Global Tropical Moored Buoy Array (GTMBA):

Indian Ocean *Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction* (RAMA)

Prediction and Research Moored Array in the Tropical Atlantic (PIRATA)

NOAA Global Ocean Monitoring and Observing Program (GOMO) Review

Dr. Jim Todd
PIRATA Program Manager

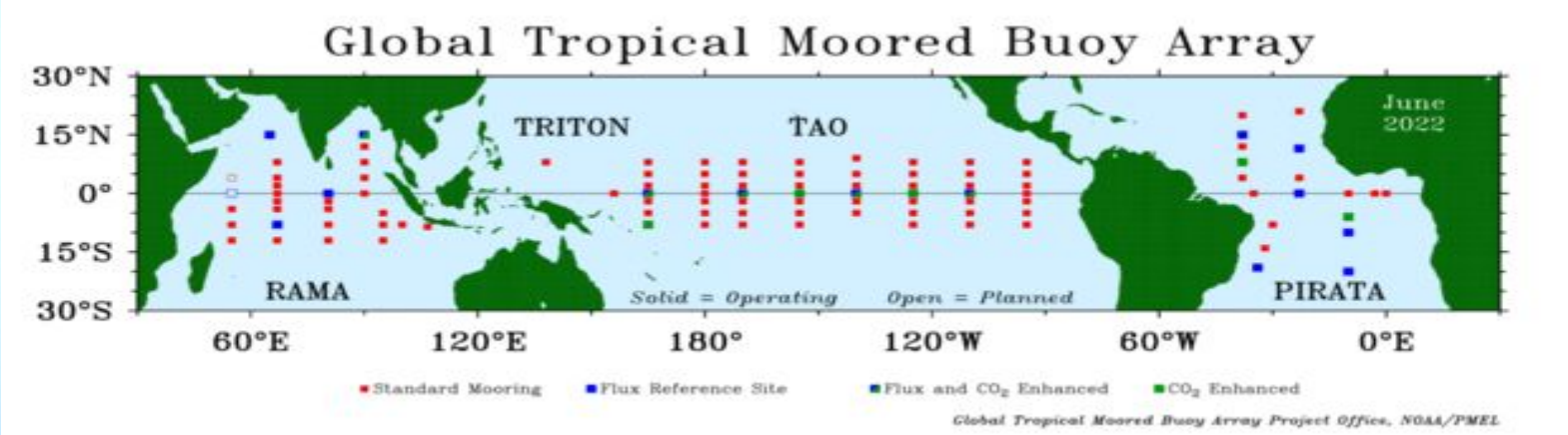
Dr. Sidney Thurston
RAMA Program Manager

11-14 July, 2022

Mission of the Global Tropical Moored Buoy Array

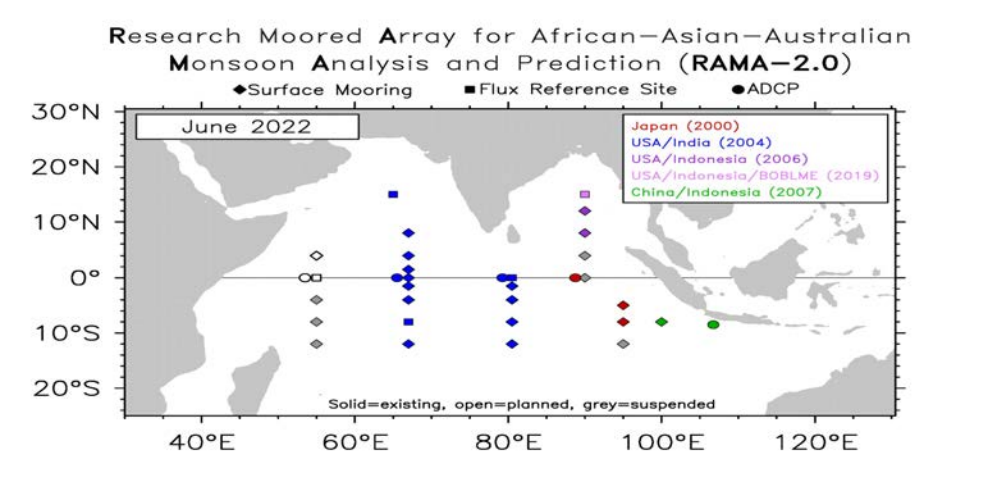
The Global Tropical Moored Buoy Array Program is a multi-national effort to provide data in real-time for climate research and forecasting.
Major components include the TAO/TRITON array in the Pacific, PIRATA in the Atlantic, and RAMA in the Indian Ocean. The major phenomenological foci of this array are:

