

Why study the Indian Ocean?

While the Indian Ocean has been the subject of research in the past, it remains one of the least sampled of the global oceans in both space and time, especially when compared to the Atlantic and Pacific oceans. Cumulative stressors active in the Indian Ocean make the need to better understand its characteristics a high priority, as does its critical and social value to billions of people.

The impacts of climate change are a growing concern in particular in the context of food security and how human impacts are affecting coastal environments and the sustainability of fisheries.

Sea level rise also threatens to inundate many of the basin's low-lying islands and coastlines, putting the very existence of some island nations and deltaic coasts in question.

What is IIOE-2?

Between 2015-2020, the Second International Indian Ocean Expedition (IIOE-2) is challenging the world's leading scientists to explore the Indian Ocean and contribute to a wave of new research aimed at contributing to an improved understanding of the physical, biological, geological, climatological and socio-economic role it plays.

While termed an 'expedition' it is much more than a series of research cruises — it is a platform and a framework to enable sub-basin wide exploration and the transfer of new knowledge, bound only by the research objectives and imagination of any individual or collaboration (national/multi-national/ international) that seeks to explore it.

The Mission:

"To advance our understanding of the Indian Ocean and its role in the Earth system in order to enable informed decisions in support of sustainable development and the well-being of humankind."

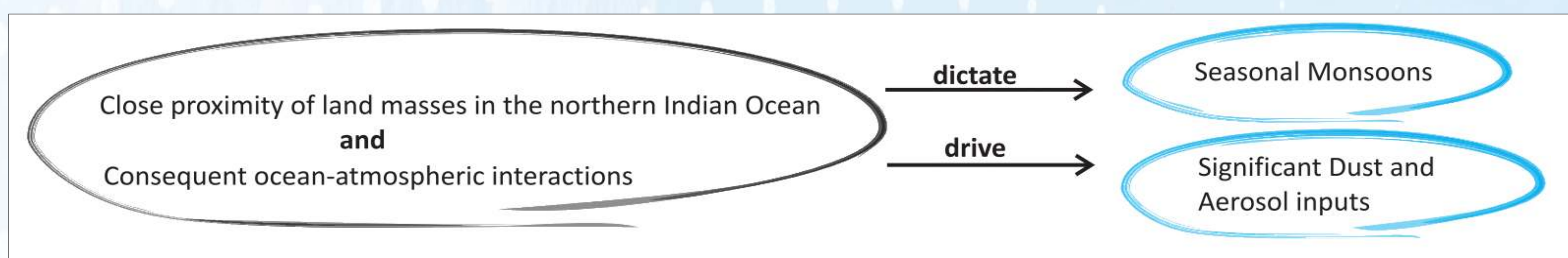
Outside of the ocean science community, very few people have a good understanding of the critical role that the Indian Ocean plays in the Earth's life support system.

The nations that surround the Indian Ocean constitute almost 25% of the world's population and are hugely dependent on its resources for food and livelihoods. This highlights the critical need for a focused scientific program like IIOE-2.

Moreover, without the focus that IIOE-2 brings to the Indian Ocean, it would be very difficult for scientists to fully understand the changes taking place and to infer how those changes affect humanity as a whole.

The Indian Ocean is full of remarkable facts & knowledge gaps that motivate critical science pursuits

1) It is Earth's most 'closed' ocean basin



2) It has an unusually complex submarine topography

This results in differences in the mechanics of water exchange particularly the North-South exchange at depth and the East-West exchanges in shallower regions.

3) It connects with the Pacific, Atlantic and Southern oceans and is critical in global ocean and climate cycles.

4) It has the Earth's only southward/poleward flowing eastern boundary current off Australia's west coast, the Leeuwin Current.

5) It hosts several phenomena over varying timescales that independently or in tandem dictate the weather of not just the countries around the Indian Ocean rim but even beyond.

6) In terms of the Blue Economy, the Indian Ocean has an asset base of several hundred billion dollars, part of an overall global ocean asset base of US \$24 trillion.

