Japanese Observational Plans in the Indian Ocean and Indonesian Throughflow

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Outline

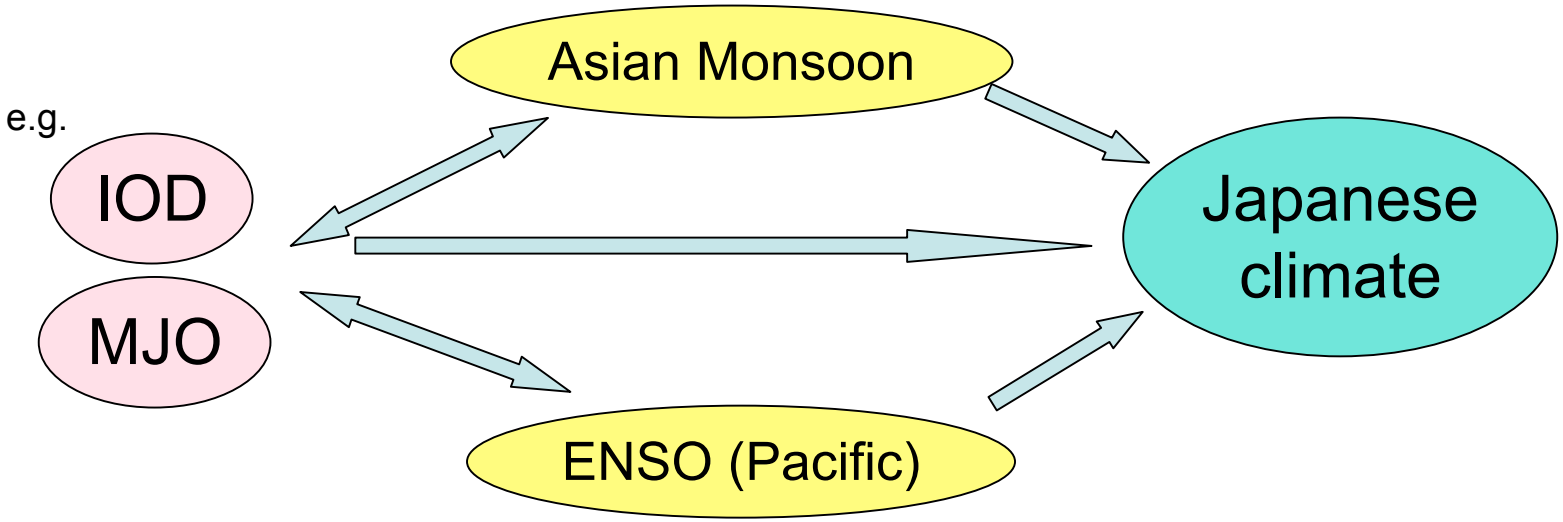
- Background
- Present status of Japanese obs. in the IO
  with some preliminary results
- Observation plans in the next few years

Note: No Japanese observation for the Indonesian throughflow.
(cf. INSTANT program)

Background

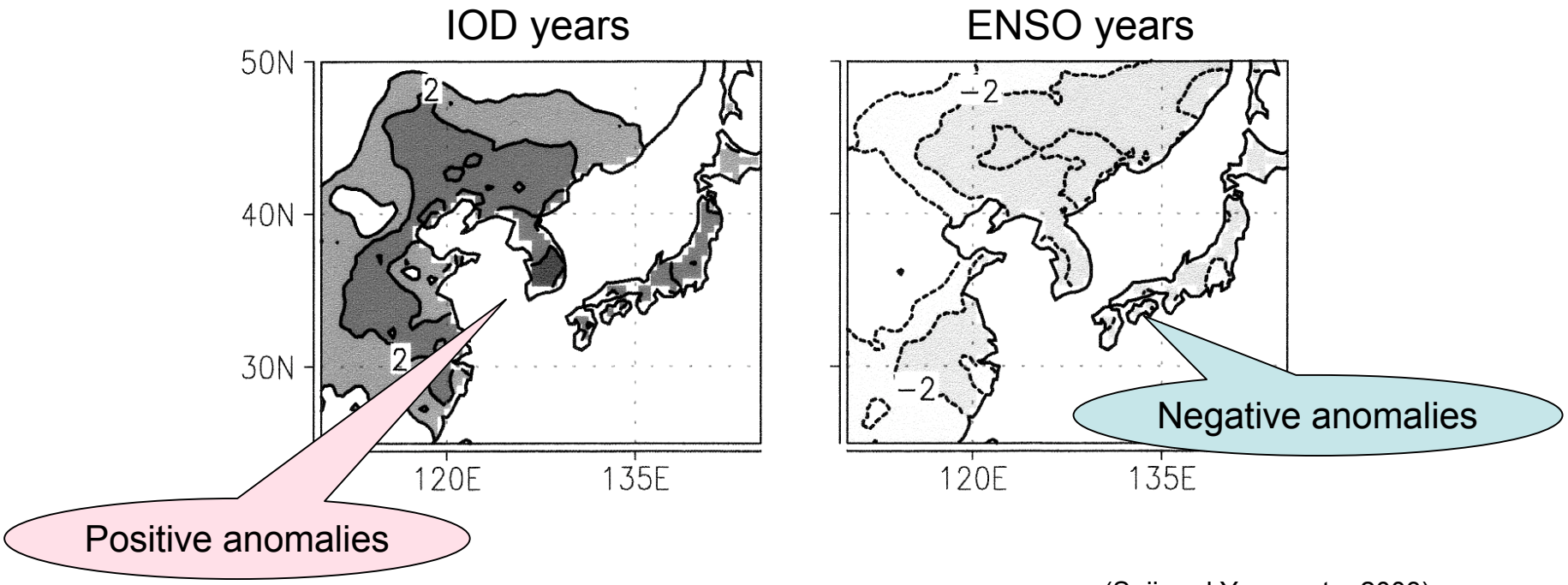
- Why do we concern about the Indian Ocean?

< Influence on Japanese climate change >



IOD Influence

Standardized surface temperature anomalies



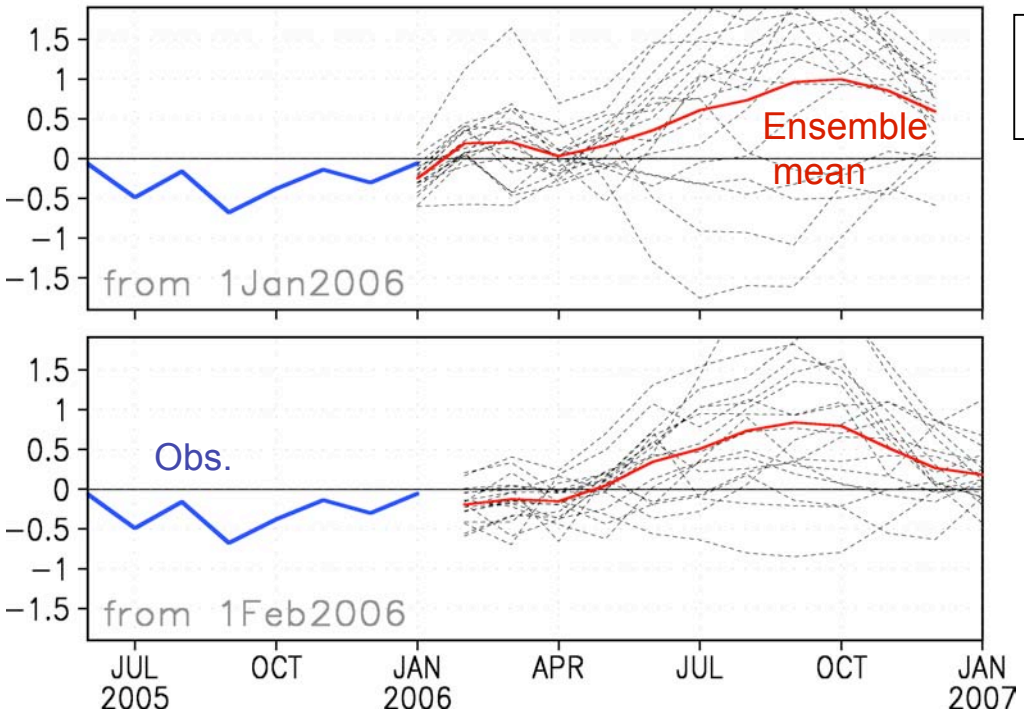
(Saji and Yamagata, 2003)