- El Niño/Southern Oscillation (ENSO) in the Pacific
- The interhemispheric dipole mode, equatorial warm events, and hurricane activity in the Atlantic
- The monsoons, the Indian Ocean Dipole, and intraseasonal variability MJO in the Indian Ocean



Indian Ocean - RAMA

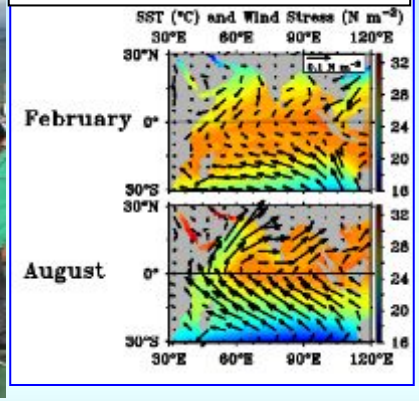
Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction



https://www.pmel.noaa.gov/gtmba/pmel-theme/indian-ocean-rama

Science Motivated By Global Societal Impacts, Implemented By Long-term Resource-Sharing Partnerships

Monsoons



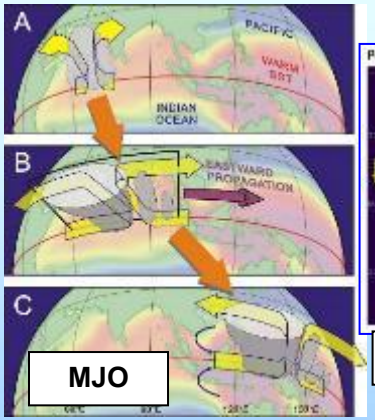
Mission goals addressed:

NOAA:

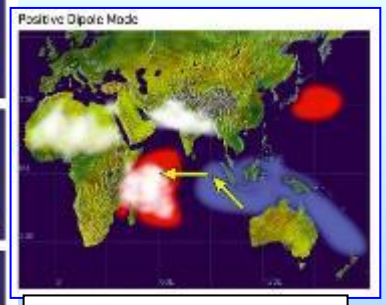
1) Climate Adaptation and Mitigation
2) Weather-ready Nation

OAR:

1) Explore the Marine Environment;
2) Detect Changes in the Ocean & Atmosphere
3) Make Forecasts Better
4) Drive Innovative Science



MJO



Indian Ocean Dipole

RAMA BY THE NUMBERS

(2004 – 2021)

- **361** moorings deployed*
- **70** cruises
- **15** ships from **11** nations
- **1465** days at sea
- **>$73M** Ship time cost-savings**
- **>400** journal publications

