

# Results, status and plans for recent Bay of Bengal and northwestern Indian Ocean physical oceanographic process studies

On behalf of all the ASIRI, EBOB, NASCAR and potential MISO-Bob PIs

Amit Tandon (University of Massachusetts Dartmouth)

Eric D'Asaro (University of Washington)

Support:



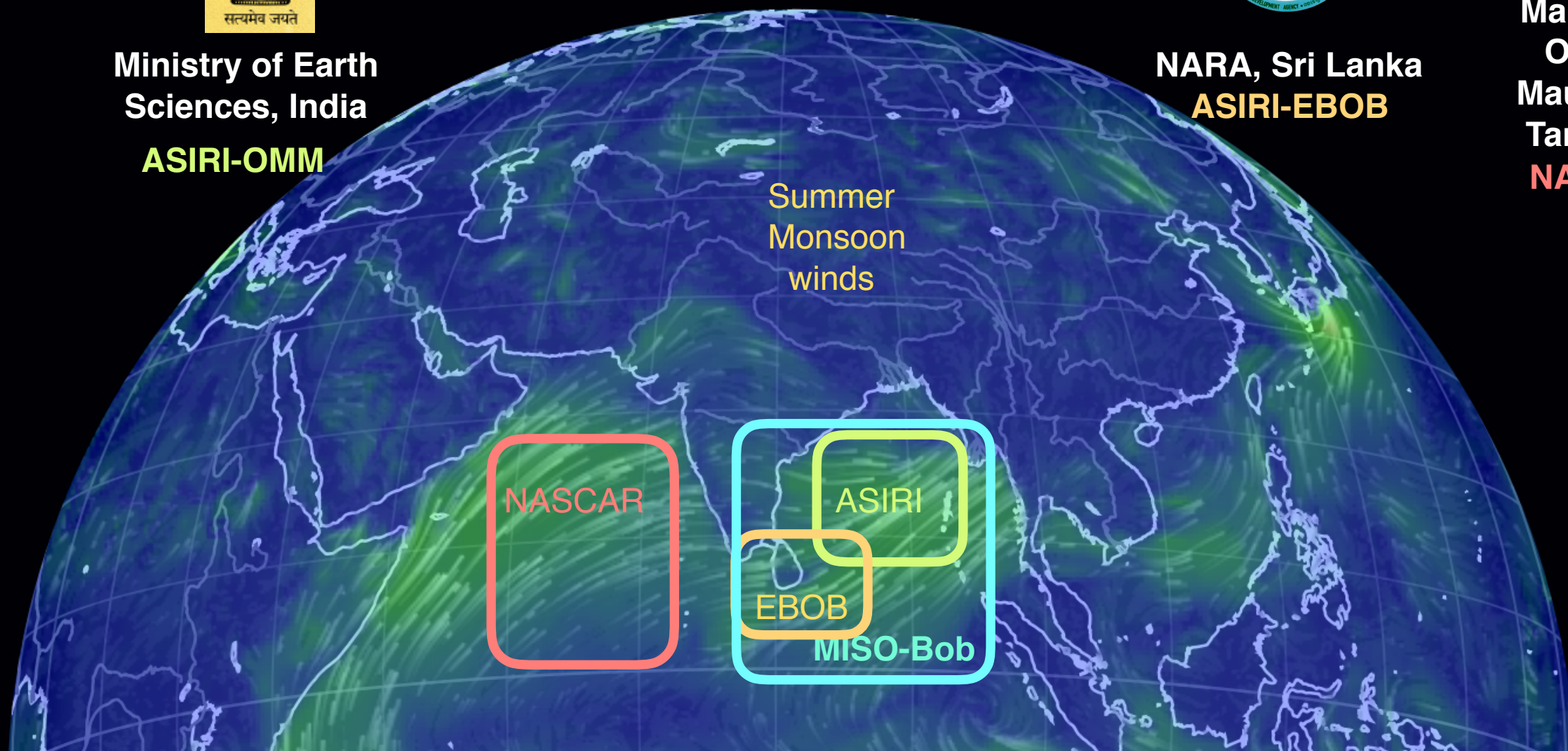
Ministry of Earth  
Sciences, India

ASIRI-OMM



NARA, Sri Lanka  
ASIRI-EBOB

Sri Lanka,  
Seychelles,  
Kenya,  
Maldives,  
Oman,  
Mauritius,  
Tanzania  
NASCAR



