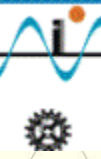


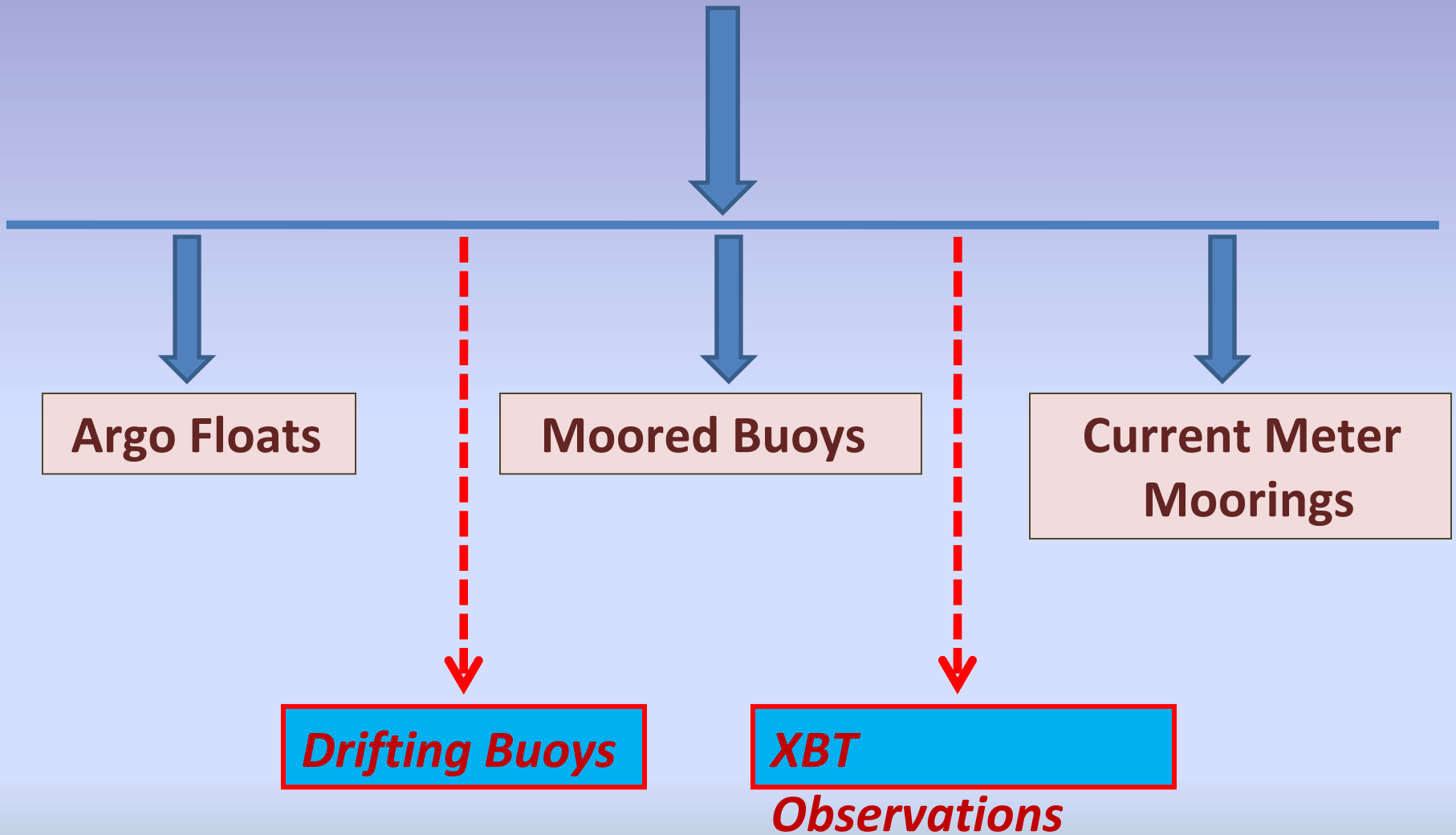
Indian XBT Program



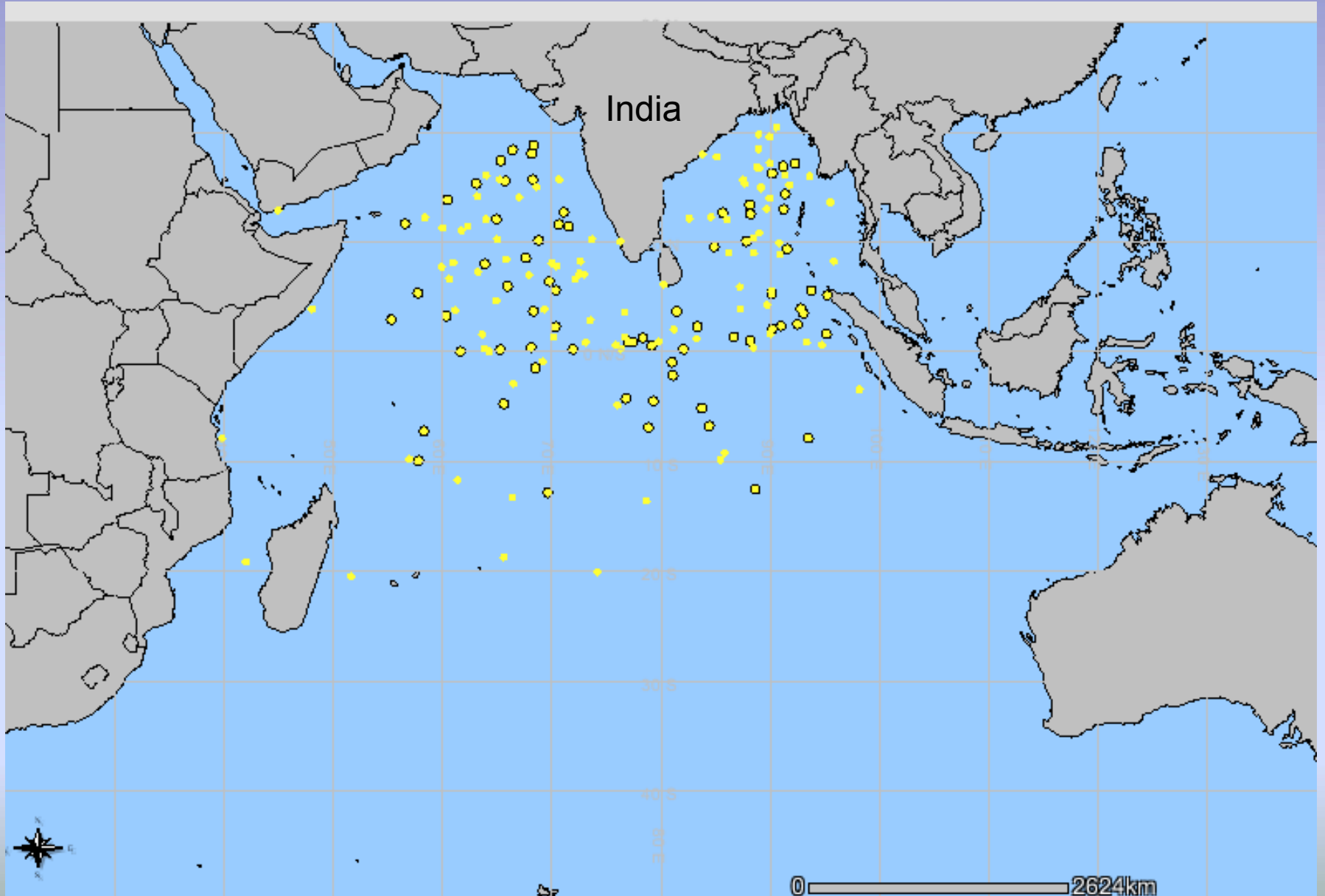
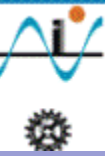
Dr. V. V. GopalaKrishna
Principal Investigator
National Institute of Oceanography
Goa - 403004
India