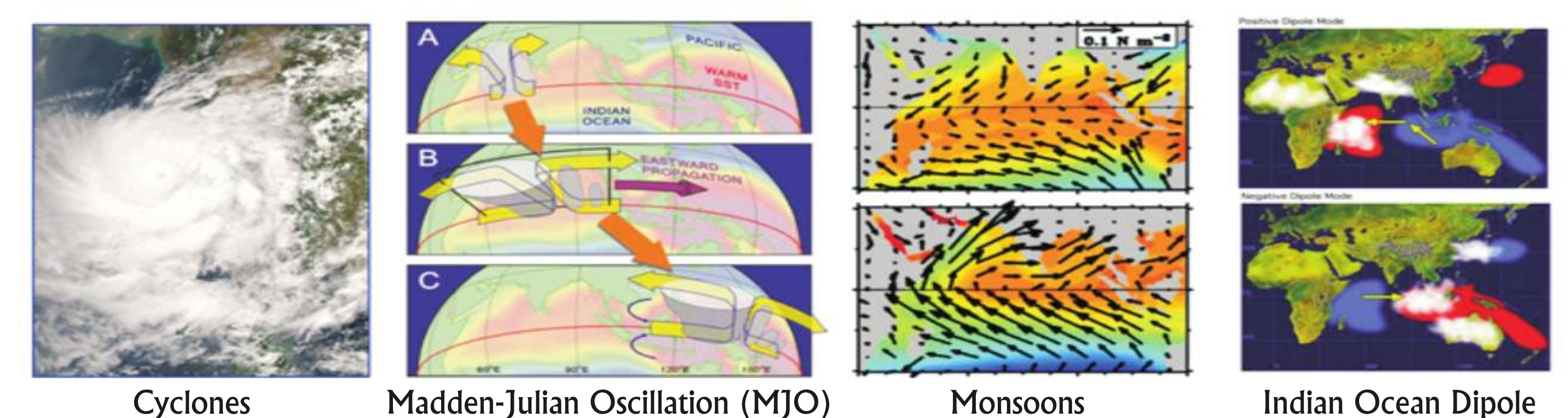


Figure-1: Intraseasonal, seasonal and interannual variations in the Indian Ocean which affect regional/basin-scale/global climate systems and biogeochemical/ecological systems in the ocean

This list showcases just a few of its unique features. In a sense, the Indian Ocean doesn't behave like other ocean basins and its mysterious ways make it scientifically challenging to unlock.

The Game Plan

IIOE-2 includes scientific research cruises, socio-economic studies, process studies, modeling & forecasting studies, technology trials, knowledge transfer through capacity development activities and over time will contribute to the setting of government policies related to the sustainable development of this ocean's resources.

IIOE-2 has a defined set of science themes, which are framed by a Science Plan (Hood et al, 2015) and are being effected under an IIOE-2 Implementation Strategy (UNESCO IOC IIOE-2 Interim Planning Committee, 2015).