# Motivation for ASIRI

- Almost a third of the world's population depends on the South Asian Monsoon for water
- Climate models have difficulty in predicting the monsoons, particularly their sub-seasonal variability (active/break periods).
- The ocean supplies heat and moisture for the monsoon. Role of oceans is important, but in coupled models SST is too low.
- Upper ocean structure, physical processes, and air-sea interaction affect the SST.
- The Bay of Bengal is strongly affected by freshwater from the monsoons. How does this modify oceanic processes?



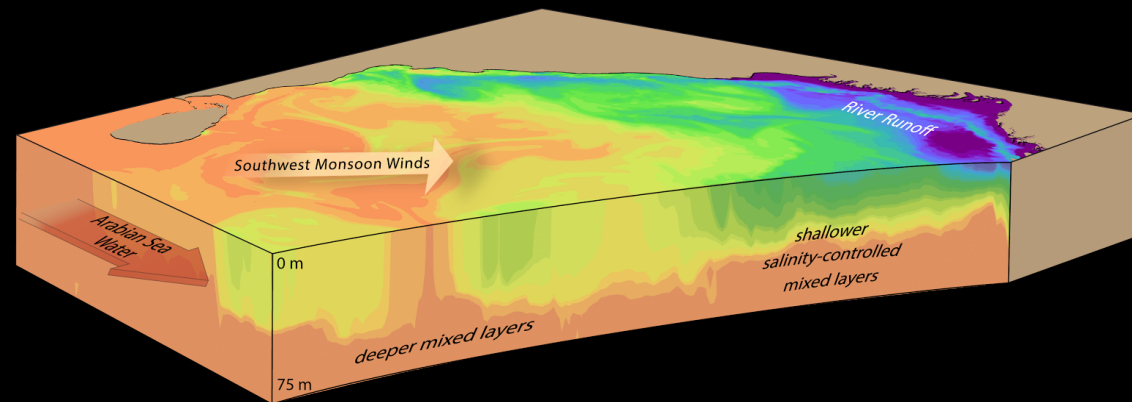
# Partnerships Motivated by Common Scientific Interests

- Improve Monsoon forecasts
  - Air-sea interaction
  - Ocean Mixing
- Extreme weather events
- Improving predictive capabilities, navigation and safety of ships at sea

