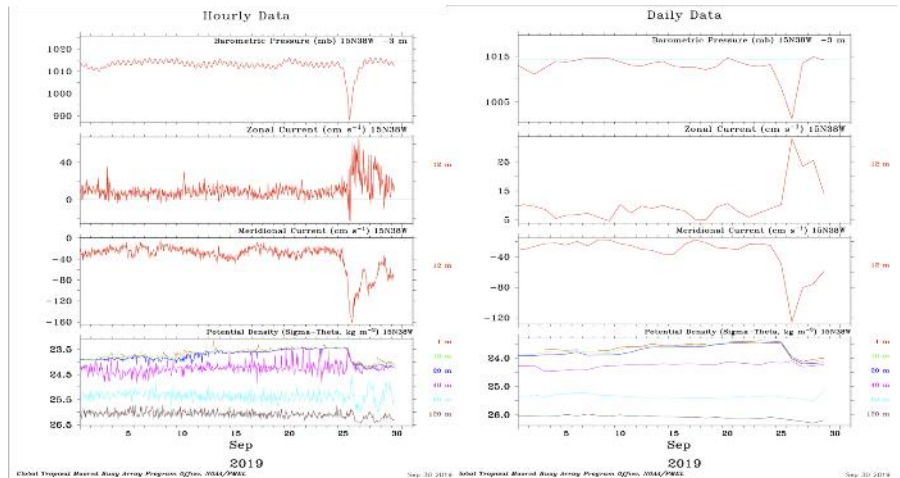
From Oct 2019: the BR PIRATA Cruise aboard the Vital de Oliveira not yet scheduled; the US PNE cruise proposed on Ronald H. Brown, originally scheduled for May/June 2020 is postponed due to the COVID-19 pandemic; thus the PNE cruise is not yet scheduled; the FR cruise aboard the Thalassa was completed in Feb-March 2020.



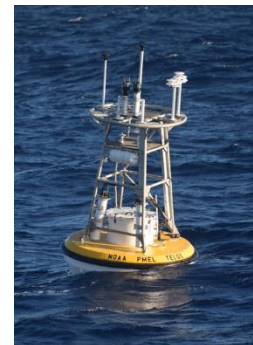
Then MM showed the implementation of the T-Flex underway. T-Flex and ATLAS systems provide equivalent data, and T-Flex performance (realtime & delayed-mode data return, record length) is equal to or better than ATLAS. There are currently T-Flex systems at 9 sites in RAMA and at 11 sites in PIRATA.

MM showed the situation encountered on Sept 25, 2019 with the signature of hurricane Lorenzo at 15N-38W by the PIRATA T-Flex. Despite the direct hit, the mooring remained in position and continued transmitting high-quality, high-resolution data in real-time. He showed the Enhanced Infrared (IR) Imagery (1 km Mercator, from MODIS/AVHRR) of Lorenzo immediately prior to passing over the PIRATA mooring on Sept 26, 2019 (Source: NOAA/NESDIS and CIRA): http://rammb.cira.colostate.edu/products/tc_realtime/products/storms/.

When comparing PIRATA Real-Time Hourly vs. Daily Average Data on Sept 26, 2019, the hourly data figures (left side) highlight the advantages of T-Flex moorings, which provide hourly data in real-time as compared to ATLAS moorings, which provide daily averages (right side) in real-time.



Then, MM presented the technology development at PMEL, with the TELOS (Telemetry and Electronics for Logging of Ocean Sensors) Data Acquisition System. Two TELOS systems were deployed near the station ALOHA in the Pacific (first TELOS deployment in the open-ocean), as in PIRATA, with: 13 line-mounted TC sensors 1-500 m, 2 CMs, and a full suite of 6 surface met sensors plus a redundant suite of 6 surface met sensors and SSTC sensor on same mooring equipped with a T-Flex system for comparison. MM showed the very nice first results (comparison of TELOS versus T-Flex) for barometric pressure and SST for the period 2019, Nov 21 to 2020, Jan 3.

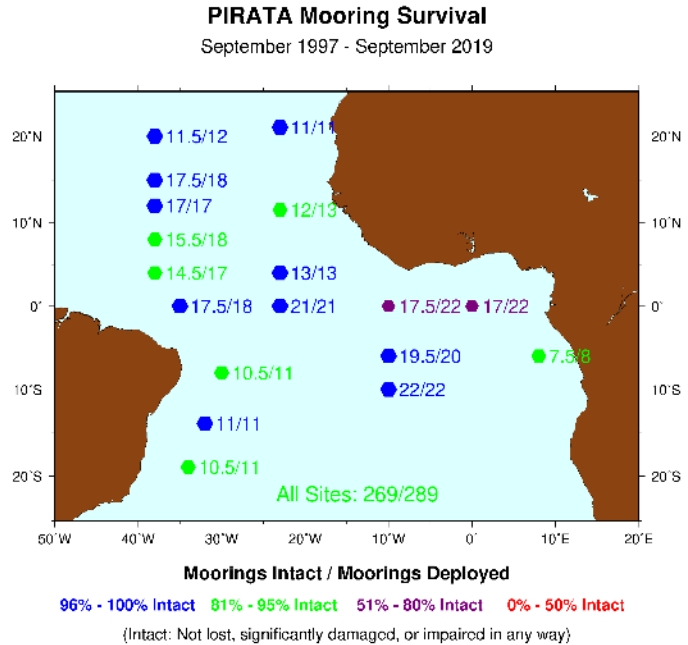


About fishery activities and vandalism, MM reminded us of the paper by Da Silva et al. (2018) showing the PIRATA network map with fishes on the western buoys. He presented the temporal evolution of the number of boats operating in the associated school fisheries in Brazil and the annual variation in the catches (t) in live weight from yellowfin (YFT), bigeye (BET), and skipjack (SKJ) from fisheries on associated schools off Brazil.