Ocean Observing Systems



Active Indian ARGO floats

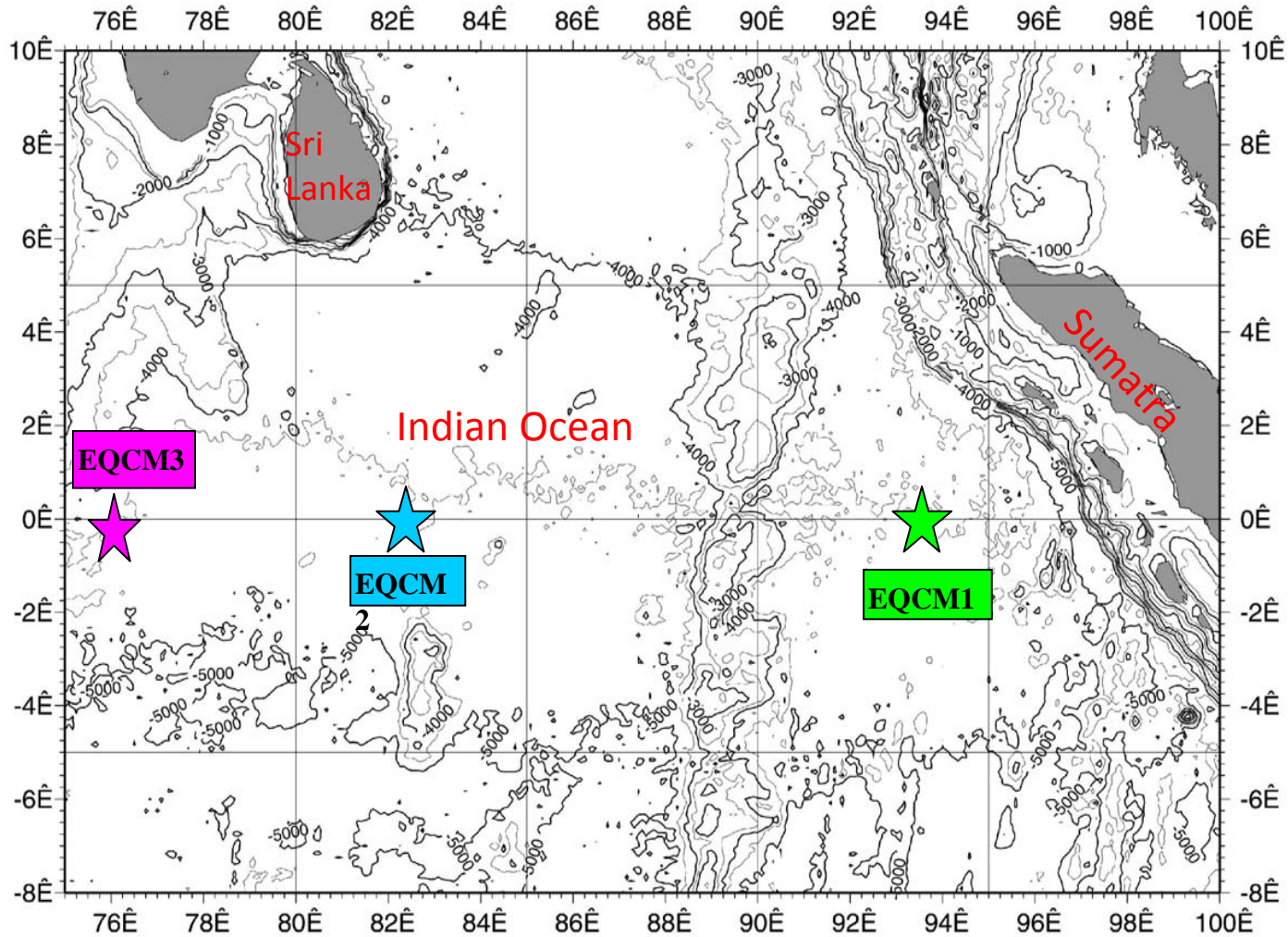




Buoy Locations

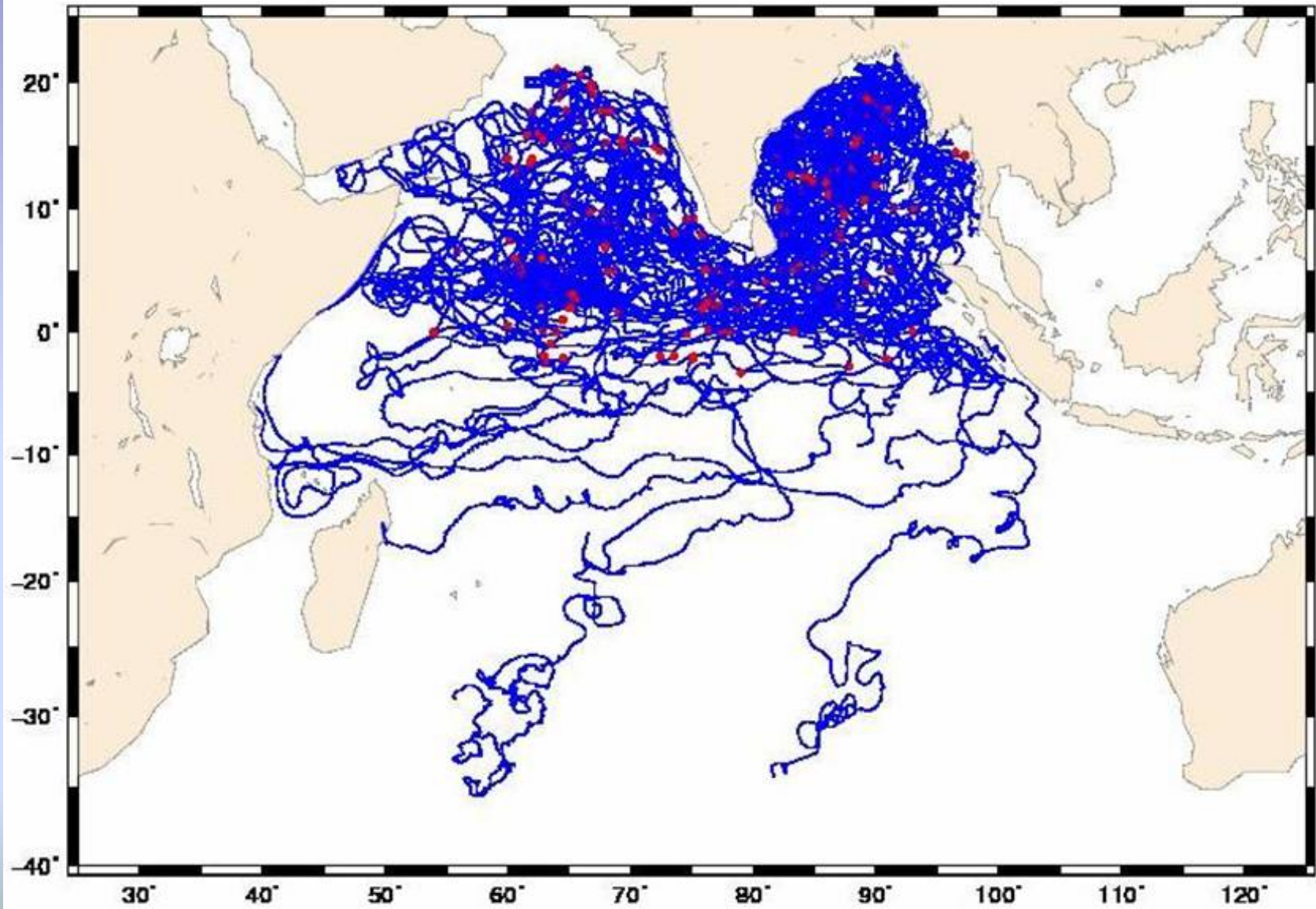


Current Meters Locations

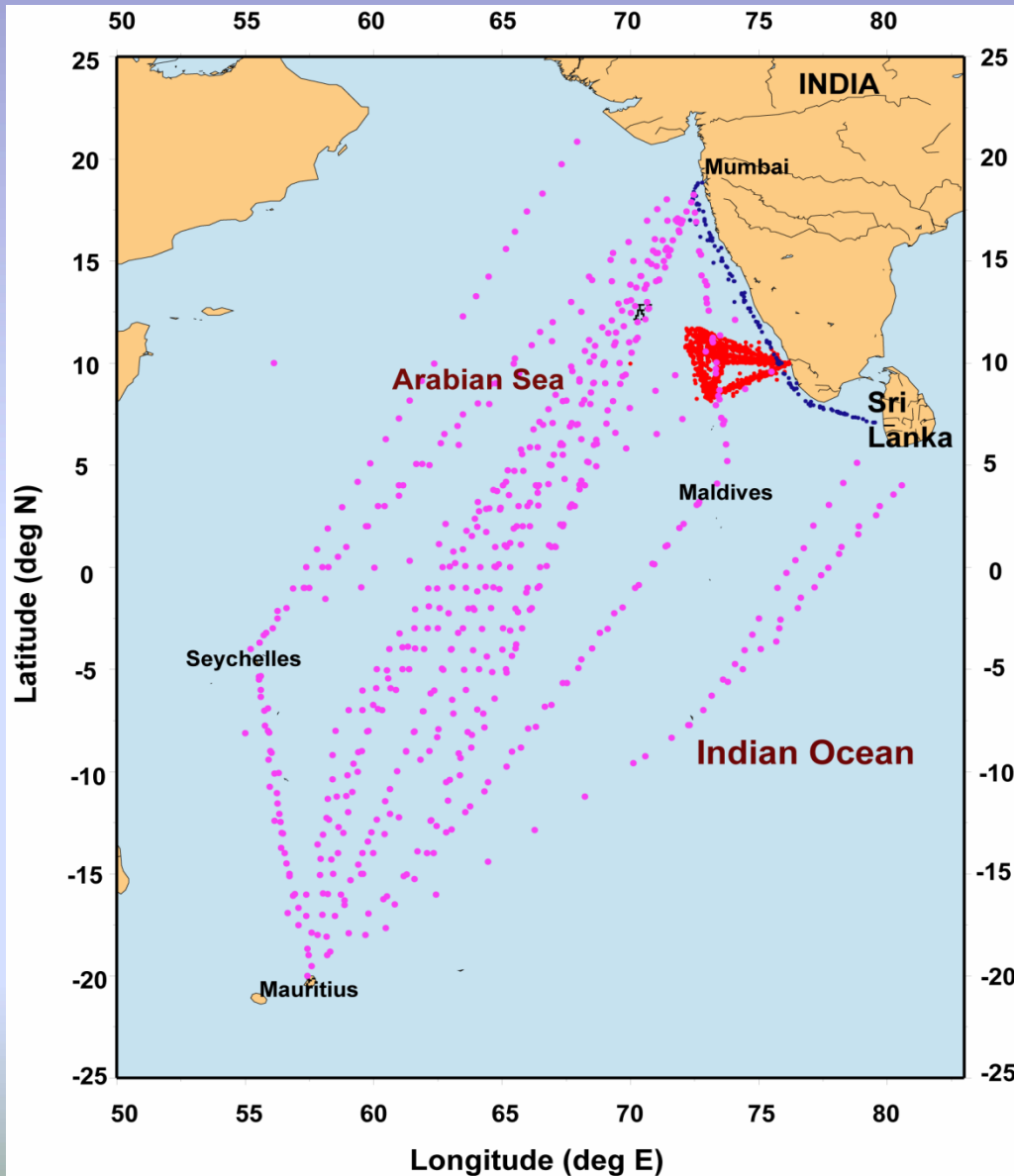


GMT 2004 Nov 24 17:37:32 kamesh-Jm0.9-contour int=500m

Active Buoys deployed since October 1991



XBT Transects in the Arabian Sea & Western Indian Ocean

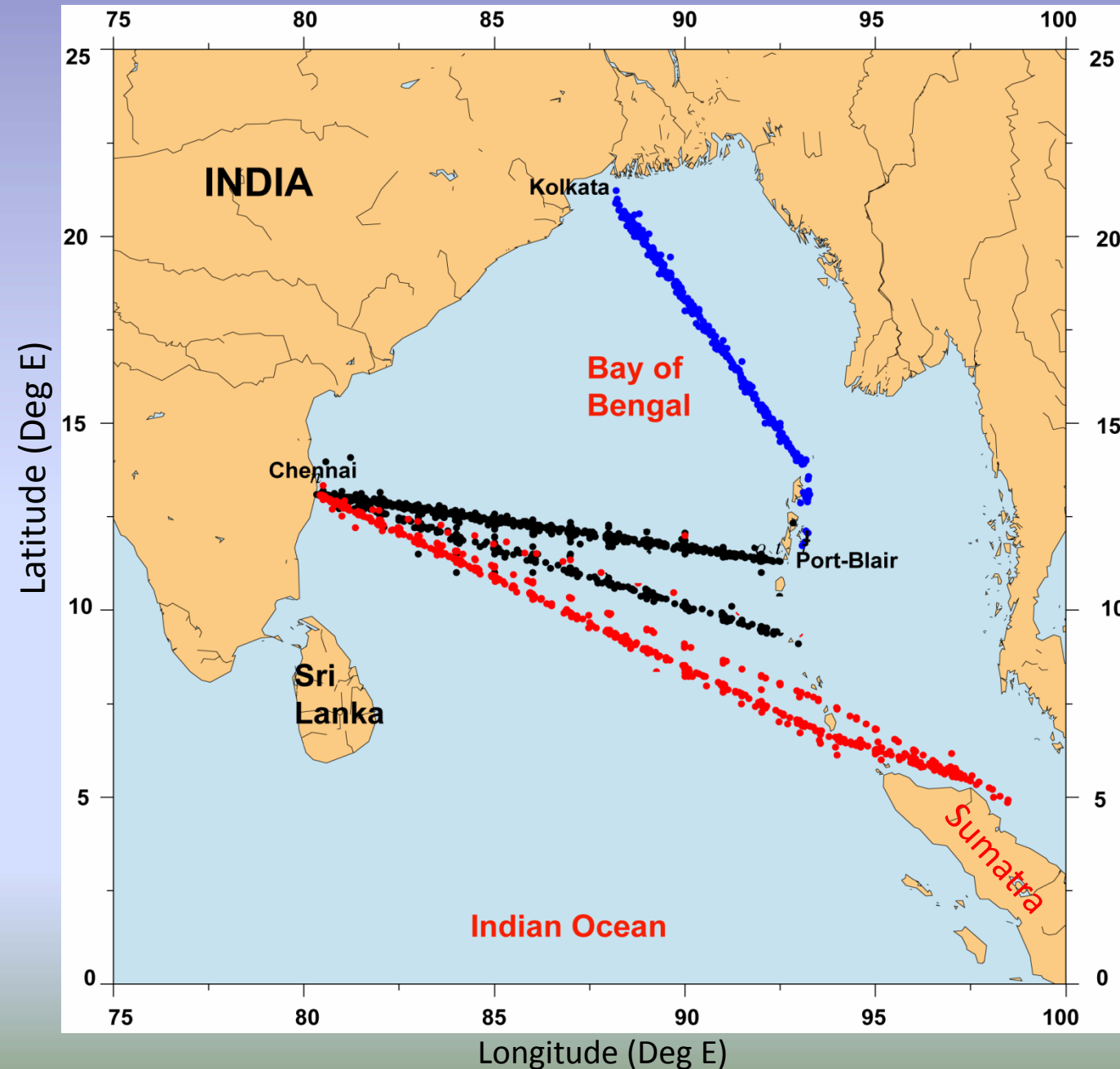


**Bombay-Mauritius (IX – 8)
1992 – 2000**

**Bombay – Colombo
2002 – 2004**

**South Eastern Arabian Sea
2002 – Ongoing (at Fortnightly
intervals)**

XBT Transects in the Bay of Bengal

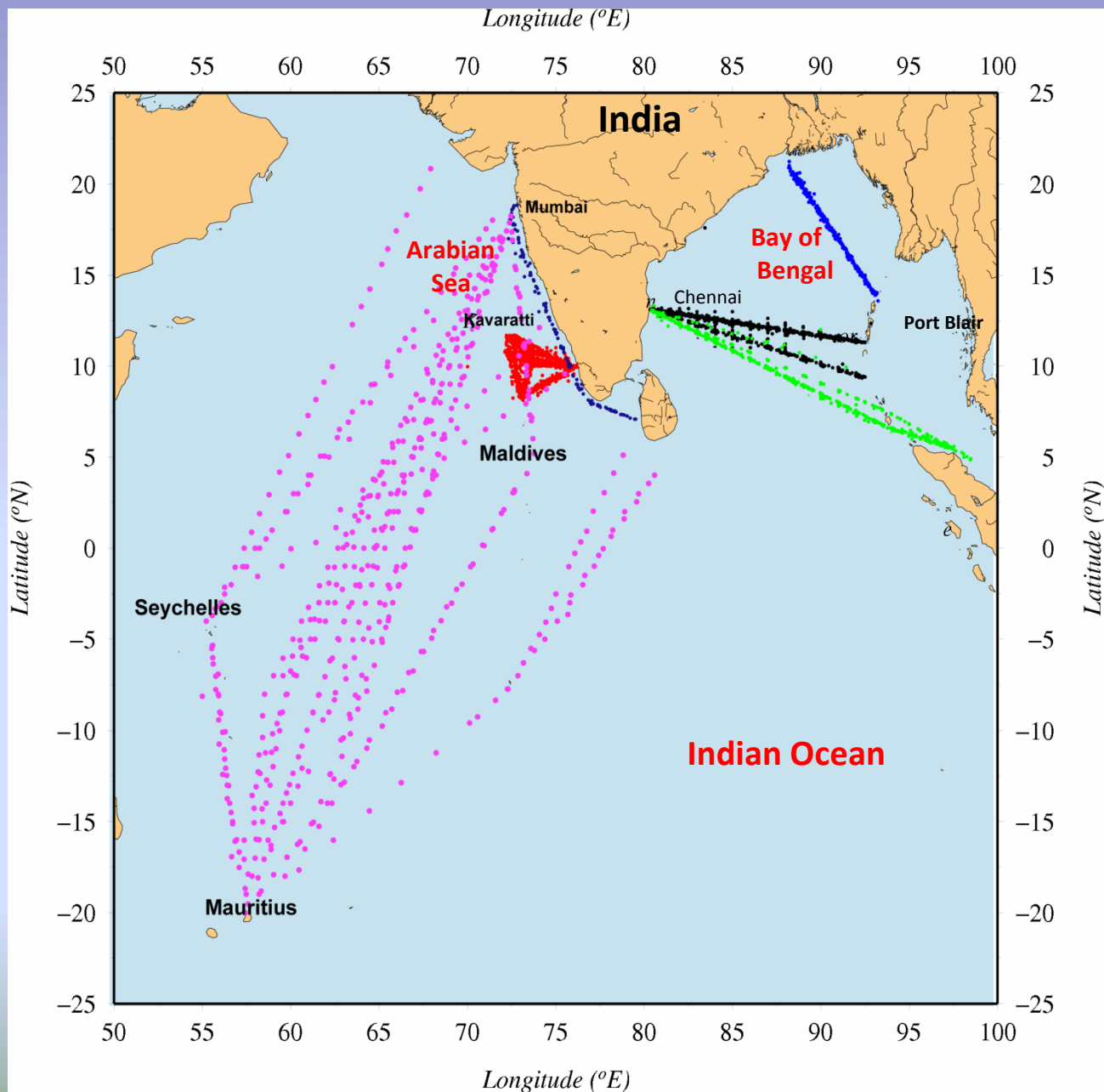


