Global Tropical Moored Buoy Array (GTMB): 

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 

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PIRATA Program Manager 

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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/pmels-theme/indian-ocean-rama
Science Motivated By Global Societal Impacts, Implemented By Long-term Resource-Sharing Partnerships

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

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
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

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

Established 2005
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!
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
- 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”
Thank You!

NOAA Global Ocean Monitoring and Observing Program

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