About piracy, MM showed that some incidents in Gulf of Guinea continue, but were confined mainly to the coastline, and piracy is abating off the horn of Africa (Sources: Office of Naval Intelligence: <https://www.oni.navy.mil/News/Shipping-Threat-Reports/> and IOC Commercial Crime Services: <https://www.icc-ccs.org/piracy-reporting-centre/live-piracy-map>).

The PIRATA mooring survival over the past 22 years, from Sept 1997 (early step of PIRATA) to Sept 2019, is 269/289 for all sites. Only the two equatorial buoys in the Gulf of Guinea (10W and 0E) still show values lower than 80% (see figure for explanations).



MM showed the global enhancements and collaborations achieved from the early PIRATA.

Core measurements on all moorings are:

Wind, AT/RH, Rain, SWR, SST, SSS, 10 subsurface T, 3 subsurface S, 2 subsurface P

Then:

- 6 Flux Reference Sites (15N38W, 19S34W, 12N23W, 0-23W, 10S10W, 6S8E): LWR, BP, 10m CM, 2 add'l. subsurface T (5m, 10m), 4 add'l. S (5m, 10m 60m, 80m)
- Continued enhancement of EU AtlantOS funded sensors (T/C and Vel.)
- 3 Surface CO₂/O₂ (LOCEAN)
- 8 Subsurface O₂ (GEOMAR); 6 in real-time
- 1 Surface Pressure (BP) at 20°N, 38°W (Meteo France)
- 2 Sites w/5 Thermal microstructure sensors (10 total) (ChiPods, OSU)
- 18 Acoustic monitors (OTN, Dalhousie University)
- AEROSE (Aerosols and Ocean Science Expeditions, NCAS)
- 9 new T/C sensors planned for each of 3 sites (FUNCEME) in 2020 at: 8°N, 38°W; 4°N, 38°W; and 0°, 35°W
- 10 additional current meters at 4°N, 23°W (AOML)

The additional current meter installed at 6°S, 8°E in 2018 was suppressed after vandalism.

Major issues raised by MM are presented in the following dedicated chapter (5). They are about Corona virus pandemic impacts, cruises, T-Flex implementation, vandalism, MOU and PMEL Budget.

2) French PIRATA report (Bernard Bourlès)

Bernard Bourlès (BB) began with good news (not so often...) announcing that the PIRATA-France program has been successfully evaluated by the CNRS/INSU (as every 5 years) in 2019. The renewal of its label as « National Observation Service for Ocean-Atmosphère » is important for getting institutional support & fundings, cruises' vessel time, etc.).

He presented the different PIRATA-France funding supports. In 2019-2020 the contribution by Météo-France was 30k€, by IRD 52k€, and by the Observatoire Midi-Pyrénées (OMP) 3k€. IRD also provided support of 34k€ in 2019 through a national call offer for Observatories national Systems. These funds have been spent on ADCP moorings (1 ADCP + buoyancy, releasers, cable, weights,...).

Then, he presented the two cruises carried out in 2019 and 2020:

PIRATA FR29 cruise:

As during previous years, and due to piracy activities in the Gulf of Guinea, the PIRATA-FR29 cruise had to be organized in one leg from Cabo-Verde without any call in continental West Africa. It was thus done from the R/V Thalassa and conducted from February 28 to April 5, 2019.

Major last moment issues occurred due to the « shutdown » in USA and a « stressfull » material shipping from PMEL... Also, no SVPs from AOML/NOAA could be shipped to France.

The 6 met-ocean buoys were replaced (+ CO₂ sensors replacement at 6S10W & 6S8E), i.e. 2 ATLAS, 3 T-TLEX and 1 ATLAS replaced by T-FLEX at 6S10W with a new CO₂ sensor.

The ADCP mooring at 0°N-10°W was replaced, providing two full years of data (2017-2019).

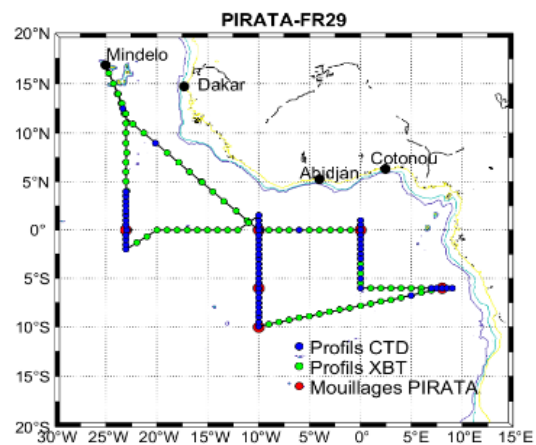
The following additional operations were carried out at some moorings: i) Replacing of 5 χ pods at 0N23W and 0N10W (5 at each site); ii) OTN sensors from Dalhousie University were replaced on all meteo-oceanic buoys, iii) measurements close to the PNE buoys at 4N23W and 12N23W.

