US IIOE–2 Activities and Plans

Raleigh Hood and the US IIOE-2 Steering Committee

IIOE 50th Anniversary Symposium
Goa, India, December, 4, 2015

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Overview of Ongoing & Planned US Research in the Indian Ocean, 2015-2020

Bay of Bengal: NRL, ASIRI (OMM and EBOB, present – 2015)

Arabian Sea: LORI observatory (Oman)
Zooplankton off of Oman (NSF)
Noctiluca blooms (NSF/NASA)
NASCar circulation gliders/drifters (ONR)
Interest/Planned: Nitrous oxide
Interest/Planned: Bio-Argo

Southwestern Indian Ocean: Agulhas Circulation, ASCA (NSF-funded)
Interest/Planned: Marion Rise (NSF)

Eastern Indian Ocean and ITF: Interest/Planned: ITF carbon and nutrient fluxes (NSF)
Interest/Planned: YMC Atmosphere-Ocean (NSF, NASA)

IO Southern Ocean: Bio-Argo (2017, NSF-funded)
Repeat Hydrography: GO-SHIP planning (2015 and beyond)
IODP: Multiple Expeditions to study seafloor, geology, etc. (2015 and beyond)
NOAA/RAMA: Complete RAMA Array, 2015-2020, pending
NSF/NASA/NOAA: Interest/Planned: US participation in EIOURI and WIOURI

Bay of Bengal (current)

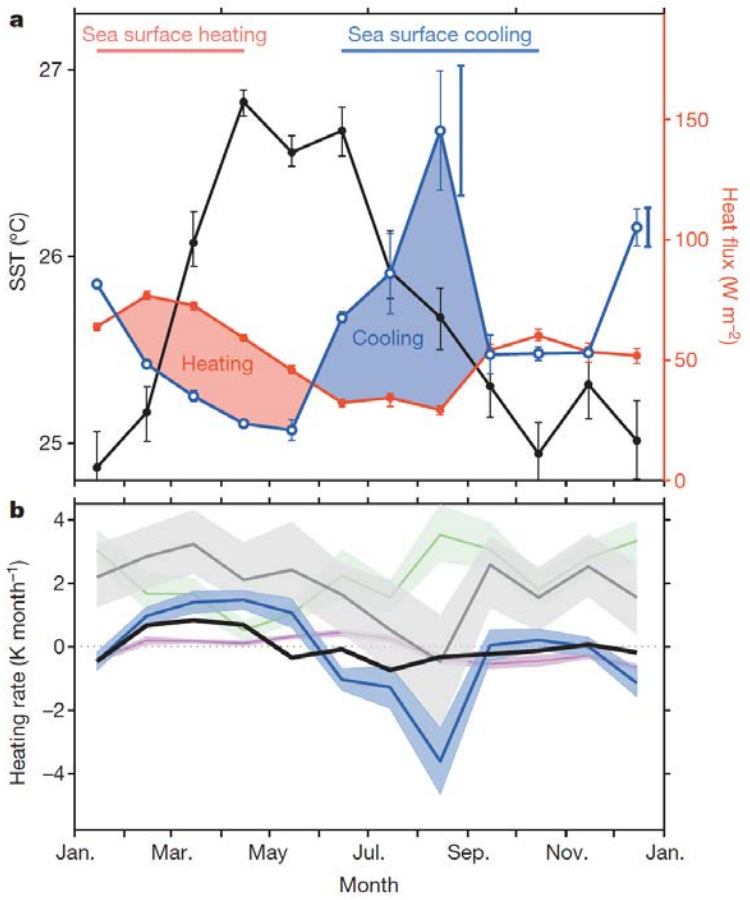
(sources: http://shipsked.ucsd.edu/Schedules/2013/)

ASIRI OMM (with India) and EBOB (with Sri Lanka) – BOB Freshwater Effects on IO Monsoon (Naval Research Laboratory and ONR)

Air-sea interactions & upper-ocean processes, water exchanges, BOB & SE Arabian Sea, radiating semi-diurnal tides from Adaman Sea

Experimental & modeling, six long-range mooring deployments (Sri Lankan Dome), ADCPs, chi-pod sensors, Dec 2013 - 2015