## India specific interests:

Modern oceanographic instrumentation  
Capacity Building

**New Delhi 2011**



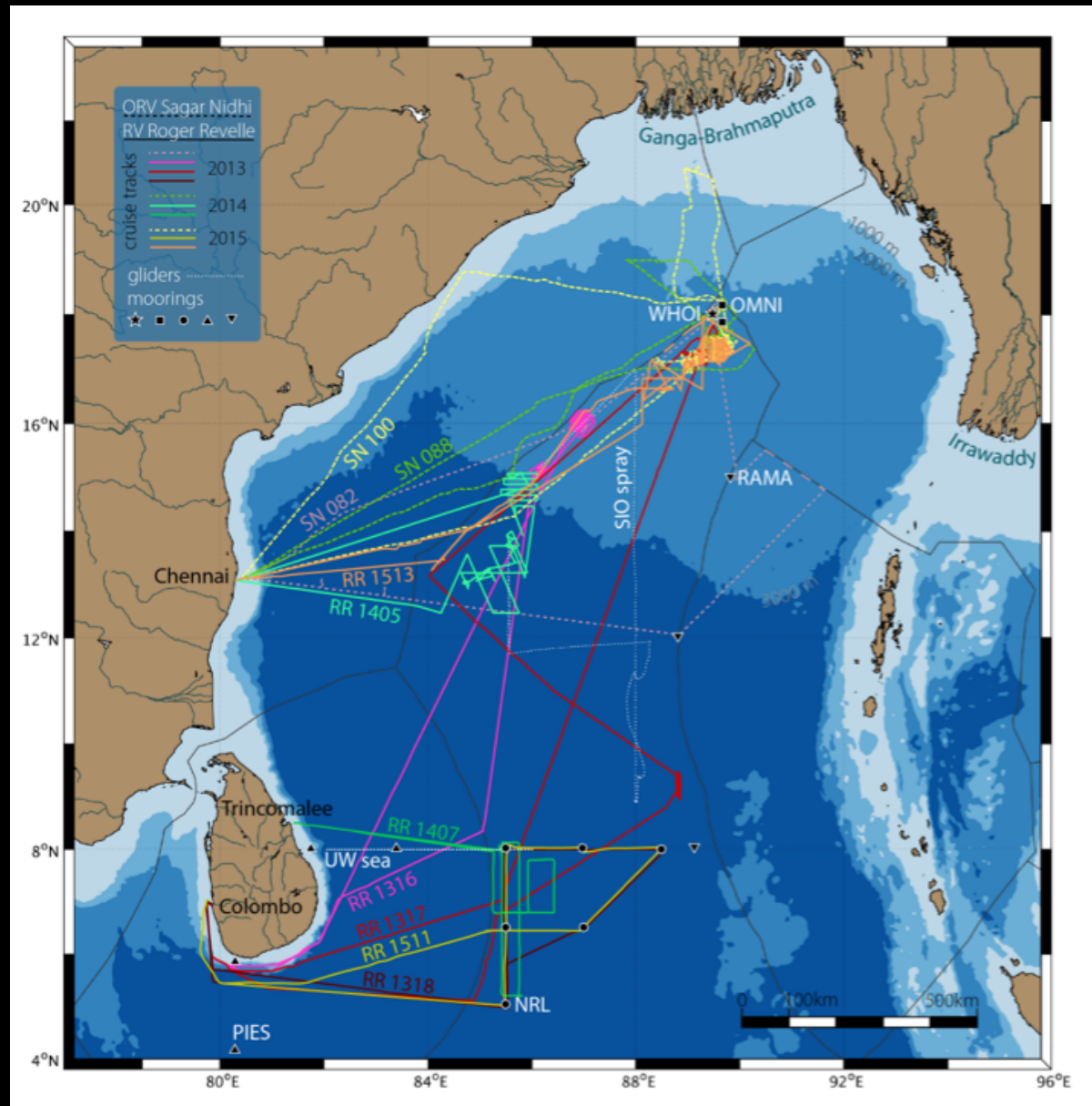
## Sri Lankan specific interests:

Coastal, regional to open-ocean oceanography  
Fisheries  
Capacity Building

**Colombo 2012**



# ASIRI-OMM: Highlights of USA-India Joint Field work 2013-2015



- Combined field efforts including multiple joint cruise operations **(2013,2014,2015)**
- R/V Revelle port calls to India
- Scientific exchange: meetings, workshops, ships
- Capacity building and training: summer schools, student exchange, targeted efforts
- Joint publications

