Mesoscale variability along the east coast of India in spring and fall revealed in satellite data and OGCM

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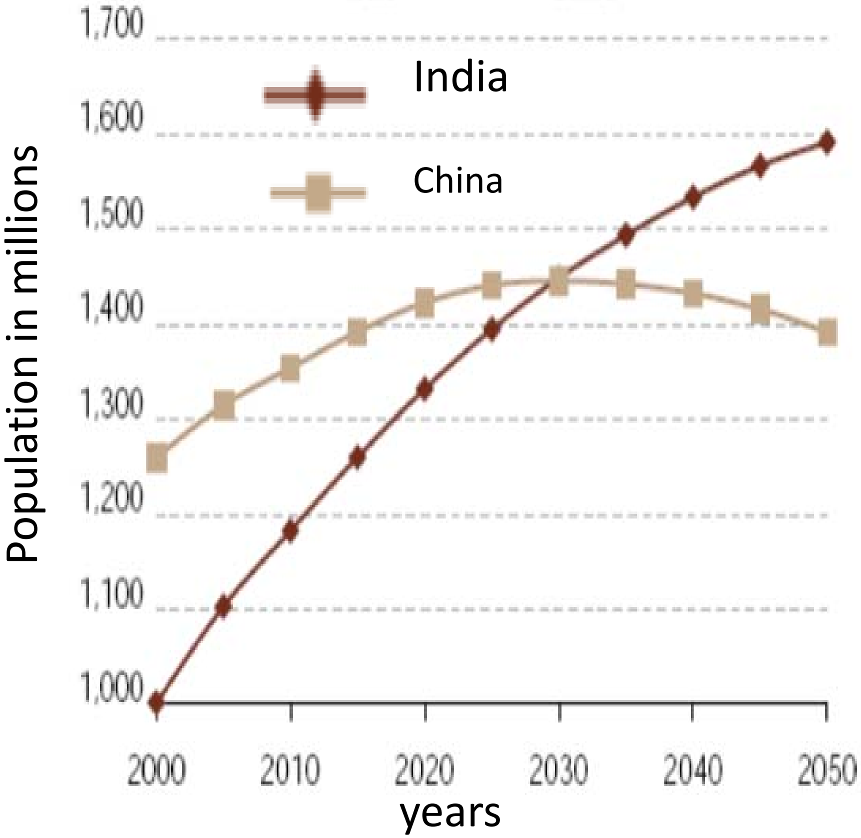
1. Introduction
2. General circulation
3. Analysis for spring (Satellite and OGCM)
4. Analysis for fall (Satellite and OGCM)
5. Summary of the results

1. Introduction: India's population growth and fisheries!!!

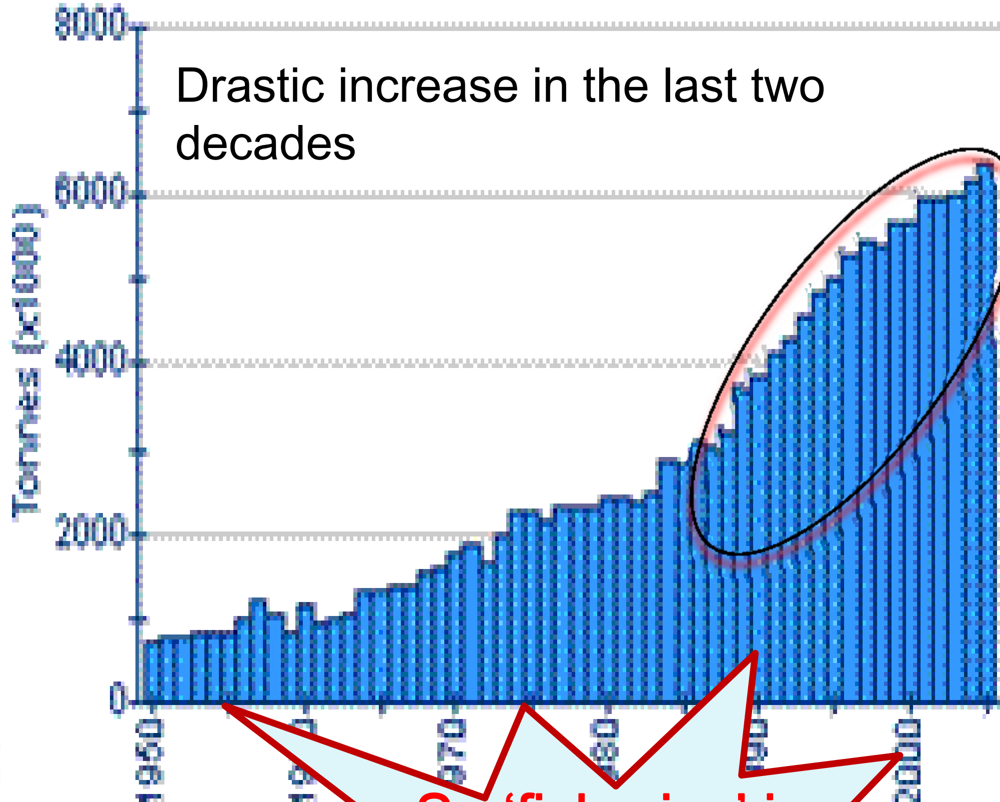
Population growth for India & China

UN Population prospects(2006)



Fish catchment by India

(UN,FAO report 2006)