**Chennai – Port Blair (IX-14)
1990 – Ongoing**

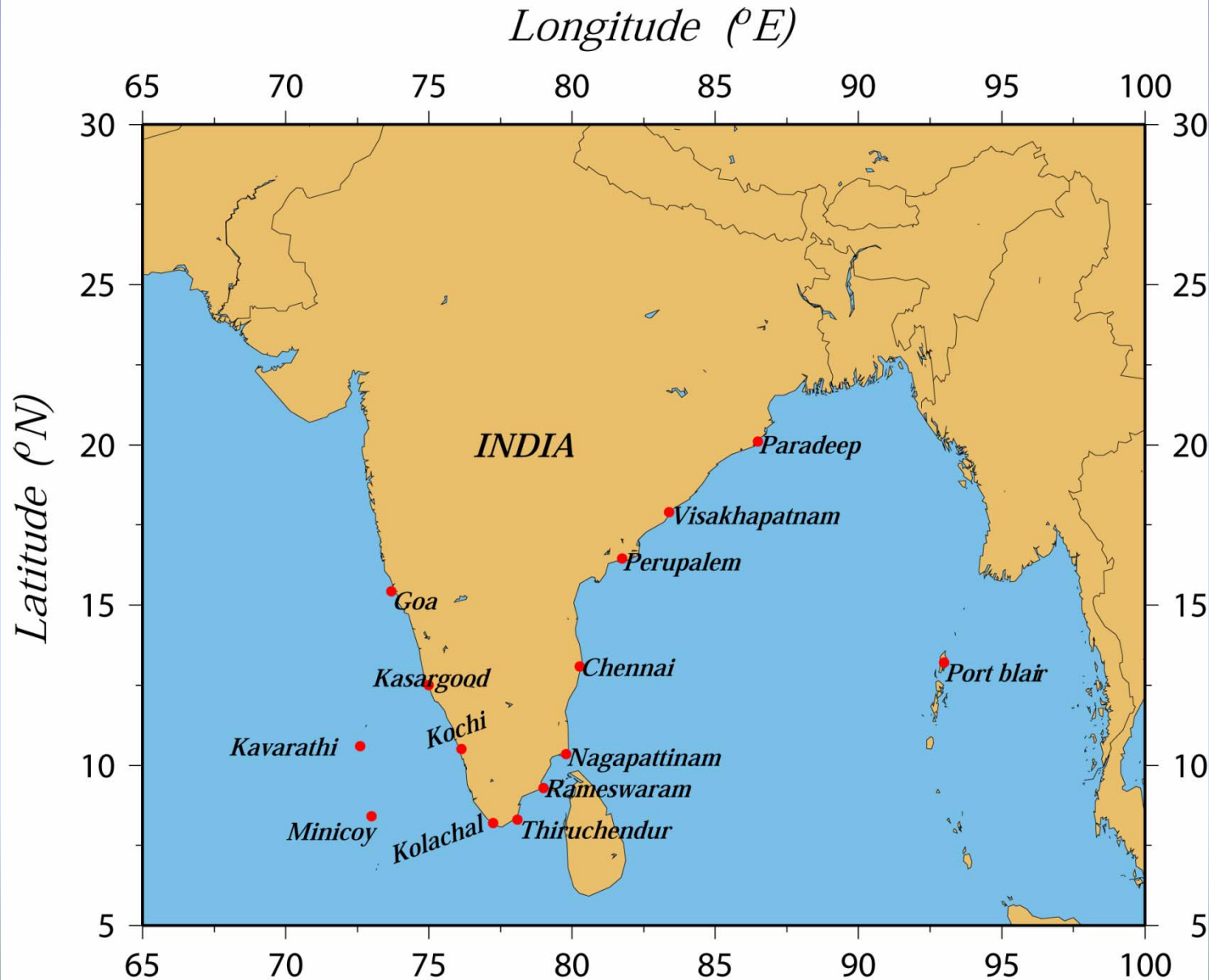
**Port Blair - Kolkata
1990 – Ongoing**

**Chennai - Singapore
2002 - 2006**

Composite Map of XBT transects in the Seas around India



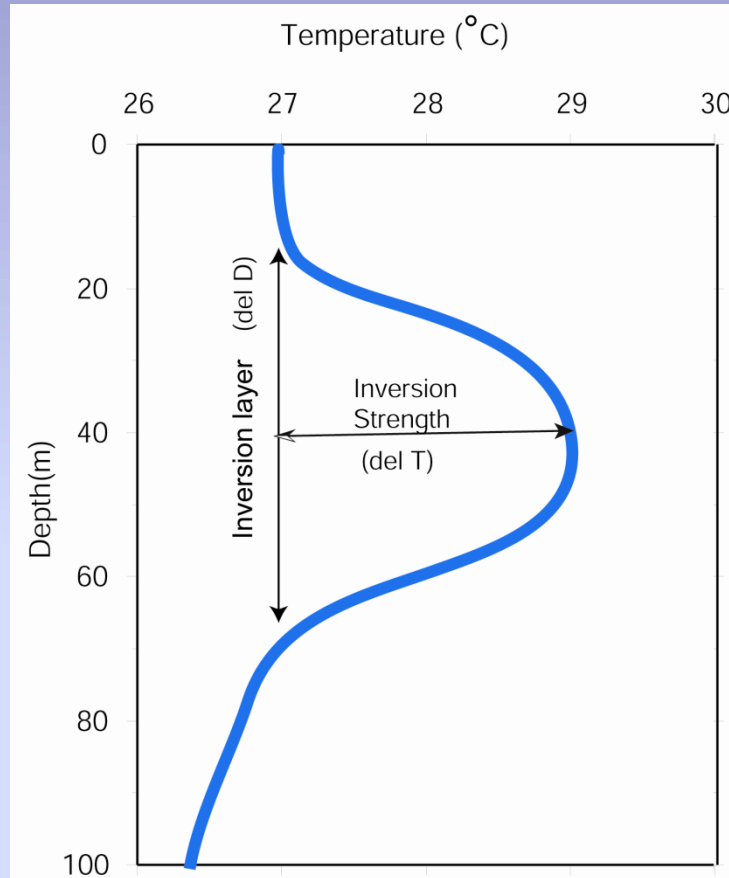
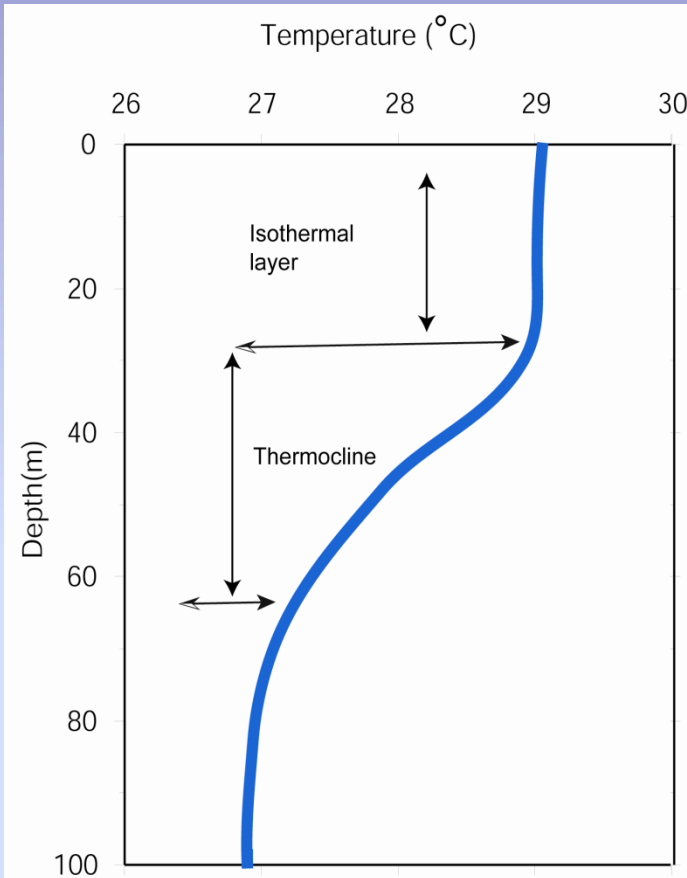
Weekly Sea Surface Salinity measurements around the Indian Coast



Evolution & inter-annual variability of temperature inversions in the south eastern Arabian Sea

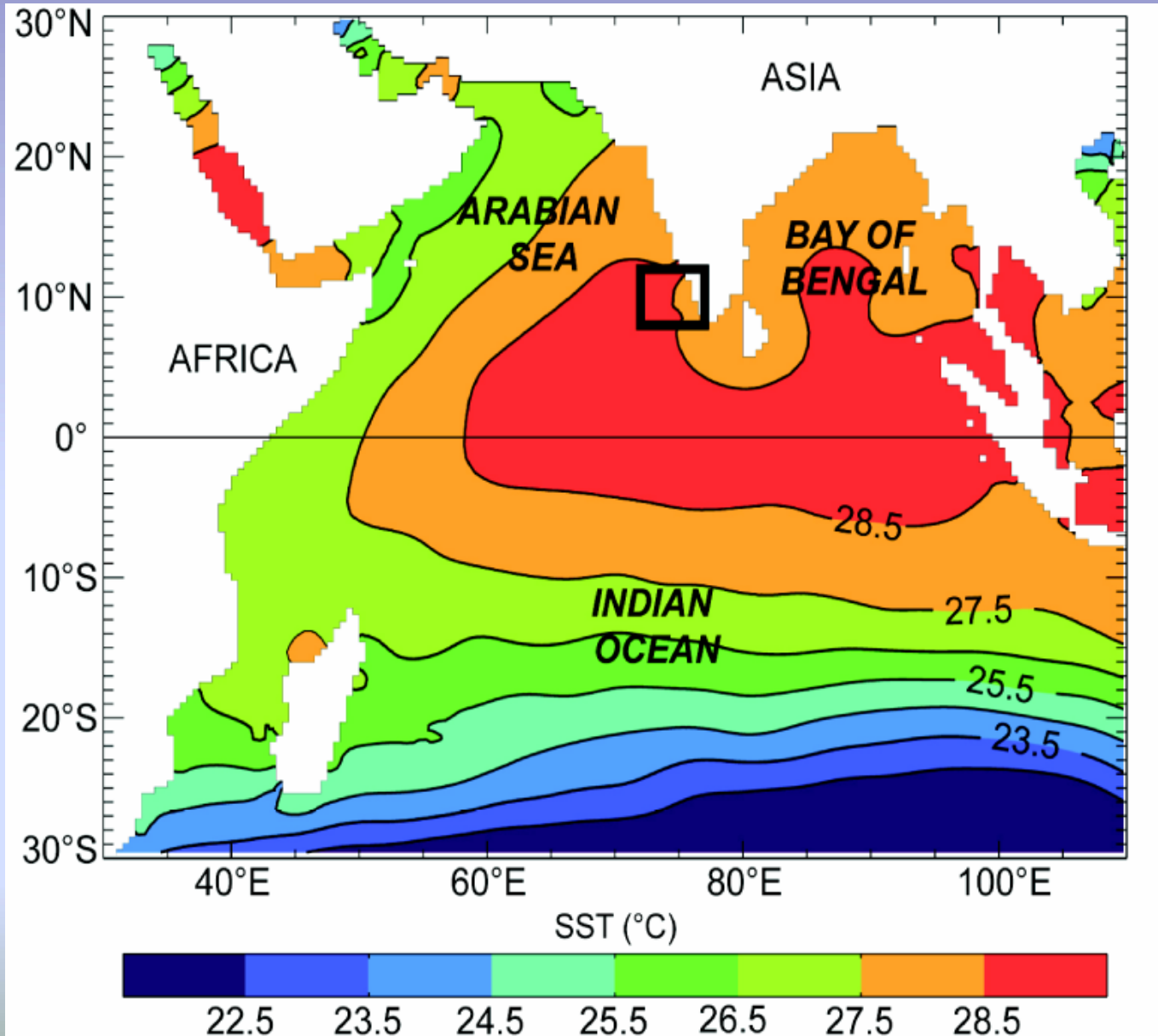
**Nisha Kurian, Surya Rao, Gopalakrishna, Ravichandran et al
[Journal of Physical Oceanography, 2009]**