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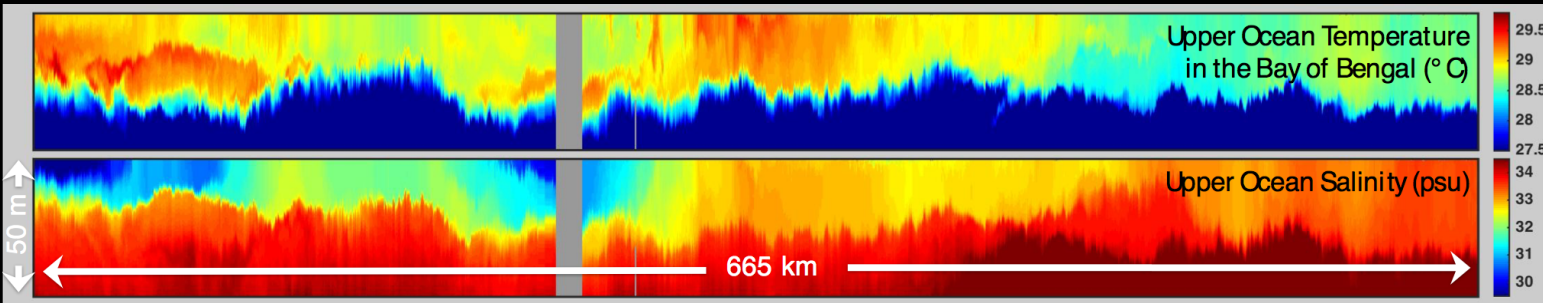




