Tropical Indian Ocean Observing System
- Present Status and Highlights of 2006 IOD -

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Tropical Mooring Array

- Limited coverage in the Indian Ocean (9 surface buoys, 2 subsurface ADCPs)
- Initial stage for implementing the array
- The array obtained the interesting data on 2006 IOD

- Pacific Ocean is well observed (67 surface buoys, 5 subsurface ADCPs)
- Subsurface T, S data are essential for high predictability of ENSO

IndOOS Array

TAO/TRITON Array

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Present status of the Indian Ocean Observing System
- Surface and subsurface mooring array
- JAMSTEC observations

Highlights of 2006 IOD event
- Eastern moorings, long-term observations
  (90E TRITON/ADCP, 95E TRITON etc.)
- MISMO-Ocean intensive observations
  (~80E m-TRITON and ADCP array)

Summary
MISMO [ Oct.-Dec., 2006 ]
(Mirai Indian ocean cruise for the Study of the MJO convection Onset)

- Observation network to investigate upper-ocean responses to the intraseasonal disturbances

- Long-term observations

  - ADCP
    (Eq., 90E) since Nov. 2000
  - TRITON
    (1.5S, 90E) (5S, 95E) since Oct. 2001
Dipole Mode Index (DMI)

- SST dipole structure started to develop in Aug. 2006
- MISMO observations were during the mature phase and the beginning of the decay phase of the IOD

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TRITON (1.5S, 90E)

\(T_{\text{mean}}\) and \(T_{\text{anom}}\)

- Subsurface negative anomaly starts in May. Three months before DMI increase.

TRITON (1.5S, 90E)

\(U\) at 10m depth

ADCP (Eq., 90E) \(U\)

- Significant weakening of eastward subsurface current in association with the subsurface negative \(T\) anomaly in May.
- Strong baroclinicity during the last half of IOD.
✓ No strong easterly anomaly in the western region in Jan/Feb.
✓ Direct wind forcing in May and Aug.

✓ Cold Kelvin wave propagation in Feb., May, and Aug.
Subsurface pre-conditioning: 1st event

Dec. 15, 2005
Cold Rossby waves in the western IO during the end of 2005

Feb. 13, 2006
Similar pattern in D20 appeared as the IC of SINTEX-F forecasting model, and cold Kelvin wave event in Feb. 2006

(Luo et al., 2006)
Subsurface pre-conditioning: 2nd event

Mar.27, 2006

SSHA [cm] 27MAR2006

May 20, 2006

SSHA [cm] 20MAY2006

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Subsurface pre-conditioning: 3rd event

Aug. 3, 2006

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MISMO-Ocean Network

Core Period: Oct.27 - Nov.22, 2006

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MISMO: ADCP Zonal Current

- Subsurface eastward flow centered at 80m depth, with surface westward flow, during relatively strong easterly wind period.

- As the easterly wind weakens, the subsurface flow weakens as well.
Strong biweekly variability is observed between 40m and 150m depth.

Local meridional wind does not show the corresponding variability, suggesting the wave propagation.
MISMO: m-TRITON T variability

- Large upward movement of the isotherms (> 10m/day, which is several times stronger than the strength of the typical equatorial upwelling)
- Warm trend in the surface layer
- Tightening of the thermocline

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Assuming $w=0$ at 40m depth, upwelling of 12.5 m/day is obtained at 270 m depth.
Summary

Long-term TRITON/ADCP at 90E and MISMO observations revealed that,

- Subsurface negative temperature anomaly appeared in May 2006, about three months before the surface signals developed.

- During the height of the IOD, the thermocline is unusually shallow, and the vertical shear of the zonal currents is significantly increased.

- A series of the cold Kelvin waves in Feb., May, and Aug. may be responsible for the pre-conditioning of the IOD in 2006.

- Strong upwelling event of >10m/day occurred during MISMO in association with the intraseasonal variability.
Indian Ocean Observing System (IndOOS); Now

Eastern tropical Indian Ocean is now covered by the mooring array, under the cooperation among India, Indonesia, USA, and Japan.

However, western equatorial Indian Ocean still remains unobserved, despite its importance on the pre-conditioning of the IOD event.
Full implementation of IndOOS is necessary.