IOD-ENSO Forecasting Experiments for 2006

- The SINTEX-F Coupled GCM

  ECHAM4 (T106L19) + OPA8 (2° x 0.5°~2°, L31) + OASIS2

- 18-member ensemble real time forecast experiments



IOD forecasts in 2006

Provided by Dr. Jing-Jia Luo of FRCGC/JAMSTEC

http://www.jamstec.go.jp/frcgc/research/d1/iod/

Scientific concerns

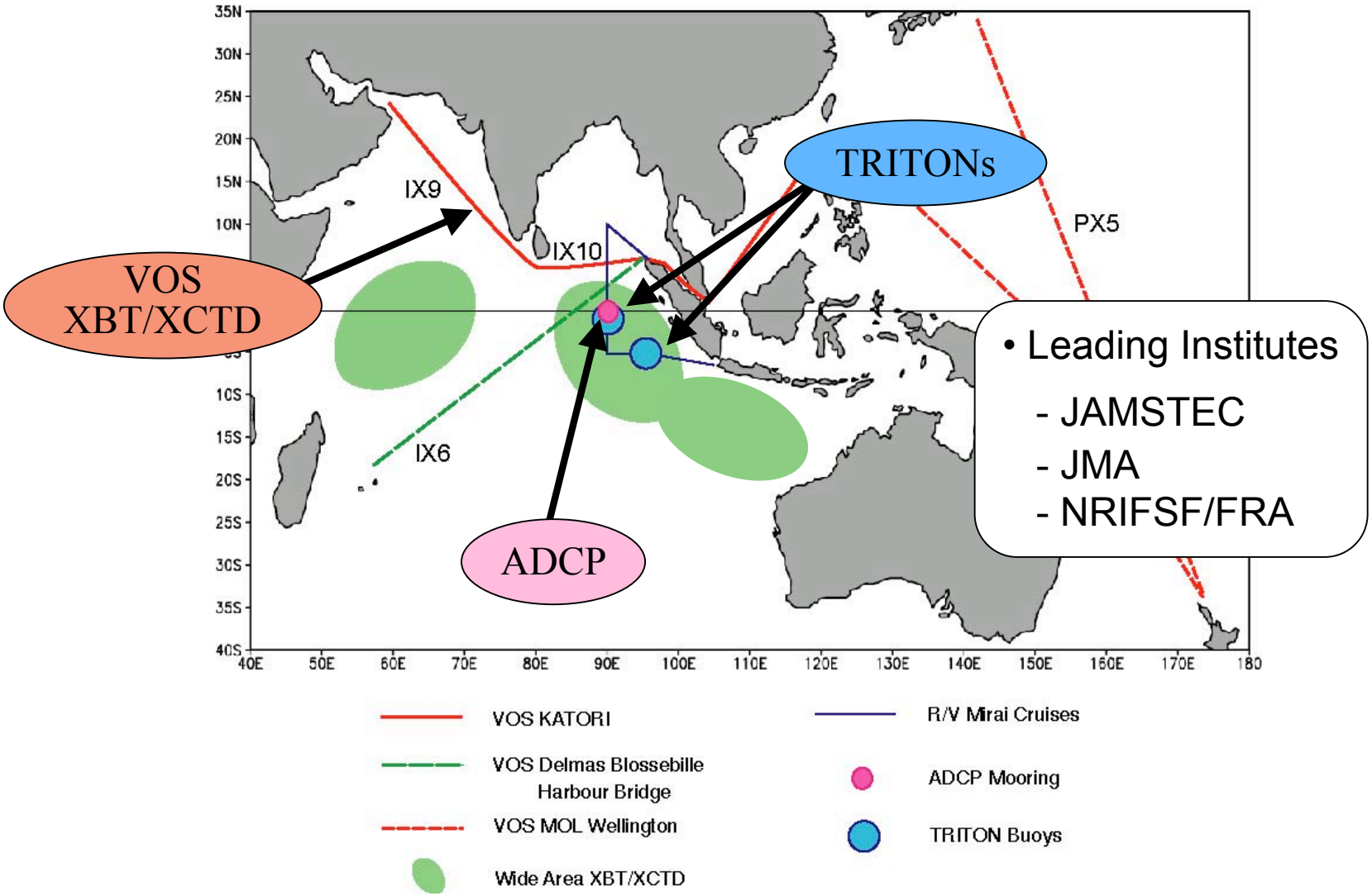
- Mechanisms of the IOD, intraseasonal variability, and other dominant phenomena in the IO
- Predictability of these phenomena and their influences on the global climate system

Researches underway, but….

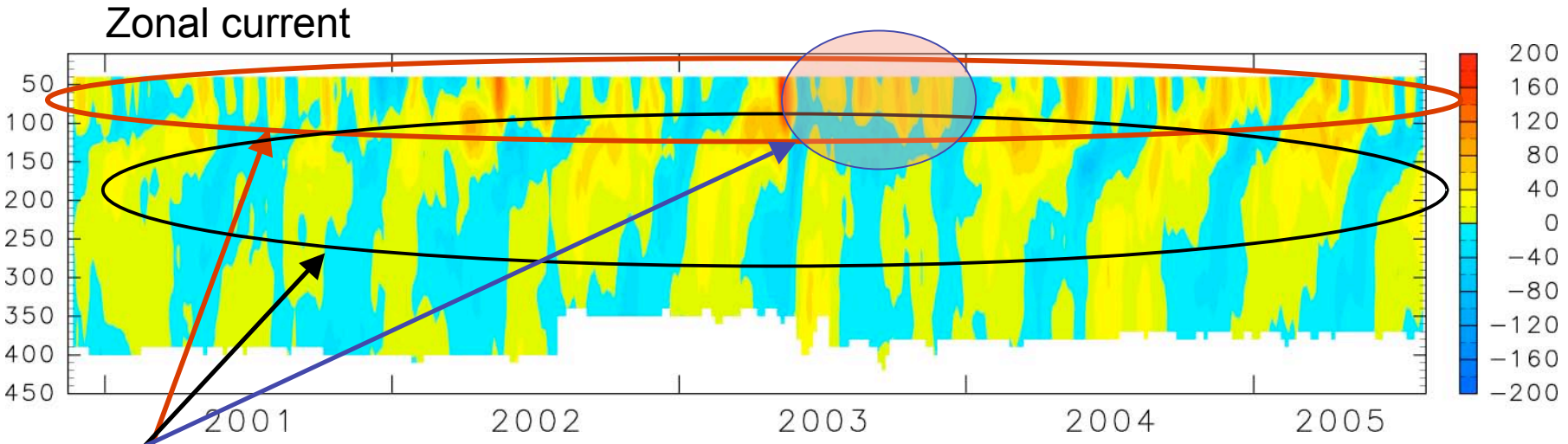
- Strongly rely on the satellite and re-analysis data
- Limited subsurface *in situ* data

  (cf. tropical Pacific observing system)

Japanese Indian Ocean Observations



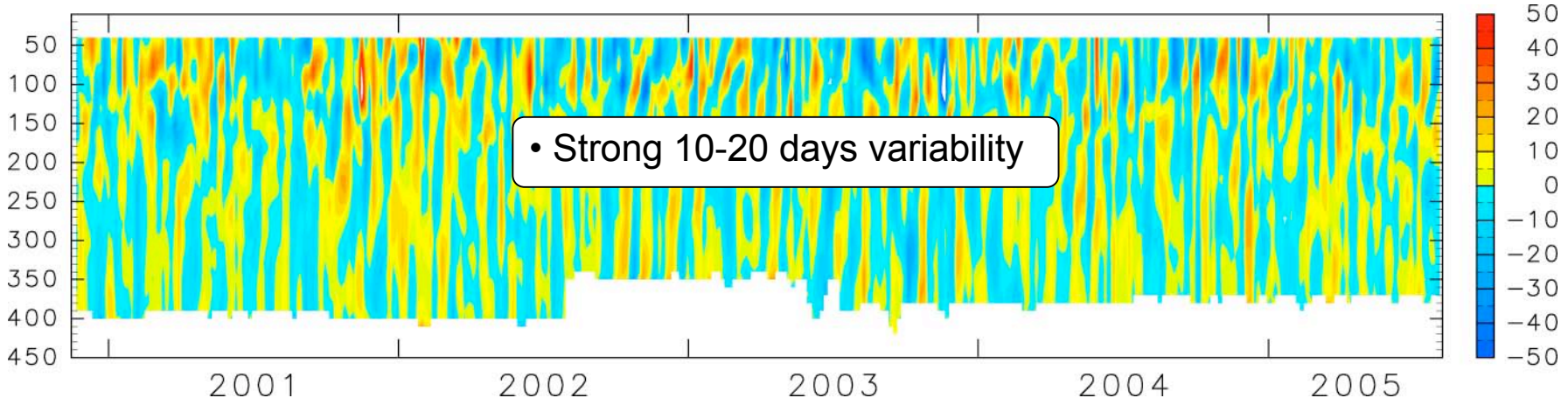
ADCP Observations (Eq., 90E)



