# The proposed field experiment CINDY2011: Basic Strategy Cooperative Indian Ocean experiment on isv in the Year 2011

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Purpose:

To get a better understanding on Intraseasonal Variation in the Indian Ocean with focus on the onset of convection in the MJO

Outline : (1) Background (3) Basic strategy (4) Current status

MISMO Workshop at YES/JAMSTEC in Yokohama, Nov. 25-26, 2008

# What we learned from MISMO ?

- 1) In-situ measurements can provide useful data sets for MJO study, which cannot be obtained from satellites (eg. Finer scale structures, lower tropospheric variation, etc.).
- 2) Most of convection associated with ISV seems to be noticeable west of MISMO region.
- 3) Large-scale equatorial waves might play a key role for initiation process. The relationship between meso-scale convective system and equatorial waves should be further studied.
- 4) Large-scale SST distribution is fundamental and important component for MJO study.
- 5) One month observation is insufficient to understand the intraseasonal variability especially for the study of oceanic features.

# While satellite-based IR image shows westward propagating cloud systems, Mirai's radar captured eastward propagating convective systems



From Yamada (2008)

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## **Occurrence of MJO-convection**



Most of cloud activity associated with ISV became noticeable around 60E in the Fall of 2006.

NOAA-OLR (daily; 7.55-7.5N; 1979-2008)

Identify first event which satisfies below.

MJO signal < -10 W/m2 + OLD sheelute value < 220 W//m2

OLR absolute value

< 220 W/m2 or < 180 W/m2

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## Eastward Propagating Signals & Relationship to Convective Activity in IO



Yasunaga (2008)

#### Equatorial Rossby Wave might play a key role on MJO-convection Onset



Yasunaga (2008)

# How about the vertical feature in the different region ?





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# Change of SST Distribution (Termination of IOD)





SST Anomaly : DEC



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# Change of SST Distribution (Termination of IOD)



# Zonal Current

- Upper: Westward
- Subsurface: Eastward (*z*Indian Ocean Clim.)
- Indian Ocean Dipole

Meridional	Current

• EQ Mixed Rossby Gravity Wave?

Horii et al. (2008)

Experiment Objectives are to describe ;

- 1) Temporal and spatial variation of atmospheric profiles (eg. Heating, wind, etc.) in terms of intraseasonal time scale,
- 2) Relationship between convective activity and equatorial waves,
- 3) Role of SST variation onto convective activity from diurnal to intraseasonal (seasonal, if possible) scale,
- 4) Ocean surface variation in the equatorial waveguide,
- 5) Others (INPUT from MISMO-WS Participants!)

# **Basic Strategy**

- 1) Construct Longer temporal and wider spatial observation network
  - \* Intensive in-situ observation sites (ships, land)
  - \* Coordination with RAMA buoy array
  - \* Collaboration with relevant field campaigns (ex. TRIO, HARIMAU, etc.)

\* Use of satellite data

(ex. A-Train, Megha-Tropiques, etc.)

2) Tight relationship with numerical research group
\* Use of Numerical Model "NICAM", "CReSS", others.

3) Open Data Policy

- \* QCed Data within 1 year from CINDY HP
- \* Enhance accuracy of operational and reanalysis data cf. MIRAI Radiosonde data is sent to GTS

## **RAMA (Current status)**



From M. McPhaden (NOAA/PMEL)

# RAMA (By the end of 2009)



## **Observation Network in MISMO**



## **Proposed Observation Network for CINDY2011**



## **Current Status**

#### Research Vessels (Candidates)

\* R/V Mirai

50 days in Indian Ocean (60-70 days from Japan to Seychelles)

Stationary observation near RAMA buoy site at (0°, 67°E) or (0°, 80°E)

Expected Measurement Systems to be used :

C-band Doppler radar Radiosonde ( every 3h to resolve diurnal cycle ) Surface Meteorology including Solar radiation and Turbulent Flux Skin Sea Surface Temperature measurement CTD ( every 3 or 6h ) ADCP

Vertical-pointing 95-GHz Cloud radar LIDAR

Ozone-sonde

Videosonde

Skyradiometer

Microstructure Profiler

Maintenance of RAMA buoys Deployment of ADCP moorings



# **Relevant Activities in India**

# India

#### \* R/V Sagar Kanya

 led by S. P. Kumar (NIO) Biogeochemical cruise (CTD at fixed site) 30 days in IO They will look for the possibility of Radiosonde observation.







