

# **FIFTH MEETING OF THE PILOT RESEARCH MOORED ARRAY IN THE TROPICAL ATLANTIC**

**(PIRATA-5)**

*9-10 November 1999, Abidjan, Côte d'Ivoire*

## **REPORT OF THE PIRATA-5 MEETING**

### **SUMMARY**

The fifth meeting of the PIRATA Steering Committee (PIRATA-5), hosted by the Institut de Recherche pour le Développement (IRD, ex ORSTOM), was held in Abidjan, Côte d'Ivoire (Hôtel Golf Intercontinental) on November 9-10, 1998. The PIRATA-5 meeting was followed by the seventh meeting of Tropical Atmosphere-Ocean array (TAO) Implementation Panel (TIP-7) on November 11-13, 1998. Participants to PIRATA-5 were invited to attend TIP-7 and vice-versa (see the list of the participants in Annex 1). About 20 countries and international scientific agencies were represented, with a total number of participants up to 50. The local organizers for both meetings were IRD, CNRS, Météo-France and GOOS/IOC. It was the first time that both the TIP and PIRATA committees met in conjunction, and the first time also they have met on the African continent. This was an opportunity to reinforce the collaboration between the PIRATA (and TAO) communities and the other climatic research and operational programs which are currently being developed over the African region focusing on the oceanographic, the atmospheric, and the surface continental domains. The location of the meetings was chosen because Abidjan is presently the place from where the eastern half of the PIRATA mooring program is managed with the use the R/V Antéa from IRD.

PIRATA-5 was devoted to discuss issues relevant: (i) to the continuation of the deployment and maintenance of the PIRATA array; (ii) to review the status of the national (Brazil, France, U.S.A.) present contributions to PIRATA on funding for the next years (1999-2000); (iii) to evaluate the first one-year PIRATA data set and other data (coastal stations, VOS data, satellite data, model results, ...); and (iv) to make scientific presentations regarding the usefulness of PIRATA data in the years to come.

Possible future expansions of the PIRATA array, in synergy with a coherent in-situ observing system on the region, were also discussed.

Finally, the problems associated with the vandalism of moored buoys, specifically related to the tuna fisheries in both the tropical Atlantic and Pacific, were debated, and a resolution for IOC to take action further at the UN level was proposed. By the time this report has been finished, such a resolution has already been approved by the IOC Executive Council (see that resolution in Annex 2).

## **OPENING SESSION**

The opening of the meeting was made by Pr. Antoine Achy Seka (University of Abidjan), Dr. Mamadou Fofana (Comité National de Télédétection et d'Information Géographique), Dr. Alain Morlière (IRD's Representative in Côte d'Ivoire), and the chairs of PIRATA and TAO Executive Committees (Jacques Servain and Mike McPhaden).

## **SESSION 1: Status of the PIRATA implementation and national participation's**

### ***1) General Status of the PIRATA implementation***

- Five ATLAS systems are operational, of which three in the western side (deployed in January-February 1998 by the Brazilian R/V Antares), and two in the eastern side, which were just deployed a few days before the beginning of this meeting by the French R/V Antéa (October-November 1998). This array of five systems is in conformity with the first phase of the PIRATA deployment (end 1997 – end 1998), such as scheduled previously (see Servain et al., 1998 in Bull. Amer. Meteor. Soc., Vol. 79, No. 10, 2019-2031).
- During that first phase of PIRATA deployment, we dealt with the losses of two systems in the eastern part of the basin, both at the equator, one at 10°W (lost in November 1997), another at 0°W (lost in October 1998). These losses were certainly due to vandalism associated with tuna fisheries.
- The second phase of PIRATA deployment will start in beginning 1999, with the deployment of five new systems (two in the eastern part in January 1999, three in the western part in February-March) and the replacement (also in February-March 1999) of three systems in the western part.
- Despite some minor problems, the acquisition of the data by all the deployed ATLAS systems remaining in the field, as well as their transmission via satellite, is satisfactory.

### ***2) National Reports***

#### ***a) Brazilian participation (M. Vianna and C. Hansen)***

The PIRATA project is presently one of the best known projects related to climate change and oceanography in Brazil. The Directorate of Hydrography and Navigation (DHN), on behalf of the Brazilian Navy, has committed ship's time through the end of the pilot project. The PIRATA program is part of the GOOS/Brazil, the Brazilian Buoy Program, both being intergovernmental programs under the auspices of the National Interministerial Commission for the Resources of the Sea (CIRM). The Ministry of Science and Technology (MCT) has manifested interest in including PIRATA in Minister's Cabinet official priority list, in addition to INPE, and a resolution on this is about to come out. The new CLIVAR-BR project includes PIRATA as one of the Brazilian main contributions. The INPE Web page [www.cmcd.inpe.br](http://www.cmcd.inpe.br) includes PIRATA infos.