Survey cruises completed, R/V REVELLE



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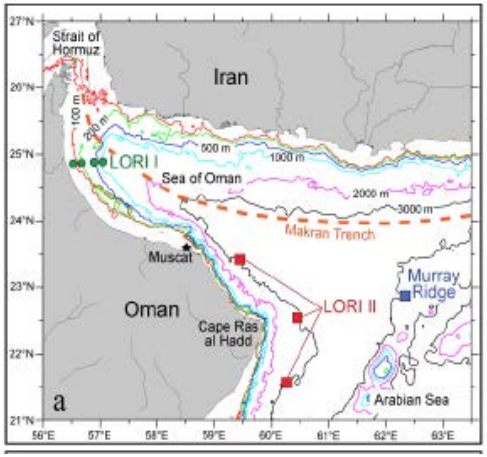
Arabian Sea (current)

Lighthouse Project (Steve DiMarco) – LORI 1 & 2 cabled observatory, Sea of Oman, since 2005, seismic, currents, guide ship traffic, tsunami warnings

Sharon Smith (NSF) – Post SW Monsoon zooplankton sampling, Masirah Island

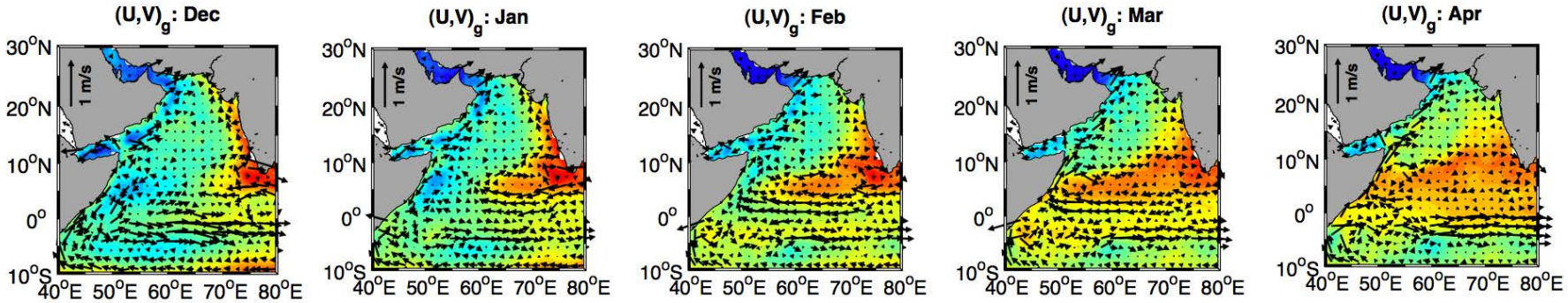
Joaquim Goes – NSF & NASA-funded, satellite algorithms & environmental controls of *Noctiluca* blooms. Also working in cooperation with JAMSTEC, comparing monsoon influences on ecosystem processes in BOB & NW Pacific.

NASCar circulation gliders/drifters – ONR funded multi-PI program to measure currents, hydrography, and mixed-layer depths in the Northern Arabian Sea using autonomous instrumentation.



du Vall et al. 2011

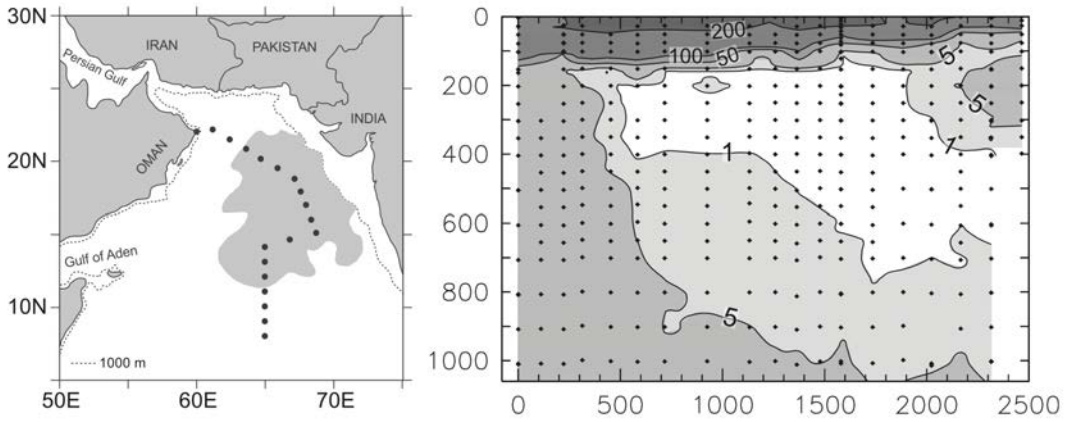
http://www.thehindu.com



Arabian Sea (pending/planned)

Jim Moffett, Bess Ward, Wajhi Naqvi – planned/pending proposal central & western AS – “hot spot” of nitrous oxide conc. accumulation of nitrous oxide under hypoxic conditions. measurements of chemical parameters and key rate processes

Lynn Talley, Steve Riser, Ken Johnson – 20 bio-Argo floats - upwelling, OMZ & control of meridional SST gradient. In planning stages, obstacle: ship support for deployment, calibration.