Thermal Inversion

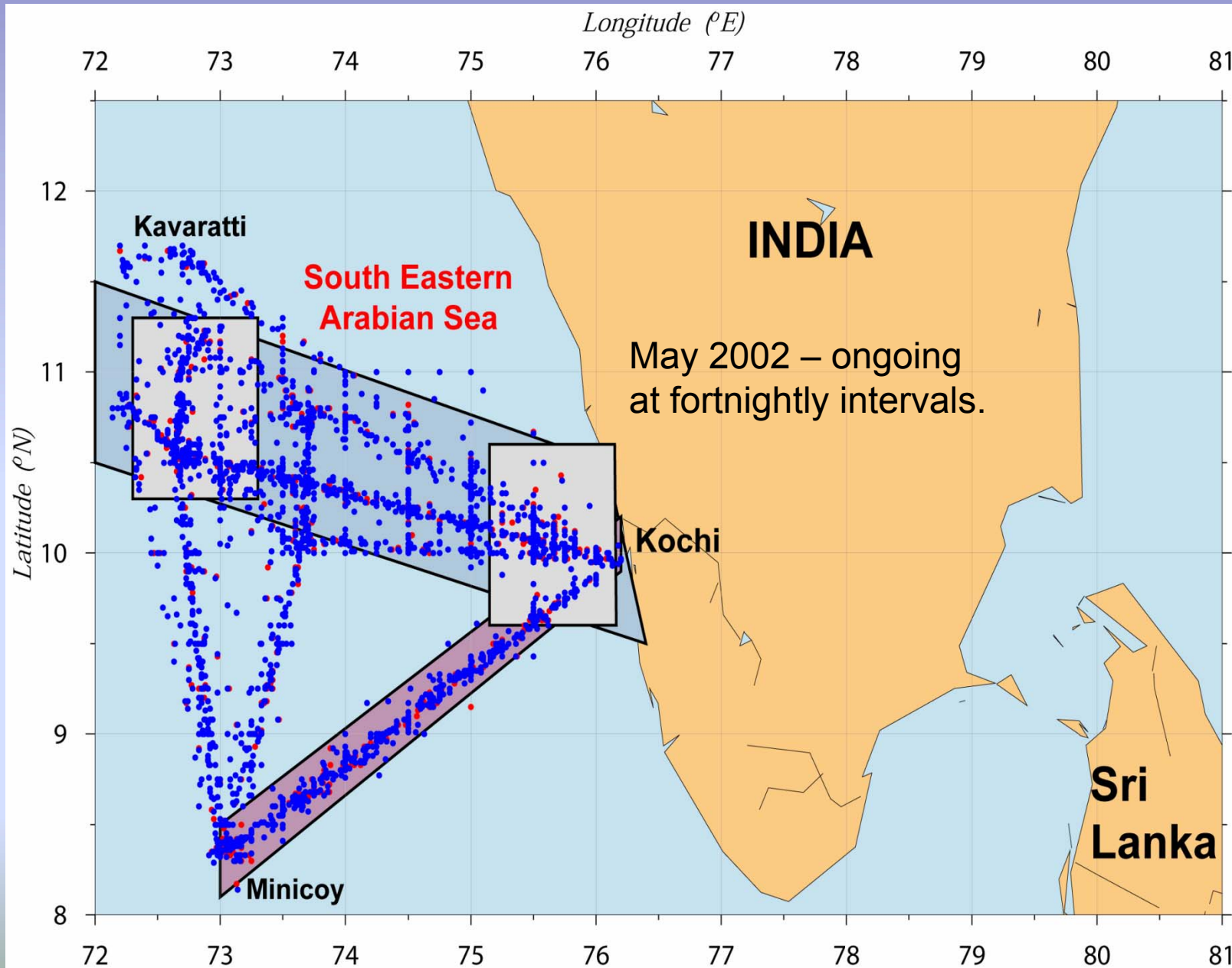
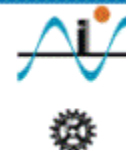


$\Delta T \geq 0.25 \text{ deg C,}$
 $\Delta D \geq 5\text{m}$

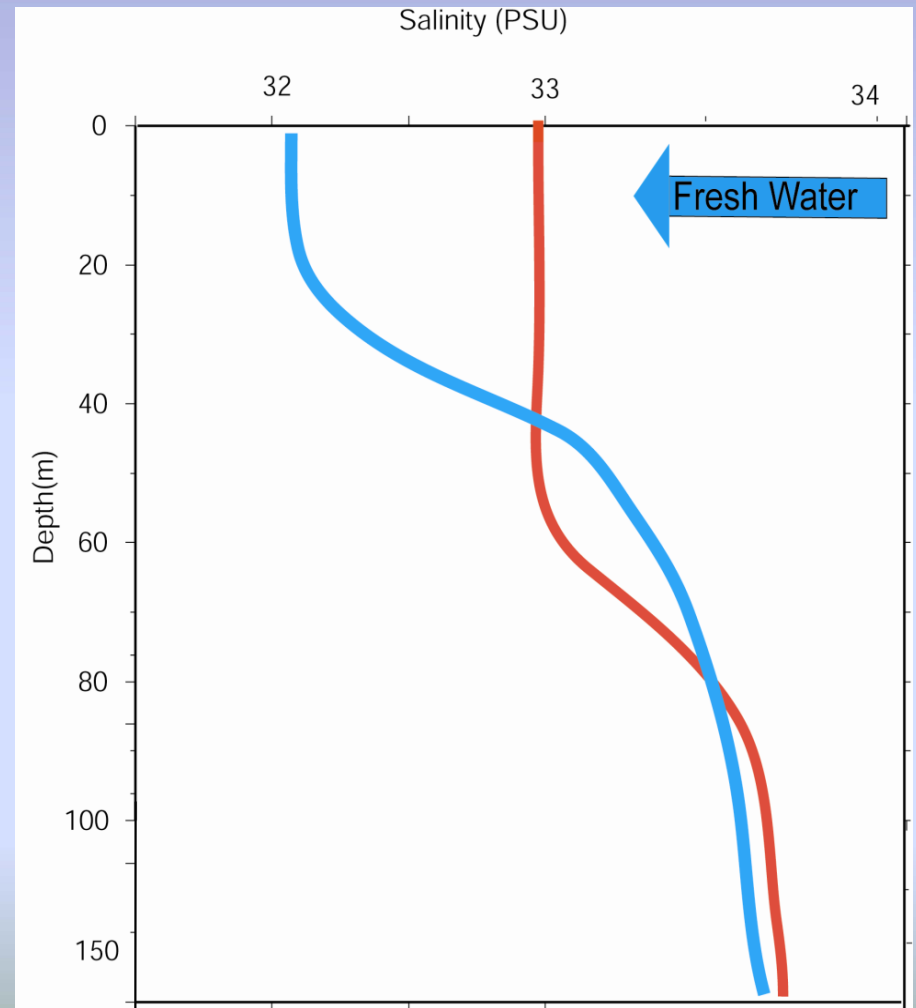
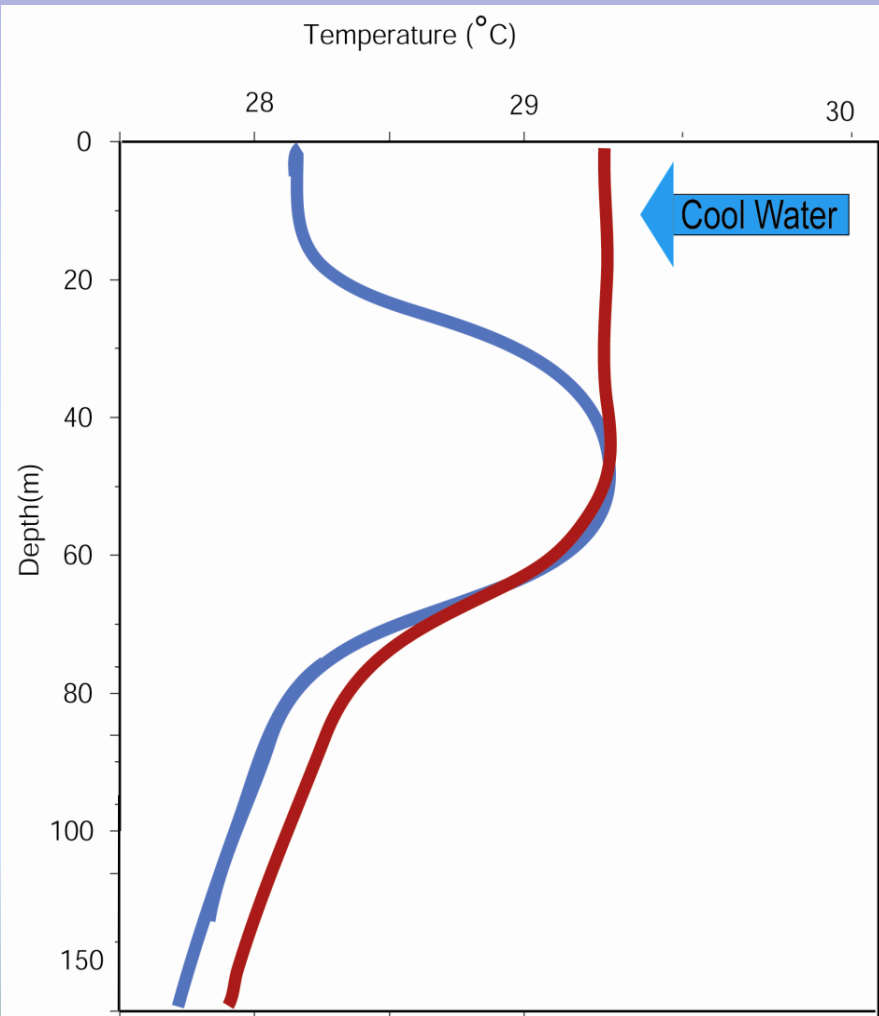
Indian Ocean Warm Pool



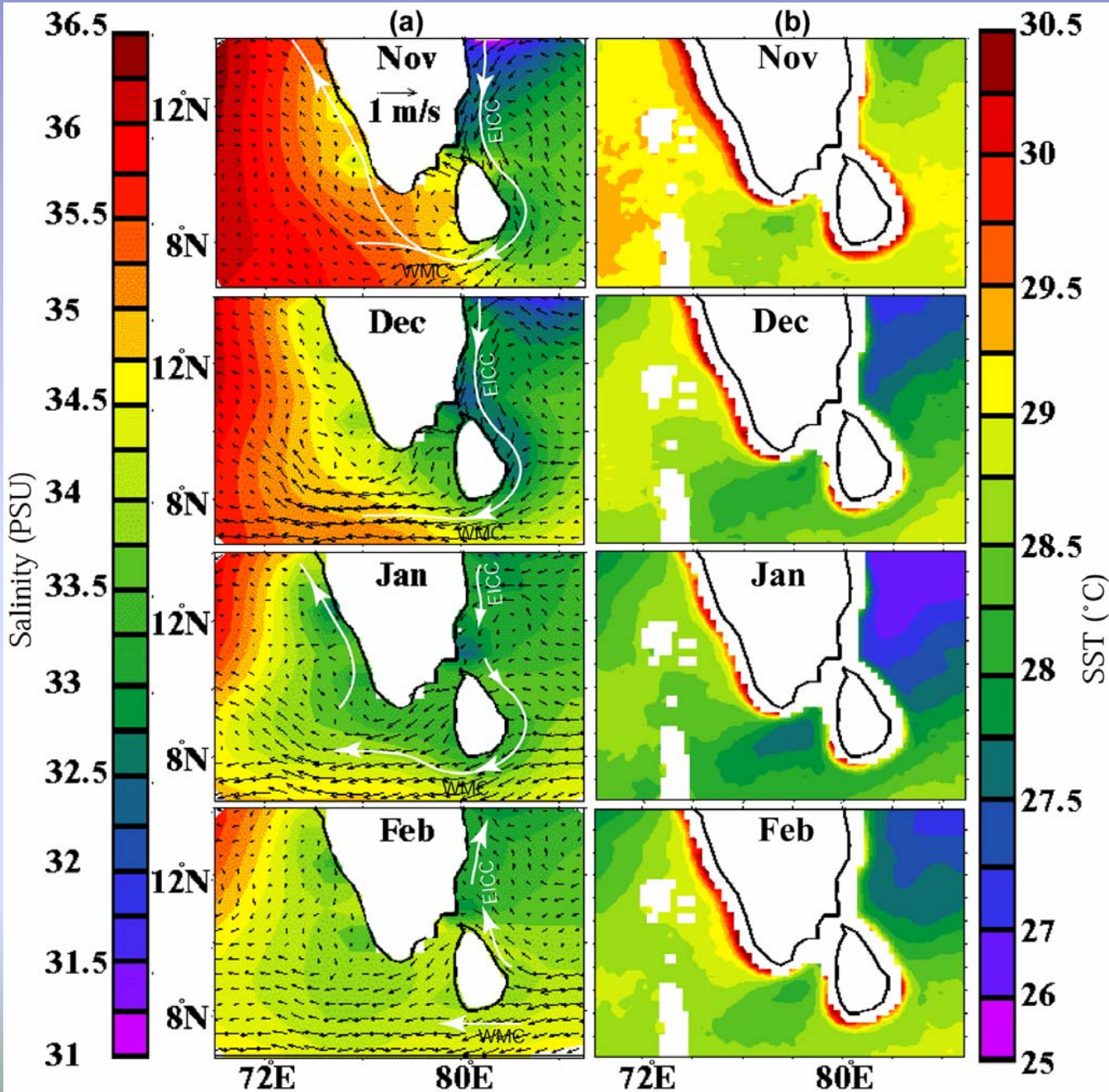
XBT data density in the South Eastern Arabian Seas