The first Brazilian PIRATA cruise (PIRATA-BR1) took place in January-February 1998 on board the R/V Antares and three ATLAS systems were deployed in the western part of the PIRATA array: 15°N-38°W (Reggae), 8°N-38°W (Lambada), 0°N-35°W (Samba). The next PIRATA-BR cruises are scheduled for February-March 1999, according the following schedule:

- PIRATA-BR2: Depart Fortaleza Feb. 2-5 1999; Replacement Reggae; Deployment 11.5°N-38°W (Forro); Replacement Lambada; Arrival in Fortaleza Feb. 20-23.
- PIRATA-BR3: Depart Fortaleza Feb. 25; Deployment 4°N-38°W (Frevó); Replacement Samba; Deployment 0°N-20°W (Jazz); Arrival in Fortaleza March 15-18.

ADCP at Jazz: INPE has acquired four RDI-ADCP's of the Workhorse model (300 KHz), good for 200 m depth range. One of these is to be deployed on the "Jazz" PIRATA mooring site, for current profiling of the upper 170 m. The situation of the deployment of the ADCP mooring is depending on availability of the mooring hardware, which was not possible to be obtained due to budget restrictions on equipment/consumables by Government funding. An alternative source of funding has been identified (FAPESP-Brazil), although there is a hope of help/cooperation from other institutions abroad.

Tide Gauges at St. Peter/St. Paul Rocks (SPSPR) and Atol das Rocas (AdR); Met. Stations at AdR and 0°N-44°W: In 1997, Brazil has established a permanent scientific station on the SPPR, under the responsibility of CIRM. It has a good habitat, with all necessary infrastructure for the maintenance of teams of 4 scientists/technicians, who could stay there for 10-20 consequent days. Two interacting committees were formed, to supervise the implementation and maintenance of the station:

1. The CIRM's Archipelago Working Group (members represent each ministry);
2. The SPSPR Scientific Steering Committee (Marcio Vianna is a member of this Committee)

The installation of a permanent new generation tide-gauge and met station has been approved for the SPSPR region, to be implemented as soon as the met station is acquired and the deployment team is ready. The shuttle-ship between the continent and the SPSPR is available every 10-15 days, but since the station can only host 4 people, there is a waiting list to be placed at. The same situation applies for deployment of the tide-gauge and met station at AdR. However, maintenance is guaranteed if a regular training of personnel scheduled to stay there is approved. At the time of the meeting, nothing has yet been decided for the implementation of the met buoy at 0°N-44°W.

*b) French participation (J. Servain)*

PIRATA-FR received a good support from the French research institutes, especially from IRD (ex ORSTOM), in term of funding, shipping, technical people, etc. Two other institutions, Météo-France and Centre National de la Recherche Scientifique (CNRS), have contributed some of the resources also. The PIRATA program (included in the Etudes Climatiques sur l'Atlantique tropical, ECLAT, which is the French component of CLIVAR in the tropical Atlantic) received also the support from the Committee of the Plan National d'Etude du Climat (PNEDC).

Three ATLAS moorings were funded by France in 1997 (two by IRD, one by CNRS/Météo-France). Two other moorings were funded by France in 1998 (one by IRD, another by CNRS/Météo-France).

IRD organized three PIRATA cruises from the beginning of the program (September 1997) until the date of PIRATA-5. There were:

- PIRATA-FR1 (2 weeks in September 1997): Deployment of Java (0°N-10°W) and Gavotte (10°S-10°W).
- PIRATA-FR1bis (1 week in January 1998): Deployment of Soul (0°N-0°W)
- PIRATA-FR2 (2 weeks in October-November 1998): Replacement of Gavotte and new deployment of Soul (which was lost a few weeks before the cruise).