*Surface moorings have 1-year design lifetime

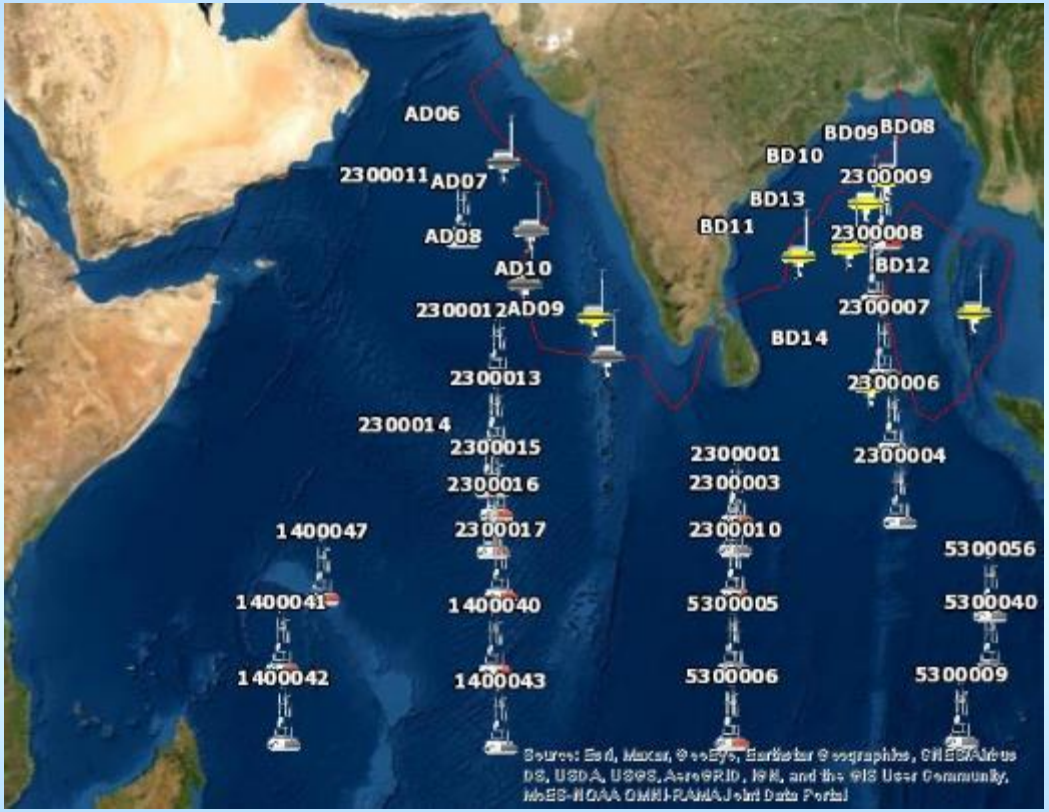
** Based on NOAA Ship rate of $50K/day

Formal NOAA-India MoES Agreements

India Ambassador Taranjit Singh Sandhu and NOAA Administrator (Acting) Dr. Neil Jacobs signing the MOU to enhance U.S.-India scientific cooperation for Ten Years.

India MoES Dr. Ramadass and Craig McLean signing the RAMA *Resource-Sharing* Implementing Arrangement and Launching Joint Indian Ocean Data Portal August 2021

Joint India Ministry of Earth Sciences (MoES) - U.S. NOAA Indian Ocean Data Portal



RAMA-OMNI Moored Buoys collect and transmit free, open and timely high resolution real-time upper ocean:

- Vertical profiles of temperature, salinity (conductivity) and currents,
- Surface meteorological data winds, humidity, pressure, temperature, rainfall and radiation,
- 3-D Wave parameters,
- Central Indian Ocean, Bay of Bengal and the eastern Arabian Sea.

NOAA's Long-Term RAMA Partnership with Indonesia BMKG

Established 2005

14th Annual Workshop
Bogor - August 2019

16th Annual Workshop
Virtual – September 2021

Synergy between BMKG and NOAA, for Delivery of Information for Climate Decision Support Services,

Ph.D. Opportunities in US,

Training Opportunities at NOAA's Climate Prediction Center (CPC) International Climate Desk,

Eastern Indian Ocean RAMA Shiptime

NOAA-BMKG Agreements Will Be Renewed June 2022

Global Tropical Moored Buoy Array
Pacific Marine Environmental Laboratory

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
UNITED STATES DEPARTMENT OF COMMERCE

Search GTMBA

Home | About | Publications | Data | Technical | Partners | Field Work

New RAMA partnership between PMEL and the Korea Institute of Ocean Science and Technology