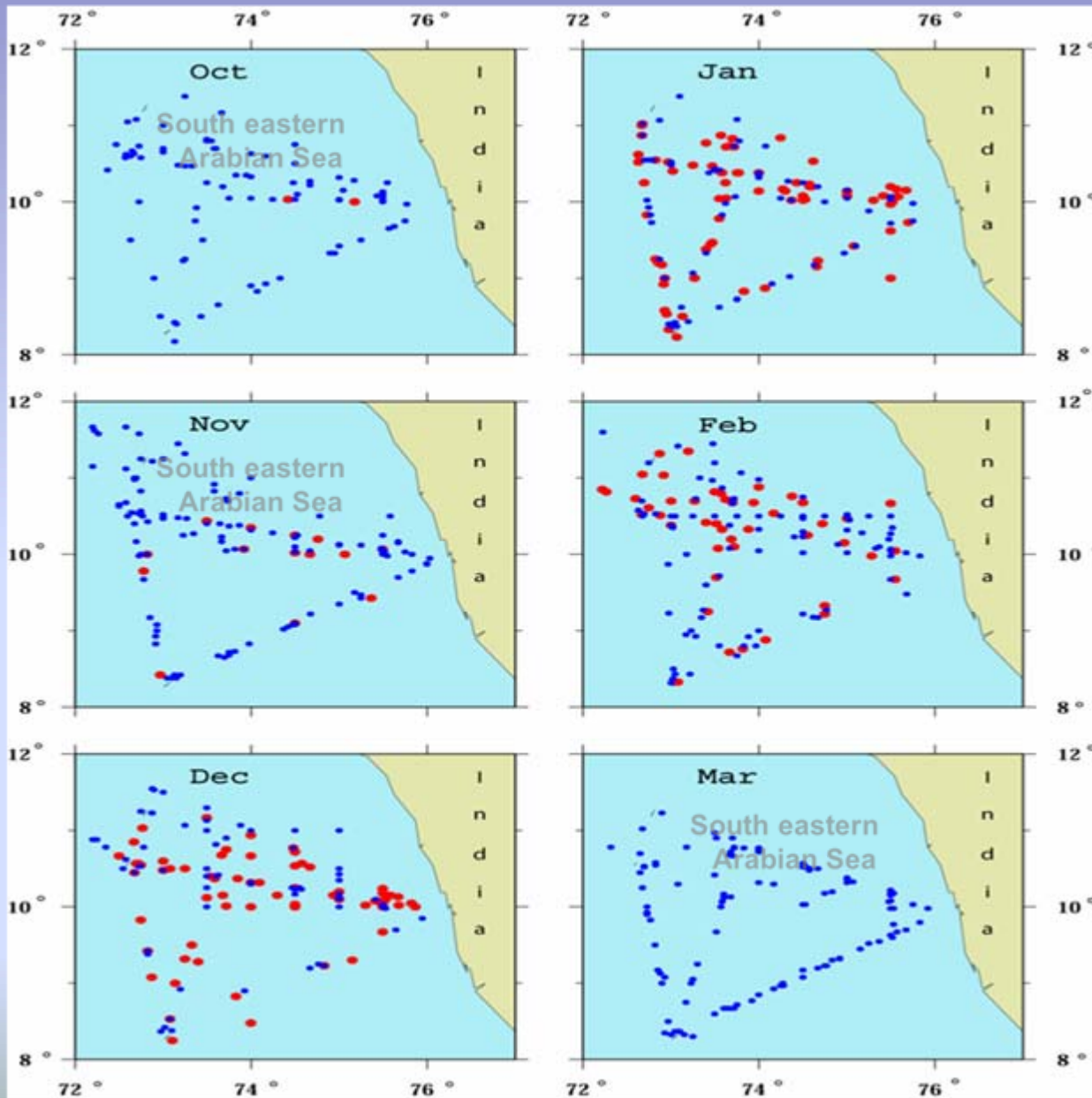
Intrusion of cool and low salinity waters



Monthly Mean Climatology of (a)SSS and (b)SST



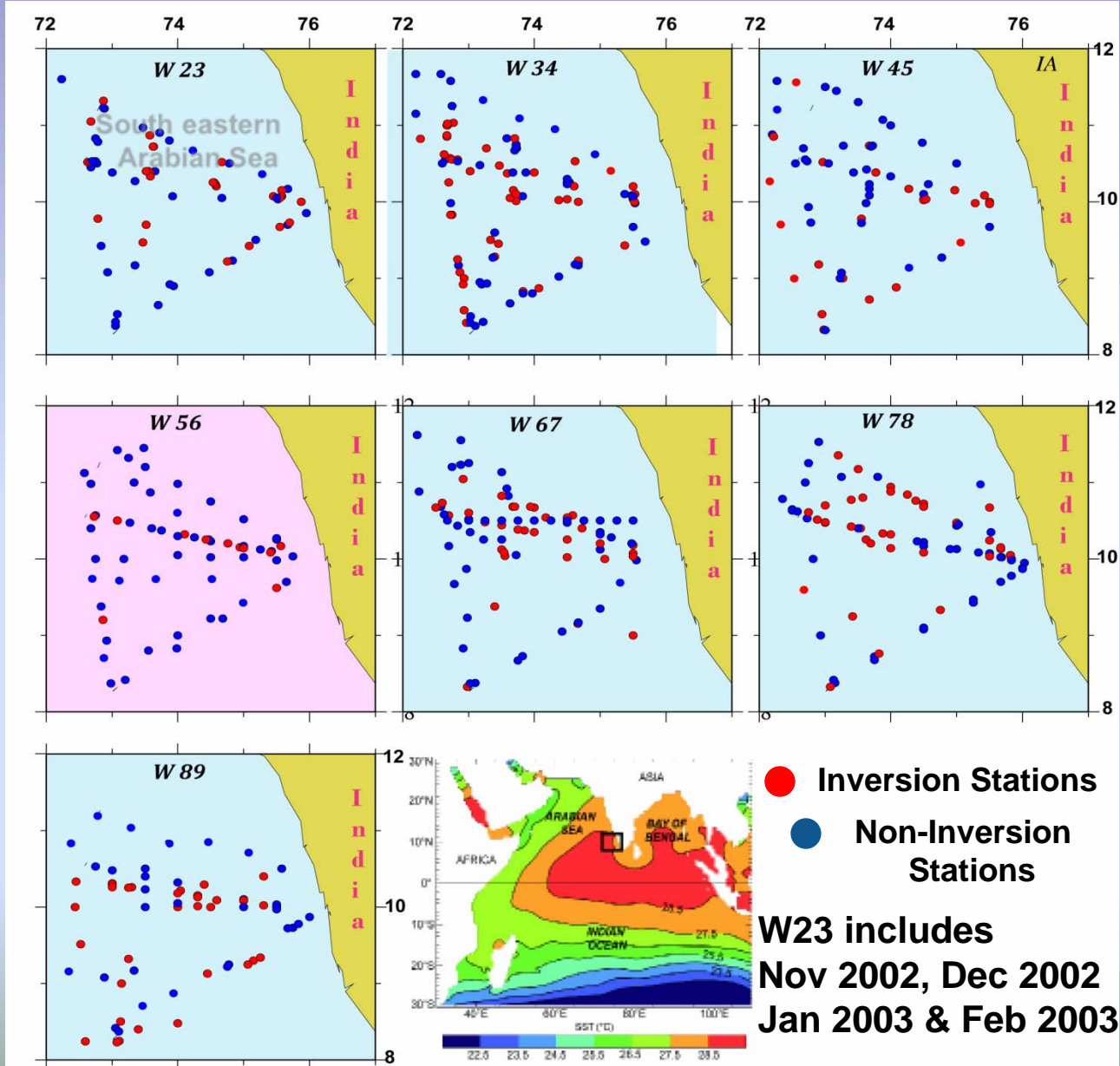
Evolution of Temperature Inversions in the SEAS.



● - Inversion Stations

● - Non Inversion Stations

Inter-annual variability of temperature inversions during 2002-2009



Governing Mechanisms

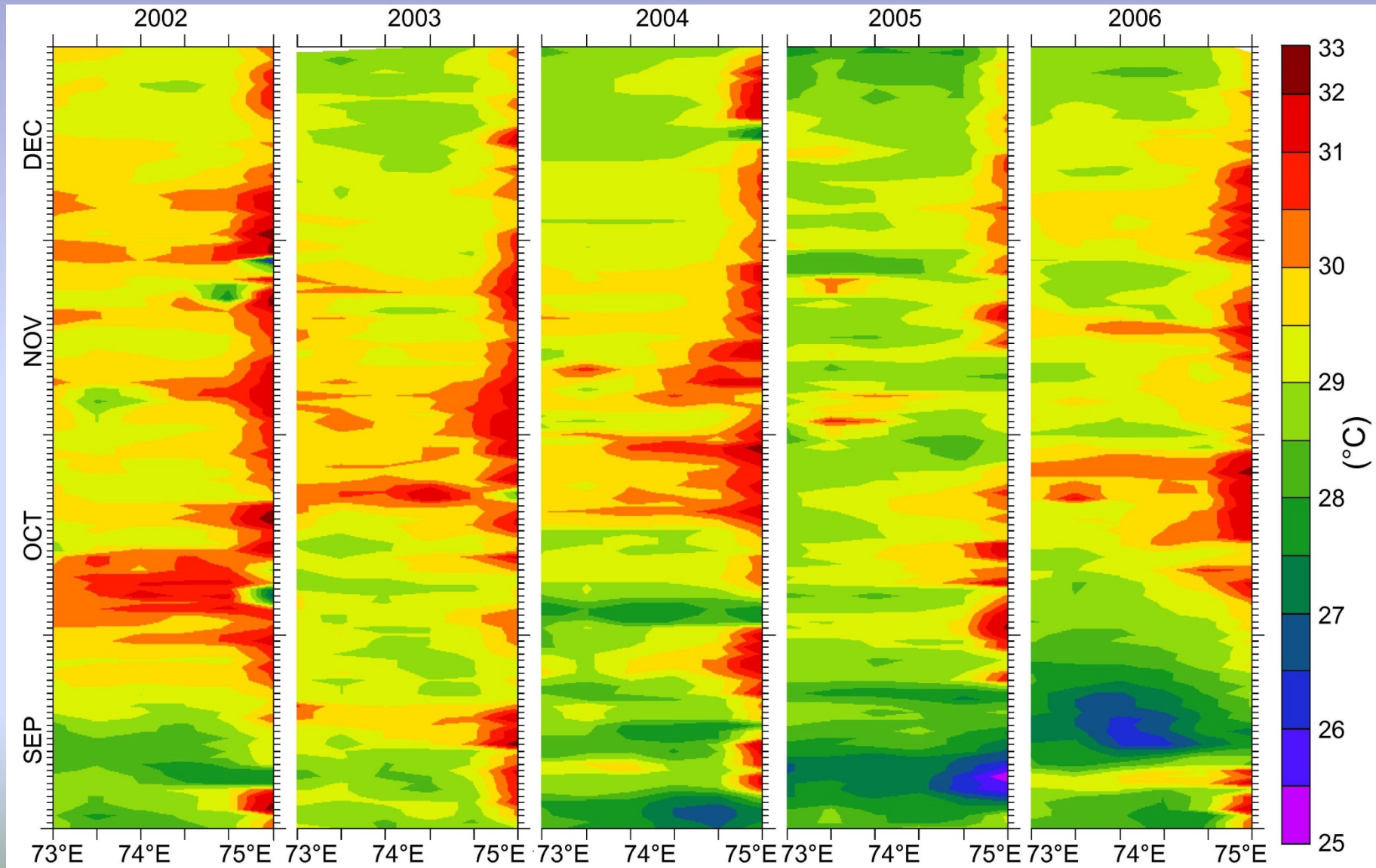
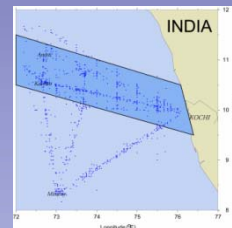
@ Anomalous background state of the Southeastern Arabian Sea

@ Intrusion of low salinity waters from the Bay of Bengal into Southeastern Arabian Sea.