So 'fisheries' is very important for India

Geographic information (Motivation of this stud

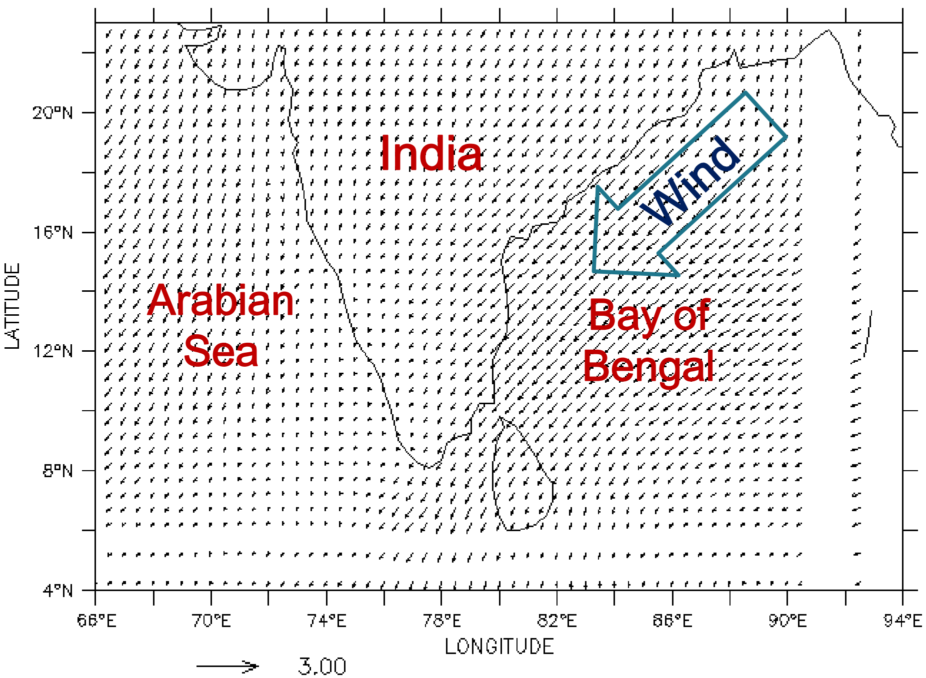
Total Area : 3.2 million km^2

Exclusive Economic Zone (EEZ): 2.02 million km

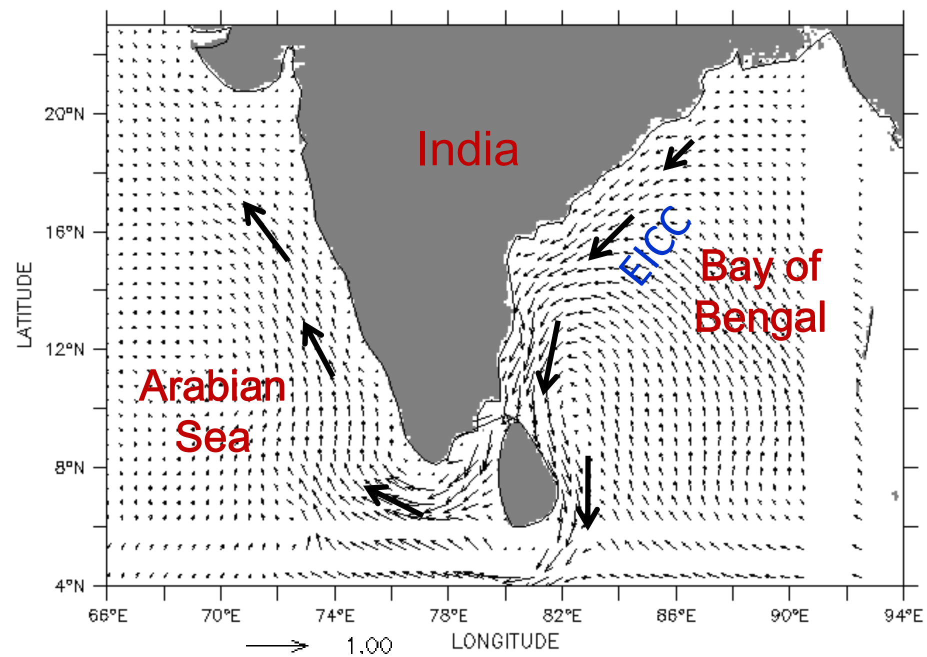
Population (in 2004) : 1.1 billion

2. Uniqueness of Indian coast: Influence of the seasonal winds 'the monsoon'

Winter monsoon (DJF)



Wind (in Pa)

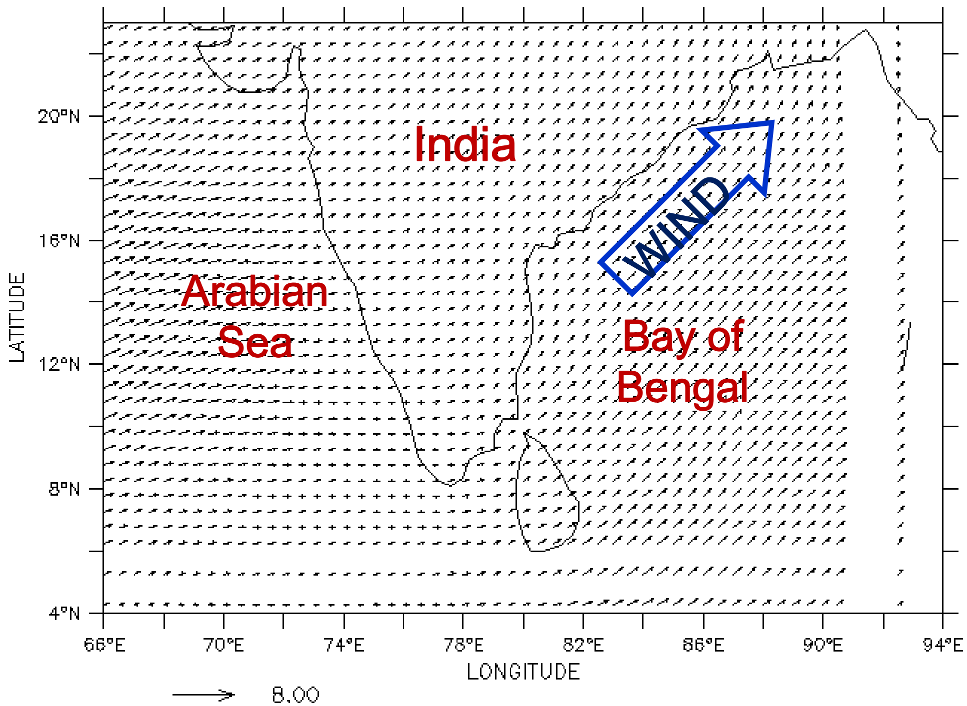


Currents (in ms^{-1})

