Activity in Japan

Outline of this talk:

1. What we should do in CINDY / DYNAMO ?
2. Proposed Observational Network
3. Current Status of Japanese activity
   ex. R/V Mirai Schedule, Observation items

What we should do in CINDY / DYNAMO

The aim of " field campaign " is to collect in-situ observations to advance our understanding of MJO initiation process and to improve the skill of MJO prediction and simulation.
To accomplish this, key objectives are set in "Science Plan" as below, respectively.

CINDY2011:

To reveal ;

1) Evolution of heating profile,
2) Relationship between meso-scale convective systems & equatorial waves,
3) Relationship between convective activity & sea surface conditions.

DYNAMO:

To test 3 hypotheses ;

1) Deep convection can be organized into an MJO convection only when moist layer has become sufficiently deep,
2) Specific convective populations at different stages are essential for MJO onset,
3) Various factors which control upper-ocean heat content, SST, flux are essential.

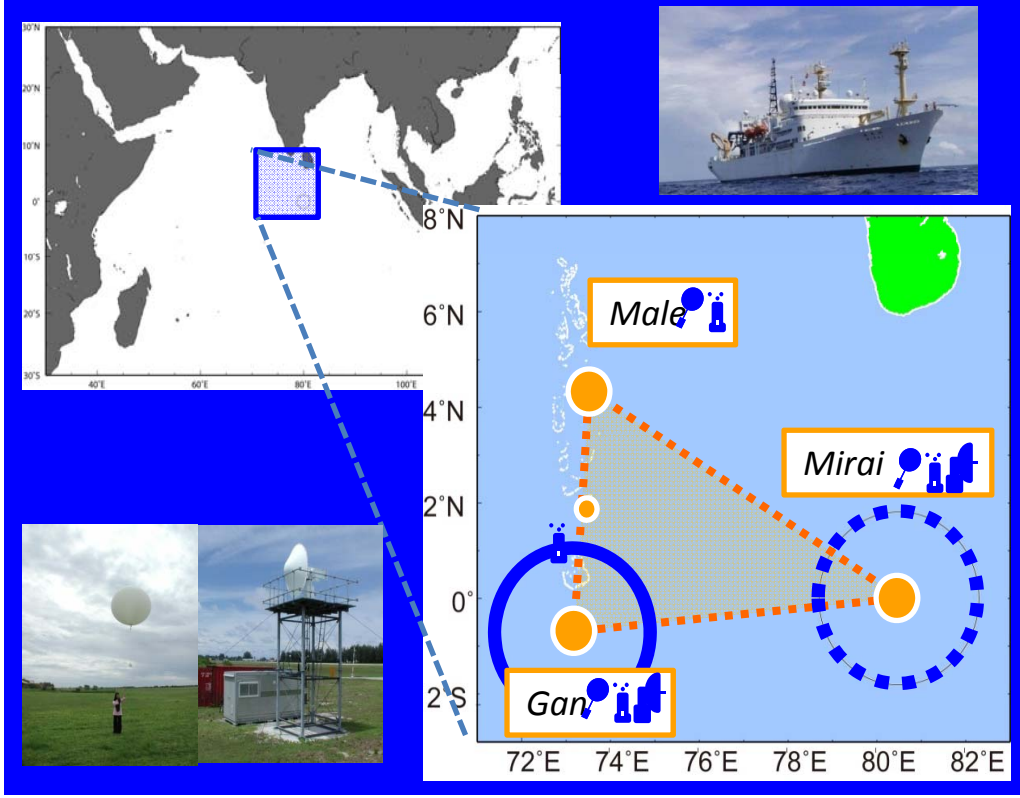
Actually, both say same thing. Exact measurements of "moisture" and "ocean surface" are essential for MJO initiation process study.