The next PIRATA-FR cruises are scheduled as:

- PIRATA-FR3 (2 weeks in January 1999): Deployment of Valse (6°S-10°W) and new deployment of Java (which was lost in November 1997, see the PIRATA-4 Report).
- PIRATA-FR4 (2 weeks in July 1999): Deployment of Rythm (2°N-10°W) and Blues (2°S-10°W). During a second leg of one-week, we will install four current systems (including a "Yoyo" system) in the vicinity of the Java site (0°N-10°W), in coordination with the French program EQUALANT-99.
- PIRATA-FR5 (2 weeks in October 1999): Replacement of Gavotte and Soul

The PIRATA-FR Web page (<http://www.ifremer.fr/orstom/pirata/piratafr.html>) is operational since the end of 1997, and is located to Centre IRD of Bretagne. This is a mirror page of the PIRATA-US Web page (see below), with some additional information's (ex. this Report) related to the ongoing PIRATA program.

The major problems which occur in the implementation of the PIRATA array are the damages caused by the fishery vandalism in the Gulf of Guinea, particularly along the equator, where the tuna is abundant and is attracted by the ATLAS systems. Two ATLAS systems have disappeared during the first year of the PIRATA program, both along the equator: Java at 10°W (after 2 months), Soul at 0°W (after 10 months). In both times, the damages initiated a few weeks before the full lost of the ATLAS systems by the stopping of the wind measurements. Investigation of technical processes to get the tuna off the ATLAS systems are presently in discussion in France. Such possible solutions, if they exist, could be, in particular, based on acoustic methods. IFREMER and other people could be interested to collaborate.

During PIRATA-FR2, about 20 rawinsondes were launched from the R/V Antéa at each passing of the NOAA/ATOVS satellite (twice a day). That was completed in cooperation with the program FLUVAP, which is another component of the French program ECLAT. The same experiment is scheduled during PIRATA-FR3 (January 1999 on R/V Antéa from Abidjan to Abidjan), and along the equatorial band during EQUALANT-99 (July-August 1999 on R/V La Thalassa from Salvadore de Bahia to Abidjan). During EQUALANT-99, an atmospheric turbulent flux experiment, operating just above the sea surface and using an instrumented mast boarded on the R/V La Thalasssa is planned. Furthermore, three 36-hour "points fixes" are scheduled at the immediate vicinity of three PIRATA sites (Samba, Rhythm and Java) to evaluate the corresponding estimated values obtained from the PIRATA high-frequency measurements.

#### *c) U.S.A. participation (M. McPhaden)*

The Atlantic PIRATA array has received enthusiastic endorsement from the U.S. CLIVAR community and from several international research programs. PIRATA is now a common-place word in U.S. Government science agencies as well as research institutions. It is seen as the conerstone of the Atlantic observing system of the future. Funding for continued

implementation of PIRATA is a top priority for NOAA Office of Global Programs (NOAA/OGP).

In 1997-8, NOAA/PMEL constructed and shipped six buoys for Brazil (Fortaleza), five of which were funded by Brazil and one by U.S. PMEL also shipped five buoys for Côte d'Ivoire (Abidjan), all of them funded by France. Furthermore PMEL sent one (or two) technician(s) to participate to PIRATA-FR1 (September 1997), PIRATA-FR1bis (January 1998), PIRATA-BR1 (January-February 1998), and PIRATA-FR2 (October-November 1998). PMEL also developed a World Wide Web homepage for display and dissemination of PIRATA data and helped to implement two mirror pages (IRD-Brest, France and INPE-São José dos Campos, Brazil).

### **3) *Institutional support and first PIRATA data using***

#### *a) IOC/GOOS Support (J. Trotte)*

The Global Ocean Observing System (GOOS) is part of an integrated observing strategy (IGOS) in which UN agencies are working together with ICSU and satellite agencies to meet the needs of the world community in what concerns marine observational data. After reviewing the events and activities of GOOS during the inter-session period, it was stated that one of the most important achievements for GOOS is the prediction and information products that would exploit the existing level of scientific knowledge to provide powerful information to several beneficiaries of the participating countries. Several examples on that has been provided, in what refers to the application of available data to societal needs.

In terms of GOOS implementation in Africa, it was noted that an interim coordinating committee has been already installed for GOOS/Africa, under the coordination of Pr. Geoff Brundrit, from the University of Cape Town, South Africa.

It is likely that GOOS implementation will involve the integration of all existing observing systems and components to achieve a longer forecast horizon. Strong support is already in place for TAO, as the best demonstrator project to check the value of climate forecasting measurements in the Tropical Pacific and El Niño predictions.

Bearing in mind the extensive use of the PIRATA data and its powerful use, that can be clearly seen from the scientific presentations made during this meeting. PIRATA received a strong support and encouragement from the Intergovernmental Oceanographic Commission (IOC), that considers it to be a potential pilot-project for GOOS in the Atlantic. It is therefore mostly desirable that PIRATA gains operational support beyond year 2000.