July 06, 2017

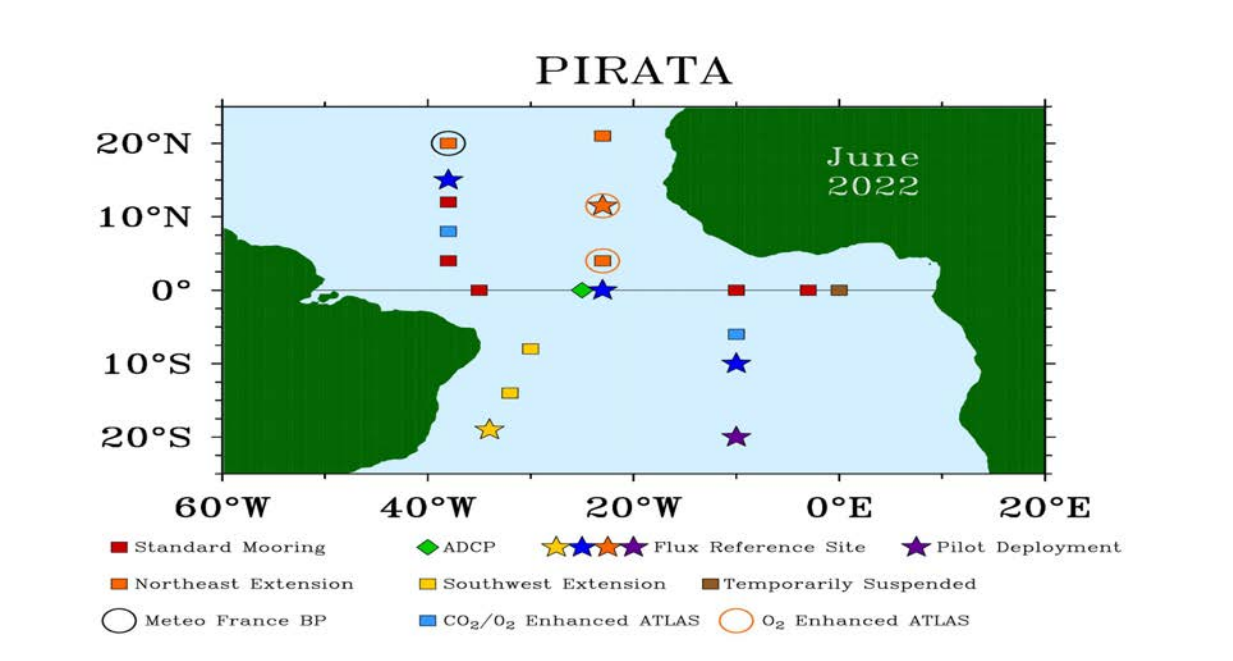
ROK Research Vessel *Isabu*
NOAA-KIOST Cruise
January 2022

- **Mauritius to Jangmok, South Korea**
- **15 December – 18 January, 2022**
- **Two (2) RAMA Surface Moorings and one (1) ADCP were successfully deployed in the Seychelles-Chagos Thermocline Ridge (SCTR)**
- **Six (6) Argo Floats**
- **20 Drifters**