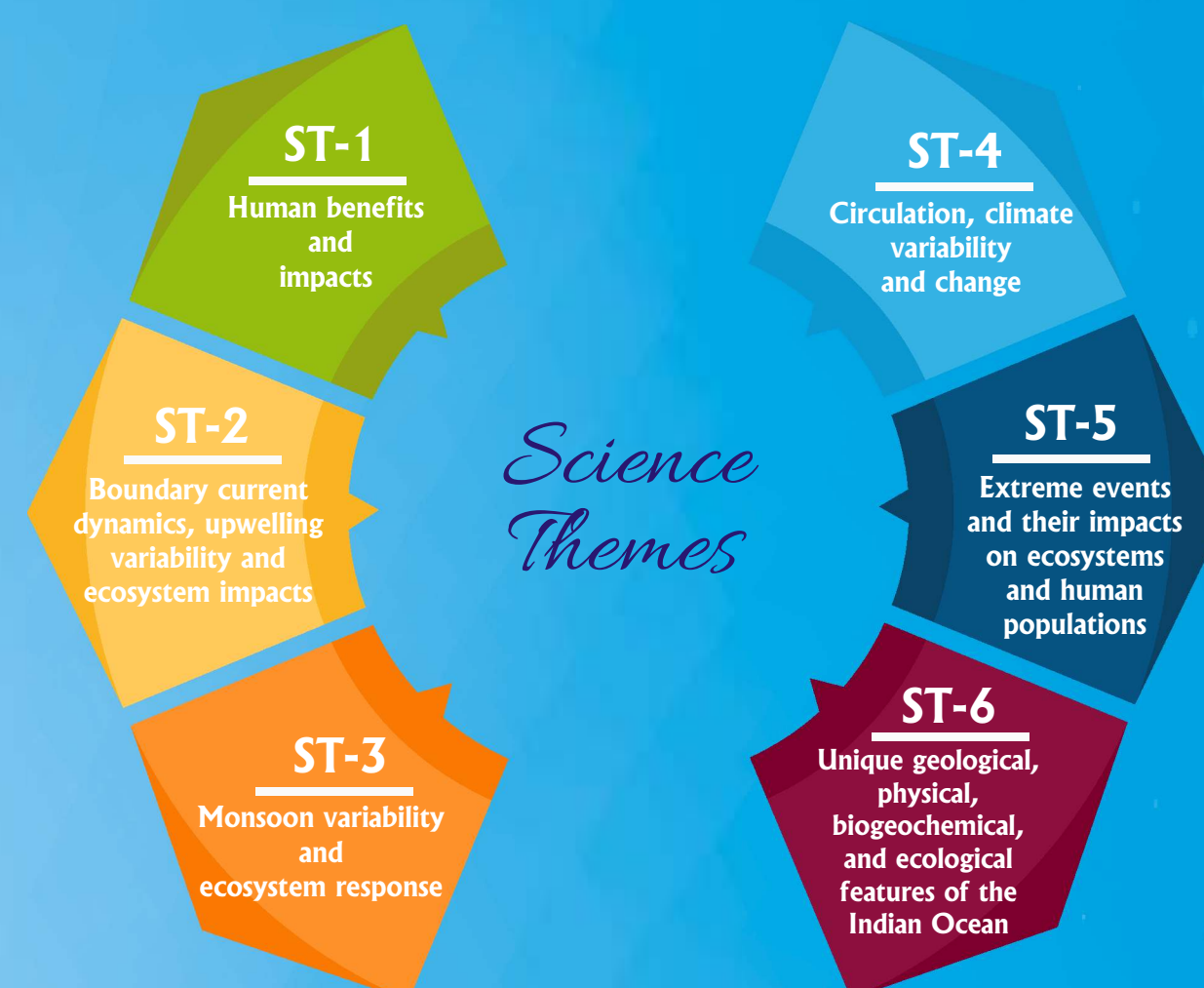


Figure-2: The six science themes guiding IIOE-2 research

Strengthening our scientific understanding of the Indian Ocean for the benefit of humanity

The program contributes directly to UN Sustainable Development Goal 14 by building a legacy of an improved understanding of the fundamental characteristics (physical, biological, geological) of the Indian Ocean, to support translation into concrete policy decisions, operational oceanography applications and the promotion of environmental stewardship. IIOE-2's capacity building focus in ocean science seeks to train next generation ocean scientists from the region, helping to ensure that its legacy will live on. In this same context, IIOE-2 is now starting to be considered as a prospective longer program that would also harmonise with the UN Decade of Ocean Science for Sustainable Development (2021-2030) (<http://en.unesco.org/ocean-decade>).

Furthering sustained ocean observations

IIOE-2 also contributes to furthering the Global Ocean Observing System (GOOS) — the platform for sustained observations of the global ocean.

The *Indian Ocean Observing System* component of GOOS is termed IndOOS and comprises a range of observational infrastructure to collectively monitor the ocean's physical and biogeochemical parameters (including temperature, salinity, surface wind and biogeochemical variables such as oxygen, nutrients and carbon).