#### *b) First PIRATA data using in operational mode*

The PIRATA data begin to be assimilated in the AGCM's and presentations were done by S. Planton (Météo-France) and D. Anderson (ECMWF).

## **SESSION 2: Scientific and Program Presentations “The Tropical Atlantic Variability”**

This session was dedicated to scientific presentations relevant to the issues raised in PIRATA motivation, and other questions associated to the tropical Atlantic variability. The initial major discussion was about the existence of one of the two main modes of the climatic

variability in the tropical Atlantic, namely the meridian mode (or dipole mode), with various arguments exchanged in favor or against it. The question remained in abeyance. It was however shown that the meridian mode is strongly connected to the dynamical forcing of the tropical Atlantic, that itself is the main factor for the development of the equatorial mode of climatic variability, like the El Niño dynamics in the Pacific. Others presentations were related to the observation and simulation of the salty barrier layer in the western equatorial region, and its consequence to climate variability.

- \* I. Wainer (The Equatorial Undercurrent in a High Resolution Atlantic Ocean Model)
- \* R. Murtugudde (Simulation of Atlantic Variability from the 1950's to the 1990's)
- \* J. Servain (Interrelationship Between the Atlantic Dipole Mode and the Equatorial Mode)
- \* D. Enfield (How Ubiquitous is the Tropical Dipole in Atlantic Sea Surface Temperatures)
- \* V. Mehta (Observations and Modeling of Tropical Atlantic Climate Variability at Decadal Time Scales)
- \* Y. Tanimoto (Temporal and Spatial Structures of the Ocean-Atmosphere Variability in the Tropical Atlantic)
- \* B. Bourles (Upper Layer Hydrology and Circulation Variability in the Western Equatorial Atlantic)
- \* S. Masson (The Barrier Layer in the Atlantic Ocean)
- \* S. Signorini (Biological and Physical Signatures in the Tropical and Sub-Tropical Atlantic Using Ocean Color Data)

### **SESSION 3: Past, Present and Future Climate Activities in the Atlantic Region**

Various presentations have succeeded, providing examples of regional programs associated with climate issues, some of them already being implemented, others still at the planning stage.

- \* C. Tanajura (The Importance of PIRATA for Current Research and Applied Projects in Brazil)
- \* J. Lutjeharms (Atmospheric Control of the Angola-Benguela Frontal Zone)
- \* K. Hilmi (Hydrological and Meteorological Changes of Moroccan Atlantic Coast from 1994 to 1998)
- \* M. Rouault (African Climate Variability)
- \* R. Okoola (The Role of the Indian and Atlantic Oceans on the African Climate Including Seasonal Predictability)
- \* G. Reverdin (The PICOLO Experiment)
- \* J. Servain / D. Dagorne (Spatial Observation of the Water Vapor Above the Atlantic and Intertropical Africa Area: Introduction of the project FLUVAP)
- \* B. Bourles (ECLAT/EQUALANT-99)
- \* A. Aman (A Multi Data Approach to Assess the Spatio-Temporal Variability of the Ivoirio-Ghanaian Coastal Upwelling)
- \* A. Konaré (A project for a seasonal dust transport for Côte d'Ivoire)
- \* M. Hoepffner (A Data Base Supporting the Research Activities on Global Environment in Africa)
- \* M. Jury (Relationships between the Atlantic and Indo-Pacific El Niño and predictability over Africa)

#### **SESSION 4: Panel Discussion about the Future of PIRATA and Recommendations**

*[This section needs to be completed]*

A recommendation (see Annex 2) emerged from PIRATA-5 and TIP-7 regarding the vandalism at sea, calling for a UN resolution to help alleviate the serious loss of mooring data and equipment that is plaguing PIRATA, TAO and other climate-oriented mooring programs.

#### **SESSION 5: PIRATA Executive Session (PIRATA Group only)**

The PIRATA Group decided to rotate some participants and to enlarge its composition. After discussions that led to the agreement with the names of the new members, the final composition of the PIRATA Steering Group is:

- A. Busalacchi (NASA, U.S.A.)
- P. Chang (Texas A&M University, U.S.A.)
- M. McPhaden (NOAA/PMEL, U.S.A.)
- A. D. Moura (IRI)
- S. Planton (Météo-France, France)
- G. Reverdin (CNRS, France)
- J. Servain (IRD, France) Chairman
- M. Vianna (INPE, Brazil)
- I. Wainer (IOUSP, Brazil)

Replying favorably to the invitation of Silvia Garzoli (NOAA/AOML), it was decided to organize the PIRATA-6 Meeting as a back-to-back meeting with the Workshop on "Climate Observing System for the Tropical Atlantic" (COSTA), scheduled to take place in Miami, 4-7 May 1999. The PIRATA-6 Meeting will then take place for 1.5 days, on 3-4 May 1999, and will be dedicated to technical, financial and logistic (ship's time requirements, etc.) discussions relevant to the implementation of the PIRATA array during its final pilot phase (until beginning 2001).