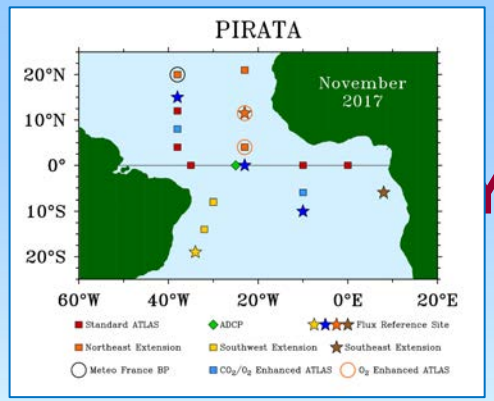
Atlantic Ocean – PIRATA

Prediction and Research

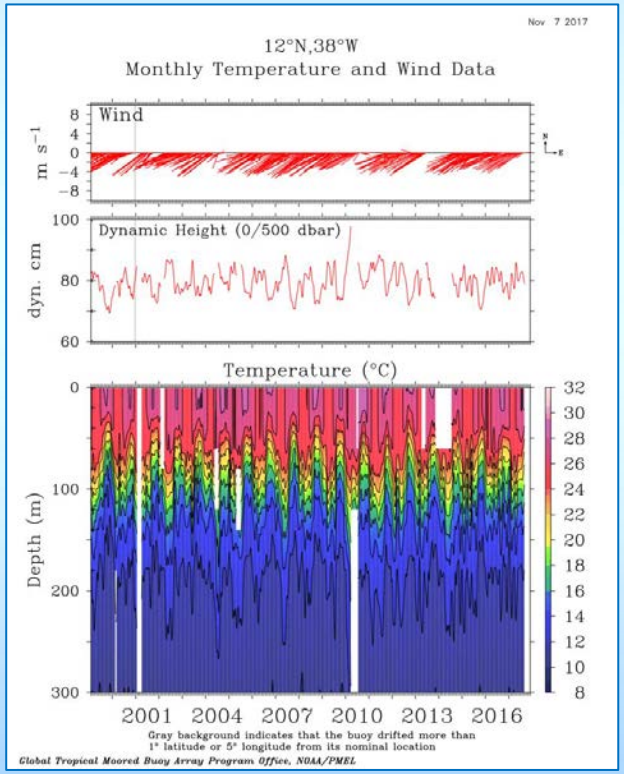
Moored Array in the Tropical Atlantic

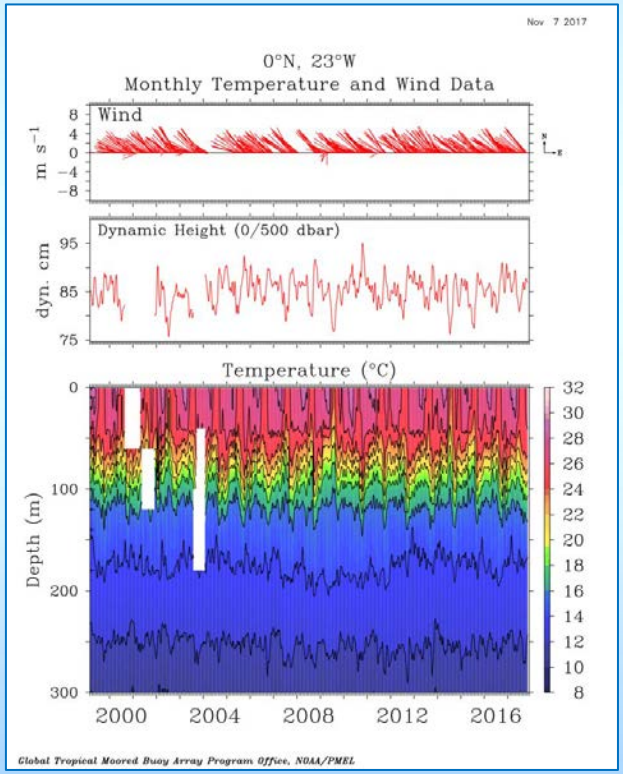


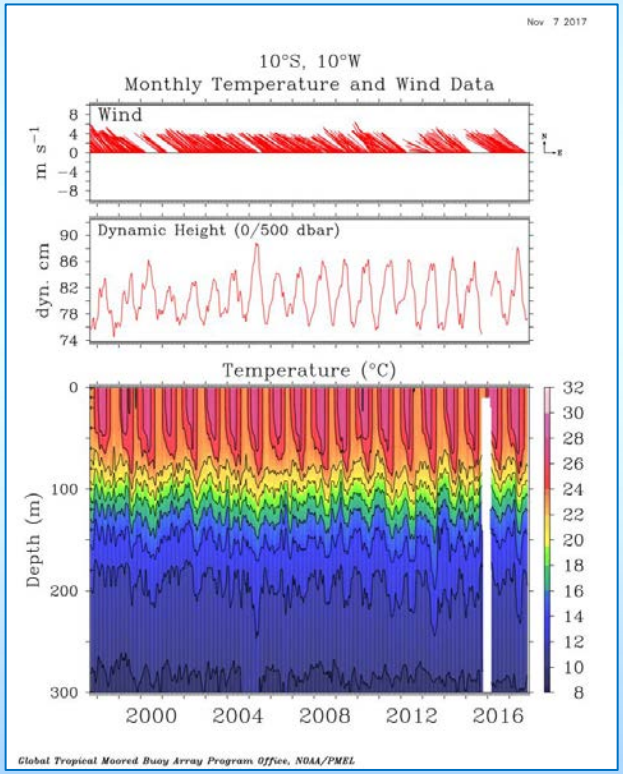