Courtesy: V. S. N. Murty and M. J. McPhaden

# **Relevant Activities in US and Australia**

# U.S.

- DYNAMO (Dynamics of MJO) ... US component of CINDY
  - led by C. Zhang(Univ. Miami/RSMAS), C. Fairall(NOAA/ESRL), R. Johnson (CSU), M. McPhaden (NOAA/PMEL)
  - \* R/V Ronald H. Brown Proposed -

50 days (to extend IOP ~ 100 days with Mirai) Doppler radar observation and Radiosonde sounding

- + Air-sea Interaction
- + RAMA

\* Observation at Land-based sites (Possibility is being looked for)

1) Radiosonde sounding at Diego Garcia 7.3°S, 72.4°E by US Navy

2) Collaboration with ARM MJO study project

# Australia

#### \* R/V Southern Surveyor - will be proposed -

led by E. Schulz, M. Wheeler, H. Hendon (CAWCR) 25 days in eastern IO Air-sea flux + Radiosonde sounding





# **Relevant Activities in France**

#### France

#### TRIO (Thermocline Ridge of the Indian Ocean)

- led by J. Vialard (LOCEAN), J.-P. Duvel (LMD)
- \* Observations by R/V L'Atalante along 8°S in early 2011 has been proposed.



#### SWICE (South-West Indian Ocean Cyclone Experiment)

led by F. Roux

\* Synchronized project with TRIO in early 2011, with focus on cyclone by observation and modeling.

## **Relevant Proposal in JAMSTEC**

Repeat Hydrography along WHP - IO2 (8°S) and IIO (~111°E)

- PI : Dr. Akihiko Murata /JAMSTEC
- Period : 55 days in Dec. 2011 Feb. 2012 (after CINDY cruise)

Measurements: 217 CTD stations from Surface to the Bottom

Temp., Sal, DO, Nutrients, Total dissolved inorganic carbon, Total Alkalinity, pH, CFCs, 14C, 13C, etc.

Data will be submitted to CLIVAR & Carbon Hydrographic Data Office http://whpo.ucsd.edu/



## Land-based Site Candidates for Radiosonde Sounding Array

#### \* Maldives Islands

Hulhule (4.2°N, 73.5°E) - Radiosonde, GPS, Surface Meteorology → Possible Collaboration : Hanimaadhoo (6.8°N, 73.2°E) ABC site ? Kadhdhoo (1.9°N, 73.5°E) - GPS, Surface Meteorology Gan (0.7°S, 73.2°E) - Radiosonde, GPS, Surface Meteorology

## \* Diego Garcia (7.3°5, 72.4°E)

US DYNAMO researcher is now contacting with US Navy to resume radiosonde observation during the intensive observation period.

#### \* Seychelles (4.7°S, 55.5°E)

Possibility of enhancement of radiosonde from twice daily to 6-hourly Site survey will be done in next year



#### HARIMAU (Hydrometeorological ARray for ISV-Monsoon Automonitoring)



## **Proposed Observation Network for CINDY2011**



## Action I tems to be taken in very near future

- Write out 1st Science Plan of CINDY2011 based on MISMO-WS results
  - → send to several scientific communities such as CLIVAR IOP and AAMP.
- 2. Organize a working group on CINDY with Site scientists, numerical model experts, satellite experts, etc.
- 3. Open CINDY home page (or mailing list?)
- 4. Site survey for land-based sounding sites, and look for any other participants with ship-time

# **CINDY2011**

#### Cooperative Indian Ocean experiment on isv in the Year 2011

- Purpose : Observational Study on Intraseasonal Variation in the Indian Ocean with focus on the onset of convection in Madden-Julian Oscillation (MJO).
- Keys : Construction of Long-time and Wider-range Observation Network by a multi national effort
- Period : Oct. 2011 Jan. 2012
- Location : Tropical Indian Ocean including off-equatorial Island sites
- Methods : Research Vessels (possible candidates)
  - \* R/V MIRAI (Japan)
  - \* R/V Sagar Kanya (India)
  - \* R/V Southern Surveyor (Australia)
  - \* R/V Ronald H. Brown (USA)

Mooring

\* RAMA buoy array

\* ADCP buoy array around (0, 80E), and if possible around (0, 67E)

Land-based sites

\* Indonesia, Maldives, Seychelles, Diego Garcia, etc.

Collaboration with other relevant projects such as TRIO, ARM, etc. Numerical research group is involved as a member of CINDY project Satellites (ex. A-Train, Megha-Tropiques)