The main objective of the 3.5-day COSTA Workshop will be to coordinate the national and international current efforts and projects which exist in different stages of development in the domain of climate programs in the tropical Atlantic, and to lay the groundwork for establishing a Tropical Atlantic Observing System for climate. As such, PIRATA would have to play a central role in its implementation, together with other existing programs such as ARGO, XBT lines, surface drifters, subsurface floats, etc.

Finally, the PIRATA Steering Group proposed the following composition for the COSTA Workshop Organizing Committee:

- Edmo Campos (USP)
- Silvia Garzoli (NOAA/AOML) Chairman
- Mike McPhaden (NOAA/PMEL)
- Joel Picaut (IRD)
- Gilles Reverdin (CNRS/LEGOS)
- Marcio Vianna (INPE)

The Fifth Session of the PIRATA Steering Group was adjourned on 10 November 1998, at 5:30 pm.

## ANNEX 1

### LIST OF PIRATA-5 AND TIP-7 ATTENDEES

**Antoine ACHY SEKA**

Université de Cocody, UFR SSMT, Laboratoire de Physique de l'Atmosphère, 22 B.P. 582 Abidjan 22, Côte d'Ivoire

**Angora AMAN**

Laboratoire de Physique de l'Atmosphère, Université de Cocody, UFR SSMT, 22 B.P. 582 Abidjan 22, Côte d'Ivoire

Fax: (225) 44 04 12

E-mail: [angora.aman@orstom.ci](mailto:angora.aman@orstom.ci)

**David ANDERSON**

ECMWF, Shinfield Park, Reading, RG29A8, United Kingdom

E-mail: [sta@ecmwf.int](mailto:sta@ecmwf.int)

**Kentaro ANDO**

Ocean Research Department, Japan Marine Science and Technology Center, 2-15, Natsushima, Yokosuka, Kanagawa, Japan

E-mail: [andouk@jamstec.go.jp](mailto:andouk@jamstec.go.jp)

**Mouhamadou BEDOU**

Laboratoire de Physique de l'Atmosphère, Université de Cocody, 22 B.P.582 Abidjan 22, Côte d'Ivoire

Phone: (225) 44 46 77

Fax: (225) 44 04 12

E-mail: [bedoum@syfed.ci.refer.org](mailto:bedoum@syfed.ci.refer.org)

**Bernard BOURLES**

IRD, BP 70, 29280 Plouzané, France

Fax: (33) 02 98 22 45 14

E-mail: [bourles@orstom.fr](mailto:bourles@orstom.fr)

**Tony BUSALACCHI**

Laboratory for Hydrospheric Processes, NASA Goddard Space Flight Center, Code 970, Greenbelt, MD 20771, USA

E-mail: [tonyb@neptune.gsfc.nasa.gov](mailto:tonyb@neptune.gsfc.nasa.gov)

**Souleymane CISSOKO**

C.R.O. Abidjan, Côte d'Ivoire

Fax: (225) 35 11 55

**Dominique DAGORNE**

Antenne ORSTOM de Lannion, CMS Météo-France, Lannion, France

Email: [Dominique.Dagorne@meteo.fr](mailto:Dominique.Dagorne@meteo.fr)

**Thierry DELCROIX**

ORSTOM, B.P. A5 Nouméa, Nouvelle Calédonie

Fax: (687) 26 43 26

E-mail: [delcroix@noumea.orstom.fr](mailto:delcroix@noumea.orstom.fr)

**Masahiro ENDOH**

JAMSTEC, 2-15 Natsushima, Yokosuka, Kanagawa, 237, Japan

E-mail: [endo@jamstec.go.jp](mailto:endo@jamstec.go.jp)

**Dave ENFIELD**

NOAA/AOML/PhOD, 4301 Rickenbaker Causeway, Miami, FL 33149-1026, USA

Fax: 305 361-4392



E-mail: [enfield@aoml.noaa.gov](mailto:enfield@aoml.noaa.gov)