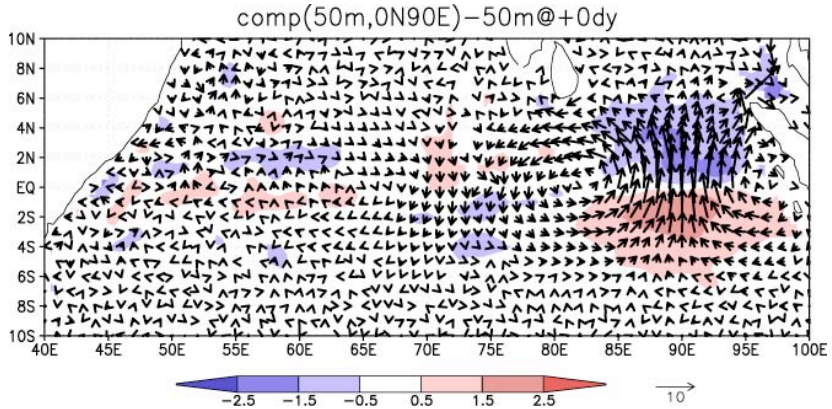
- Strong intraseasonal variability (ISV) (~ 30-60 days) (Masumoto et al., 2005)
  Subsequent propagation along the coast of Sumatra/Java (Iskandar et al., 2005)
- Vertically propagating subsurface semiannual signal
  Relation with the EUC; T signals of TRITON (Hase et al., 2006)
- No Wyrtki jet, a series of ISV
  Termination of the developping IOD event (Rao et al., 2004)

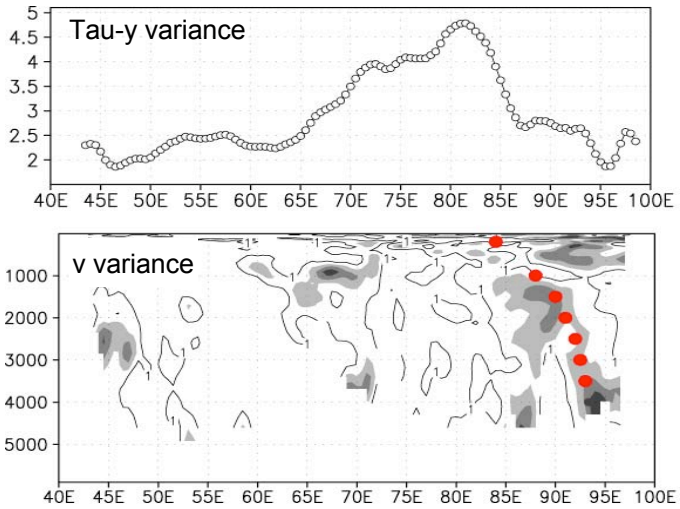
ADCP Observations (Eq., 90E)

Meridional current



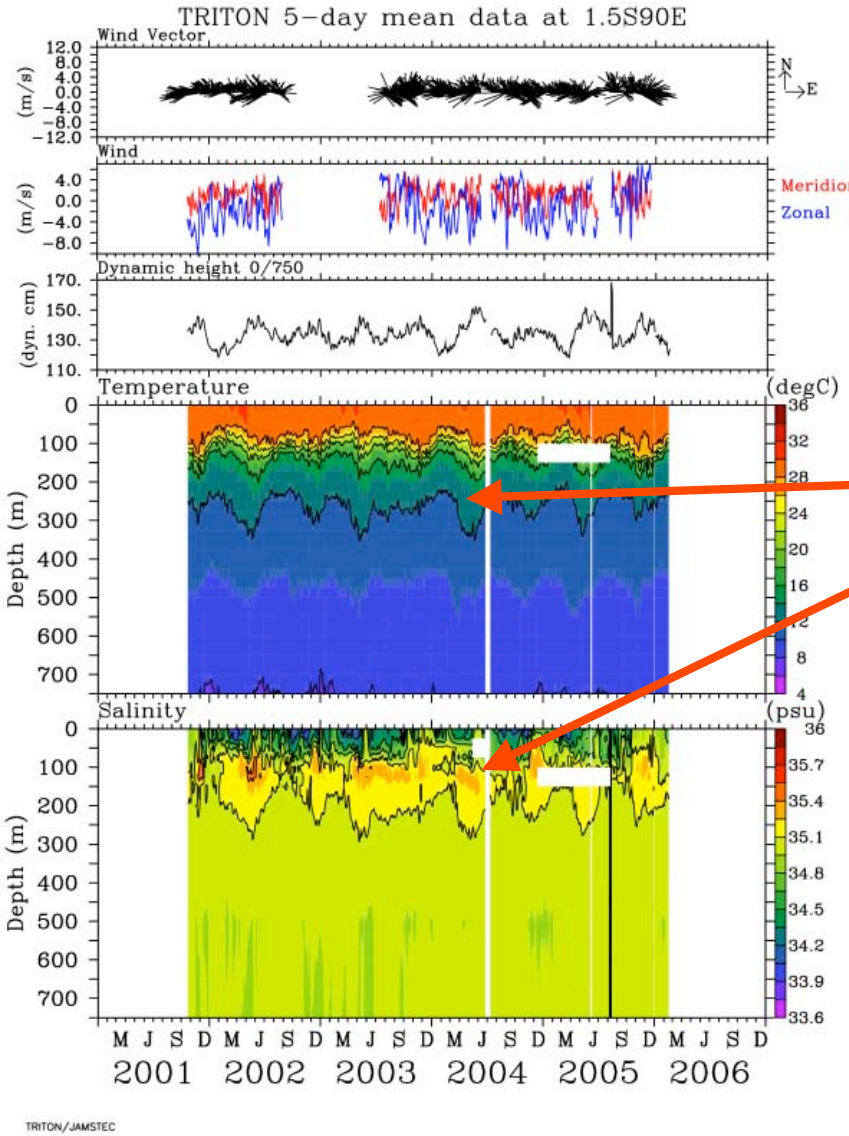
OGCM results indicate…

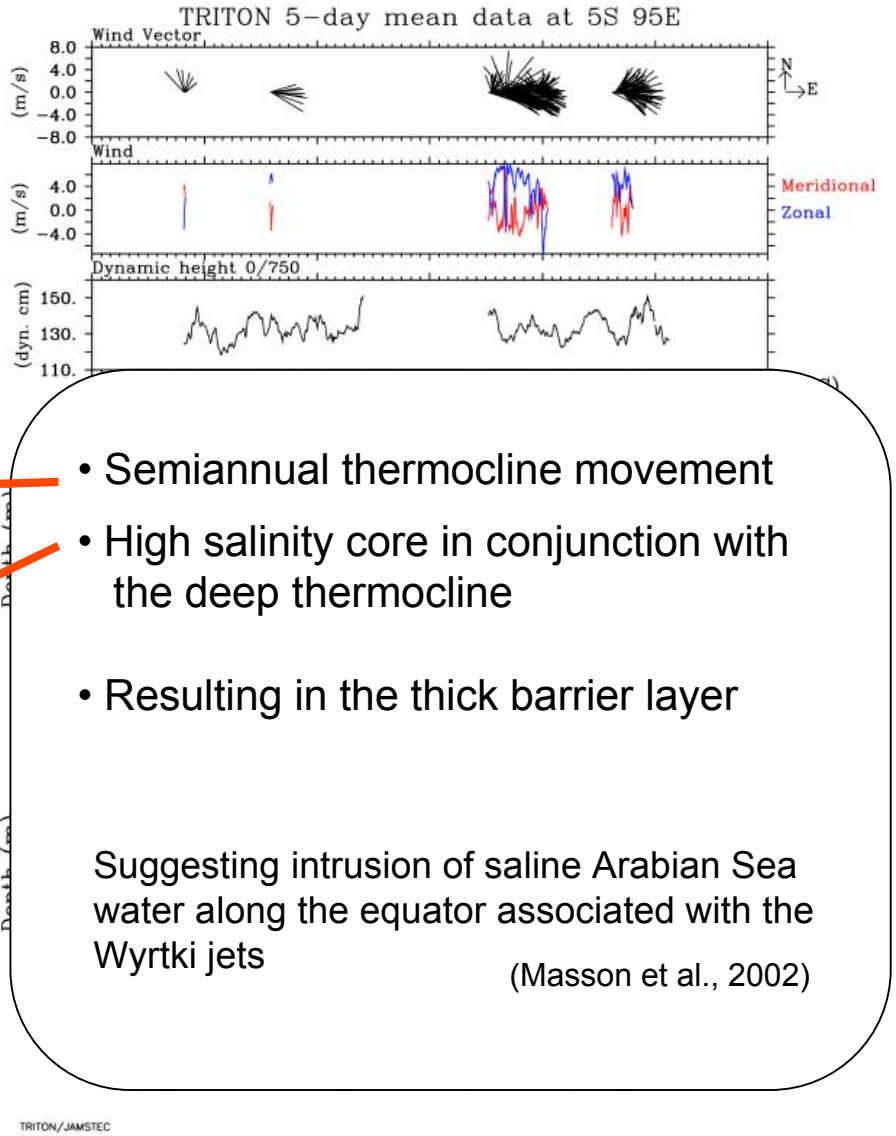




(Ogata et al., 2006)