http://www.pmel.noaa.gov/gtmba/pirata



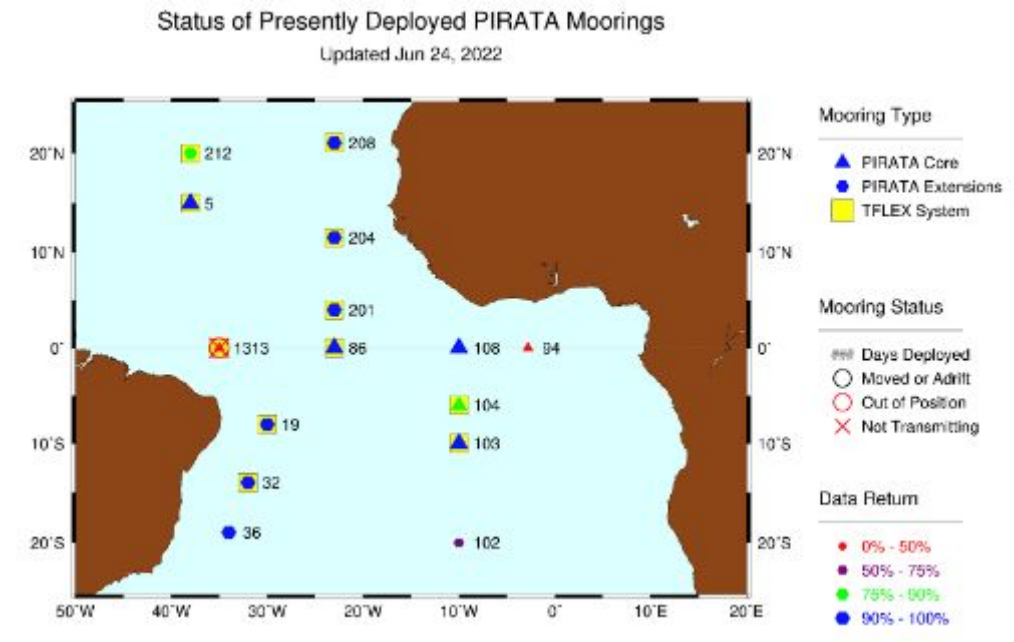
PIRATA: Almost 25 Years of Delivering Met-Ocean Observations!







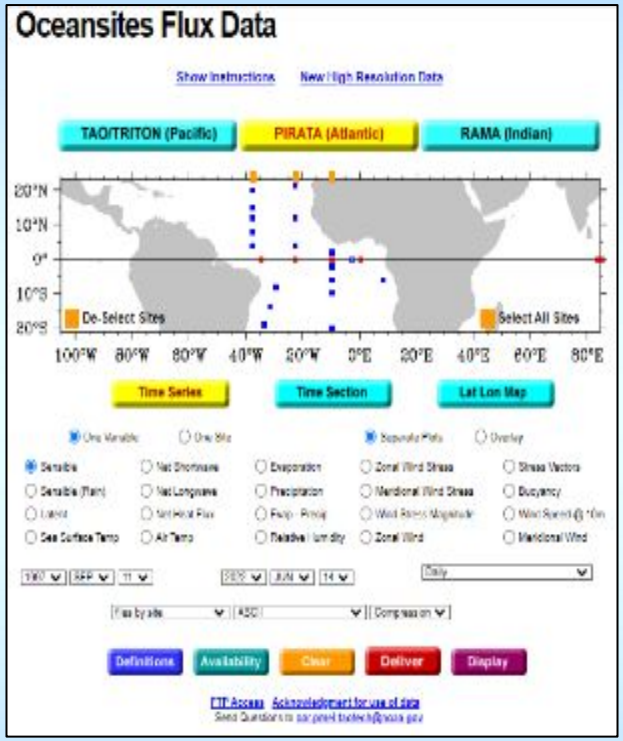
Status of Presently Deployed PIRATA Moorings
June 24, 2022



