

*To advance our understanding of interactions between geologic, oceanic and atmospheric processes that give rise to the complex physical dynamics of the Indian Ocean region, and to determine how those dynamics affect climate, extreme events, marine biogeochemical cycles, ecosystems and human populations.*

## **2018 NOAA Ship Ronald H. Brown Multidisciplinary Expedition to the Indian Ocean**

The United States National Oceanic and Atmospheric Administration (NOAA) Office of Oceanic and Atmospheric Research (OAR) has been working in the Indian Ocean for over twenty five years. For more than a decade NOAA has been enjoying close and mutually beneficial resource-sharing partnerships with institutes across the basin in east Africa, India's Ministry of Earth Sciences (MoES) and Indonesia's Badan Meteorologi Klimatologi dan Geofisika (BMKG)/Badan Pengkajian dan Penerapan Teknologi (BPPT) for Indian Ocean Observing System (IndOOS) mooring implementation and deployments of expendable instruments such as Argo floats and drifters. Most recently in July 2017 NOAA commenced collaboration with Korea's Institute for Ocean Science and Technology (KIOST) in the central Indian Ocean. The large number of Institutes collaborating in the Indian Ocean Basin speaks to the significance and reach of its global impacts.

Although, the Indian Ocean is one of the least observed major basins in the world, it is a major driver of weather and climate variability over the Indian Ocean Region, broader Asia and North America. The South Asia Monsoon system impacts rainfall and agriculture in the Indian Ocean rim region, which affect approximately one-third of the global population living in the region. Propagation of the Madden-Julian Oscillation (MJO), formed over the Indian Ocean, has far reaching influence over high-impact events, such as extreme rainfall and flooding along the west coast of the U. S. as well as hurricane formation in the eastern Pacific, Caribbean Sea, and Atlantic. Ocean-atmosphere interactions in the Indian Ocean region affect the evolution of El Niño and the Southern Oscillation (ENSO), which has pronounced impacts on seasonal weather patterns over the United States and around the world. These are just a few reasons why NOAA is committed to the region to enhance ocean observations, scientific discoveries and capacity building on the social and economic applications of Indian Ocean observations.

The Second International Indian Ocean Expedition (IIOE-2) provides an exceptional opportunity for NOAA to contribute to this multinational campaign by deploying its Flagship Ronald H. Brown to the Indian Ocean for a multi disciplinary expedition from early February until the end of May 2018. Port calls in Goa India and Darwin Australia will coincide with the proposed 2<sup>nd</sup> NOAA-MoES Ocean Science and Ocean Observation Colloquium in Goa and additional opportunities to provide education and outreach. Ronald H. Brown is ideal for such IIOE-2 operations due to its particular parameters: 11kts transit, 60 day endurance, deck space for large mooring operations, 75 kHz ADCP, operations in winds above 20 knots and sea states above 5 feet.



The NOAA Ship's multidisciplinary expedition to the Indian Ocean will consist of three primary cruise segments during its 100 days traversing the basin: 1) Global Ocean Ship-Based Hydrographic Investigations Program (GO-SHIP) I7N repeat hydrography line in the western Indian Ocean, 2) deploying three (3) new Arabian Sea moorings and servicing nine (9) existing moorings for the Research Moored Array for African-Asian-Austral Monsoon Analysis and Prediction (RAMA), and 3) contributions to the multinational Years of the Maritime Continent (YMC) field campaign to include enhanced oceanic and atmospheric observations across the Indonesian archipelago/seas for better understanding of the MJO and other phenomena with global impacts.

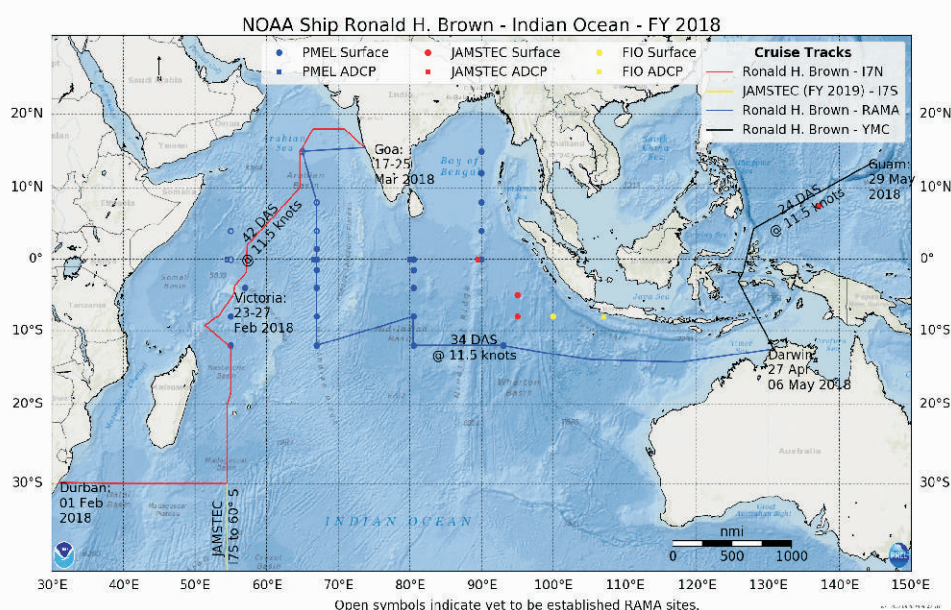
## I7N Segment

U.S. GO-SHIP is a systematic and global re-occupation of select World Ocean Circulation Experiment (WOCE)/Joint Global Ocean Flux Study (JGOFS) sections of the 1990s. The Goals of U.S. GO-SHIP supported by NOAA include:

- ☞ Quantifying large-scale ocean natural and “anthropogenic” carbon property distributions from the surface to the ocean bottom, and their decadal changes;
- ☞ Assessing changes in the ocean's biogeochemical cycles and transport in response to natural and/or man-induced activity; and
- ☞ Providing the necessary data to support continuing model and sensor development that will lead to improved forecasting skill for oceans and global climate.

The I7N segment will be for 42 days between Durban South Africa and Goa India with a short stop in the Seychelles. The Indian Ocean Expedition I7N segment will contribute to GO-SHIP efforts by:

- ☞ Providing the only data in the last 20 years to estimate global carbon uptake and deep ocean temperature and salinity, below the depth Argo can measure, in this region;
- ☞ Obtaining ocean data to better constrain global ocean acidification rates aiding NOAA's Ocean Acidification Program (OAP) requirements, and offer an important contribution to the Global Ocean Acidification Observing Network (GOA-ON).
- ☞ Augmenting the I7S Cruise by Japan JAMSTEC in 2019 to implement the full 55E Hydrographic Survey.



## RAMA Segment

This cruise track will be for 34 days transiting from Goa, India to Darwin Australia with port calls in each city as described above. Major highlights of this open ocean segment will be to:

- ☞ Implement three (3) new mooring sites in the Arabian Sea and maintain existing nine (9) RAMA moorings in the Western and Central Indian Ocean along 67E and 80E;
- ☞ Make CTD casts at each mooring site to no less than 700m;
- ☞ Deploy Argo Floats, NOAA Drifters, OSU Chipods (turbulence resolving), and Dalhousie Univ OTN Ocean Tracking Network sensors.

## YMC Segment

The NOAA Ship will next transit for 24 days between Darwin and Cairns Australia through the Indonesian Seas to engage in the multinational Years of the Maritime Continent (YMC) field campaign in close collaboration with Indonesia BMKG, LIPI, BPPT, KKP and international contributors. YMC experiments will study land-sea-atmosphere coupling through deep atmospheric convection, precipitation, and ocean mixed layer. The primary goals of this segment of the NOAA Ship Ronald H. Brown will be to obtain data to better understand:

- Processes critical to MJO propagation through the Maritime Continent 'barrier', the critical uncertainty in MJO forecasting;
- Reasons for unrealistic timing of deep convection and distribution of land vs oceanic rainfall amounts, and the exaggeration of the barrier effect on MJO propagation over the Maritime Continent in global climate models, which constitute the most glaring source of error in the CMIP5 inter-comparisons from the recent IPCC report.

NOAA looks forward to enhancing our engagement with our Indian Ocean Partners and contributing to the IIOE-2 by maintaining close coordination with the two IIOE-2 Joint Project Offices (JPO) located at INCOIS and the IOC Perth Program Office. By means of this 2018 Ronald H. Brown Indian Ocean expedition, NOAA hopes to also catalyze the community towards the completion of the Indian Ocean RAMA array, advance scientific discoveries, deliver social and economic benefits by applying this new information and other triumphs during the IIOE-2 era.

[Report by Dr. Sidney Thurston, NOAA Climate Program Office, Maryland; [Sidney.Thurston@noaa.gov](mailto:Sidney.Thurston@noaa.gov)]

## Endorse your projects in IIOE-2

Don't miss the opportunity to network, collaborate, flesh out your research project and participate in IIOE-2 cruises!!

The endorsement of your scientific proposal or a scientific activity focusing on the Indian Ocean region is a recognition of the proposal's or activity's alignment with the mission and objectives of IIOE-2, of its potential for contributing to an increased multi-disciplinary understanding of the dynamics of the Indian Ocean, and of its contribution to the achievement of societal objectives within the Indian Ocean region. Over 25 international, multi-disciplinary scientific projects have already been endorsed to date by the IIOE-2. Yours could be the next one!

Visit <http://www.iioe-2.incois.gov.in/IIOE-2/EndorsementForm.jsp> for further details and for projects already endorsed by IIOE-2.

## 2018 Meeting Announcement - IIOE-2 Steering Committee, IGOOS, IORP, SIBER & IRF Annual Meetings

The second face-to-face meeting of the IIOE-2 Steering Committee is scheduled to be held along with the Annual Meetings of IGOOS, IORP, SIBER and IRF during 19-23 March 2018. The meetings will be hosted by the Government of Indonesia and will take place in Lombok. Watch out for further details on the IIOE-2 website: [www.iioe-2.incois.gov.in](http://www.iioe-2.incois.gov.in)

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