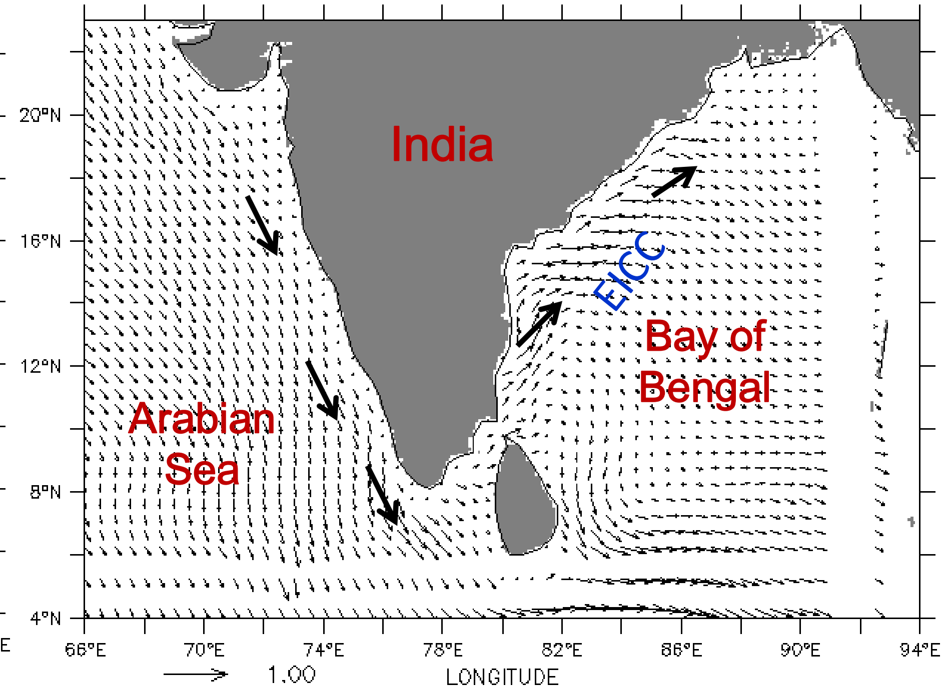
EICC : East India Coastal Current

2. Uniqueness of Indian coast: Influence of the seasonal winds 'the monsoon'

Summer monsoon (JJA)



Wind (in Pa)

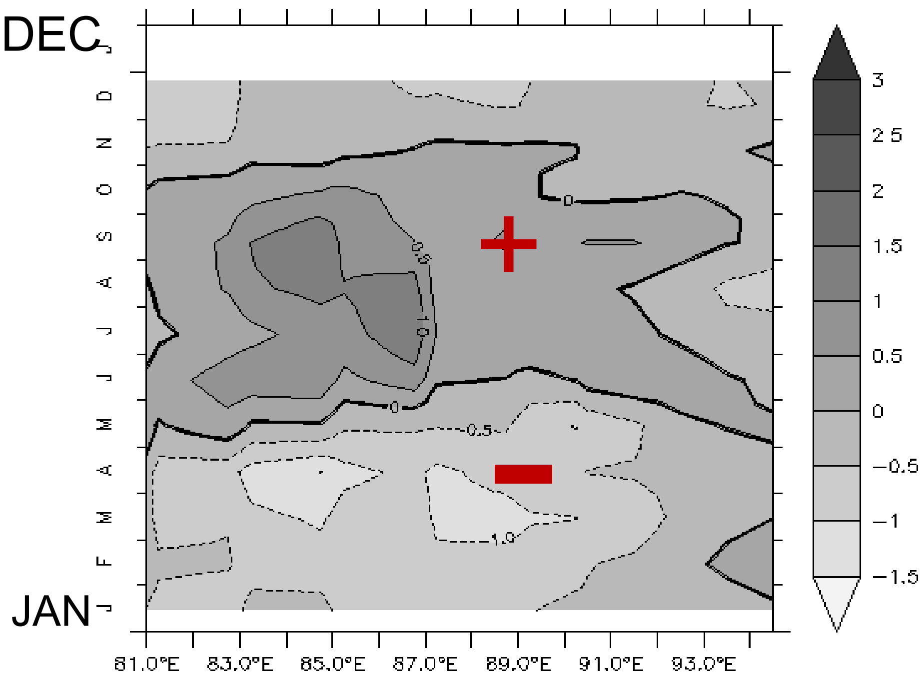


Current (in ms^{-1})