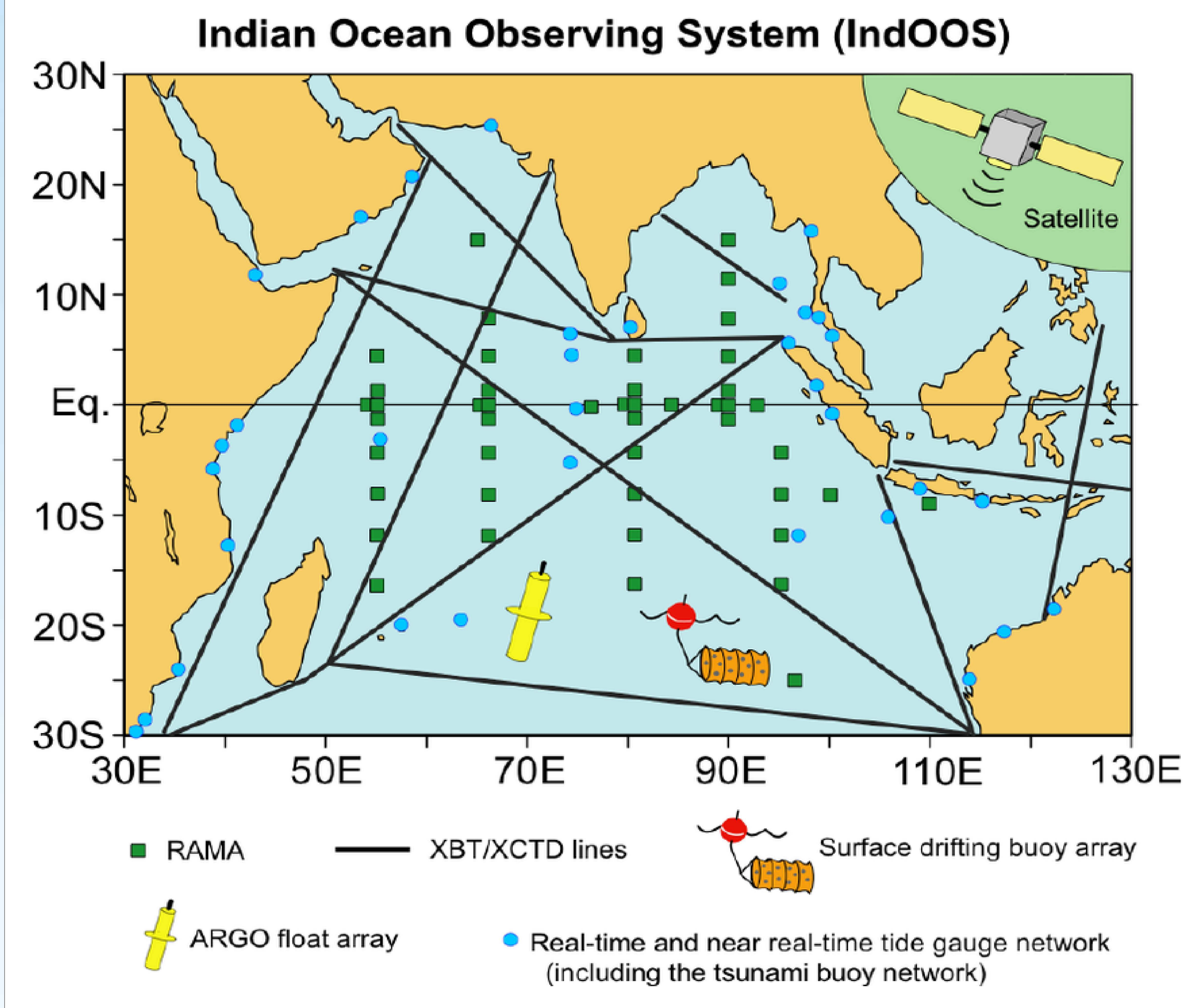


Figure-3: A schematic of the Indian Ocean Observing System (IndOOS) and its inter-connected system of ocean data collection platforms including ocean buoys, tide gauges, the Argo array of drifting floats and commercial ships.

IndOOS data by way of one example is a critical component of climate and weather forecasts which contribute to improved forecasting of annual monsoons and longer term climate phenomena such as the Indian Ocean Dipole.

IndOOS is undergoing a technical review during the IIOE-2. The review is supported and facilitated through IIOE-2 activities. In turn, this serves to improve the Indian Ocean data input into the Global Climate Observing System (GCOS), which supports the work of the Intergovernmental Panel on Climate Change (IPCC).

IIOE-2's progress so far.....

- 16 scientific cruises have been conducted since IIOE-2 was launched in December 2015, as part of 30 cruises or projects that have thus far been endorsed under the banner of IIOE-2.
- Seven IIOE-2 National Committees have now formed, from Australia, Germany, India, Japan, South Africa, UK and USA to facilitate coherent national engagement in IIOE-2.
- IIOE-2 is successfully motivating efforts to make oceanographic data from the region discoverable and widely accessible through an IIOE-2 metadata portal, accessible via the IIOE-2 website (www.iioe-2.incois.gov.in).
- IIOE-2 coincides with and embraces the Year of the Maritime Continent (YMC) 2017-18.