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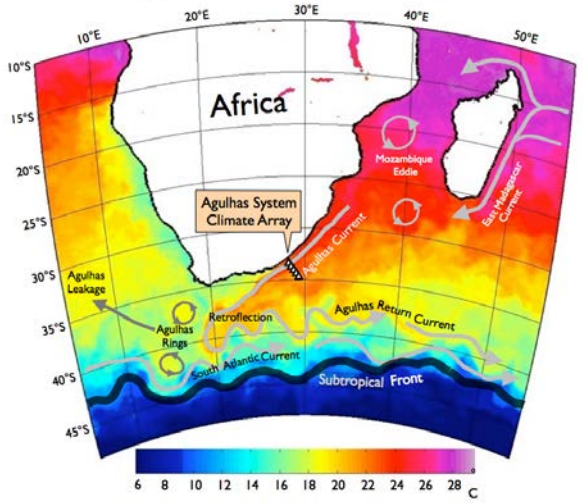
Southwestern Indian Ocean

Lisa Beal, Juliet Hermes, Geert-Jan van Brummer

Agulhas System Climate Array (ASCA) – NSF funded, collaboration with South African and Dutch Scientists

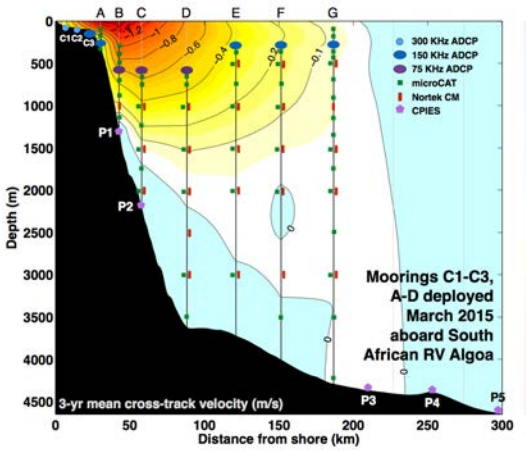


Major Scientific Objectives of ASCA:

Characterize the relationship between volume and temperature transport in the Agulhas Current.

Quantify the seasonal variability in basin-wide overturning and heat transports of the Indian Ocean, by synthesizing ASCA measurements with Argo and satellite data over the ocean interior.

Investigate the annual and interannual variability of the Agulhas Current in the context of wind forcing and changes in retroflection and leakage.