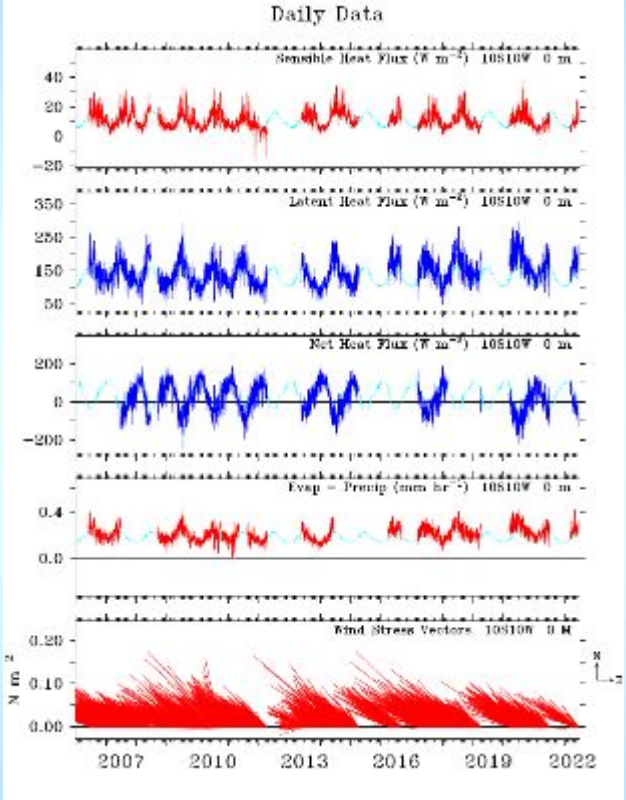
PIRATA consists of 18 surface moorings: 8 PIRATA core surface mooring sites and 8 PIRATA extension surface mooring sites. 2 PIRATA mooring sites will be decommissioned due to lack of funding.

Dissemination of GTMBA Flux Long Time-Series Data

- Public display and delivery of GTMBA flux data from moored buoys in PIRATA, RAMA, and TAO.
- Long time-series spanning decades.
- Partners: France, Brazil, Germany, India, Indonesia, South Korea, Japan, China
- **FY17-FY21 highlights:** High-resolution (hourly) flux data available for public access.



Data access for download and/or display at:
https://www.pmel.noaa.gov/gtmba/data-access/flux



Web-generated flux data figures

RAMA & PIRATA Future Plans and Opportunities

- Replace mooring assets lost during pandemic,
- Reinstate implementation of more capable high-data rate T-Flex to replace obsolescent ATLAS moorings,
- Advance Subseasonal-to-Seasonal (S2S) forecasting by enhancing near-surface observations of temperature/salinity/current velocity/longwave radiation in RAMA where MJO originates,
- Increase frequency of telemetered data and add barometric pressure/longwave radiation to all RAMA sites in cyclone genesis regions of the Bay of Bengal, Arabian Sea, and Seychelles Chagos Thermocline Ridge Region (focus of KUDOS),
- Increase frequency of telemetered data, add barometric pressure/longwave radiation, and enhance near-surface observations of temperature/salinity/current velocity at PIRATA sites in Atlantic “Hurricane Alley”

NOAA Global Ocean Monitoring and Observing Program
Sidney.Thurston@noaa.gov
James.Todd@noaa.gov