61 CTDO₂/LADCP (3x0-4000m, 27x0-2000m and 30x500m; 1x40m) were carried out (along sections at 10W, 0E and 23W, and around 6S8E), along with 84 XBT profiles.

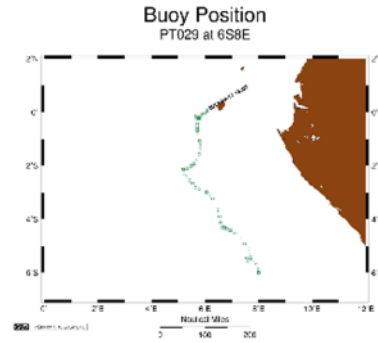
648 seawater samples were collected for biogeochemical (surface: SSS, CO₂, nutrients, Chl pigments & along the vertical during CTD-O₂ casts: S, O₂, nutrients, Chl pigments, CO₂ at 6S10W & 8S6E) parameters. Continuous underway ADCPs, TSG, FerryBox and acoustic measurements (the R/V Thalassa is equipped with a SIMRAD EK80 6 frequencies acoustic sensor + 120kHz for the horizontal, and such measurements are of great interest for biotic and abiotic ecosystem components) were acquired. For the 1st time since 2006 on a PIRATA-FR cruise, pCO₂ underway measurements were also carried out. Also, for first time, incident cosmic neutrons (spectrophotometers) were detected underway.

Sargassum algae and fauna (gooseneck barnacles, crabs, shrimps, worms, tuna...) samples were collected for taxonomy, biological, microplastic and Hg analysis.

Also, 6 Argo profilers were deployed (+ one 0-4000m CTDO₂/LADCP profile close to a Deep-ARGO deployed in 2018 off Congo) and 13 SVP-B (as Météo-France contribution to AtlantOS).

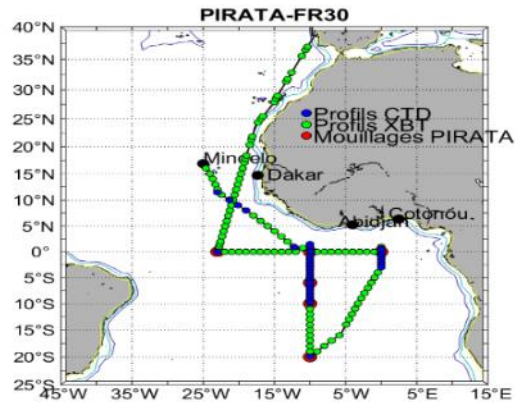


BB showed that the T-Flex at 6S8E went adrift on August 8th 2019, for the 2nd year in a row. It was retrieved at Sao Tome (thanks to a local organization that previously serviced a tide gauge and a met station there) and its shipping back to France is going on (delayed due to COVID19 pandemic). The tube, atm sensors, TC surface & CO₂ sensors are safe... BB precised that, in addition to material loss and costs, this also induces significant extra expenses (for shipping, customs...) for PIRATA-Fr.



PIRATA FR30 cruise:

As in previous years, the PIRATA-FR30 cruise was organized in one leg from Cabo-Verde, from the R/V Thalassa and conducted from February 16 to March 31, 2020. Due to the Covid19 pandemic, the works were stopped on March 16 before shipping back to Brest (France) onboard the R/V Thalassa, instead of stopping in Mindelo on March 22 as initially expected. Fortunately, most of the major work (including moorings servicing) was done and only 2 days of CTD-O2/LADCP casts were cancelled at 23°W.



Major last moment issues occurred: Seabird provided some new TC sensors to PMEL with malfunctioning inductive modems, so the 0N10W remained as ATLAS instead of being replaced by a T-Flex system. Also, due to bad weather in the North Atlantic and strikes in France, the material shipping from PMEL to France was stressful... Also, one T-Flex buoy was missing in the inventory.

Five meteo-oceanic buoys at 23W0N (T-Flex), 0E0N (ATLAS), 10W10S (T-Flex), 10W6S (T-Flex), and 10W0E (ATLAS) were serviced. As decided during the PIRATA 23b meeting in Hawaii (see Annex 1), the buoy deployed from 2013 at 8E6S (T-Flex) was not replaced. A new buoy was deployed at 20S10W (with an ATLAS system) as a potential future southward extension of the PIRATA network (and following recommendations by PREFACE, ATLantOS & PIRATA/TAOS).

Also, the CO₂ parameters sensor installed at 10W6S was replaced, and a new one was added at 10W0N (replacing the one previously implemented at 8E6S); turbulence sensors (Xpods) at 2 PIRATA sites (5 at 23W0N and 10W0N; at 21m, 35m, 50m, 65m and 81m depth), and OTN sensors on the 6 buoys (one on each at 200m depth), were replaced.

The ADCP currentmeter moorings at 0E0N were replaced, providing two full years of data (2018-2020).