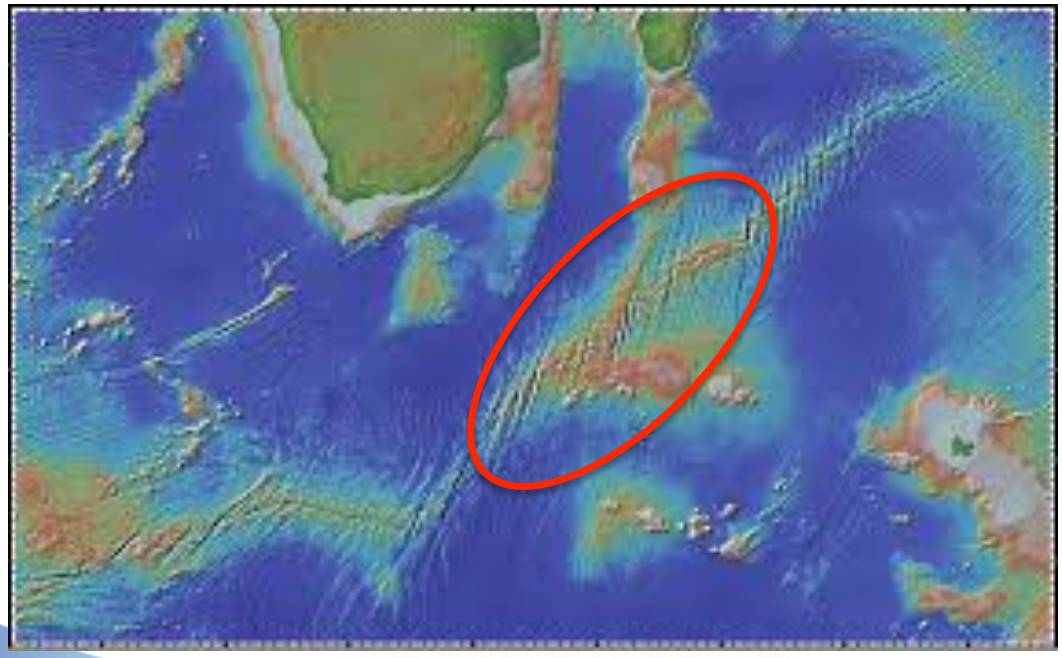
Southwestern Indian Ocean

Henry Dick et al.

Marion Rise (NSF) - Interest/Planned

Conduct marine geological and geophysical studies of the Marion Rise on the Southwest Indian Ridge.

Thin crust as evidence for depleted mantle supporting the Marion Rise allows direct examination of crustal architecture over its full length.



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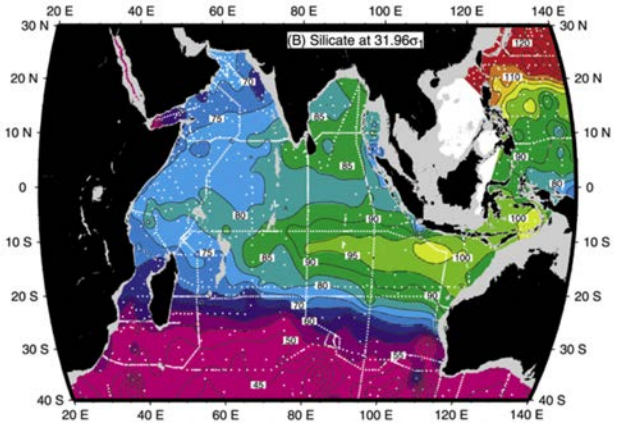
Eastern Indian Ocean and ITF

Ray Sambrotto, Dwi Susanto, et al.

ITF Carbon and Nutrient Fluxes (NSF) - Interest/Planned

Measure/estimate carbon and nutrient fluxes through the ITF. Quantify potential impacts on Indian Ocean biogeochemistry and carbon budget



Chidong Zhang et al.

Year of the Maritime Continent

A major IIOE-2 field champagne in 2017-2018

The goal of the YMC is to understand the role of the Maritime Continent in the global weather-climate continuum

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Southern Ocean, Indian Sector

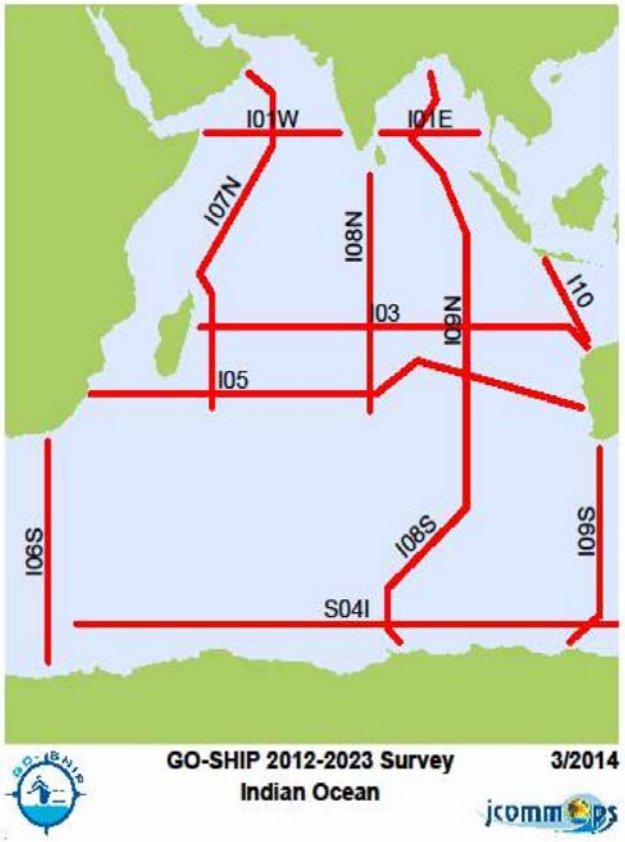
Lynn Talley, Ken Johnson, Jorge Sarmiento, et al.