**John ENSWORTH & MARK MORRISSEY**

EVAC / The University of Oklahoma, 710 Asp Ave Suite 8 Norman OK 33069, USA

Phone / Fax: 1 (405) 447-8412

E-mail: [ensworth@ou.edu](mailto:ensworth@ou.edu)

**Mamadou FOFANA**

CNTIG, Avenue Delafosse B.P. V324 Abidjan, Côte d'Ivoire

Phone: (225) 22 35 30

Fax: (225) 22 35 29

**Regina FOLORUNSHO**

Nigerian Institute for Oceanography, PMB 12729, Victoria Island, Lagos, Nigeria

E-mail: [niomr@linkserve.com.ng](mailto:niomr@linkserve.com.ng)

**Carlos HANSEN**

Diretoria de Hidrografia e Navegação, R. Barao de Jacoguais, Niteroi, R.J. Brazil, CEP 24. 048-900, Brazil

Phone/Fax: 55 21 620 00 73

E-mail: [202@dhm.mar.mil.br](mailto:202@dhm.mar.mil.br)

**Karim HILMI**

Institut National de Recherche Halieutique, 02 rue Tiznit, Casablanca, Morocco

Phone: (212) 2 26 81 92

Fax: (212) 2 26 69 67

E-mail: [hilmi@inrh.org.ma](mailto:hilmi@inrh.org.ma)

**Michel HOEPPFNER**

Medias-France, CNES, B.P. i 2102, 18 Avenue E. Belin, 31 401 Toulouse Cédex, France

Phone: (33) 5 61 27 42 15

Fax: (33) 5 61 28 29 05

E-mail: [michel.hoeffner@medias.cnes.fr](mailto:michel.hoeffner@medias.cnes.fr)

**Samuel HORMAZABAL**

Programa de Oceanografía Física y Clima, Universidad de Concepcion, Casilla 116, C Concepcion, Chile

E-mail: [shormaza@profc.udec.cl](mailto:shormaza@profc.udec.cl)

**Huang-Hsiung HSU**

Department of Atmospheric Sciences, National Taiwan University, Taipei, Taiwan

E-mail: [hsu@atmos1.as.ntu.edu.tw](mailto:hsu@atmos1.as.ntu.edu.tw)

**Mark JURY**

Geography Department, University Zululand, Kwa Dlangezwa, 3886 South Africa

E-mail: [mjury@pan.uzulu.ac.za](mailto:mjury@pan.uzulu.ac.za)

**William KESSLER**

NOAA / PMEL 7600 Sand Point, Way NE, Seattle WA 98115, USA

Phone: 206-526-6221

Fax: 206-526-6744

Email: [kessler@pmel.noaa.gov](mailto:kessler@pmel.noaa.gov)

**Abdourahamane KONARÉ**

Laboratoire de Physique de l'Atmosphère, 22 B.P. 582 Abidjan 22, Côte d'Ivoire

E-mail: [konarea@syfed.ci.refer.org](mailto:konarea@syfed.ci.refer.org)

**Aka Marcel KOUASSI**

Centre de Recherches Océanologiques B.P. V18 Abidjan, Côte d'Ivoire

Phone: (225) 35 50 14 / 35 58 80

Fax: (225) 35 11 55

E-mail: [kouassi@cro.orstom.ci](mailto:kouassi@cro.orstom.ci)

**S. Prasanna KUMMAR**

National Institute of Oceanography, Dona Paula, Goa 403 004, India  
E-mail: [prasanna@csnio.ren.nic.in](mailto:prasanna@csnio.ren.nic.in)

**Yoshifumi KURODA**

JAMSTEC, 2-15, Natsushima, Yokosuka, 237, Japan  
E-mail: [kuroday@jamstec.go.jp](mailto:kuroday@jamstec.go.jp)

**Kunio KUTSUWADA**

School of Marine Science and Technology, Tokai University, 3-20-1, Orido, Shimizu, Shizuoka, 424-86 10, Japan  
E-mail: [kkutsu@scc.u-tokai.ac.jp](mailto:kkutsu@scc.u-tokai.ac.jp)

**Gary LAGEROEF**

Earth and Space Research, 1910 Fairview Ave E, Seattle, WA 98102, USA  
Phone: (1) 206-126-0501 XT 11  
Fax. : (1) 206-726-0524  
E-mail: [lager@esr.org](mailto:lager@esr.org)