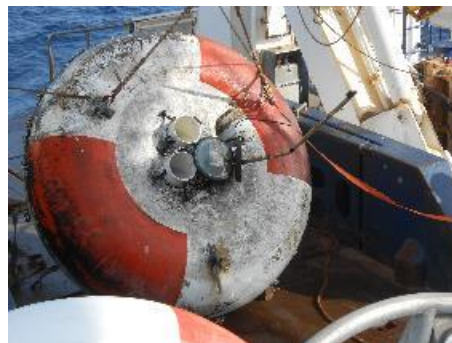
42 CTDO₂/LADCP (1x5215m ; 4x~4000m, 25x2000m ; 3x1000m ; 8x500m ; 1x200m) were carried out (along sections at 10W, and 0E), along with 87 XBT profiles along the trackline south of 16°N (a few other profiles also done between 16°N and Brest during the transit); 474 sea water samples were collected for biogeochemical (surface: SSS, CO₂, nutrients, Chl pigments & along the vertical during CTD-O₂ casts: S, O₂, nutrients, Chl pigments, CO₂ at 10W6S & 10W0N) parameters, and a few samples for C₁₃ and ¹⁸O. Continuous underway meteo, ADCPs, TSG, FerryBox and acoustic measurements were acquired. Also, for the 2nd successive year, incident cosmic neutrons (spectrophotometers) were detected underway.

Sargassum algae and fauna (gooseneck barnacles, crabs, shrimps, worms, tuna...) samples were collected for taxonomy, biological, microplastic and Hg analysis.

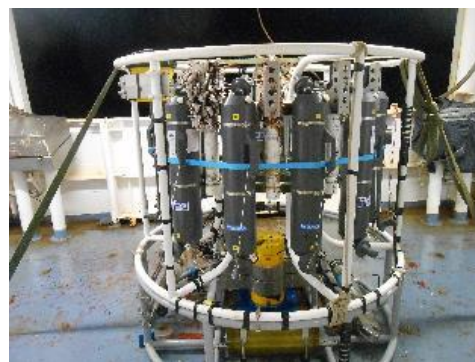
Also, 22 SVP were deployed (14 provided by Meteo-France and 8 by NOAA/AOML) and 4 Argo profilers, including 2 Deep-Argo.

For the 1st time, the cruise allowed the retrieval of 1 Deep-Argo around 1°N-12°W. This profiler was deployed in 2018 at 0N10W in 2018 during the PIRATA FR28 cruise. Such an operation has been conducted in synchronization with the French Argo team in Brest, and took a few hours only. One can refer to the “BluePrint”: we can do it!

About the buoy at 23W0N: it stopped data transmission on December 25th, 2019. It was found (after difficulties... without any radar echo!) on March 16th 2020, without its upper tripod: the tube/batteries and atmospheric sensors were properly dismantled. This is typically the result of fishers’ vandalism... Also, fishermen tinkered with a lamp powered by the solar battery from a stolen acoustic beacon (exactly as if the fishermen wanted to be the only ones who knew where the buoy was). It was the first time we saw such a fisher's vandalism feature!



In order to check the PIRATA buoys’ SSS provided in Delayed Mode (QC process typically involves comparing against adjacent sensors and CTD casts when CTD data are available in close proximity to the mooring) and to check the impact of fouling on the measurements (sensors are cleaned before sending them back to PMEL, that could be a source of error!), an original experiment was conducted. Some uncleaned SBE TC sensors were fixed on the bathysonde and immersed during 45’ around 50m or 200m. A comparison with the CTD TC sensors will be done once all sensors are calibrated. This will allow verifying an eventual drift of the sensors due to fouling that one cannot estimate once sensors are cleaned...



About works in the lab:

BB provided some information about the PIRATA-FR website (<http://www.brest.ird.fr/pirata/>) that was renewed and actualized in 2018-2019, with information on cruises, PIRATA-related reports and documents, and easy access to all data sets. At present, there are DOIs for all PIRATA-FR cruises (yearly actualized), and for all data sets: Acoustic data (J.Habasque et al., NEW, early 2020); L-ADCP data set (P. Rousselot et al., NEW, 2019); Chemistry, S-ADCP, ADCP moorings and CTDO₂ data sets (B.Bourlès, et al., 2018).

BB informed that Jérôme Llido (IRD/LEGOS) and Pierre Rousselot (IRD/IMAGO) were welcomed at PMEL during a one-week visit in October 2019. During this visit, they envisaged an experience to check some potential issues with SSS data provided in Delayed Mode that was carried out during the FR30 cruise, as shown just above.

Miscellaneous additional information:

80k€ should be available via the EU TRIATLAS program, for the purchase of sensors. However, one will have to wait for the agreement of EC due to changes in sensor demand (it was first for the buoy 6S8E & for ADCP moorings...). At present, the demands are for: 6 T/C sensors SBE-37-IMP for 0E0N and 10W6S PIRATA buoys: EUR 36,000; 2 Aquadopp currentmeters for 0E0N PIRATA buoy: EUR 20,000; and 2 SBE37-ODO (O2) sensors for 10W0N buoy : EUR 24,000.