– NSF funded

Bio-Argo floats (160+ total), nitrate, O_2, pH, bio-optics
SO modeling effort

50 floats planned for IO, south of 30-35°S
S. Africa to Australia
Deployments planned for **2017-2018**
Coincident with I9S repeat hydrography (2017-2018)

GO-SHIP Repeat Hydrography/WOCE Sections



GEOTRACES activities in the Indian Ocean?

Current efforts in S. Atlantic & Pacific

Plan to return to IO this decade
rerun I8S, I9N, I6S, I5 (last run 2007-2009)
I7N also desired

GO-SHIP section	Nominal location	Year	Country
I08S	95°E south of 32°S	2015-2016	U.S.A.
I09N	95°E north of 32°S	2015-2016	U.S.A.
I01E	10°N Bay of Bengal	2016	U.S.A.
I09S	115°E	2017	Australia
I05	32°S	2018	U.S.A.
I06S	30°E	2019	U.S.A.
I08N	90°E north of 32°S	2015 or 2018	Japan/India
I07N	60°E	No commitment (due to security reasons)	See ^
I10/IR06	Java to NW Australia (110°E)	2015 or 2018	Japan
I03	20°S Australia to Madagascar	No commitment	See #
S04I	62°S	No commitment	
I01W	10°N Arabian Sea	No commitment	

^ Although not in the USA planning, they will do the section if international security warnings are removed.

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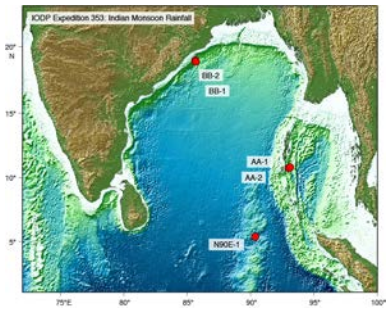
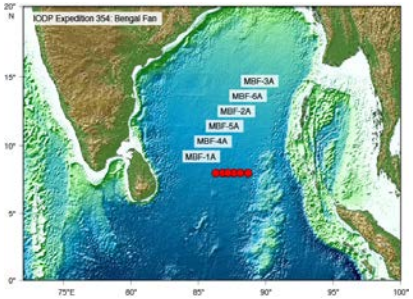
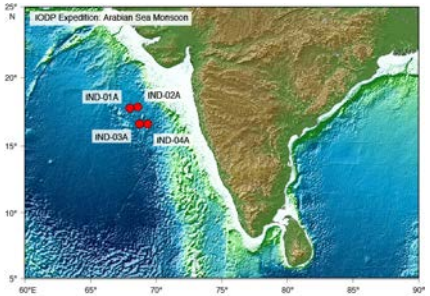
International Ocean Discovery Program

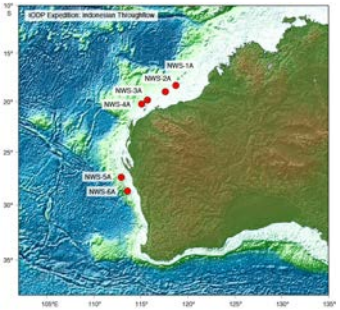
U.S. scientists are participating in the International Ocean Discovery Program (IODP), which is carrying out multiple deep-sea drilling expeditions in the Indian Ocean in 2015 and beyond, to study seafloor sediments, geological features, paleo-climate, deep-sea life, geohazards and planetary dynamics.

Exp 353	Completed	Indian Monsoon
Exp 354	2015-2017 planned	Bengal Fan
Exp 355	2015-2017 planned	Arabian Sea
Exp 356	2015-2017 planned	Indonesian Through Flow
Exp 360	2015-2017 planned	Drill through Moho to mantle









http://iodp.tamu.edu/scienceops/expeditions.html

Contingent upon approval of operations (JOIDES Resolution) beyond and National Science Board funding