TRITON buoy (1.5S, 90E)





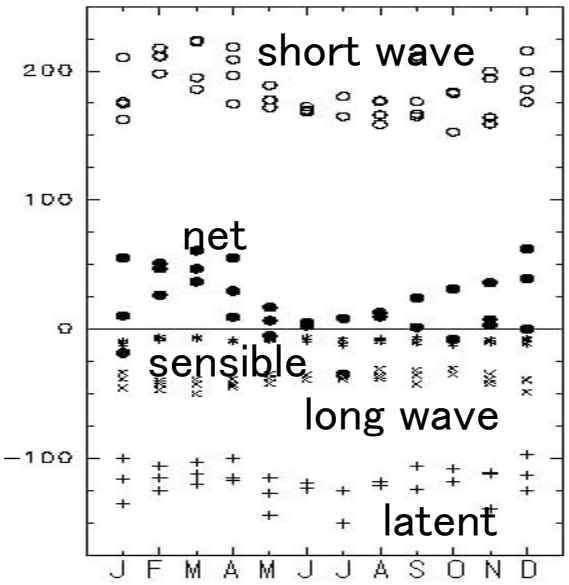
- Semiannual thermocline movement
- High salinity core in conjunction with the deep thermocline
- Resulting in the thick barrier layer

Suggesting intrusion of saline Arabian Sea water along the equator associated with the Wyrtki jets

(Masson et al., 2002)

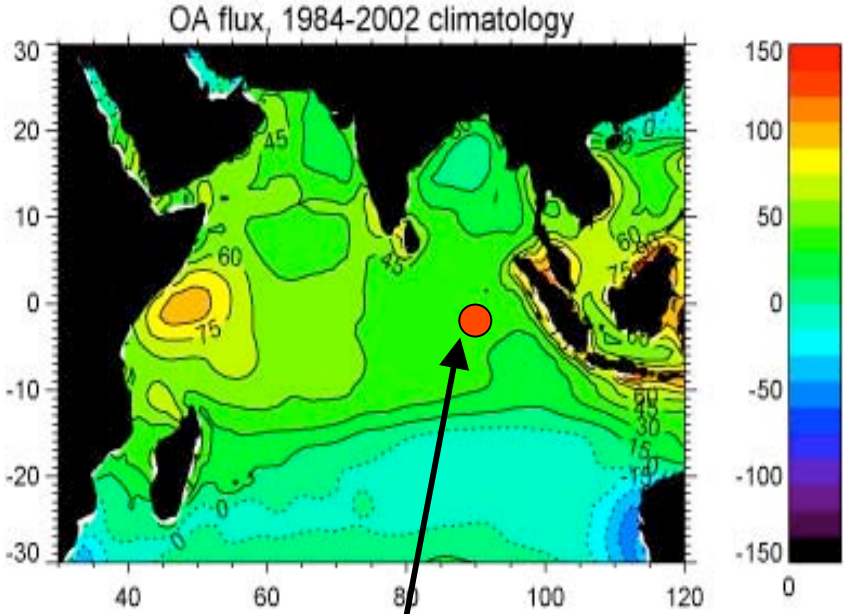
Heat Flux comparison

TRITON heat fluxes at 1.5S90E
(H. Hase/IORGC)



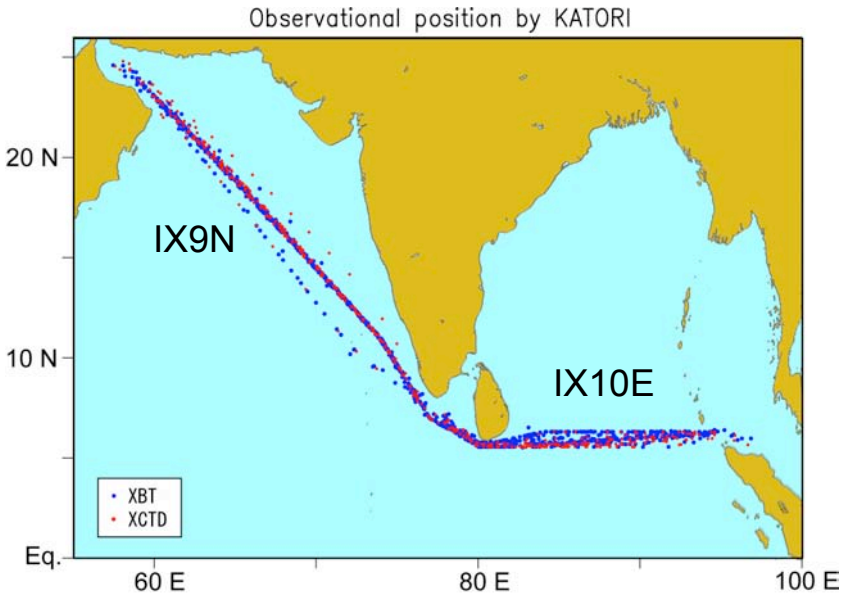
2-year average (for 2002/03)	
Sensible heat flux	−8.9
Latent heat flux	−119.8
Net short-wave radiation	181.0
Net long-wave radiation	−38.4
Net heat flux	13.9

Flux data product
(Yu and Weller, NOAA/WHOI)

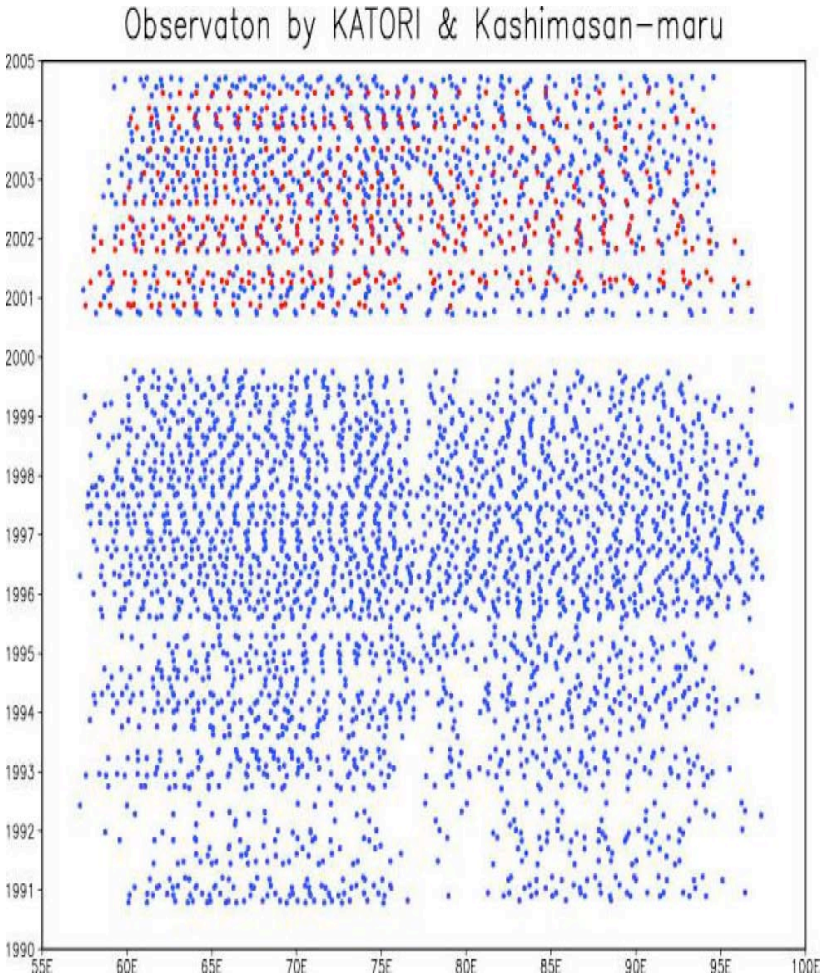


At 90.5 lon, -1.5 lat
Net Heat Flux = 41.38W m^{-2}
Latent Heat Flux = -117. W m^{-2}
Sensible Heat Flux = -9.99 W m^{-2}
Net Shortwave Radiation = 214.2 W m^{-2}
Net Longwave Radiation = -45.7 W m^{-2}