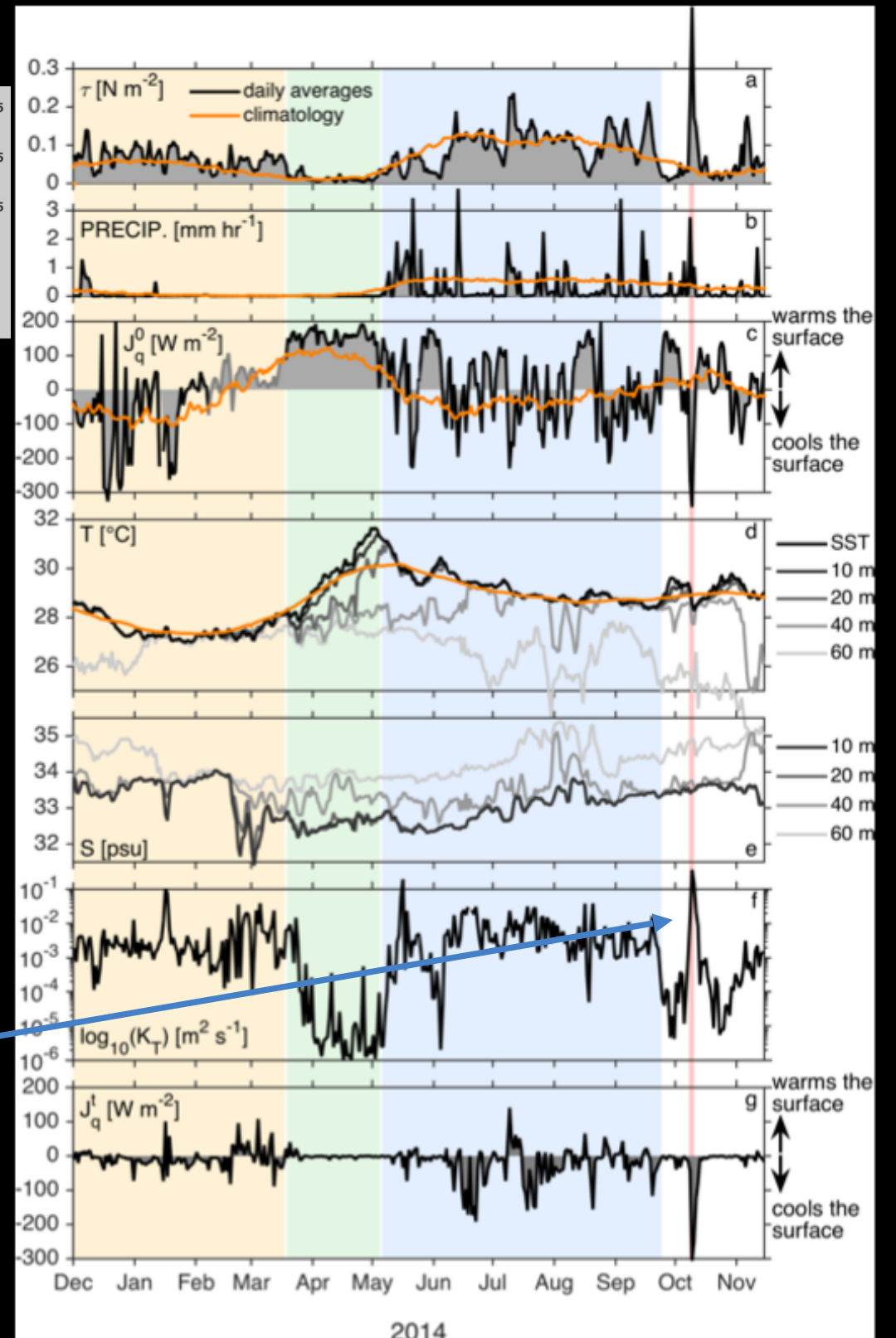
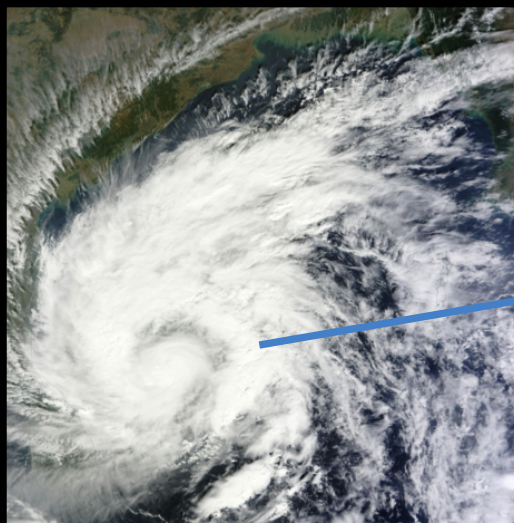
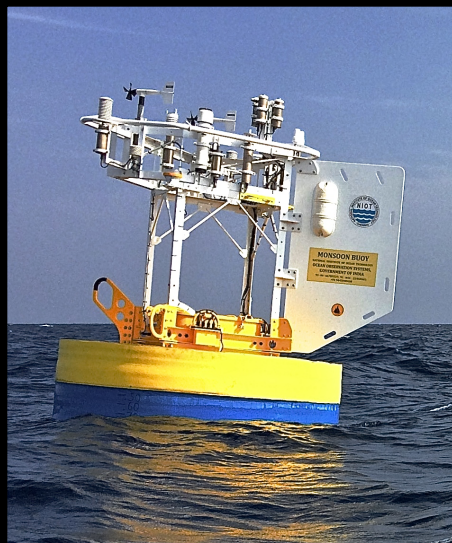
# Results