IRD (Fabrice Hernandez), UERJ (Leticia Cotrim) and UFPE (Moacyr Araujo) are involved in the WP7 of the EU EuroSea project (www.eurosea.eu), aiming to demonstrate the interest for CO₂ sensors on the 38W8N PIRATA-BR buoy, in parallel to other CO₂ platforms in the Tropical Atlantic ocean, and then contribute to CO₂ ocean indicators. The EU Blue Growth EuroSea project (2019-2023) and TRIATLAS are legacy of the AtlantOS project. It is planned to equip the buoy with a new CARIOCA sensor, like in the past, for a one year period, whenever possible, ideally in 2021.

At this date (April 22nd), we are waiting for the end of the lockdown (probably mid-May) in order to ensure the retrieval of the PIRATA material onboard the R/V THALASSA & shipping back to PMEL, along with the retrieval of the 8E6S buoy material from Sao Tomé & shipping back to PMEL.

The French PIRATA cruises are under a national evaluation process by the French « national fleet scientific committee », in order to maintain the annual vessel time. Results should be known in fall (but no worry!...).

BB informed about the potential recruitment of a « chemistry engineer » in the IRD/US IMAGO team! This should allow maintaining the nutrients analysis (risk after the retirement of F. Baurand in 2022... this will be confirmed in a few weeks!).

Jérôme Llido will soon replace BB as coordinator of PIRATA in France (2021 or 2022). Then, he should be part of the PIRATA SSG and BB should leave.

BB presents a list of issues to be discussed, that some of them are presented in the following dedicated chapter (5). These issues are about i) the PIRATA MoU: ii) Worrisome perspectives (budgets & institutional supports) ; iii) fishing activities off Brazil, along the equator (23W) and in the Gulf of Guinea (discussions to have with CICTA-ICCAT, in order that they take the same decisions as IOTC-CTOI in the Indian Ocean, even not always efficient! *Some important inputs are provided in Annex 2*); iv) How to deal with the 20S-10W buoy in the close future? v) Other sources of funding for sensor purchasing (in support of PMEL expenses?); vi) SSG composition, e.g. issue with Nathalie Lefevre who left (who for biogeochemistry in France/or Germany?); vi) Brazilian cruises data, and vii) DOI for PIRATA buoy data.

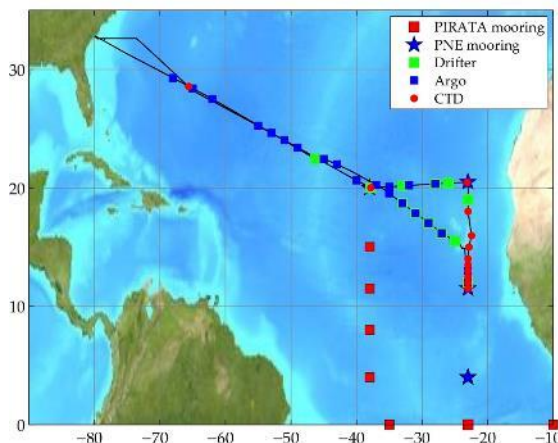
3) NOAA/AOML PIRATA Northeast Extension (PNE) report (Gregory Foltz)

Gregory Foltz (GF) presented the PNE 2019 cruise, conducted on the R/V Ron Brown from March 1 to 29, 2019, i.e. just 12 months after PNE 2018, from Charleston, South Carolina, US from the NOAA ship Ronald H. Brown. The Chief Scientist was Renellys Perez, NOAA/AOML.

Due to government shutdown and mechanical delays, the science was reduced due to loss of 12 days at sea.

Three moorings were serviced: 23W11.5N, 23W20.5N and 38W20N.

Also, the AEROSE team and Brazilian observers were onboard.



Cruise delays and a sick crew member (medical evaluation) prevented the recovery at 23W4N. This mooring was serviced in May 2019, by Dave Zimmerman and Ryan Wells (UW/JISAO), aboard R/V Thomas G. Thompson.

Only 12 CTDO₂/LADCP casts were done (i.e. ~50 stations suppressed), including 3 at the three mooring sites plus 8 along 23W between 20.5N and 11.5N.

22 Argo floats and 14 surface drifters were deployed, and Sargassum algae were monitored along the cruise track (observations classified as: none, trace, isolated, filaments, rafts).

Underway shipboard ADCP/TSG/pCO₂/M-AERI data were collected. There were cavitation issues with the TSG which were partially fixed during the cruise.

101 radiosondes and 8 ozonesondes were launched, and atmospheric chemistry measurements done during strong dust event, in the framework of AEROSE.

8 undergrad/grad students participated to the cruise.

During the cruise, food and water were delivered to Jean-Jacques Savin (transiting Atlantic in barrel).



GF provided information about the PNE 2020 cruise, initially scheduled on the R/V Ronald H. Brown from May 12 to June 11, 2020, from Praia (Cape Verde) to Bridgetown (Barbados). Chief Scientist will be GF (NOAA/AOML), the science team will be over 15 people, and 68 CTDO₂/LADCP are planned. 2 groups will join the cruise: the AEROSE team (Howard Univ, NOAA/NESDIS) and a Macroalgae research group (DOE project).

At present, due to the Covid19 pandemic, the latest update is June 1 at the earliest.