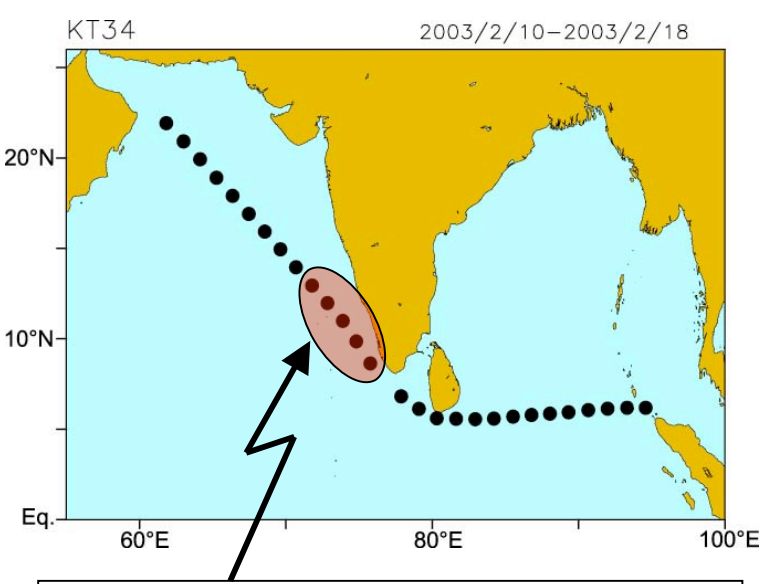
VOS XBT/XCTD (along IX9N,IX10E)

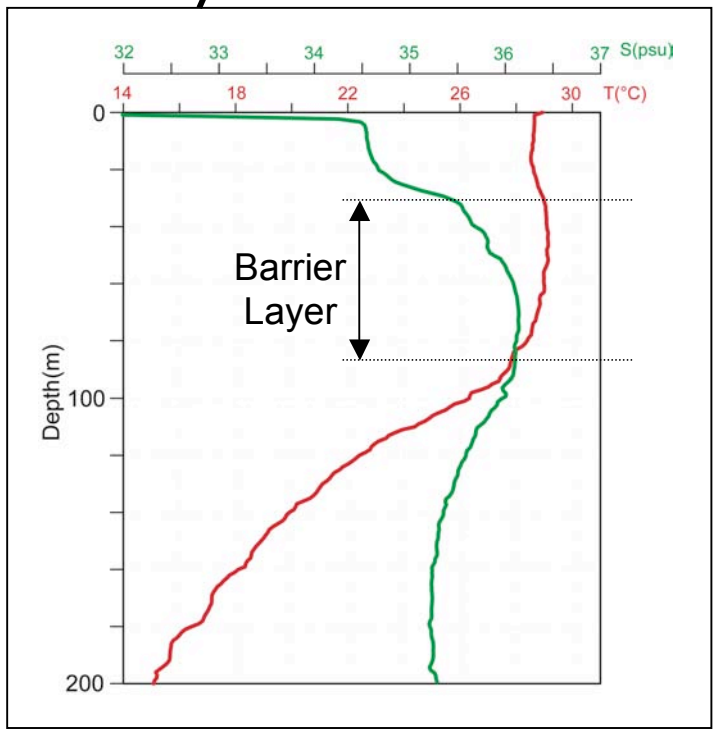


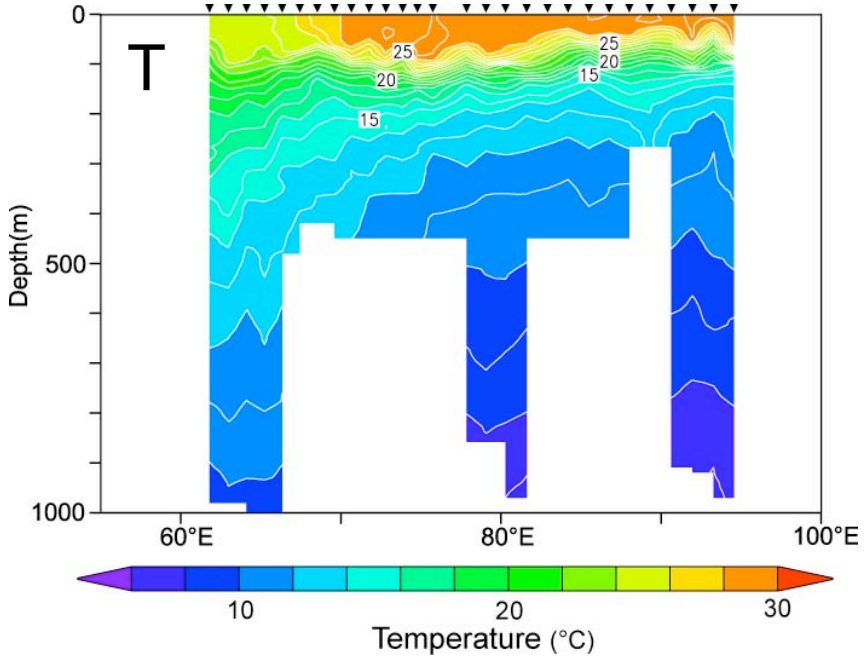
KATORI

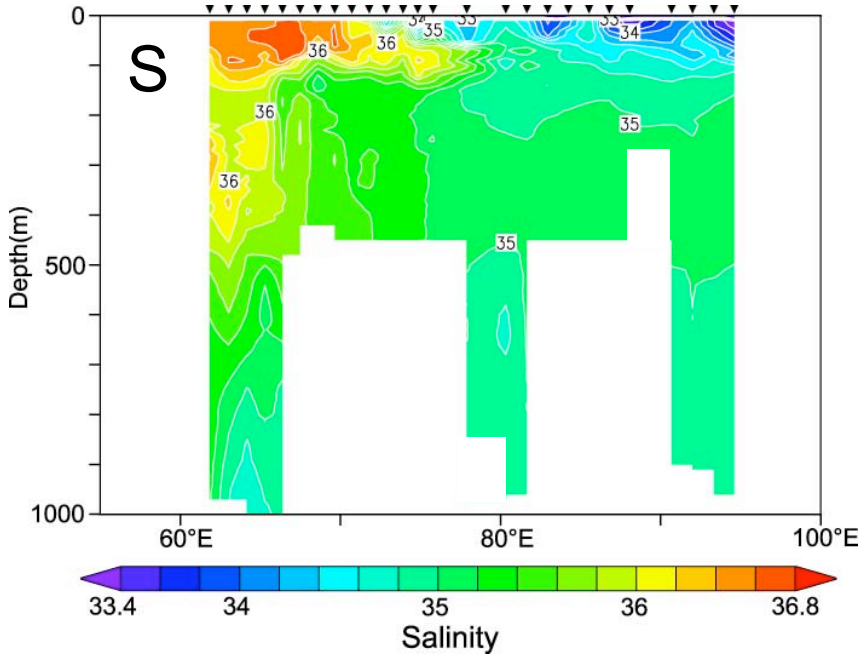


- XBT
- XCTD


KT34
2003/2/10–2003/2/18
20°N
10°N
Eq.
60°E
80°E
100°E

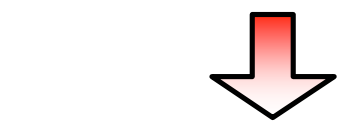

32
33
34
35
36
37
S(psu)
14
18
22
26
30
T(°C)
0
100
200
Depth(m)
Barrier
Layer


T
0
500
1000
Depth(m)
25
20
15
60°E
80°E
100°E
10
20
30
Temperature (°C)