## ASIRI-OMM: Air-Sea interaction from annual cycles to cyclones

Warner et al. 2016



- Complex sub-surface structure with fronts
- Annual air-sea interaction and mixing
- Measured cyclone during ASIRI





# Results

## ASIRI-EBOB: New data sets revealed boundary currents around Sri Lanka

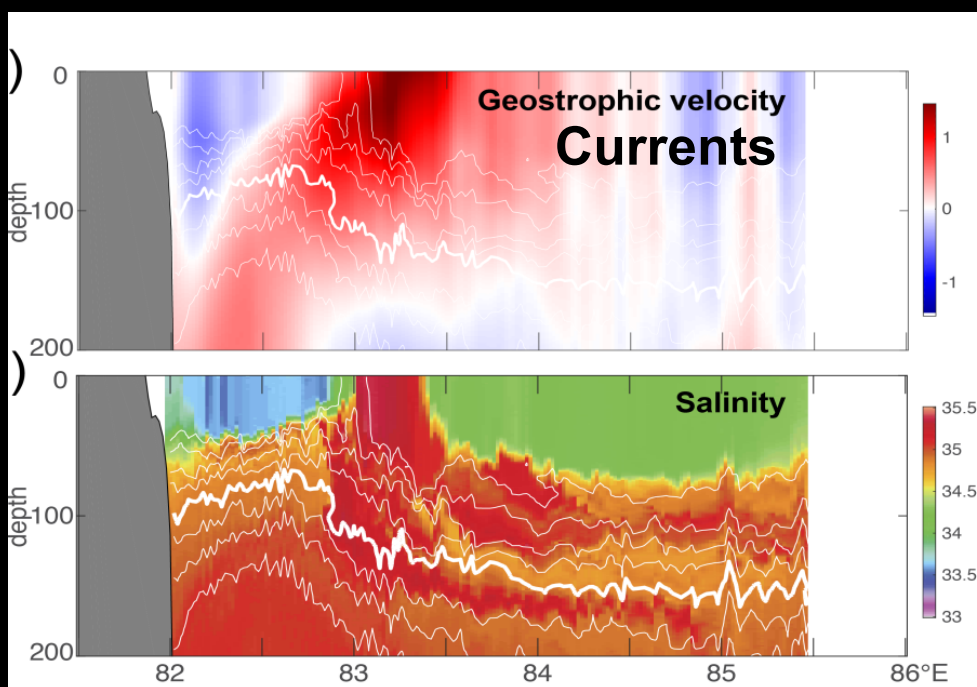
South of Sri Lanka is a choke point for the northern Indian Ocean circulation (between the Arabian Sea and the Bay of Bengal)