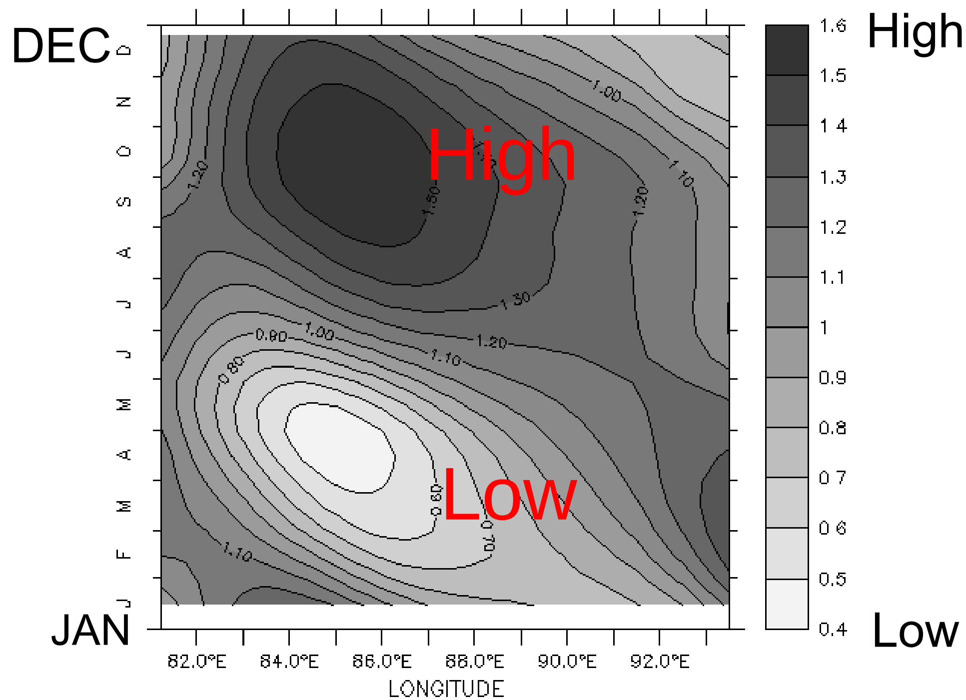
EICC : East India Coastal Current

2. Importance of inter-monsoon periods: Spring (MAM) & fall (SON)

Longitude-Time plot (15˚N) wind stress curl ($X10^6$ Pam^{-1})



Longitude-Time plot (15˚N) (150m) density anomaly (Kgm^{-3})

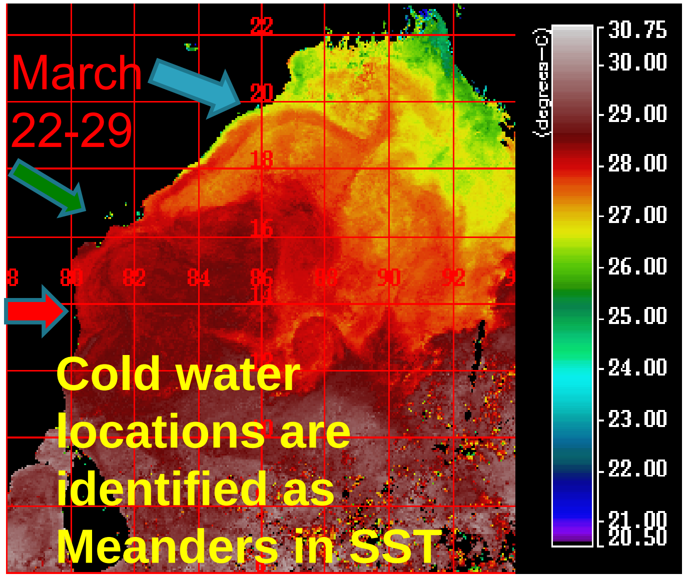


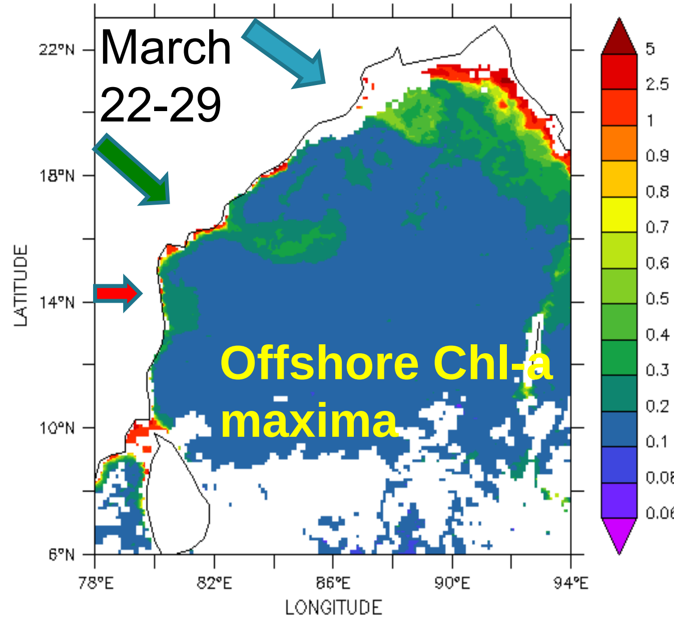
Wind stress curl ➡ Ekman pumping ➡ Western boundary currents.

Wind stress curl enhances EICC than the monsoon driven coastal currents.

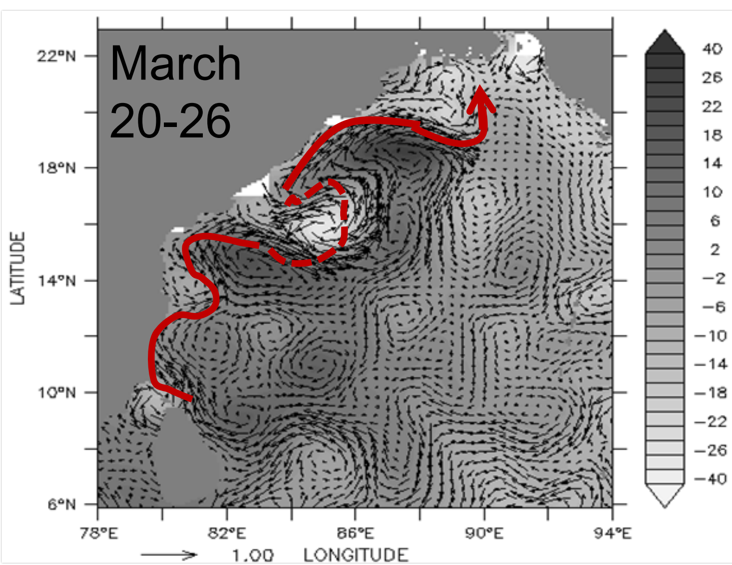
Availability of satellite data under relatively clear sky.