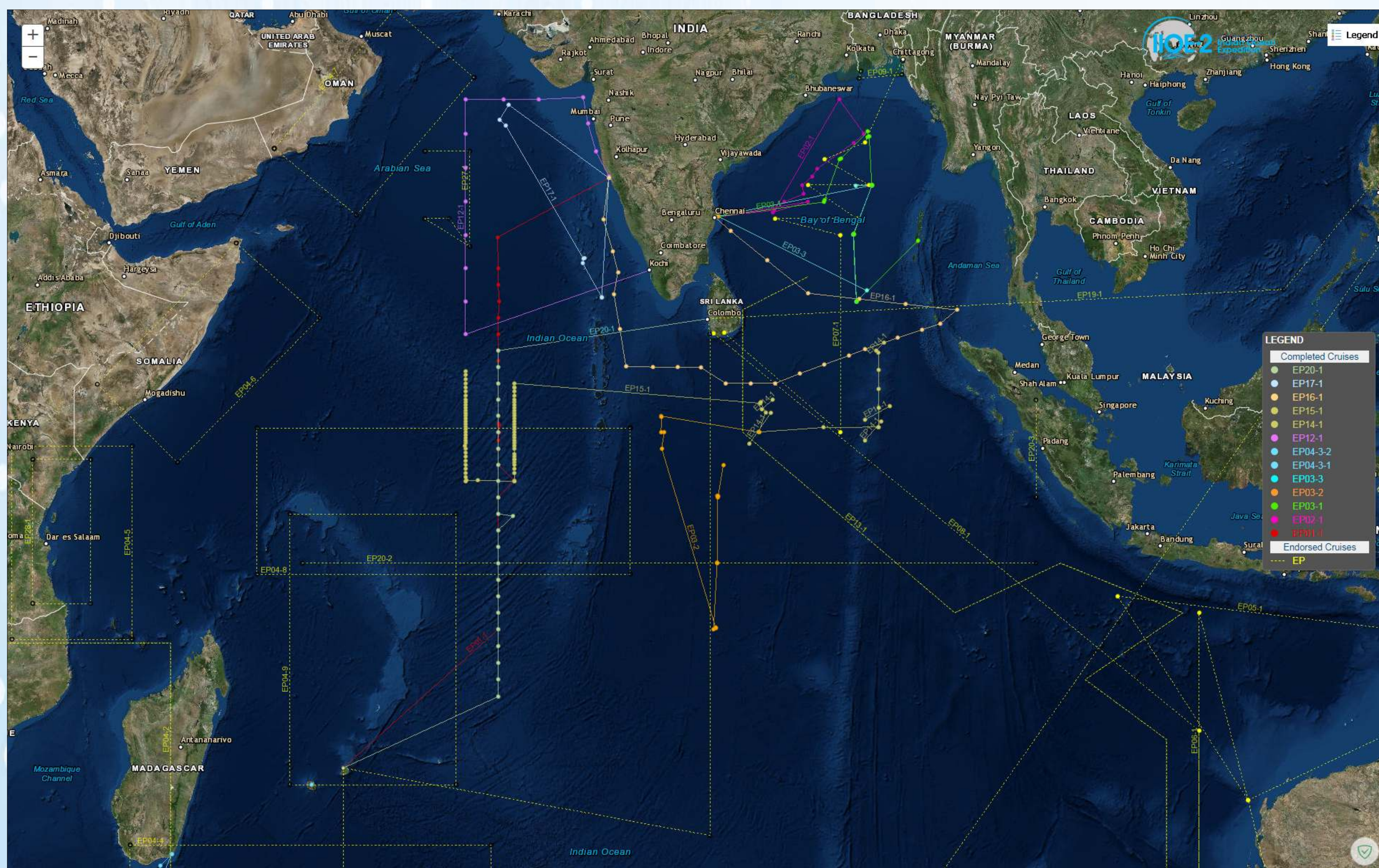


Figure-4: Completed and proposed IIOE-2 endorsed cruises as of May, 2018. Information taken from IIOE-2 WebGIS Application at <http://www.iioe-2.incois.gov.in/WebGIS.html>

The Eastern Indian Ocean Upwelling Research Initiative (EIOURI) is an exemplar of a major project endorsed under IIOE-2. It is a multi-national initiative involving scientists from Australia, China, Indonesia, Japan and USA. It seeks to understand the physical and biogeochemical aspects of upwelling in the eastern Indian Ocean, their role as part of the larger global ocean and climate system, including the impact of climate change.