**Johann LUTJEHARMS**

Dept Oceanography University of Cape Town, 7700 Rondebosch, South Africa  
Phone: + 27.21.650.3279  
Fax. : + 27.21.650.3979  
E-mail: [johann@physci.uct.ac.za](mailto:johann@physci.uct.ac.za)

**Sébastien MASSON**

LODYC/UPCM, University Paris VI, 4, Place Jussieu, BP100, 75005, Paris, France  
Phone: (33) 1 44 27 27 11  
E-mail: [smasson@lodyc.jussieu.fr](mailto:smasson@lodyc.jussieu.fr)

**Mike MCPHADEN**

NOAA / Pacific Marine Environmental Laboratory, 7600 Sand Point Way NE, Seattle, Washington, 98115, USA  
Phone: (206) 526-6783  
Fax: (206) 526- 6744  
E-mail: [mcphaden@pmel.noaa.gov](mailto:mcphaden@pmel.noaa.gov)

**Vikram MEHTA**

Code 913, NASA / Goddard Space Flight Center, GreenbeltMaryland 20771, USA  
Phone: (301) 286-2390  
Fax: (301)286-1759  
E-mail: [mehta@climate.gsfc.nasa.gov](mailto:mehta@climate.gsfc.nasa.gov)

**Alain MORLIÈRE**

Rue du Chevalier de Clieu  
15 BP 917, Abidjan 15, Côte d'Ivoire  
Phone: (225) 24 37 79  
Fax: (225) 24 65 04  
Email: [patron@abidjan.orstom.ci](mailto:patron@abidjan.orstom.ci)

**Divino MOURA**

Univ. of Maryland, NASA/GSFC, Code 970 Bldg 33, Greenbelt, Maryland 20771, USA  
Phone: (914)365-8493  
Fax: (914)365-8366  
E-mail: [amoura@iri.ldeo.columbia.edu](mailto:amoura@iri.ldeo.columbia.edu)

**Raghuram MURTUGUDDE**

Univ. of Maryland, NASA/GSFC, Code 970 Bldg 33, Greenbelt, Maryland 20771, USA  
Phone: (301)614-5667  
E-mail: [ragu@barolo.gsfc.nasa.gov](mailto:ragu@barolo.gsfc.nasa.gov)

**Paulo NOBRE**

IRI / LDEO, 61 Rt.9W Ocean 408, Palisades, New York, 10964, USA

Phone: + 1(914)365-8334

E-mail: [Pnobre@iri.ideo.columbia.edu](mailto:Pnobre@iri.ideo.columbia.edu)

**Abé Delfin OCHOU**

Laboratoire de Physique de l'Atmosphère, Université de Cocody, 22 B.P.582 Abidjan 22, Côte d'Ivoire

Phone: (225) 44 46 77

Fax: (225) 44 04 12

E-mail: [ochouad@syfed.ci.refer.org](mailto:ochouad@syfed.ci.refer.org)

**Raphael OKOOLA**

University of Nairobi, Box 30197, Nairobi, Kenya

E-mail: [okoola@meteo.go.ke](mailto:okoola@meteo.go.ke)

**Joël PICAUT**

NASA/Goddard Space Flight Center, Code 970, Greenbelt, Maryland, 20771, USA

E-mail: [jpicaut@neptune.gsfc.nasa.gov](mailto:jpicaut@neptune.gsfc.nasa.gov)

**Steve PIOTROWICZ**

NOAA / ERL-R/E

1315 East-West HWY, Silver Spring MD 20910, USA

Phone: 301 -713-2465 XT 24

Fax: 301-713-0158

E-mail: [steve.piotrowicz@noaa.gov](mailto:steve.piotrowicz@noaa.gov)

**Serge PLANTON**

Météo-France, Centre National de Recherches Météorologiques, 42 Av. G. Coriolis, 31057, Toulouse, France

Phone : (33) 5 61 07 93 76

Fax: (33) 5 61 07 96 10

E-mail: [planton@meteo.fr](mailto:planton@meteo.fr)

**Gilles REVERDIN**

LEGOS, 14 Av. E. Belin 31400 Toulouse, France

E-mail: [gilles.reverdin@cnes.fr](mailto:gilles.reverdin@cnes.fr)

**Thomas RICKENBACH**

NASA / TRMM Office Code 910.1, NASA GSFC, Greenbelt, Maryland 20771, USA

E-mail: [ricken@trmm.gsfc.nasa.gov](mailto:ricken@trmm.gsfc.nasa.gov)