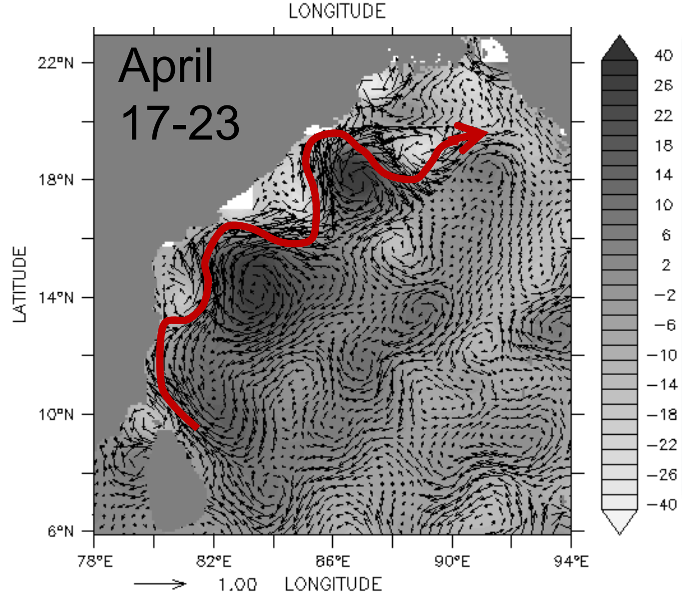
3. Satellite data analysis for spring, 2003





Productive regions matches with cold water locations





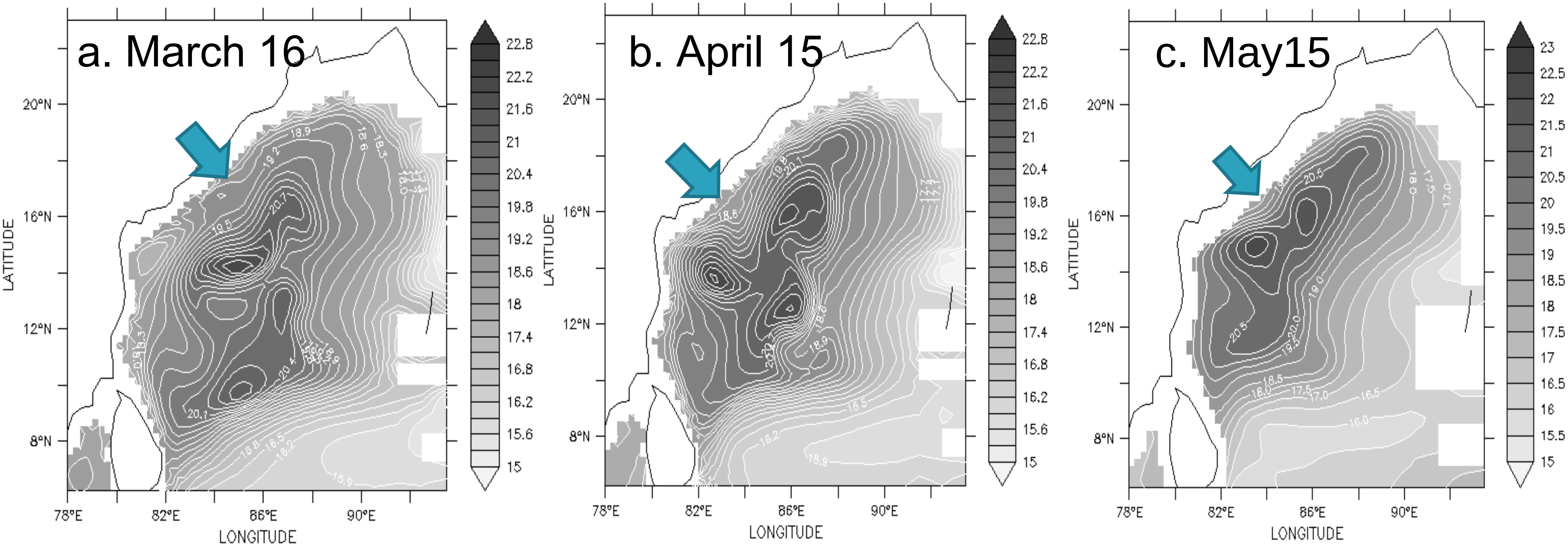
Meanders are present in the geostrophic velocity pattern.

Northern meander ➡ an eddy within ~ 1 month.