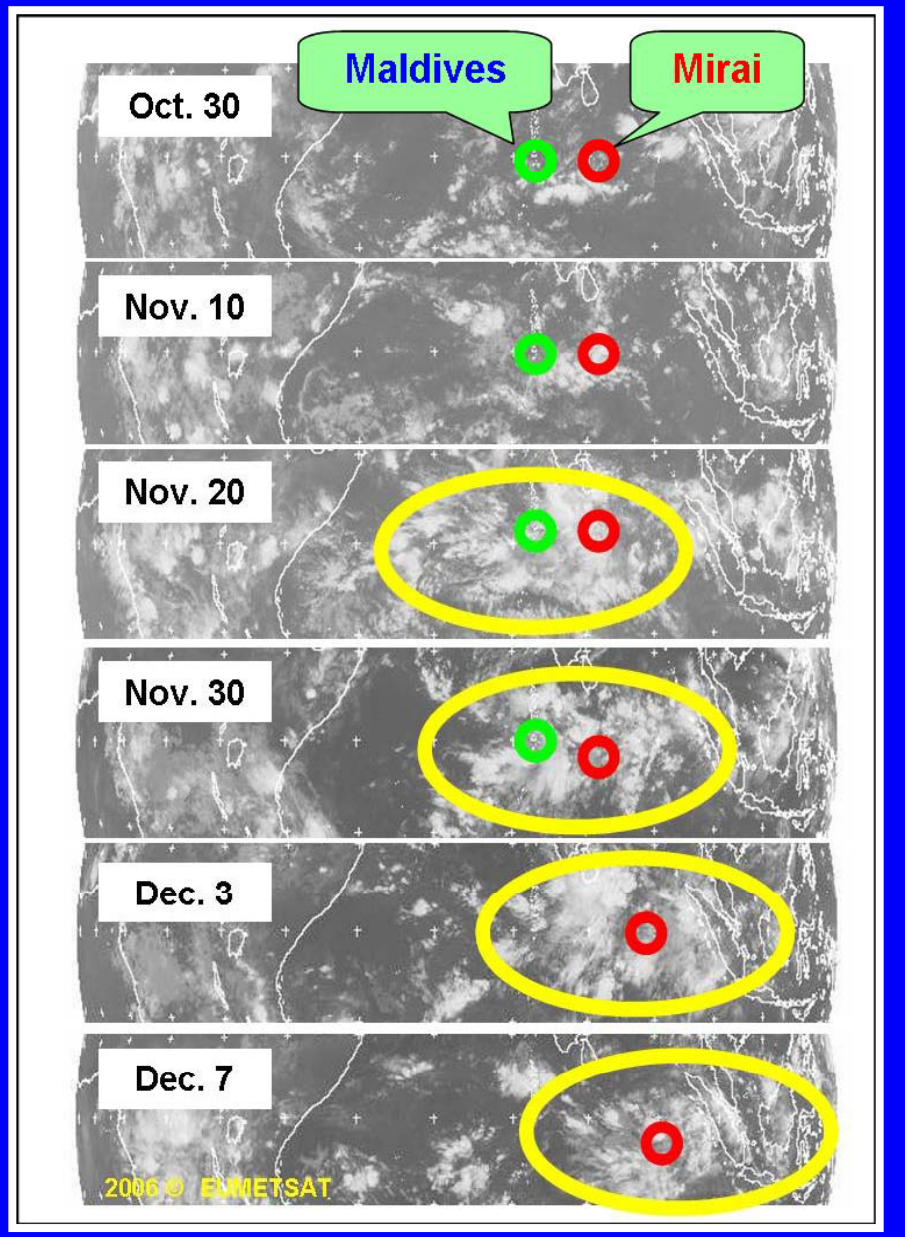
What we learned from MISMO (1/3)

Mirai Indian Ocean cruise for the Study of the MJO-convection Onset

Observation Period on Station:
Oct 24 - Nov 25, 2006 (33 days)

Key Viewpoint :
Testing Discharge-recharge theory (Local vertical process) by in-situ observations