**Mathieu ROUAULT**

Dept Oceanography, University of Cape Town, 7700 Rondebosch, South Africa

Phone : + 27.21.650.3607

Fax. : +27.21.650.3979

E-mail: [rouault@physci.uct.ac.za](mailto:rouault@physci.uct.ac.za)

**Yolande SERRA**

Dept of Atmospheric Science, University of Washington, Seattle, WA 98195- 1640, USA

E-mail: [yserra@u.washington.edu](mailto:yserra@u.washington.edu)

**Jacques SERVAIN**

Centre Orstom, B.P. 70, 29280 Plouzané, France

Phone: (33) 2 98 22 45 06

Fax: (33) 2 98 22 45 14

E-mail: [servain@orstom.fr](mailto:servain@orstom.fr)

**Sergio SIGNORINI**

NASA / GSFC SAIC General Sciences Corporation, Greenbelt, Maryland, USA

E-mail: [sergio@bluefin.gsfc.nasa.gov](mailto:sergio@bluefin.gsfc.nasa.gov)

**Clemente TANAJURA**

LNCC / CNRQ? AV. Getulio Vargas 333, Petropolis RJ 27560-070, Brazil

Phone: 55 24 233 6164

Fax: 55 24 231 5595

E-mail: [cast@lncc.br](mailto:cast@lncc.br)

**Youichi TANIMOTO**

Frontier Research System, Seavans Bldg. N- 7F, Shibaura 1-2-1, Minato-ku, Tokyo, Japan

Phone: + 81-3-5765-7100

Fax: + 81-3-5765-7103

E-mail: [tanimoto@frontier.esto.or.jp](mailto:tanimoto@frontier.esto.or.jp)

**Janice TROTTE**

IOC / UNESCO GOOS Project Office 1, rue Miollis 75732, Paris, France

Phone: 00 33 1 45 68 39 78

Fax.: 00 33 1 45 68 58 12

E-mail: [j.trotte@unesco.org](mailto:j.trotte@unesco.org)

**Marcio VIANNA**

INPE / Oceanography, Sao José dos Campos, SP, Brazil

Phone: 55-12-345-6446

Fax: 55-12-345-6460

E-mail: [mvianna@ltid.impe.br](mailto:mvianna@ltid.impe.br)

**Ilana WAINER**

Dept. of Physical Oceanography, University of São Paulo, Praça do Oceanografico 191, São Paulo, SP  
05508-900, Brazil

E-mail: [wainer@usp.br](mailto:wainer@usp.br)

ANNEX 2

A RECOMMENDATION FOR A UNITED NATIONS' RESOLUTION

Restricted distribution

**IOC/EC-XXXI/R.4**  
Paris, 06/12/2017  
Original: English

**RESOLUTION EC-XXXI.4**

Submitted by the IOC Secretariat

Agenda item 5.5

**IOC SUPPORT OF EFFORTS TO REDUCE VANDALISM OF OCEANOGRAPHIC EQUIPMENT AT SEA**

The Executive Council,

**1 Recognizing**

- (i) the importance of operational systems to the development of GOOS, which is highly dependent on establishing instrumented moorings for permanent observations of the oceans,
- (ii) that vandalism by vessels, in particular fishing vessels, has been a major threat to the viability of maintaining such arrays, since at some sites data and equipment return have been reduced to significantly less than 50%,

**2 Emphasizing** the great value of:

- (i) TAO and PIRATA for improving marine weather and surface wave forecasts, which facilitate efficient ship routing, provide early warning of natural hazards such as storms and hurricanes, and support search and rescue efforts at sea,
- (ii) TAO and PIRATA data for improving climate forecasts of El Niño, La Niña, and related phenomena which affect the lives of hundreds of millions of people around the globe through droughts, floods, fires, and their socio-economic impacts,

**3 Appreciating** the degree of financial commitment already made by those governments involved in setting up the TAO and PIRATA moored arrays that constitute important demonstration projects for GOOS,

4 **Encourages** Member States to protect moored drifting and other unattended equipment at sea;

5 **Instructs** the Executive Secretary IOC to prepare a proposal that the Director-General of UNESCO would present at the appropriate UN level which:

- (i) addresses the problems of the vandalization of oceanographic equipment by vessels, in particular by fishing vessels;
- (ii) encourages appropriate action by the competent international organizations, taking into account the relevant provisions of the UN Convention on the Law of the Sea (UNCLOS), as well as national legislation of Member States on unattended equipment in their respective EEZs and international waters.

6 **Further instructs** the Executive Secretary IOC to bring this item to the attention of the XXth session of the IOC Assembly.

**Financial implications:** none