The meanders moved downstream ➡ Baroclinic instability

3. Mesoscale variability in spring from OGCM

Temperature at 150m



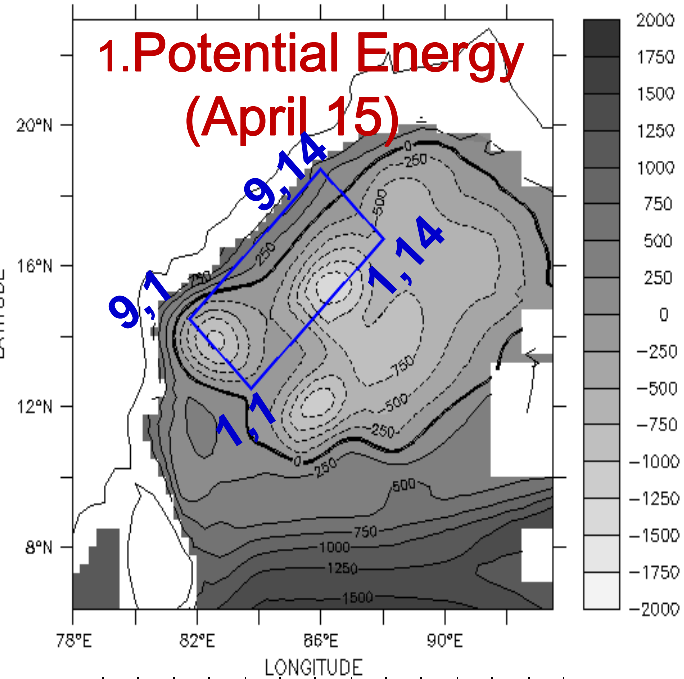
First stage: the EICC formed due to Rossby waves

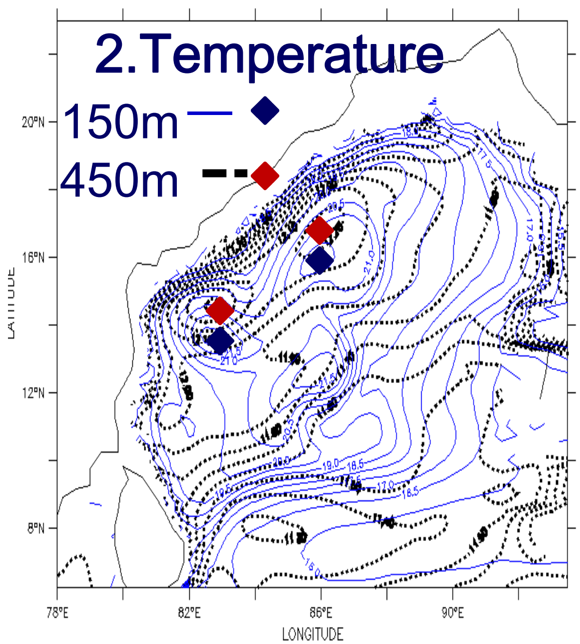
Second stage: meanders due to instability

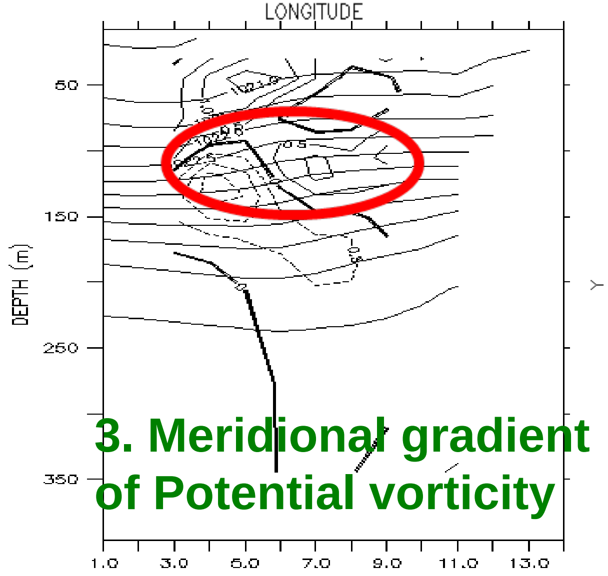
Third stage: meanders fully developed and reached equilibrium, downstream propagation

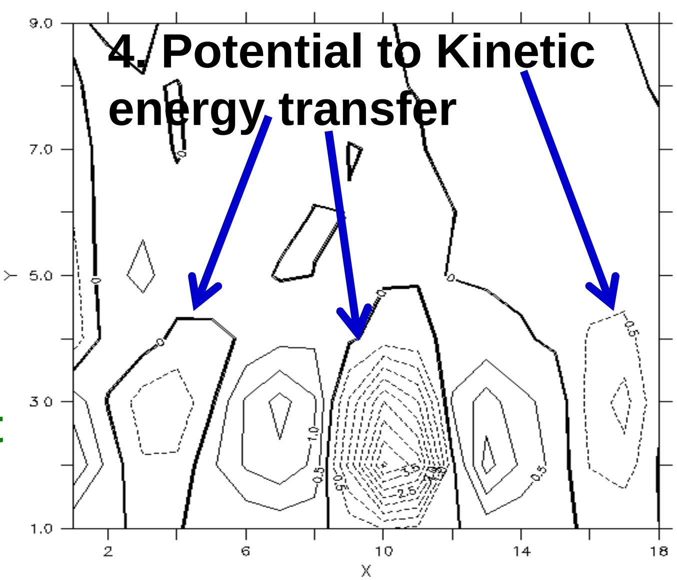
=> Let's look at potential vorticity and energy transfer

3.OGCM suggests baroclinic instability in spring









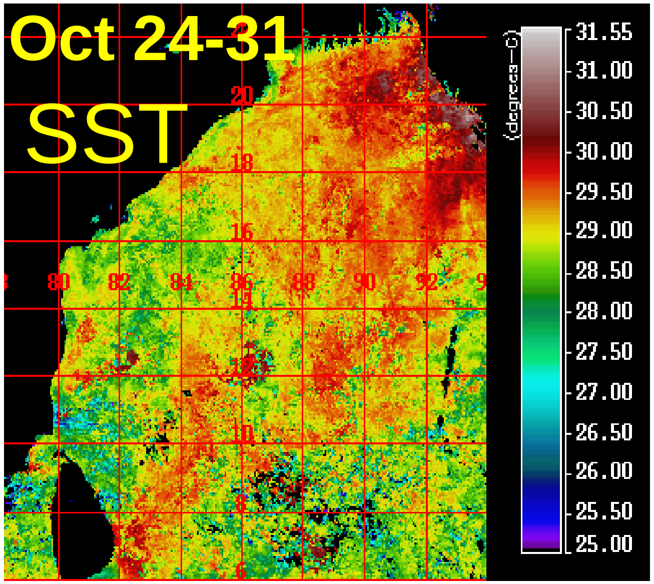
1. Excess potential energy along the coast for liberation.

