RAMA: Status, Progress and Plans

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With contributions from
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CLIVAR/GOOS Indian Ocean Panel (IOP-11)
Pan-CLIVAR Meeting
The Hague, Netherlands
14 July 2014
70% of sites occupied at present (32 of 46)
Newest Site:
1.5°S, 67°E
Piracy and ship time limitations have slowed down implementation
Planned RAMA Cruises Jul 2013 - Jun 2014

8 cruises
6 ships
7 nations
34 moorings
208 days
RAMA Cruises Jul 2013 - Jun 2014

6 cruises
5 ships
6 nations
23 moorings
151 days
USNS HEEZEN recovers drifting RAMA mooring in the Mozambique Channel

Deployed 24 April 2013
Adrift 9 June 2013
Aground 11 Aug 2013
Recovered 21 Aug 2013
Planned RAMA Cruises Jul 2014 - Jun 2015

- 6 cruises
- 4 ships
- 5 nations
- 26 moorings
- 151 days
RAMA Ocean Acidification Mooring

Research Moored Array for African–Asian–Australian Monsoon Analysis and Prediction (RAMA)

- Surface Mooring
- Flux Reference Site
- ADCP
- Deep Ocean

July 2014
70% Complete

BOBLME
OA System @ 15°N, 90°E
23 Nov 2013

Japan (2000)
India (2000)
USA/India (2004)
USA/Indonesia (2006)
China/Indonesia (2007)
USA/ASCLME (2008)
USA/Australia (2012)
USA/India/BOBLME (2013)

Solid=existing, open=planned
CO₂ and pH

pH of Seawater at BABOA (90E, 15N)

xCO₂ of Seawater and xCO₂ of Air at BABOA (90E, 15N)
Piracy on the Decline
Number of Indian Ocean Incidents

http://www.oni.navy.mil/Intelligence_Community/piracy.htm
Arabian Sea Piracy Continues to Decline

Lloyds of London Exclusion Zone not changed to reflect lower incidence of piracy

July 2013 Sagar Nidhi cruise into EZ had armed security guards

2014-2015 Sagar Kanya and Sagar Nidhi cruises will not have guards.
T-Flex Field Testing

7 Side by Side Comparison with ATLAS
- 4 Completed
- 3 In progress – 2 in RAMA
- T-Flex/ATLAS data are equivalent
- Performance (data return, longevity) very good
- Improvements underway to improve robustness of AT/RH
- Unexplained T-Flex failure in PIRATA to be recovered early 2015

Standalone Implementation to begin in 2015
T-Flex Field Testing

12°S 67°E ATLAS went adrift in May
T-Flex/ATLAS data equivalent before going adrift
T-Flex data will replace ATLAS after going adrift.

Mean Hourly Wind Speed Diff = 0.12 m s⁻¹

Daily Mean T(z)
RAMA Capacity Building

- PMEL/NIOT Technical Training August 5-9, 2013
  ATLAS and T-Flex moorings, CO₂ System
  Prasad Punna
  Kesavakumar Balakrishnan
  Vengatesan Gopalakrishnasami

- PMEL/FIO Technical Training
  May – October 2014
  ATLAS/T-Flex/Bailong
  Met Sensor Comparison
  Chunlin Ning, Sr. Engr.

- PMEL/BPPT Fulbright Scholar
  November 2014 – January 2015
  Wahyu Pandoe

- NOAA Capacity Building Workshop with BMKG,
  Jakarta, 20-23 Aug 2014 (Coordinated by Sid Thurston, NOAA)
RAMA Data Access

To select mooring sites, click orange boxes to select lines of sites, click and hold on your mouse to draw a box around sites, or click single sites. Red indicates which sites are selected. Solid squares show where all selected variables are available. Half filled squares show where some are available. Empty squares show where none are available. This page may take a few moments to load on slower networks and computers.


**All RAMA Publications for 2013: 15**

Ship Time/Indonesia

Issues:

Only one of 4 moorings serviced in April 2013 (weather)
Planned Feb 2014 cruise cancelled
Agreement with Indonesia Fisheries (KKP) not renewed in 2014

Strategy:

New formal agreement between NOAA and BMKG in process
Meeting to discuss scheduled for 20-23 Aug 2014 in Jakarta
30-day cruise under tentatively planned for Feb-Apr 2015
Ship Time/SAPPHIRE

Issues:

Last cruise in April 2013 (under ASCLME)
Timing of next cruise (under SAPPHIRE) uncertain
Difficulties in securing South African ship time

Strategy:

Continue dialogue with David Vousden, SAPPHIRE coordinator and chair, IRF
Explore possible use of the Tethys Explorer out of Seychelles
Potential vessel for use along 55°E

MV Tethys Supporter, Port Victoria Seychelles
Length 36 m, Beam 8.5 m
Twin Screws, Bow Thruster
Cruising Speed 10 kt
2 Cranes
Presently lacks full ocean depth bathymetry
PMEL tech inspecting ship this week
Ship Time/Australia

Issues:

- Planned July 2014 cruise cancelled on new RV Investigator
- Proposal for 3 yrs of cruise support (2015-17) to MNF declined

Strategy:

- Integrate RAMA into IMOS plan (being reprioritized now for 2015-2025)
- Propose expansion of RAMA into Timor Sea with PMEL support

Proposal: Three RAMA moorings and one Timor Sea mooring maintained for 5-6 years by 4 cruises on an Australian vessel (RV Investigator) at approximately 12-18 month intervals
Equatorial Indian Ocean Circulation

Seasonal Cycle of Zonal Current at 0°, 80.5°E
Oct 2004 – Dec 2013

Surface currents
Solid=local winds, Dashed=zonally averaged winds

Mean seasonal cycle based on 9+ years of data (61-d running mean filter)
Seasonal Cycle of Volume Transports along the Equator (2.5°N-2.5°S)

If the jet is 500 km wide and has an average speed of 75 cm/s in a layer 60 m thick, there is a transport of $22.5 \times 10^6$ m$^3$/sec…

Wyrtki, 1973
Thank you!

Questions?
Comments?
Suggestions?