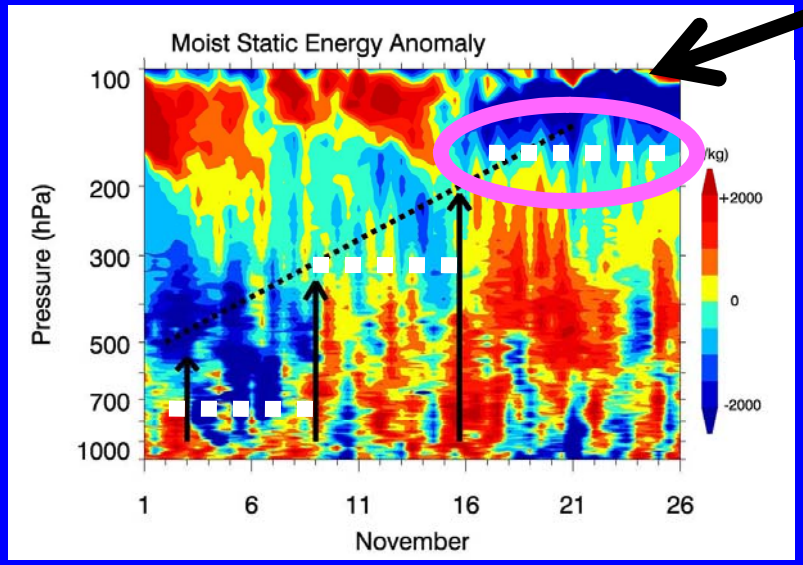


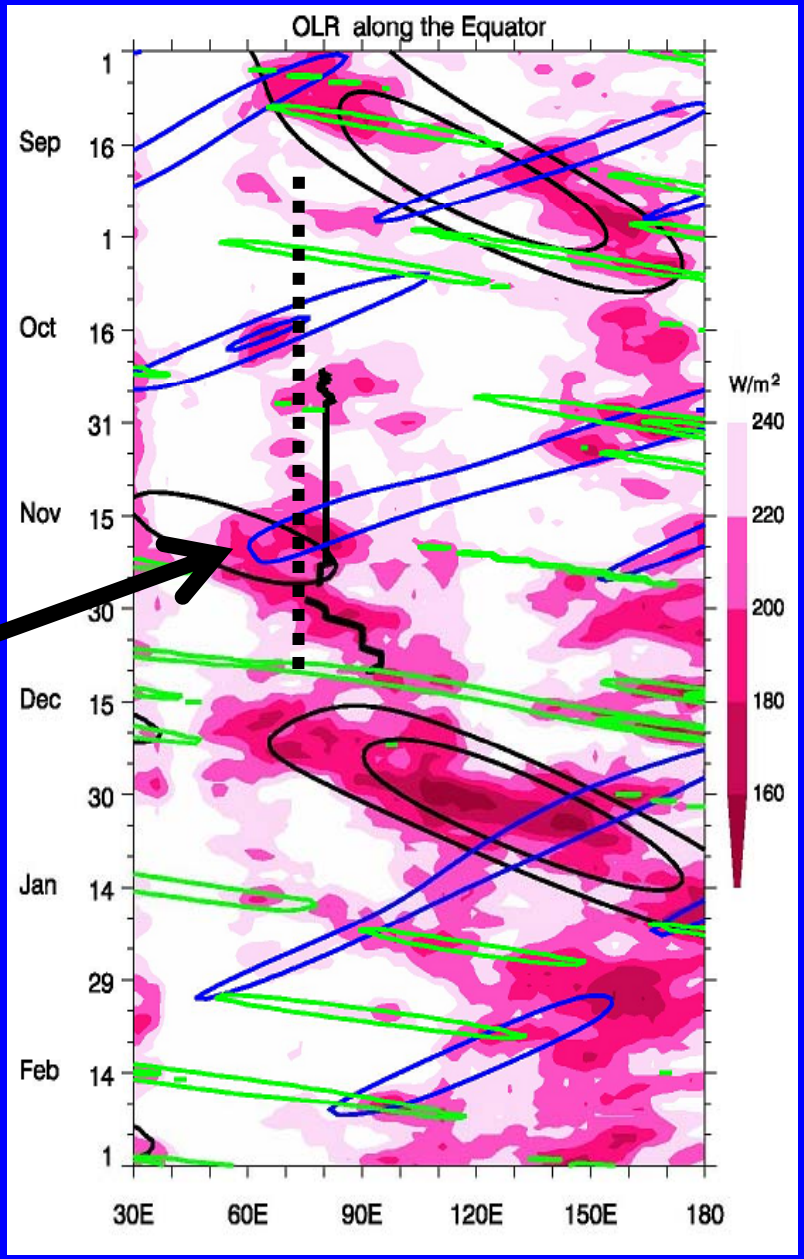
What we learned from MISMO (2/3)

MISMO Observation network captured the onset of (weak) MJO convection, and showed gradual (step-wise) deepening of convection prior to the onset.

However, it also taught us ;

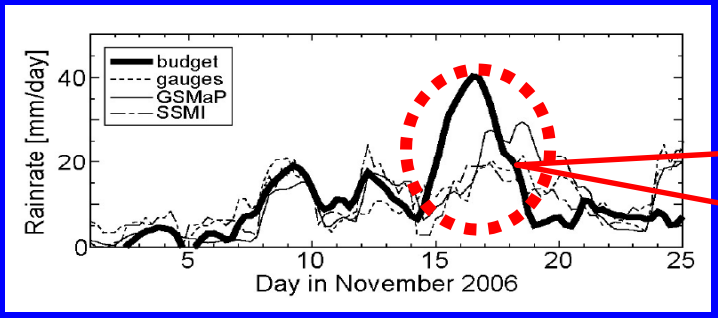
1) One month observation period was insufficient to monitor the initiation process, and
2) We could not argue on the relationship between convection and equatorial waves.