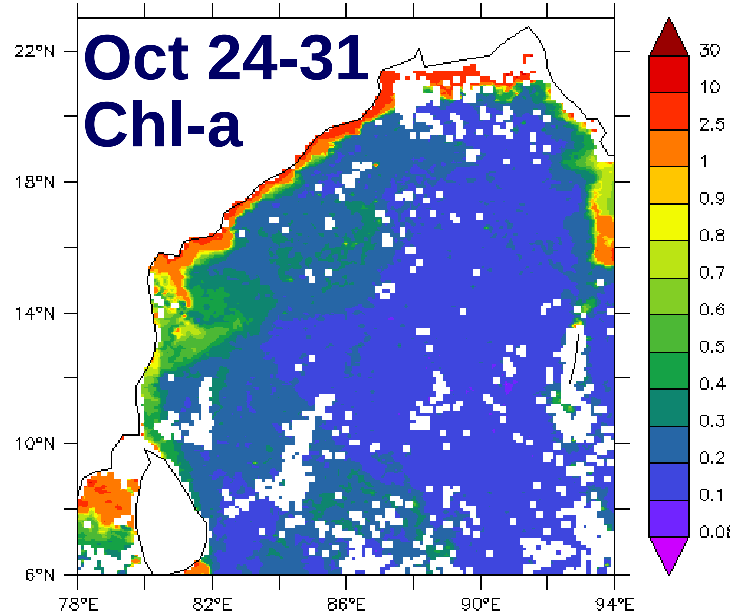
2. Phase shift between upper & lower layer temperature ➡ baroclinic instability.

3.Necessary condition for baroclinic instability is satisfied.

4.Extraction of available potential energy from the mean flow is shown.

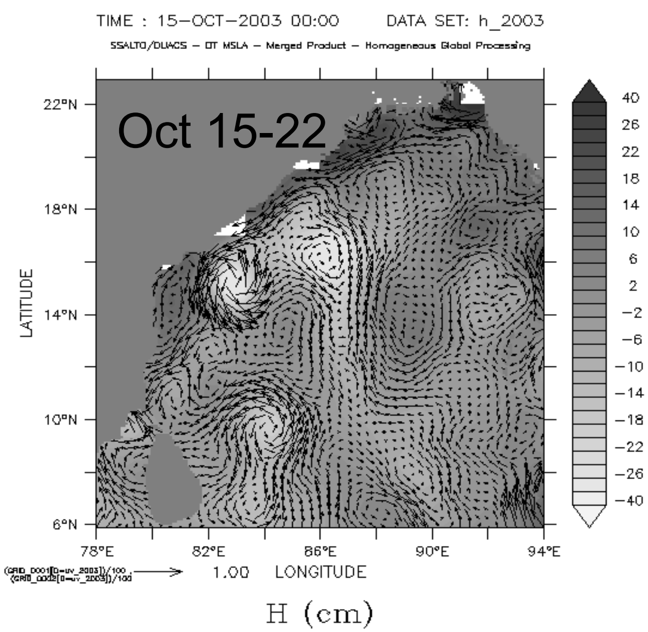
4. Satellite data analysis for fall, 2003

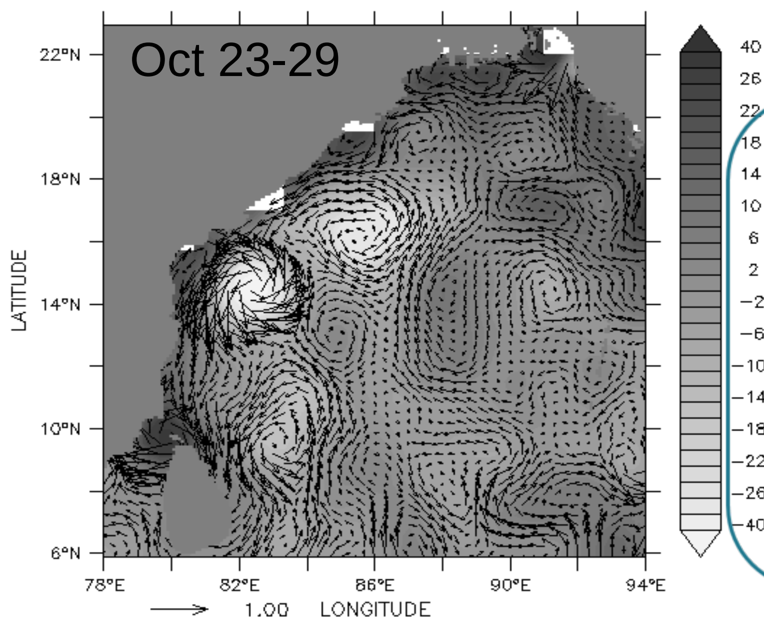




Difficult to identify meanders from SST.

Chl-a maxima along coastal strip.