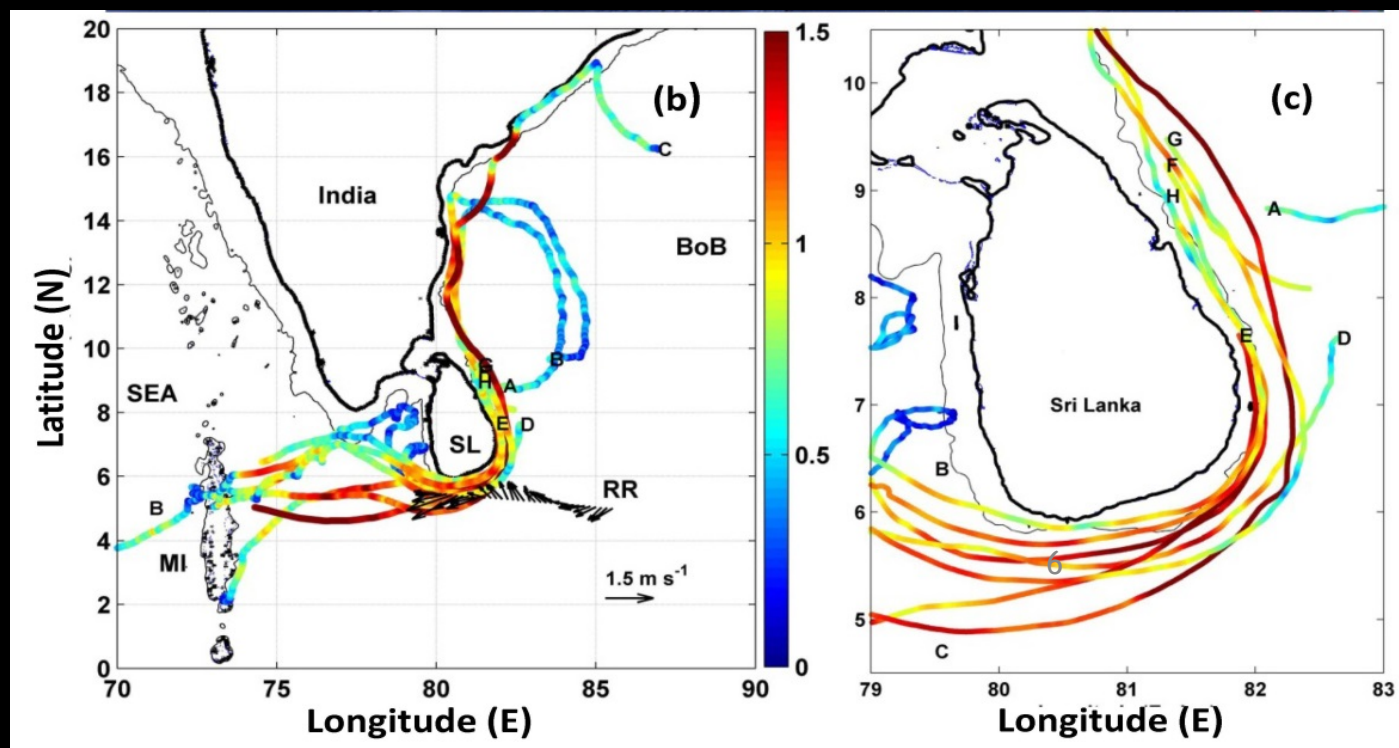
UW Gliders



SIO Drifters



East of Sri Lanka



Surface Currents



# Results

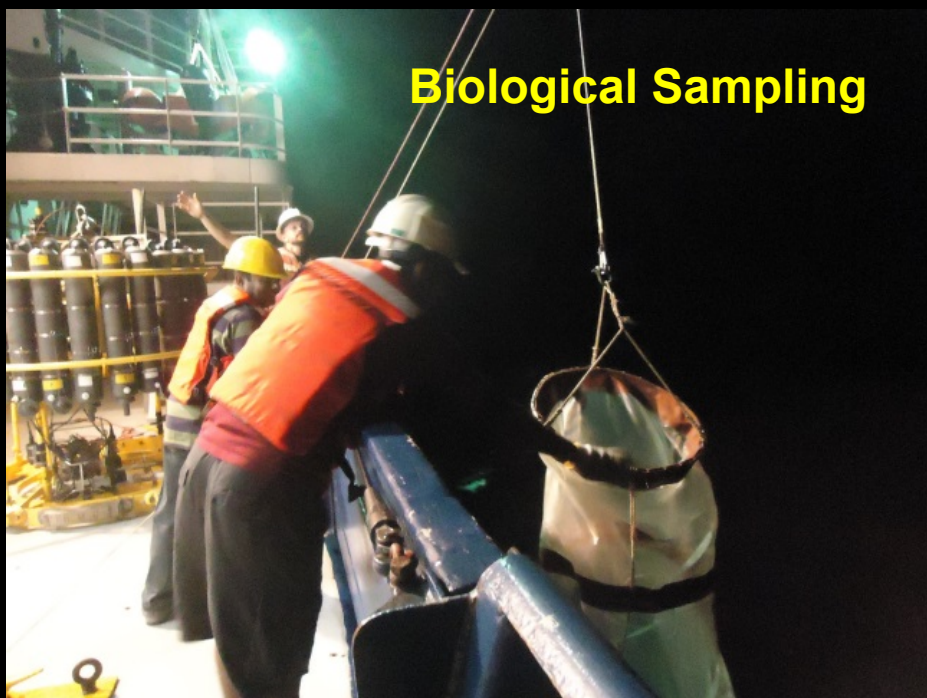
## ASIRI-EBOB: New insights into the open ocean circulation