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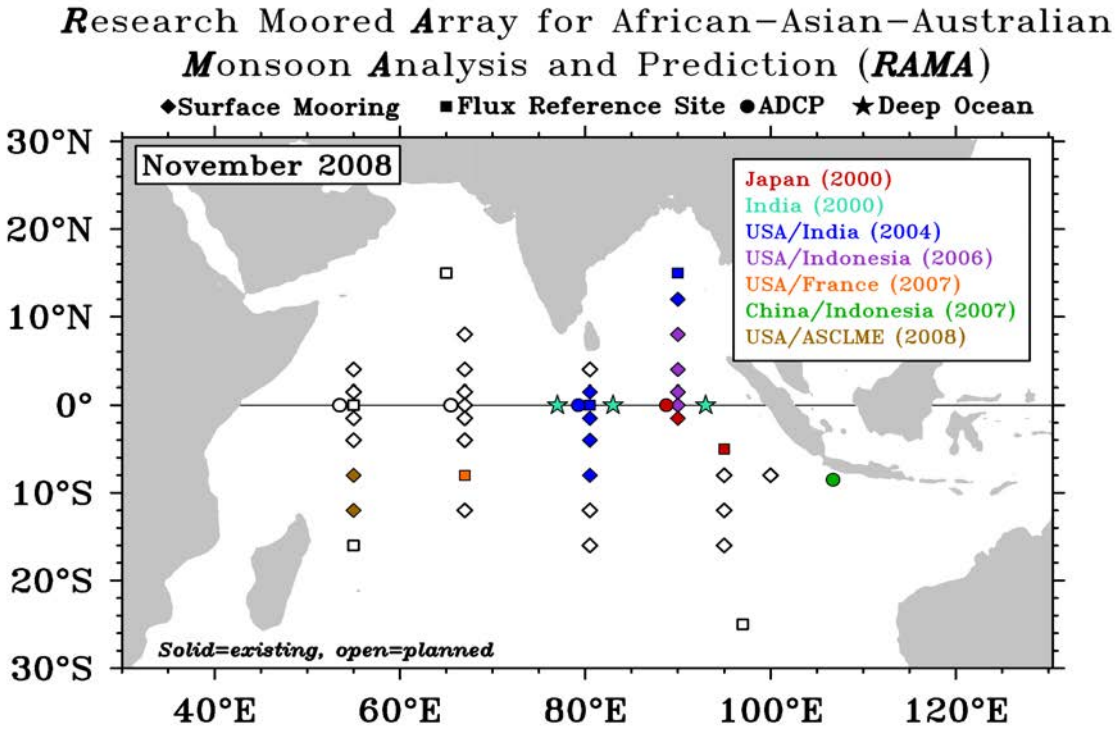
NOAA Proposal to Complete RAMA
(Mike McPhaden, NOAA-PMEL, pending)

A pre-proposal has been submitted to NOAA to fund completion of the Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction. This proposal includes biogeochemical sensor deployments.



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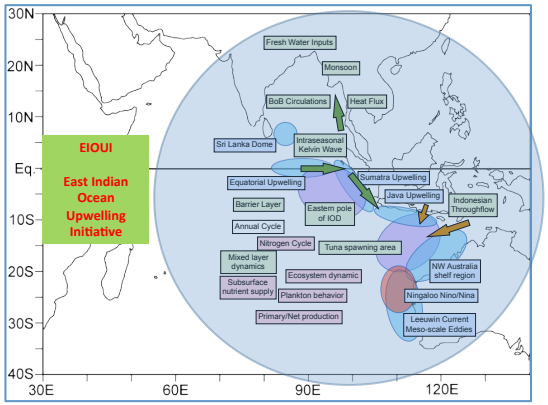
US Participation in EIOURI and WIOURI
(Mike Landry et al., NSF, planned)

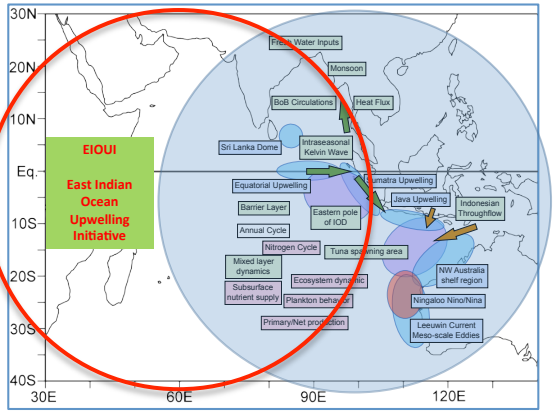
Eastern Indian Ocean Upwelling Research Initiative:

Planning for an Eastern Indian Ocean Upwelling Research Initiative (EIOURI) is already in an advanced stage. The main foci of this initiative will be on the upwelling regions that develop seasonally off Java, Sumatra, and northwestern Australia. ***US Scientists will be submitting proposals to participate.***



Western Indian Ocean Upwelling Research Initiative:

In addition to EIOURI, planning efforts have been initiated to develop a complementary upwelling research initiative on the western side of the basin: A Western Indian Ocean Upwelling Research Initiative (WIOURI). ***US funded research is already part of WIOURI.***



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