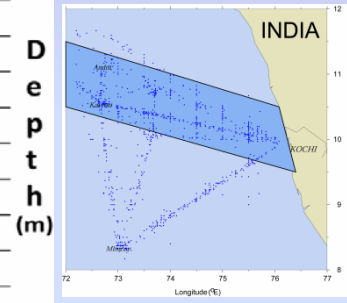
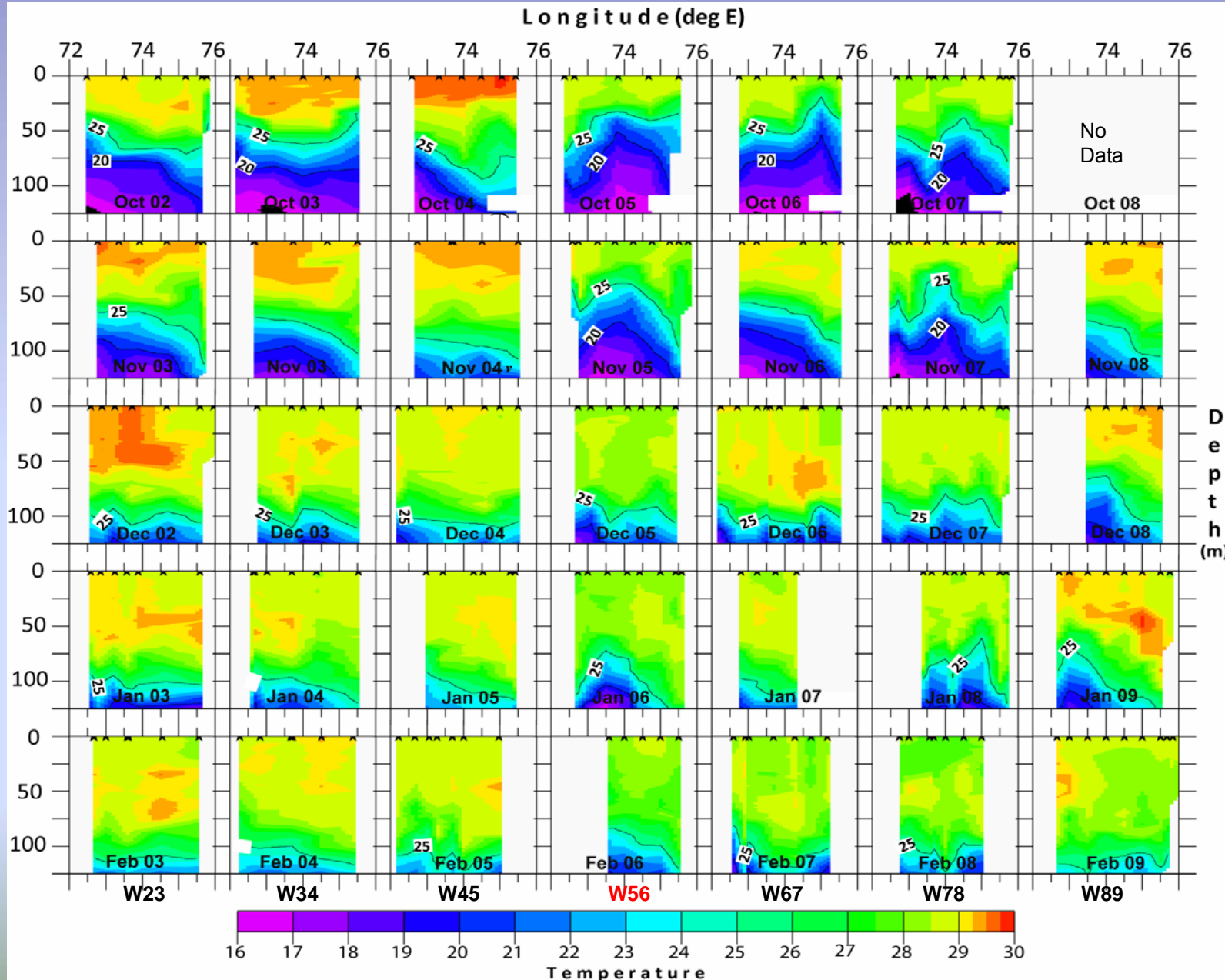
@ Intrusion of cooler waters (SST gradient between Southeastern Arabian Sea and the Bay of Bengal).



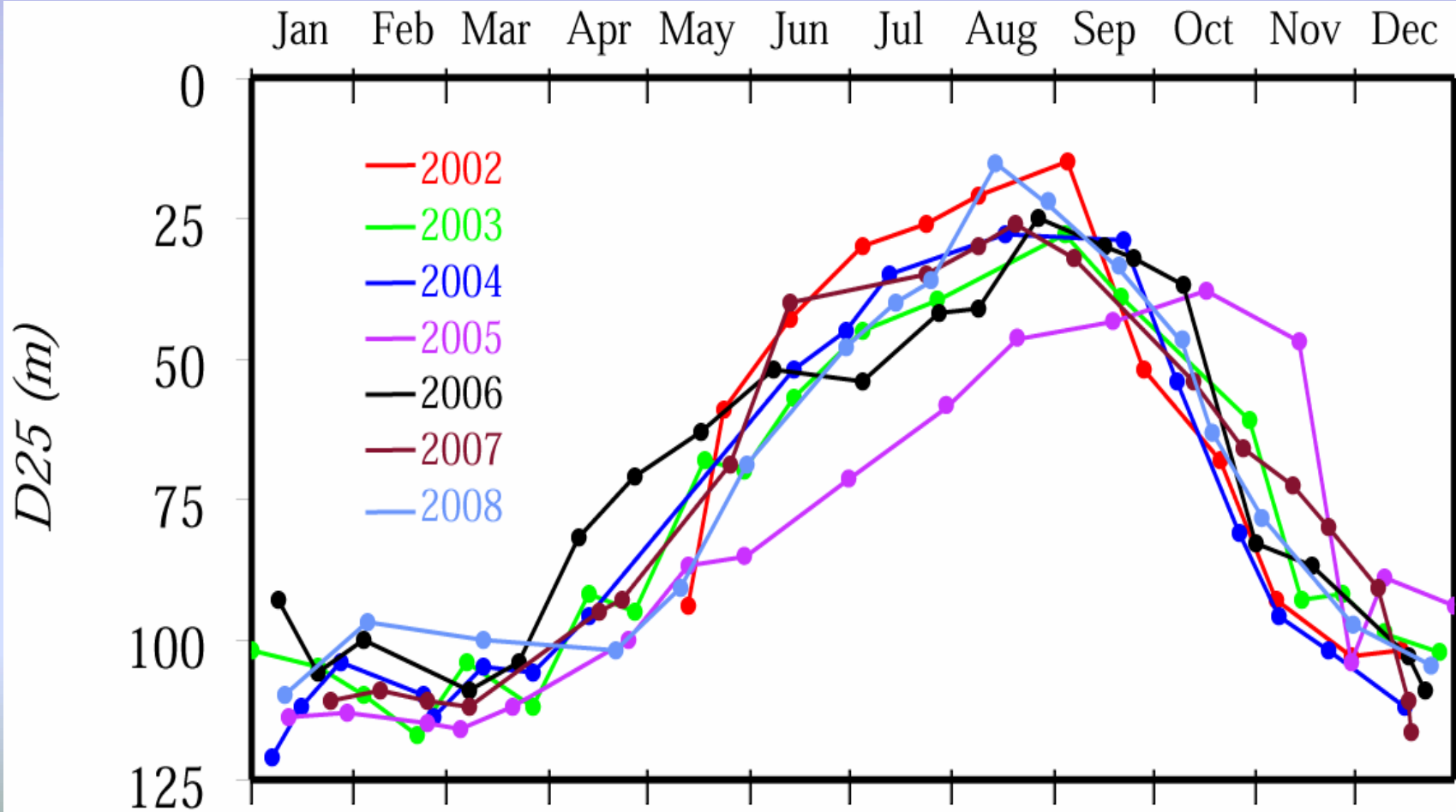
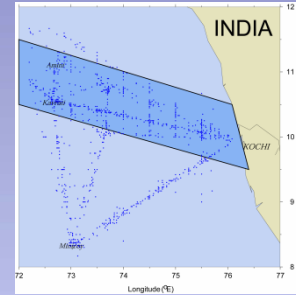
TMI SST along KK transect during 2002-2006

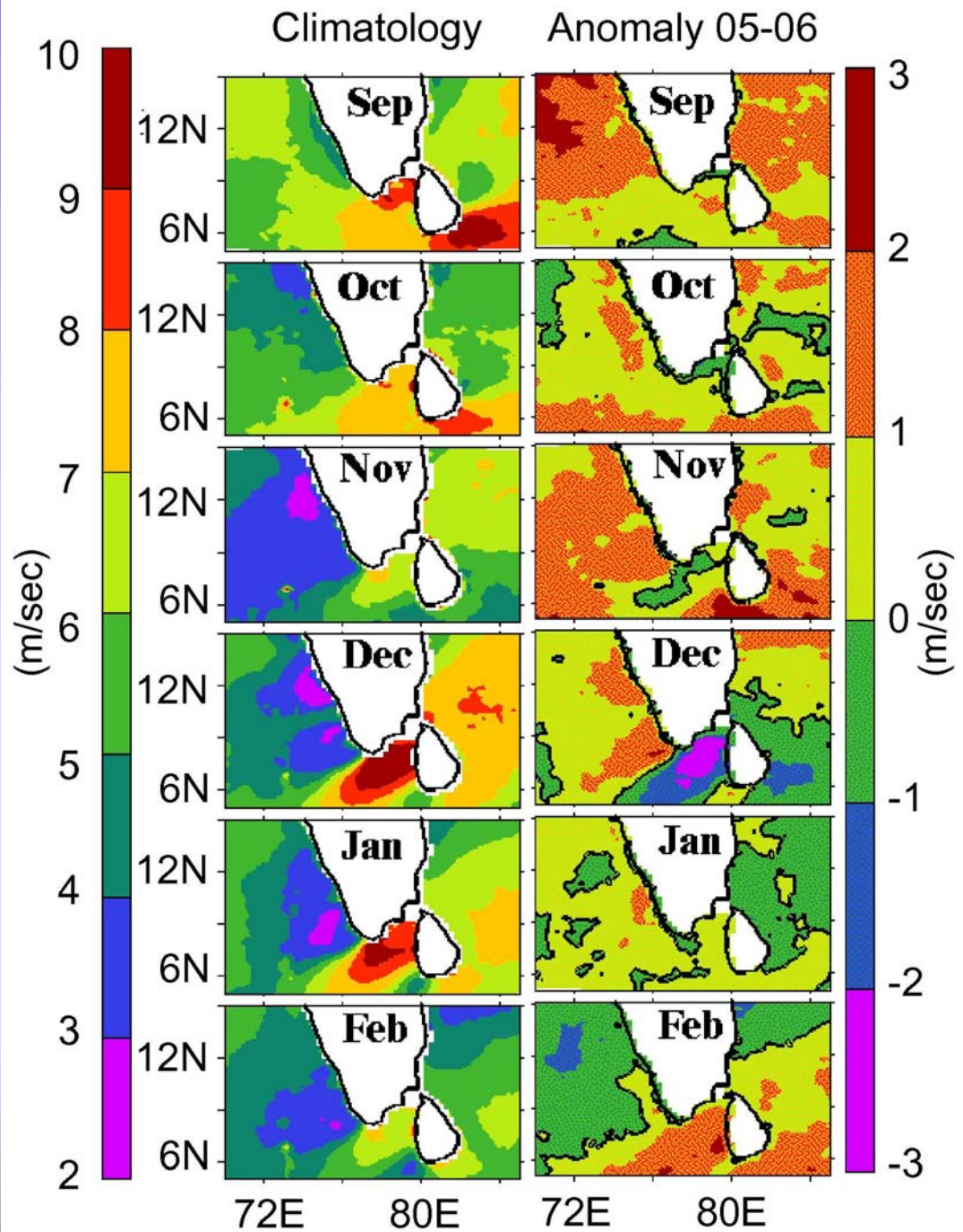


Snap-Shot of Thermal Sections during winters of 2002-2009



Annual March of D-25 during 2002-2008



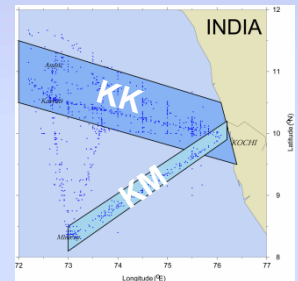
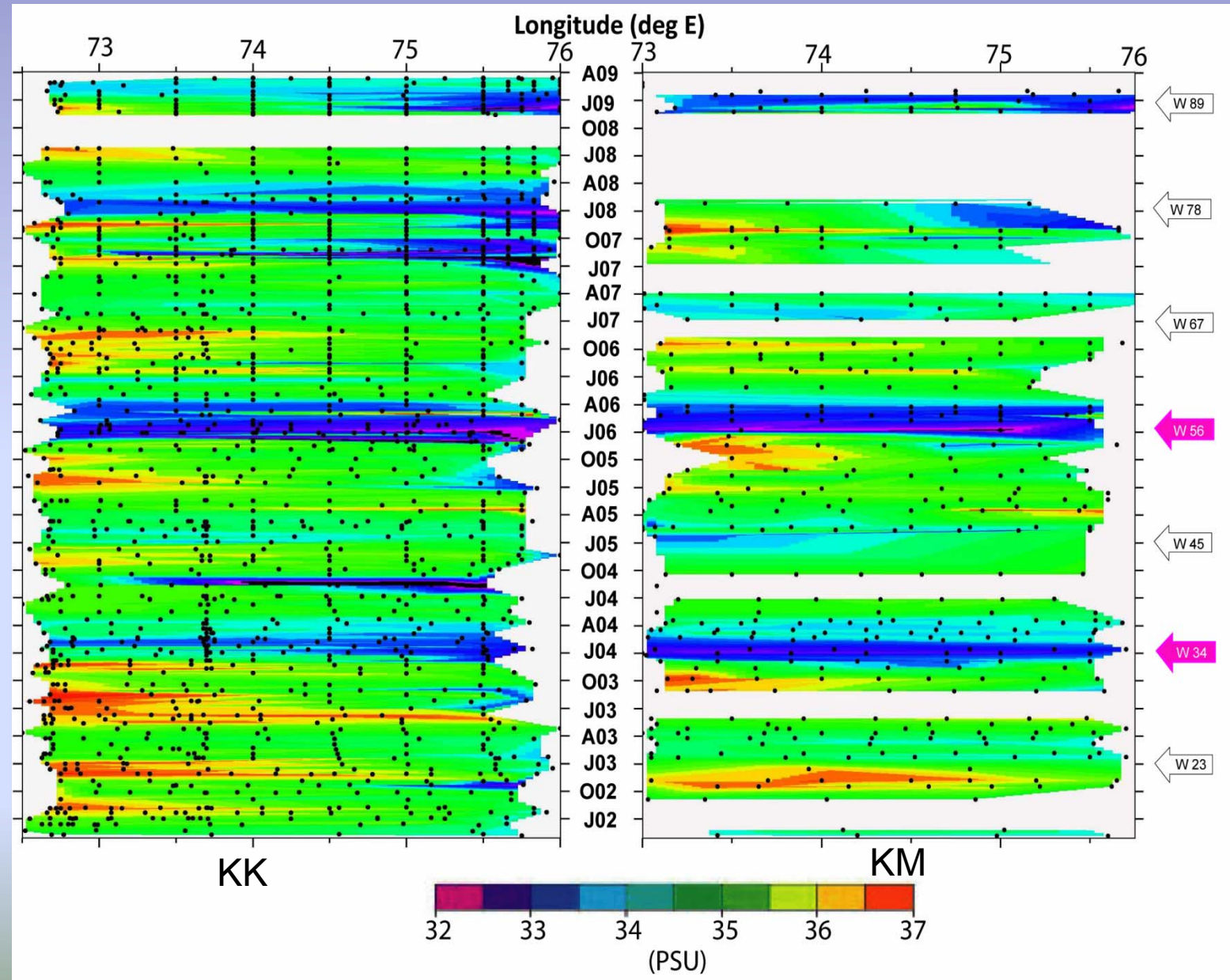


Left Panel : QuickSCAT monthly mean wind speed.