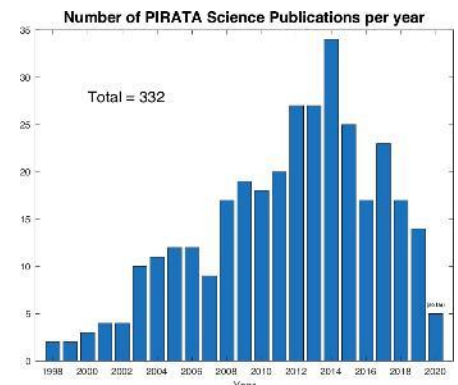
Then GF showed some scientific results about the TACOS experiment at 23W4N and presented the time series form early 2017 (TACOS 1 with 11, TACOS 2 with 5 and TACOS 3 with 11 currentmeters). Seasonal and intraseasonal (TIW) variations during 2017-18 were analyzed and published (Perez et al., 2019, JGR, doi:10.1029/2019JC015064). A second analysis focused on the seasonal variations of shear and the turbulent cooling of SST, including a comparison with numerical model results (GFDL), and was also published (Foltz et al., 2020, JGR, doi:10.1029/2019JC015529).

GF also presented another study carried out by a PhD student, about the quantification of atmospheric thermal tides at PIRATA mooring locations and their impacts on rainfall. One paper is in revision (Christophersen et al., JGR).

GF informed that the next TACOS deployment will be at 38W20N (hurricane development area).

To conclude, GF reminded that the PIRATA bibliography is maintained by Renellys Perez and available through the PNE website (up to 332 peer-reviewed publications as of 14 April 2020).

All are invited to inform Renellys about PIRATA, or PIRATA related, publications (email: Renellys.C.Perez@noaa.gov).



4) Brazilian PIRATA report (Ronald Buss de Souza)

The status of PIRATA-Brazil in 2019-2020 was presented by Ronald Buss de Souza (RBS), who is a Senior Researcher at CPTEC/INPE and the new PIRATA's Brazilian Coordinator. RBS was first introduced by Paulo Nobre (CPTEC/INPE), formerly PIRATA's Brazilian Coordinator.

RBS reminded us that the PIRATA BR XVIII cruise, carried out from the R/V Vital de Oliveira, was at sea between 22-26 Oct 2019, and was interrupted due to an oil spill off Brazilian coast. During this cruise only the buoy at 34W19S were serviced.

RBS showed the trajectory of the 35W0N buoy that went adrift on April 21, 2020, i.e. just the day before.

Then, RBS reminded and illustrated the scientific goals of such a project based on moored buoys. Some are the monitoring of i) the Intertropical Convergence Zone ; ii) the key components of the Tropical Atlantic variability; iii) the Ocean-Atmosphere coupling at the synoptic scale; iv) the Ocean-Atmosphere coupling at the turbulent scale.

He presented some oceanographic variables along the 38W section obtained during PIRATA-BR cruise (results provided by Leticia Cotrim, UERJ), and showed the map "From PIRATA toward a more complete Tropical Observing System" included in the TAOS paper by Foltz et al., 2019.

RBS concluded with a few key points:

- 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 ongoing, 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.

Finally, RBS acknowledged i) the Brazilian Ministry of Science, Technology, Innovations and Communications – MCTIC, the Brazilian Navy for the success and continuity of PIRATA and our American and French partners; ii) Brazilian engineering crew at the Meteorological Instrumentation Laboratory – LIM at INPE and the captain and crew of both RV Antares and Vital de Oliveira along all these years; iii) all the PIRATA scientists from all the "PIG BACK" projects from several universities and research centers in Brazil.

5) SSG issues and discussion (with PRB):

All topics could not be discussed, due to available time (and time lags...). Only the main ones, and the more developed, are summarized here.

a) PMEL Budget:

During his presentation, MM presented some slides about the major budget issues PMEL has to deal with for maintaining the Global Tropical Moored Buoy Array (GT MBA). He first informed that GT MBA is supported through two sources of funding: OOMD funds RAMA and 8 PIRATA Extension moorings, NWS funds core PIRATA (10 moorings). A total of about 40 moorings per year is currently supported with these funds. The budget is almost flat (and totally flat for NWS funds: 600k\$/y) from several years: it was \$4.1M in Fiscal Year (FY) 2010 and \$4.3M in FY 2019, i.e. an increase lower than 5% in 10 years...

But costs are significantly increasing from 2010, due to:

- The growth of RAMA: 8 more sites (from 17 to 25 buoys);
- Implementation of T-Flex system (9 in RAMA, 11 in PIRATA), that is more capable but more expensive (+50k\$) than ATLAS system;
- The general inflation (\$1 in 2010 became \$1.20 in 2019)
- More corporate taxes (+200k\$ in FY19 versus FY15)
- Heavy losses due to vandalism in past 2 years (RAMA; 6°S-8°E; 35°W and 38°W).

Consequently, the GTMBA Budget Deficits increased from about 330k\$ in 2016 up to 740k\$ in 2020 (estimated overrun for FY 2020 may be lower because of corona virus related work stoppages), i.e. about 460k\$ for RAMA versus 280k\$ for PIRATA.