Deep Moorings

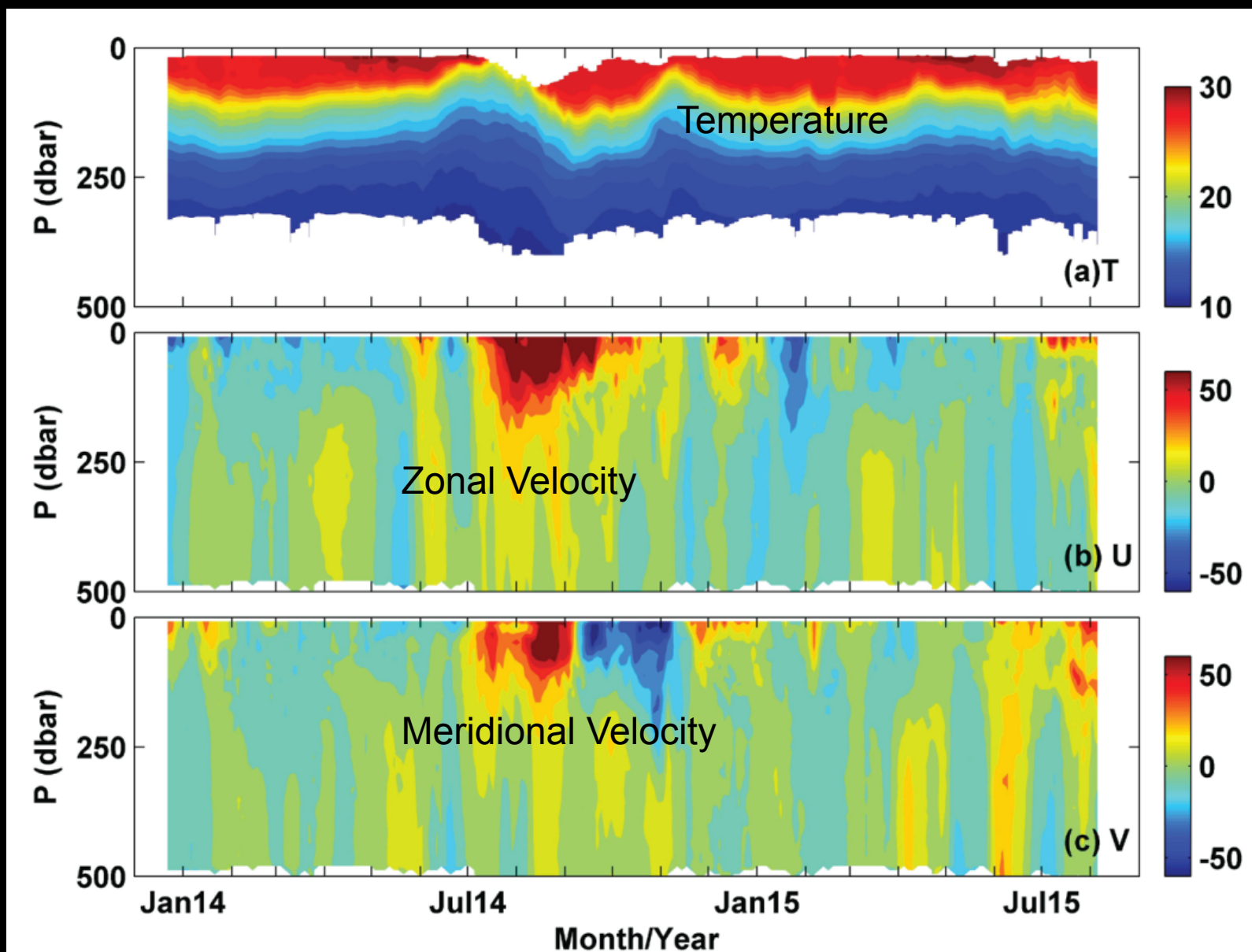


Long-term observations of monsoon currents from deep moorings: large transports and sub-surface pathways.

Biological Sampling

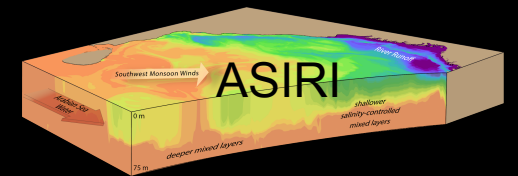


Sri Lankan scientists obtained valuable experience by participating open ocean observations in the R/V Roger Revelle.





# Capacity Building, Joint Analyses



- Training workshops & Summer schools
- Training in advanced instrumentation, observations, & analysis
- Publications with Indian partners including Oceanography 2016 special issue on Bay of Bengal

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