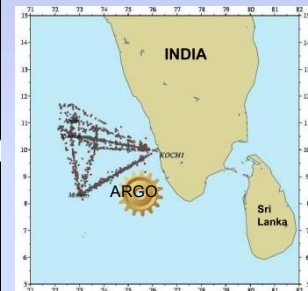
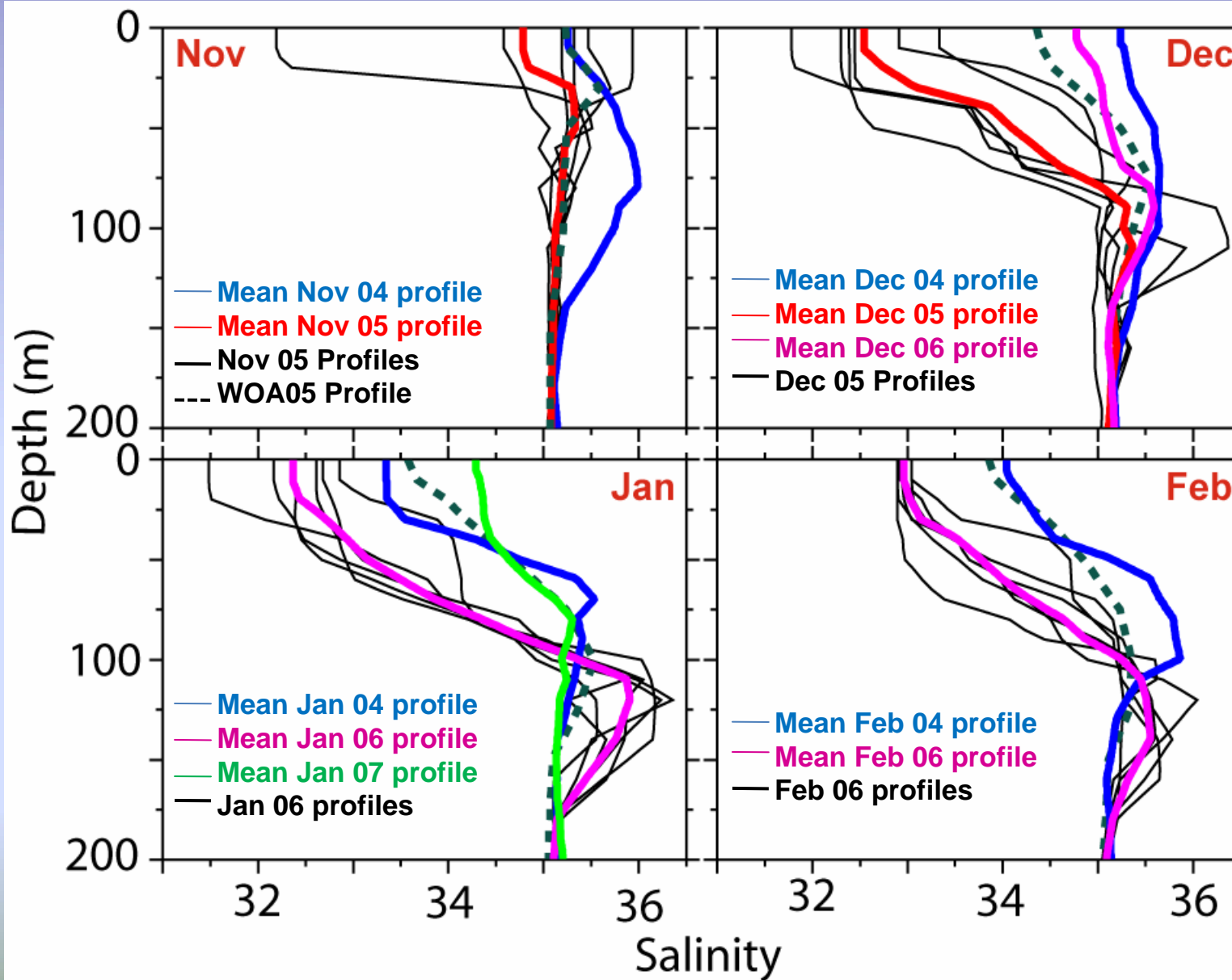
Right Panel : Wind speed anomaly during 2005 - 2006.

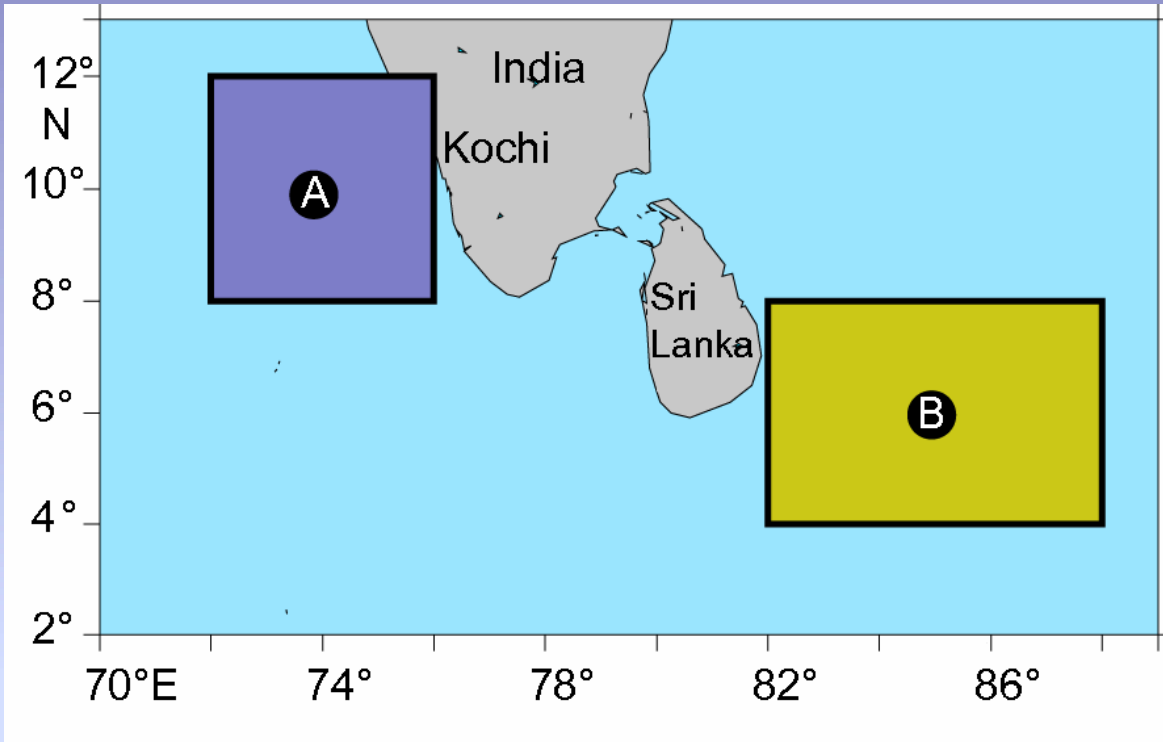


Hovmuller plot of SSS along KK and KM routes

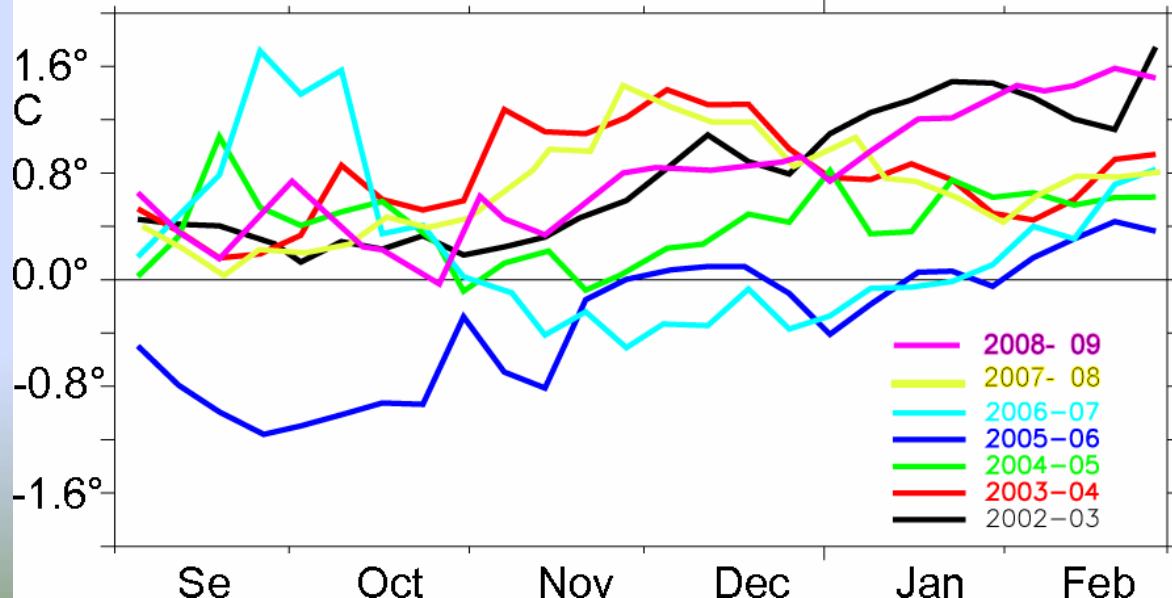


Comparison of Argo salinity profiles for W56 with mean monthly profiles in the SEAS.





TMI SST difference between Boxes A & B during Winter Seasons of 2002-2008



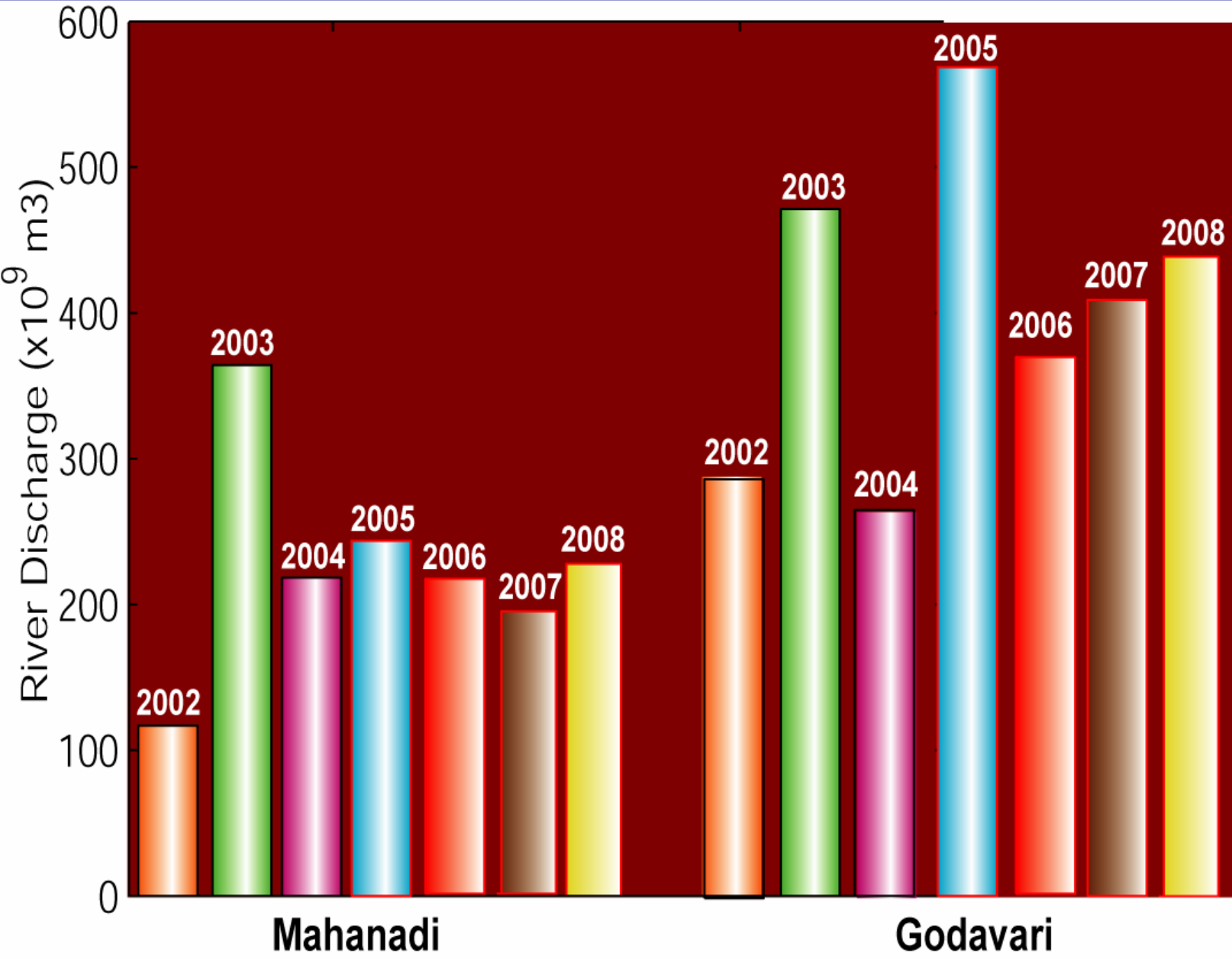
SUMMARY

- ❖ Occurrence of thermal Inversions during winter is a common phenomenon in SEAS.
- ❖ Using 2002-2009 XBT & SSS data we have examined the Inter-annual variability of temperature inversions in South Eastern Arabian Sea (SEAS).
- ❖ In spite of Strong Haline Stratification , why few inversions occurred during W56 in SEAS??.
- ❖ Governing Mechanisms responsible for the anomalous events are examined.
- ❖ Highlighted the importance of secondary warming, SST gradient between SEAS & intruding waters for the formation of thermal inversions.