MM presented different mitigation strategies: 1) Freezing Implementation of T-Flex; 2) Suspending maintenance of 3+ RAMA sites; 3) Suspending maintenance of 6°S, 8°E; 4) Maintain provisional PIRATA site at 20°S, 10°W for one year only; 5) Seeking additional funding; 6) Other as necessary.

This means that it should be difficult to continue the “PIRATA business” as usual...

It seems clear that these PMEL funding issues have to be taken into consideration for the future discussions and the MoU. Philippe Dandin reminded that budget pressure could condition the program in the future. In France, the MoU content also conditions the PIRATA agreement between IRD and Meteo-France that should be renewed in 2021.

During the discussion, BB precised that the site 20S20W could/should be considered as replacing 6S8E, and should not be suppressed. This position has been decided from scientific and robust arguments (refer, e.g., to the PIRATA and TAOS papers by Bourlès et al. 2019 and Foltz et al., 2019) and buoys suspension should not be decided for budget issues only, and decided within the SSG/PRB. In France, if vessel time has to be reduced accordingly (at least 10 days less, i.e. the number of additional days obtained starting in 2006 to service the 6S8E buoy, and enough to service the 20S10W buoy), it will be very difficult, even impossible, to get 10 vessel days back... Moacyr Araujo supports the need to maintain the 20S10W site.

b) The future Memorandum of Understanding (MoU)

The present MoU ends in July 2021, but the text has to be fully re-edited. One question is: do we have to make significant changes or only minimum changes? Do we include a vision for the future, e.g. in the description of the network? MM and Janice Trotte Duha suggest to keep prudent: “the MoU is not a jail”.

Alexandre Ganachaud reminded us of the four objectives of the MoU that should be simple : 1) ensure it is signed by our institutions so that PIRATA can go on; make wording correct; 2) ensure MOU permits operations - authorization and data acquisition; 3) broadening science vision and strategy; 4) co-agreements to share more data, including from cruises; expand data to biogeochemistry; insert cruise data in agreements for standards and sharing. Philippe Dandin confirmed and suggested: “make it simple!”. Fabrice Hernandez suggested to refer in the MoU to some main goals of the “UN Decade of Ocean Sciences for Sustainable Development” and to GOOS issues.

David Legler suggested to stop the MoU discussion there (it was late) and to continue in a few days through videoconferences.

c) Data issues:

About the DOI for PIRATA buoys data sets: BB suggested that DOI for PIRATA data in general and moorings data in particular would be relevant. Kenneth Connell precised that this is not so obvious for buoys: DOI attributed to a program, a buoy...?

About cruises and underway data sets: David Legler raised the need for a better organization of underway data and a better data distribution. One needs a better coordination for cruise data. It was said that Brazilian cruise data sets (e.g. CTD and ADCP) are not properly acquired and difficult to treat. Efforts have to be made to solving this problem.

d) Other miscellaneous issues:

Vessel time in Brazil: Moacyr Araujo asked about the BR R/V plans. RS answered that linking PIRATA-BR cruises with other programs (e.g. microplastics, biogeochemistry...) could be relevant, and that the next BR cruise could be in October/November 2020. BR strongly supports and acknowledges the PIRATA program and the cruise will be done.

Would a cruise coordination post-COVID19 be possible?

Human power (engineers, scientists, ...) is also raised by Alexandre Ganachaud and Janice Trotte Duha.

Fishers & vandalism: see Annex 2 (BB); Janice Trotte Duha said that fishers are not only Brazilian.

The next 'real' meeting will be organized in Miami.

SSG composition: Moacyr Araujo and BB should leave in 2021-2022. Janice Trotte Duha too...

July 28th, 2020

by Bernard BOURLÈS & SSG contributors.

ANNEX 1:

Report of the PIRATA-23b meeting in Hawaii (September 2019).

Several “Pirates” and SSG members attended to the OceanObs19 conference in Honolulu and had a short meeting on Wednesday 18 September (12H30-14h). This meeting was decided in order to discuss about important issues and eventually to take some decision about i) the fate of the 6S-8E buoy, ii) how to deal with fishing activities and vandalism, and iii) the next PIRATA meeting in April... Were present: Mike Mc Phaden, Gregory Foltz, Renellys Perez and James Todd (NOAA); Leticia Cotrim (UERJ), Regina Rodrigues (UFSC), Ronald Guss de Souza (INPE), Fabrice Hernandez and Bernard Bourlès (IRD).

1) Fishing activities and vandalism. It is reminded that from 2-3 years and the publication of papers mentioning the buoys as opportunity for fishing, the situation in the western part of the basin becomes difficult, mostly at the 8N-38W location. In the South-East, the 6S-8E location has been vandalized in August 2019 for the second year in a row. Mike informs about the cost of such events, e.g. about \$535k from 2009 for 8N-38W and about \$355K from 2018 for 6S-8E (so, in two years, in the case sensors and tube of the present drifting buoy’s sensors cannot be retrieved; note that the CO2 sensors are not taken into account there; so add about \$140k). He also informs about the evolution of the mooring survival, with a very bad evolution, particularly for these two sites.

The present MoU states that NOAA is committed to replace up to two full moorings per year. However, budget has not increased for 20 years, T-Flex are significantly more expensive than ATLAS systems, and one cannot continue to replace moorings and lose money...