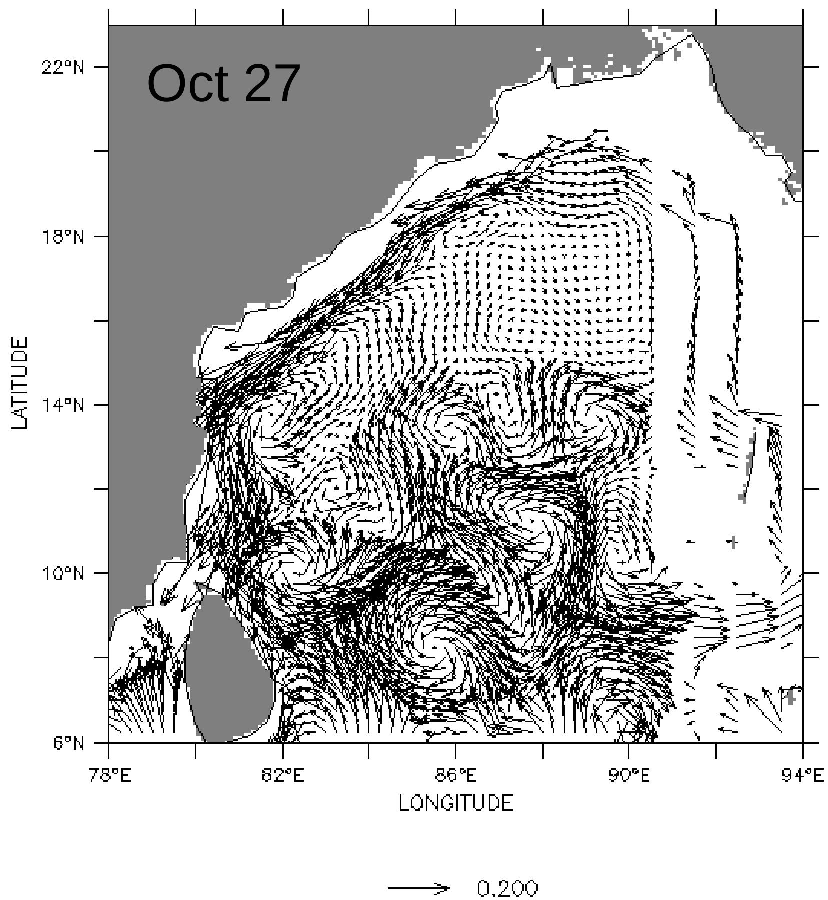




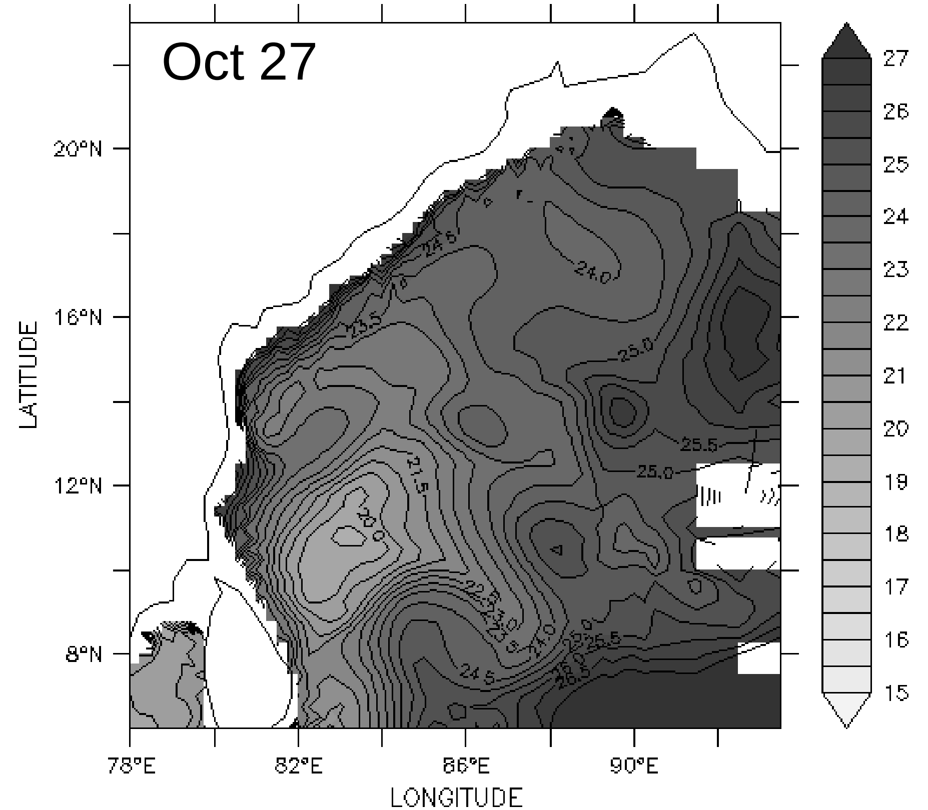
The southward narrow EICC
Weak mesoscale meanders

4. Mesoscale variability in fall from OGCM

Velocity at 90m



Temperature at 90



Narrow southward EICC was reproduced
with weak mesoscale variability

5. General summary for EICC mesoscale variability in Spring and fall inter-monsoon

◆ Spring: Active mesoscale variability. OGCM showed **'baroclinic instability'**. It helped fisheries nourishment prior to the upwelling favored summer monsoon winds.

◆Either satellite data or OGCM did not show pinching off of eddies. Indicates weak instability compared to the Kuroshio or Gulf Stream.

◆Linear stability model and a local QG model (Ikeda, 1981) supported the OGCM results.

◆Fall: Weak mesoscale variability. The linear stability model and the local model suggested that baroclinic instability is not possible. But the local model suggested **'barotropic instability'**. It might help to enhance the productivity along the coastal belt.

Note of thanks……..

My sincere thanks to the PICES committee for giving me a chance to present my study on Indian Ocean.

Thank you very much for your kind attention

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