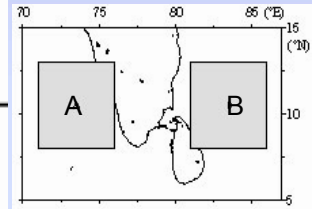
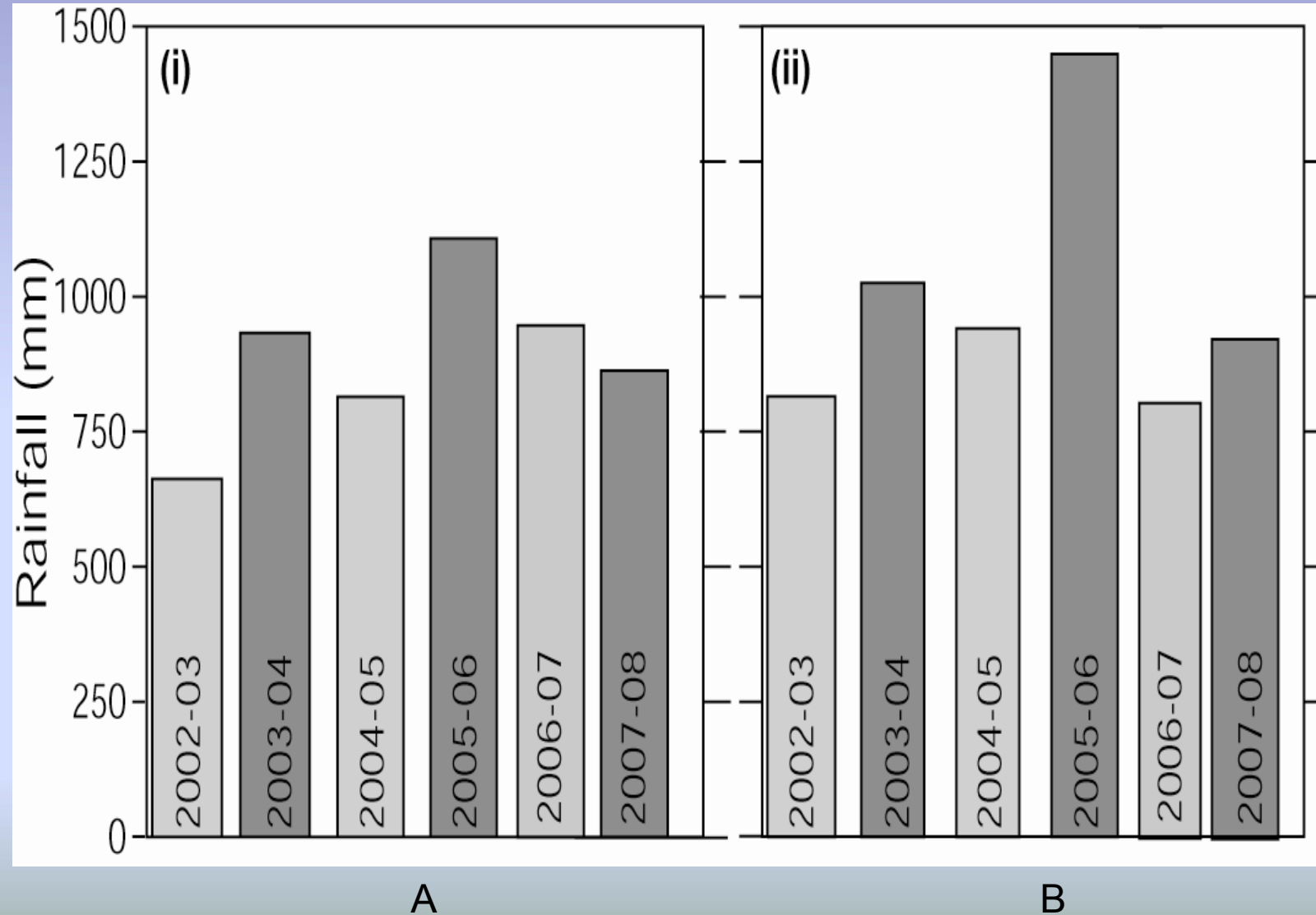
A tropical beach scene featuring a large, leaning palm tree in the foreground. The tree's trunk is thick and textured, and its fronds are lush green. The background shows a clear blue sky, a turquoise ocean with white waves, and a sandy beach. The text "THANK YOU" is overlaid in the center-left of the image.

THANK YOU

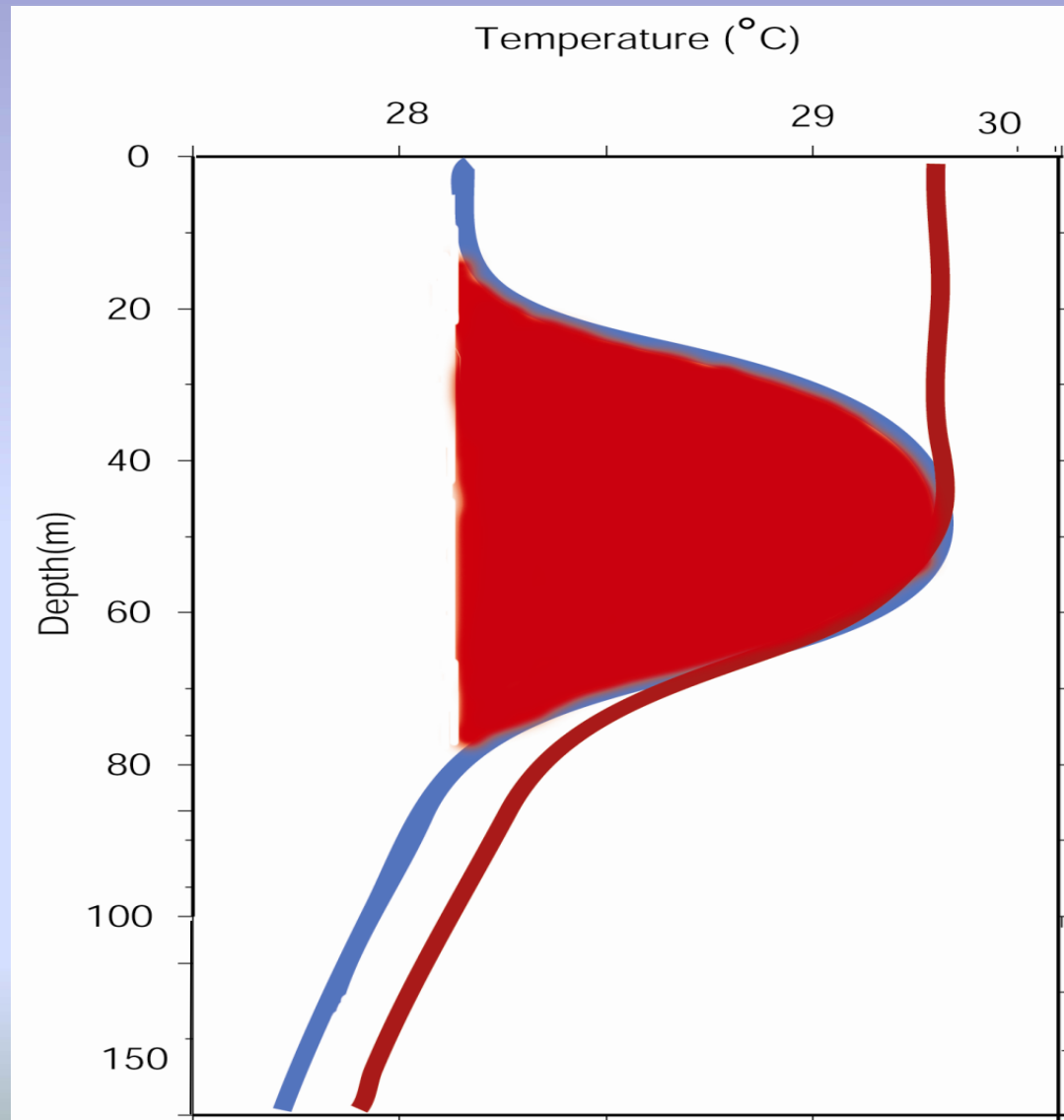
River Discharges of Mahanadi and Godavari

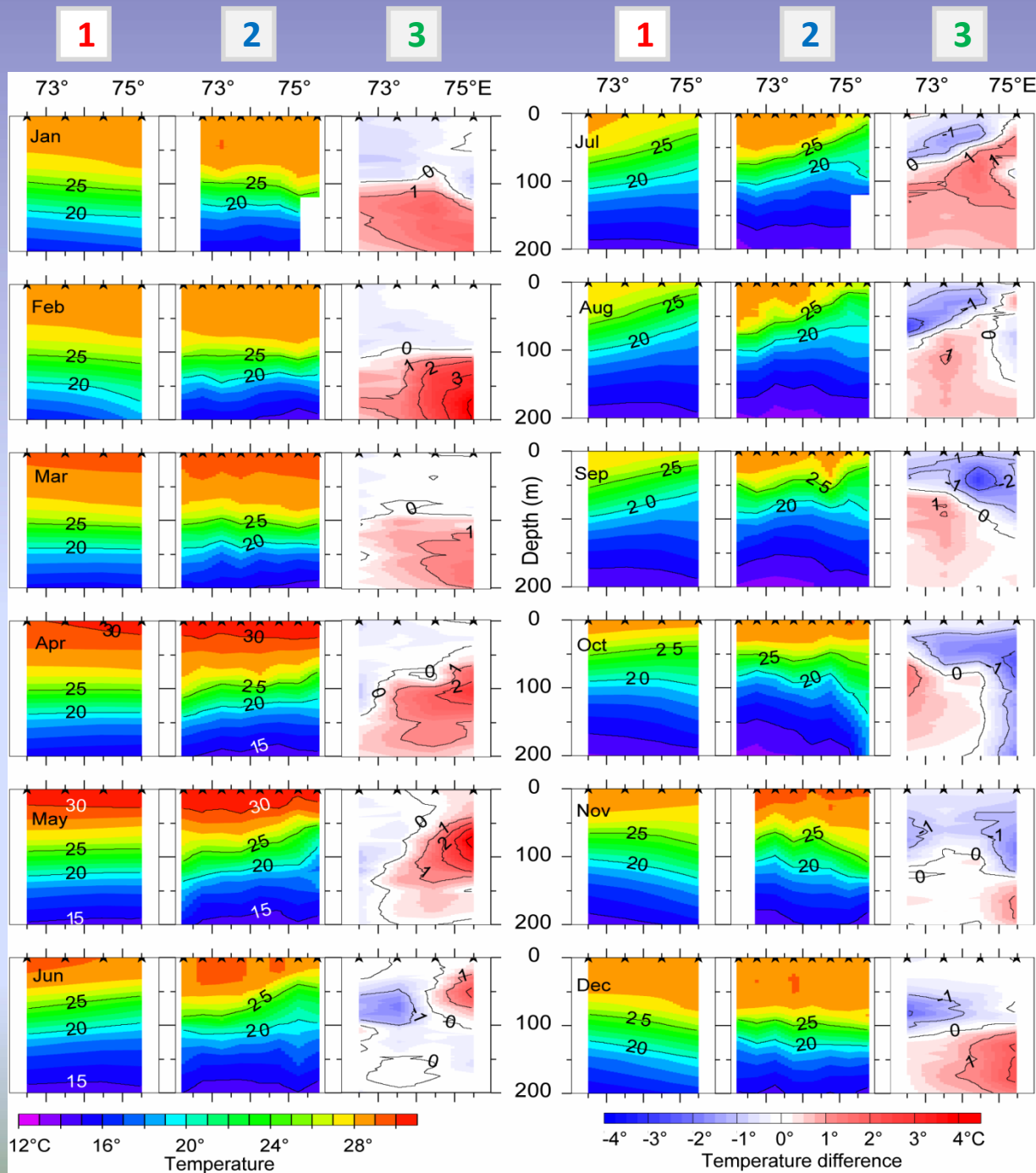


Annual Rainfall in the two boxes shown

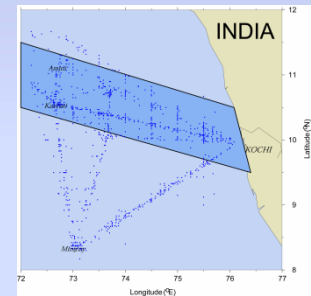


Why inversions are important





XBT and WOA05 Climatologies



- 1** XBT climatology.
- 2** WOA 2005 climatology
- 3** Differences.