The 8N-38W site has to be maintained for several reasons (scientific, historical, part of the 38W section, etc.).

About the 6S-8E different options are evoked and discussed:

- i) to replace again with a T-Flex; such option is too risky and expensive, if vandalized again in 2020 (fishers well know that it is there...);
- ii) to replace by an ATLAS system; this is also costly for few potential data return and same risk of vandalism in 2020!
- iii) to stop maintaining this site, at least for one or a few years (also depending of the fishing activities evolution and actions taken toward the fishers community -ICCAT, FAO, etc-.). This last option is chosen. Bernard Bourlès informs that the next PIRATA-FR30 cruise will be carried out from mid-February 2020; material for this cruise has to be decided as soon as possible. He suggests to think about an alternative option: deploy a T-Flex system in the South-Atlantic (around 20S-10W), as suggested as potential extension from several years (and stated in the AtlantOS Deliverable 3.19, the PIRATA and TAOS 2019 papers). Feasibility studies will be done as soon as possible in France (vessel time, EEZ, bathymetry...). In case if it possible, this induces to go there back in 2021. Fabrice Hernandez reminds that Spanish SAGA cruises are scheduled in the South Atlantic, offering potential collaborations. Note that such option does not mean that France commits to maintain this site on the long term. The 6S-8E site could be maintained again in the future if situation evolves in a positive way off Congo (however, 5 years of data already allows promising scientific studies!). This also means that the CO2 sensor there could be deployed on another site.

2) The next PIRATA meeting will be organized in Miami in late April. 2,5 days will be dedicated to science, and 0,5 day to SSG. It is said that one could stay one additional day to deeper discuss of several issues: new MoU (actualize science, etc), actions toward fishers etc. PIRATA partners have to be invited (eg OTN, Xpods, TAOS, TRIATLAS & AtlantOS, climate, even fishers representative? Etc.).

3) Miscellaneous: Ronald Buss de Souza (who replaces Paul Nobre at INPE) informs about the next PIRATA-BR cruise (from October to December 2019). Greg Foltz and Renellys Perez say that there are still some vessel issues for the next PNE cruise (vessel not identified yet).

ANNEX 2:

Inputs (from Daniel Gaertner, IRD/MARBEC, Sète) about tuna fishing in the Atlantic (extracts from email exchanges with Bernard Boulrès in August 2019).

In the case of Brazil this fishery concerns trolling and hand line fishing. It has increased in recent years and seems to be the cause of the very large increase in Brazil's bigeye catches (when the bigeye quotas were established by CPC at ICCAT Brazil was fishing less than the threshold established at the time, which enabled it to escape these measures and increase its catches; which of course is strongly criticized by the CPCs subject to the quota). Scientific contacts in Brazil are Paulo Travassos pautrax@hotmail.com & Gelson Da Siva : guelson@ufersa.edu.br.

I don't think the EU has a fisheries agreement with Gabon. On the other hand, it is likely that there are private fishing agreements and that the 2 professional organizations of Spanish purse seiners (OPAGAC and ANABAC) as well as the vessels of CPCs of convenience sheltering purse seiners belonging to Spanish shipowners (Guatemala, Salvador, Panama , Belize) fish in the Gabonese EEZ.

I do not think there is a resolution by ICCAT similar to that of the IOTC on the prohibition of fishing near an oceanographic buoy. However, this should be checked with the Executive Secretary of ICCAT: Camille Jean Pierre Manel: camille.manel@iccat.int

If not, and therefore considering asking for the same type of regulation as in the O. Indian, it is difficult that the PIRATA program can directly request it from ICCAT. FAO, for example, should be the bearer of this request, unless it goes directly through the CPC Delegations, which have the possibility of proposing regulations during the ICCAT Commission meeting. Without excluding the first possibility, this second solution seems to me the most logical. Of the three countries carrying PIRATA: France, Brazil, USA, only Brazil could have a measured opinion on this proposal. I can hardly see the USA opposing it and France either as a direct ICCAT CPC (under St Pierre and Miquelon) or as a member of the "European Union" CPC can put this on the table. In both cases (St Pierre and UE) you have to go through the Department of Fisheries and Aquaculture (DPMA) via Tristan Diefenbacher: tristan.diefenbacher@agriculture.gouv.fr & Benoit Archambaud : benoit.archambault@agriculture.gouv.fr

It is not impossible that Gabon, which is not in favor of the development of purse seine fishing in its waters and in particular under FADs but which happily gives private fishing rights to armaments, supports this type of resolution as well as other African CPCs (contacts at the highest level of fisheries administrations are to be seen with the DPMA or DG Mare). In case of reluctance by CPCs, there is the alternative of NGOs which, although they cannot propose a resolution, speak orally and in writing during the Commission.

Before implementing all of this, the easiest way would be to send a letter / email to the representatives of the Professional Organizations of European armaments in the purse seine so that they can send this good practice information to their crews: Michel Goujon, Director Orthongel (mgoujon@orthongel.fr); for OPAGAC: Julio Morón (julio.moron@opagac.org) or his assistant Miguel Herrera (miguel.herrera@opagac.org); for Anabac I don't know who the director is but the email seems to be: anabac@anabac.org