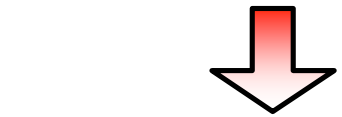

S
0
500
1000
Depth(m)
36
35
60°E
80°E
100°E
33.4
34
35
36
36.8
Salinity

Seasonal variability of the southeastern Arabian Sea

Thick Barrier Layer

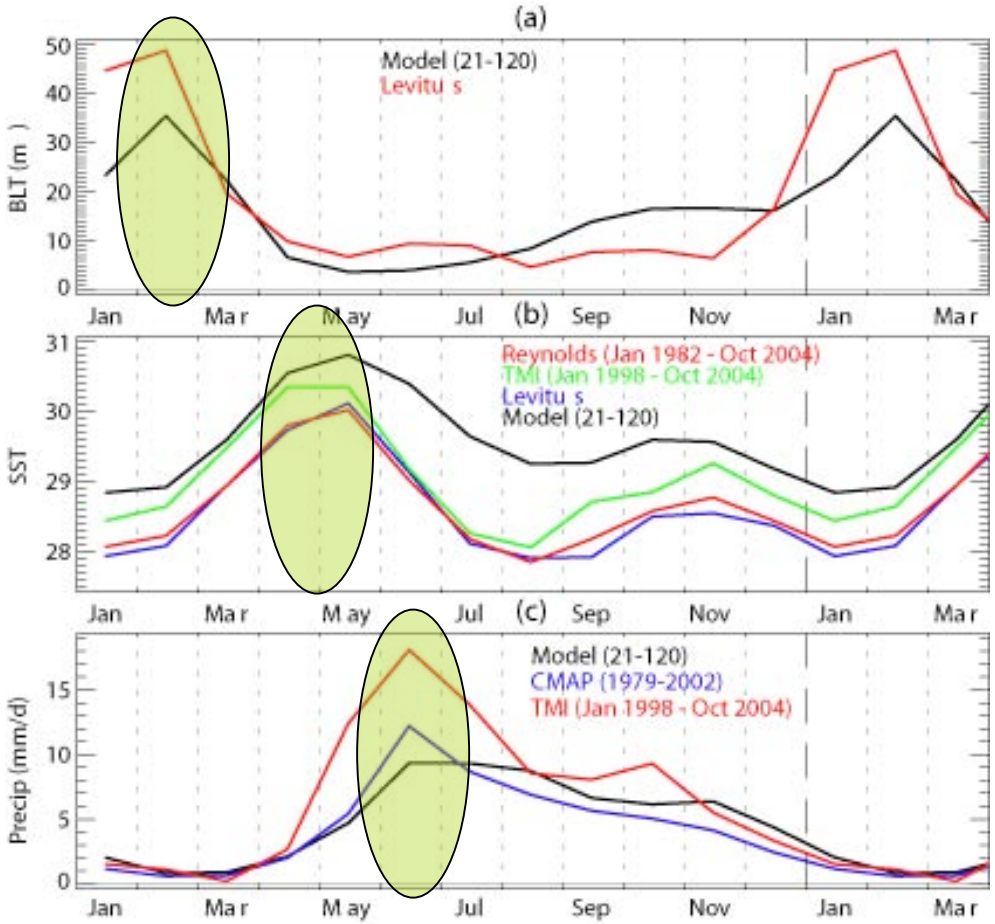


Spring SST warming



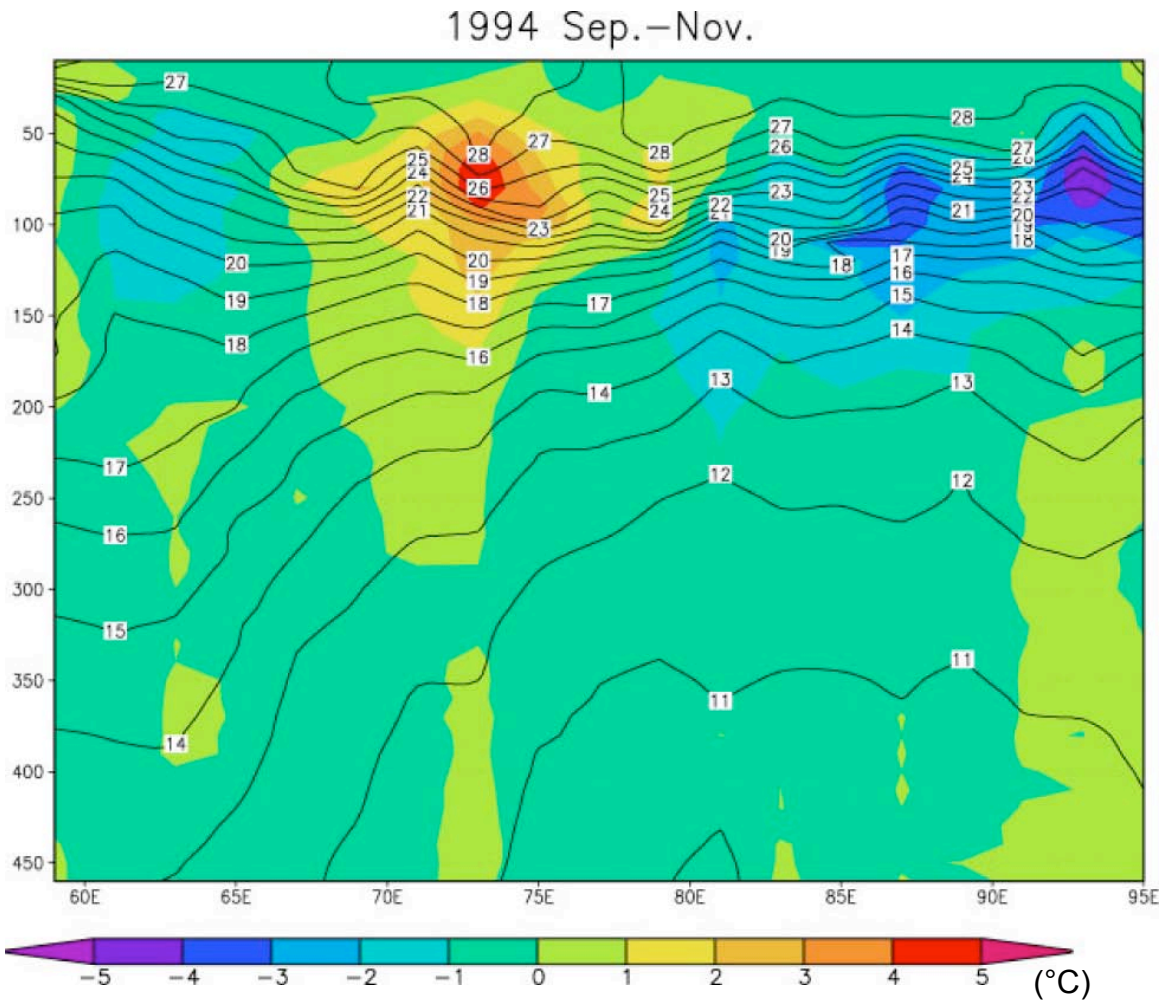
Anomalous Precipitation

Monsoon onset



(Masson et al., 2005)

Temperature anomaly during 1994 IOD



Observation Plans in the next few years

- Japan EOS (Earth Observation System) Promotion Program

  The MEXT budget, for 5 years starting from 2005,
  promoting GEOSS related activities in Japan

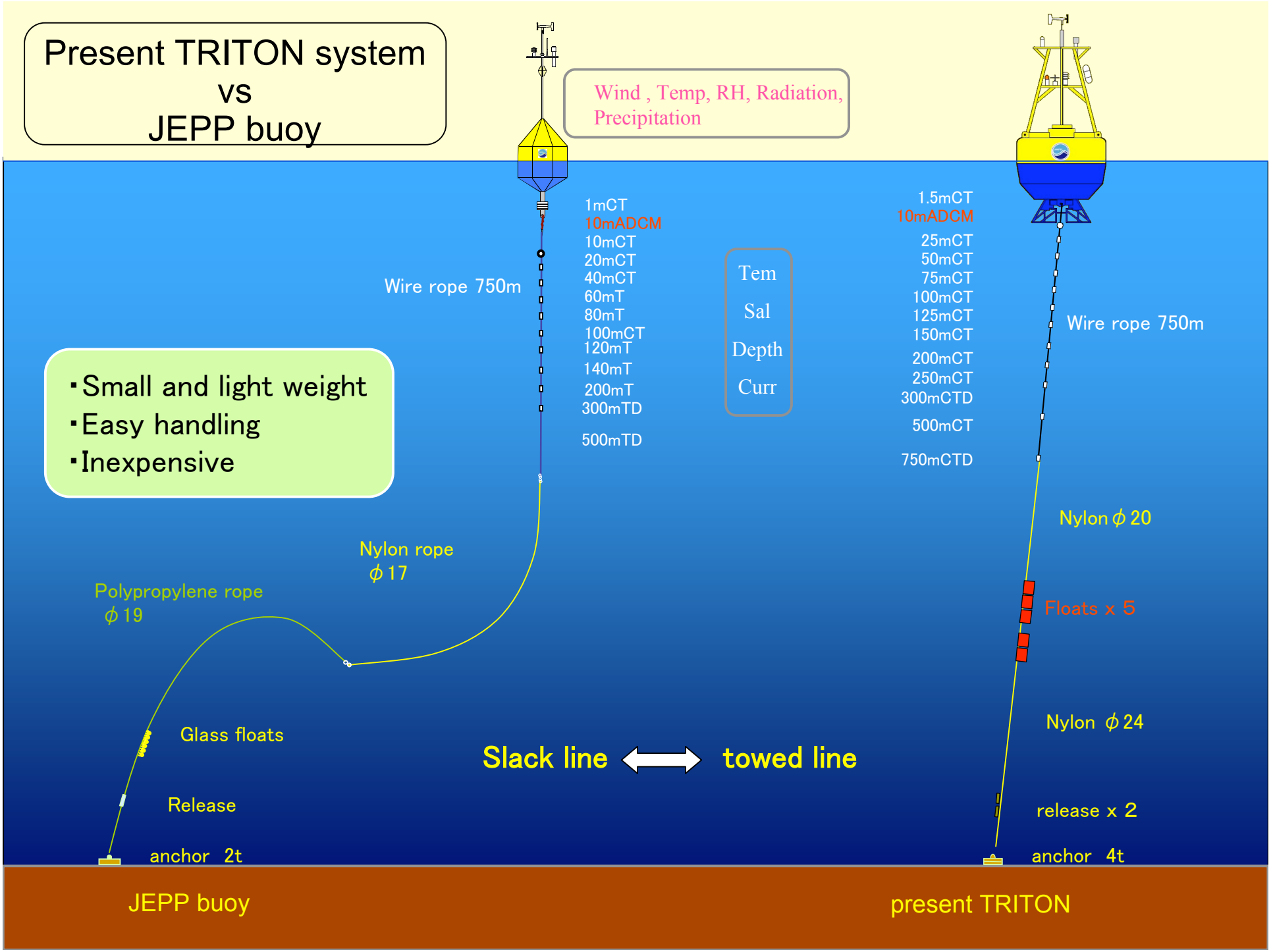
- JAMSTEC started a new 5-year program under this JEPP program