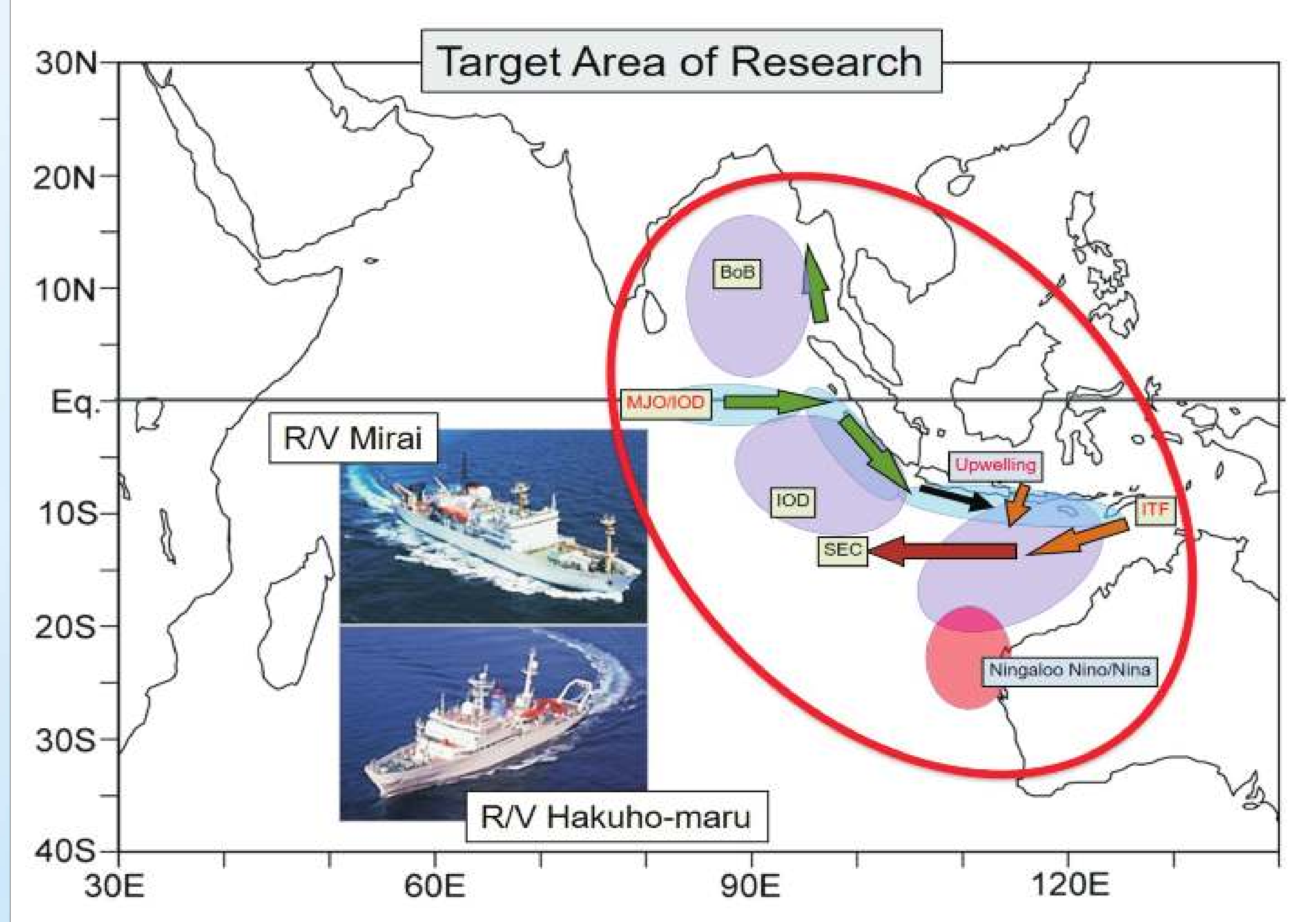


Figure-5: The target regions and areas of research of vessels engaged in EIOURI. This figure shows vessels from Japan.

Data collected through EIOURI will be made available and the cruises form an important component of IIOE-2 capacity development objectives by involving early career scientists and providing further training through workshops on outputs to facilitate flow-on socio-economic impacts. EIOURI is being complemented by the Western Indian Ocean Upwelling Research Initiative (WIOURI), which is now gathering strength and building its own growing constituency.

Connect to IIOE-2 and be a part of its legacy....

Endorse your projects in IIOE-2 and be seen at
<http://www.iioe-2.incois.gov.in/IIOE-2/EndorsementForm.jsp>



Access the latest issue of Indian Ocean Bubble-2
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Acknowledgements

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Overall program implementation is being overseen by an international Steering Committee and the IIOE-2 Joint Project Office (JPO), through an Indian Node hosted by INCOIS in Hyderabad, India (iioe-2@incois.gov.in) and an Australian Node hosted by the IOC PPO in Perth, Australia (nick.dadamo@bom.gov.au).

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