  "Indian Ocean Moored Buoy Network Initiative for Climate Studies (IOMICS)"

  PI : Keisuke Mizuno (IORGC)
  Co-PI : Yoshifumi Kuroda, Yukio Masumoto

  Major purposes:

  - to develop a new small-size buoy system (JEPP buoy)
  - to obtain *in situ* data in the eastern IO for better description and understanding of the upper-layer variability

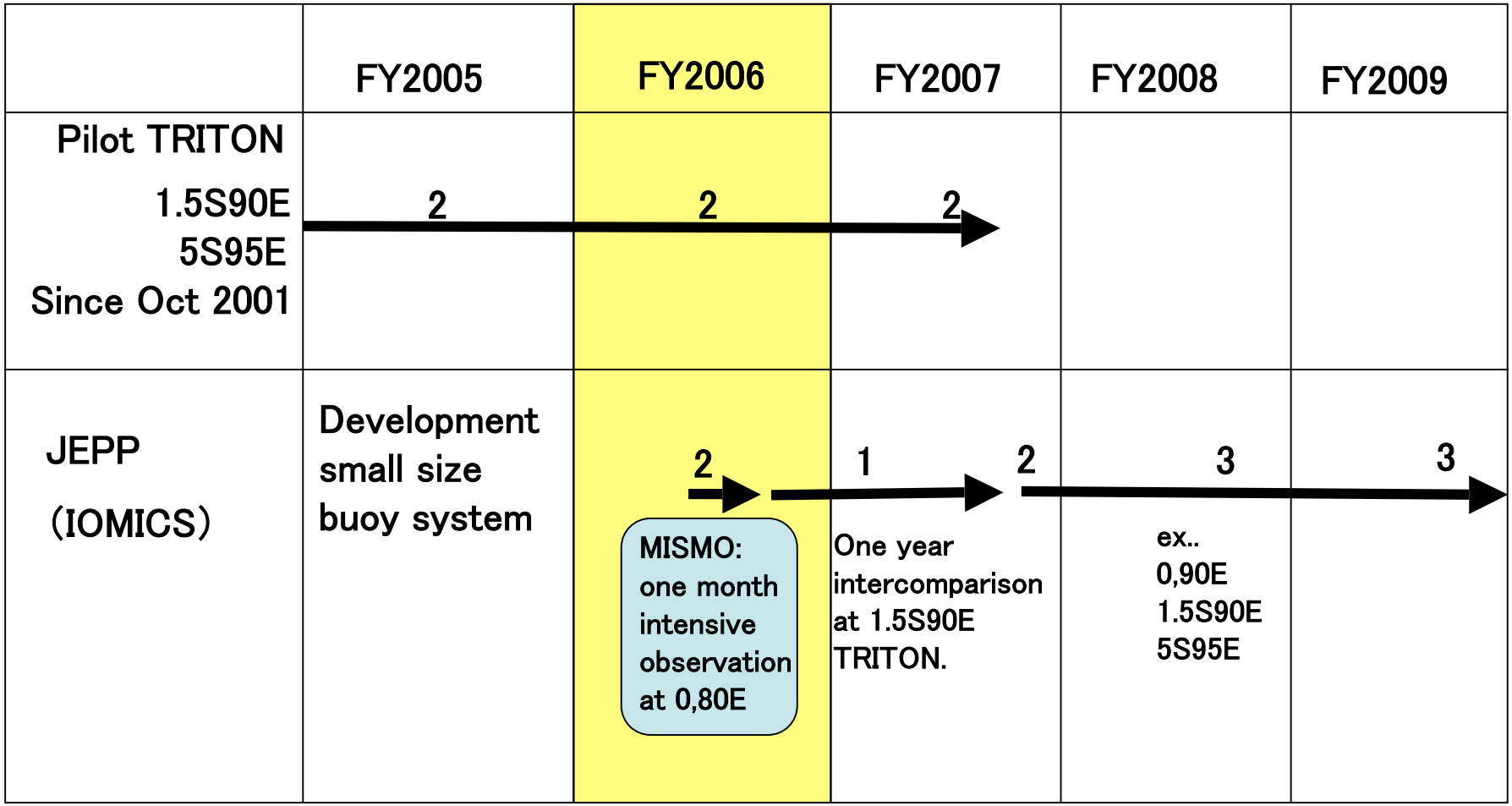

Present TRITON system
vs
JEPP buoy
Wind , Temp, RH, Radiation, Precipitation
1mCT
10mADCM
10mCT
20mCT
40mCT
60mT
80mT
100mCT
120mT
140mT
200mT
300mTD
500mTD
Wire rope 750m
Tem
Sal
Depth
Curr
1.5mCT
10mADCM
25mCT
50mCT
75mCT
100mCT
125mCT
150mCT
200mCT
250mCT
300mCTD
500mCT
750mCTD
Wire rope 750m
・Small and light weight
・Easy handling
・Inexpensive
Nylon rope
ϕ17
Polypropylene rope
ϕ19
Nylon ϕ20
Floats x 5
Glass floats
Nylon ϕ24
Slack line
towed line
Release
release x 2
anchor 2t
anchor 4t
JEPP buoy
present TRITON

R/V Yokosuka, September 2005

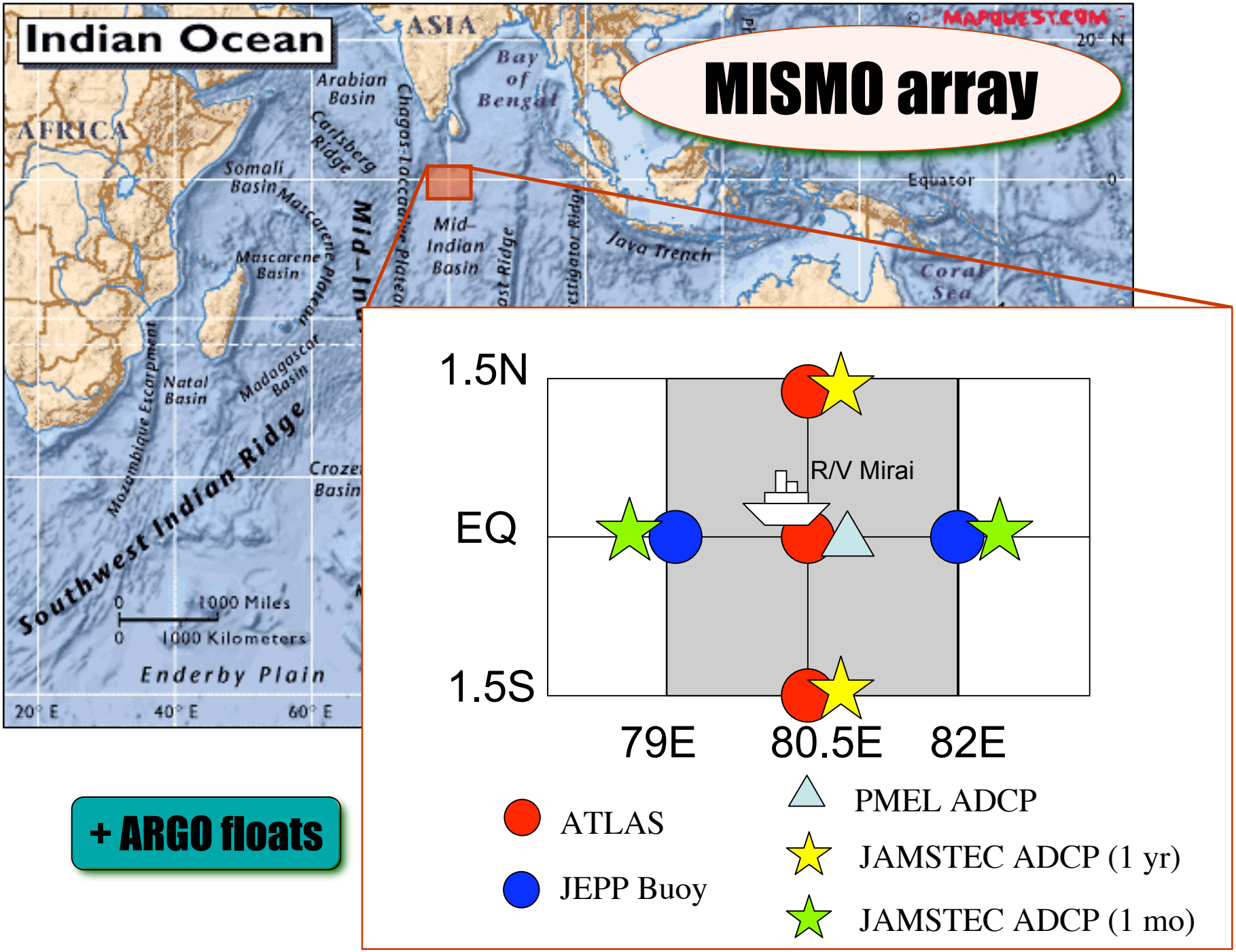
JAMSTEC Indian Ocean Mooring Plan

by Japan EOS Promotion Program (JEPP)

Indian Ocean Moored Buoy Network Initiative for Climate Studies (IOMICS)



As of February 2006


Indian Ocean
MISMO array
ASIA
AFRICA
Arabian Basin
Bay of Bengal
Carlsberg Ridge
Somali Basin
Mascarene Basin
Mid-Indian Basin
Java Trench
Coral Sea
Equator
Natal Basin
Madagascar Basin
Mozambique Escarpment
Southwest Indian Ridge
Enderby Plain
1000 Miles
1000 Kilometers
20° E
40° E
60° E
20° N
0°
1.5N
EQ
1.5S
79E
80.5E
82E
R/V Mirai
ATLAS
JEPP Buoy
PMEL ADCP
JAMSTEC ADCP (1 yr)
JAMSTEC ADCP (1 mo)

+ ARGO floats

Purposes of MISMO

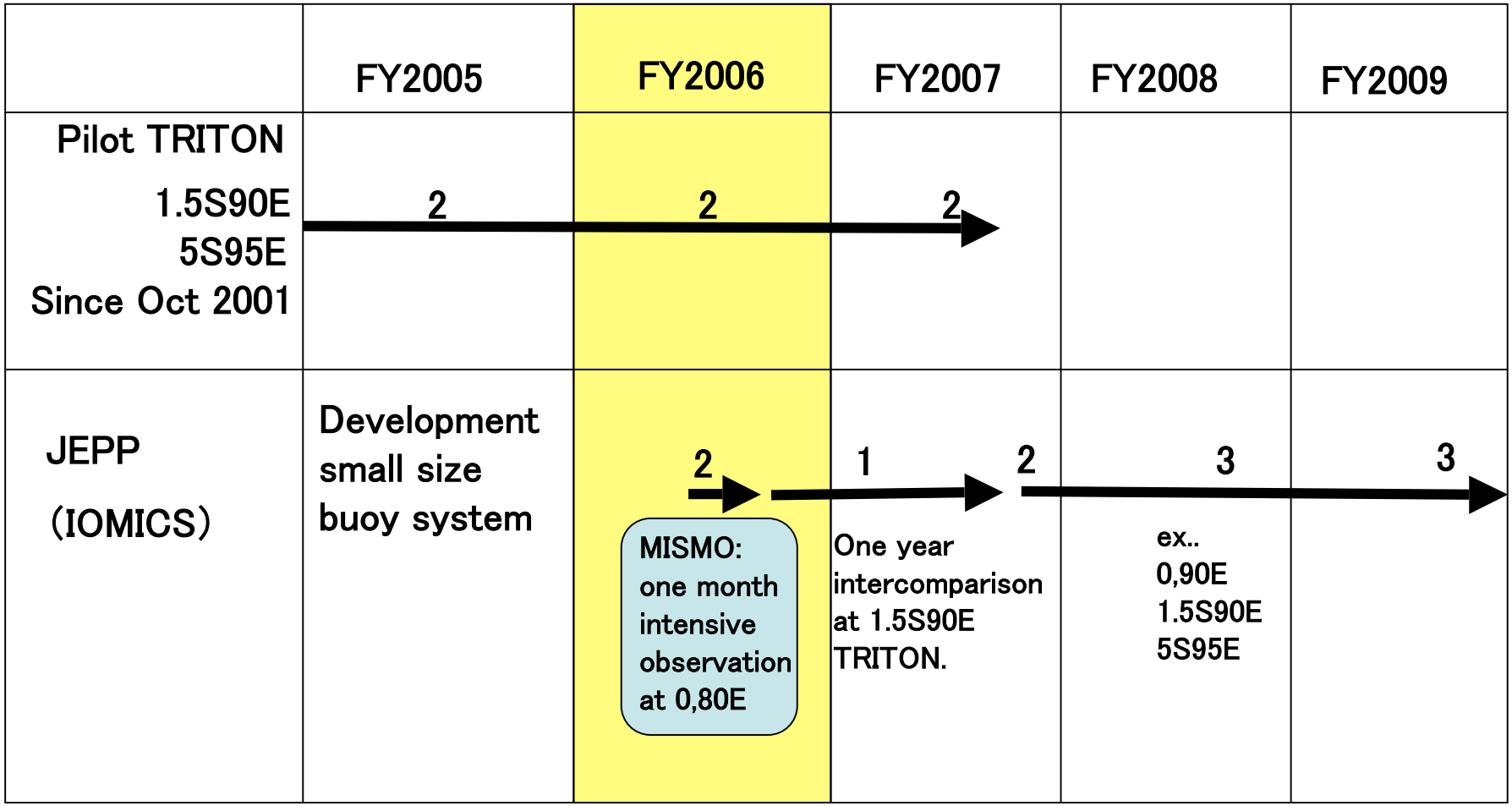
To understand, during the passage of the atmospheric intraseasonal disturbances,

- **heat and momentum budgets in the upper-layer,**
- **upper-layer current variability, especially w,**
- **surface heat fluxes by using several different estimations,**
- **mixed-layer variability, including the barrier layer influences on the mixed-layer depth**
- **spatial and temporal characteristics of the equatorial waves at the intraseasonal time-scale.**

JAMSTEC Indian Ocean Mooring Plan

by Japan EOS Promotion Program (JEPP)

Indian Ocean Moored Buoy Network Initiative for Climate Studies (IOMICS)



As of February 2006

Some issues

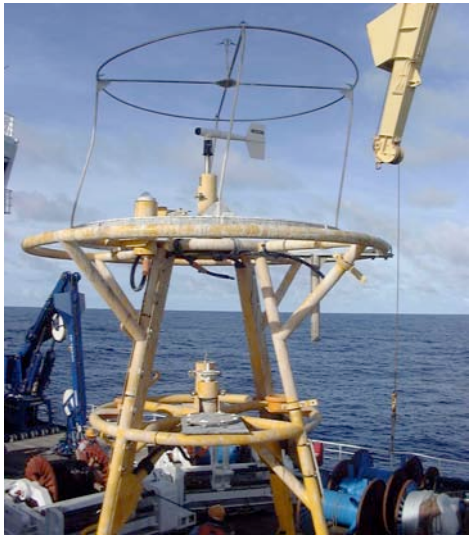
Two major issues (for moorings):

- **Ship Time**

  Collaboration with the rim countries

- **Vandalism**

• 5S,95E buoy
• August 2002
• Propeller, rain gage, radar reflector, lights, cables were stolen



• 1.5S,95E buoy
• July 2004
• All met sensors and electronics units were stolen

< Remedy ??? >