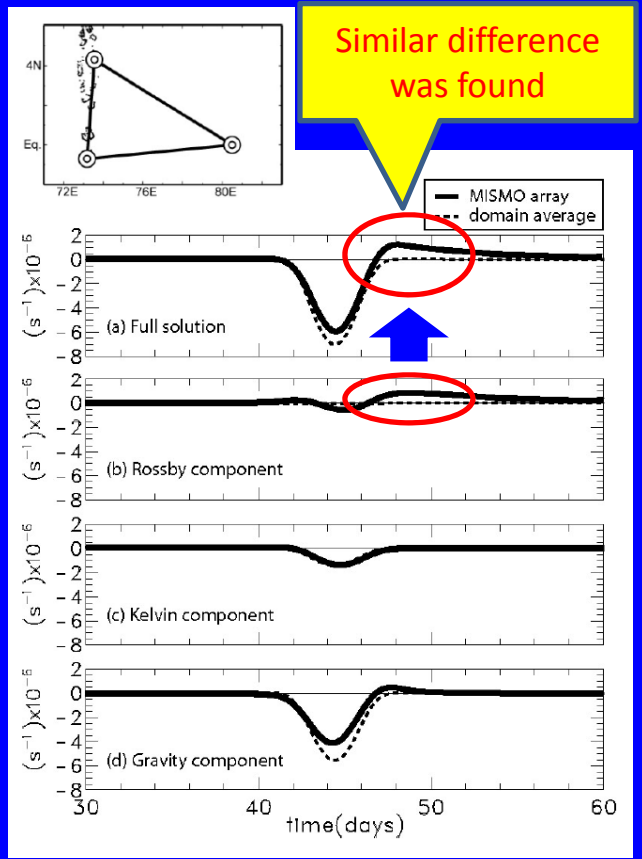
What we learned from MISMO (3/3)

Triangle-shaped Observation Network might not be appropriate to monitor equatorial Rossby wave.

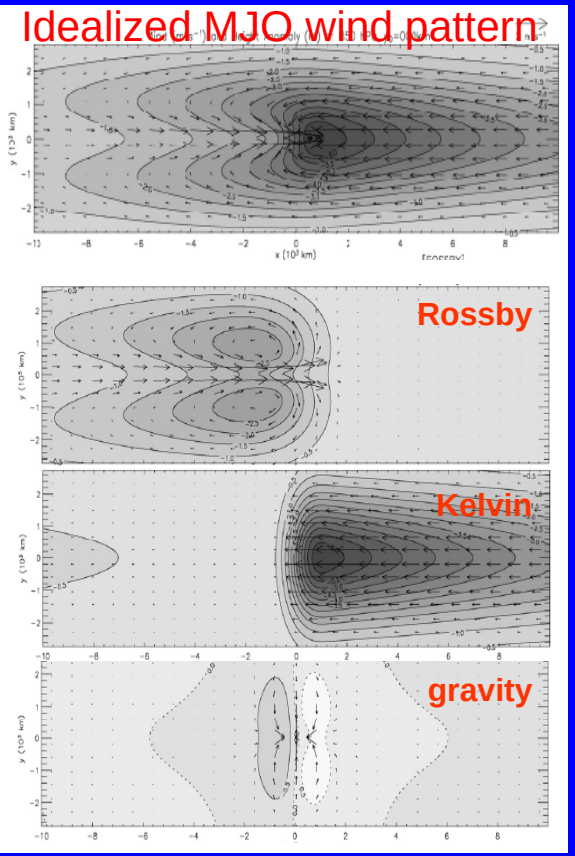


For Budget Analysis of Rain, large discrepancy was found between in-situ observations and satellite data, just after the onset of MJO-convection.

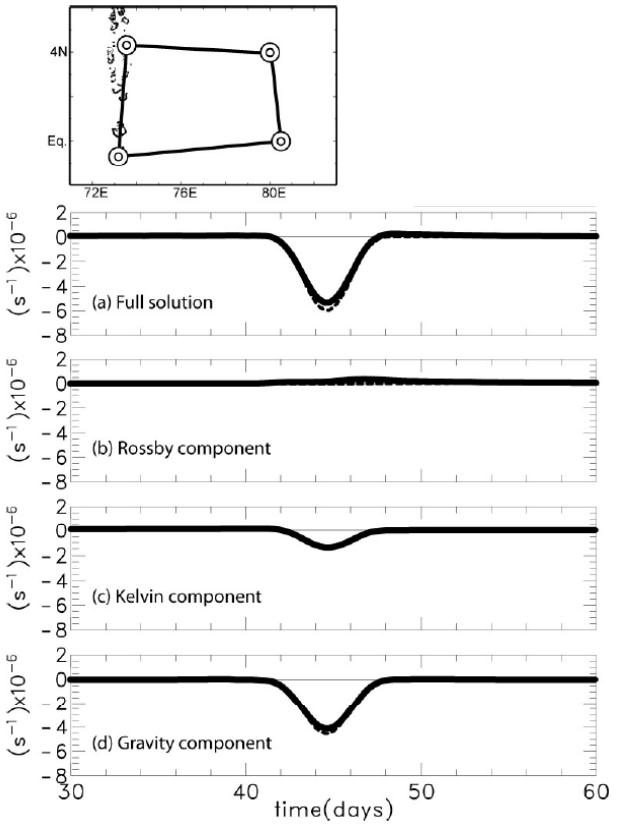
Similar difference was found



Idealized MJO wind pattern



From Schubert & Masarik (2006)



From Katsumata et al. (2010)

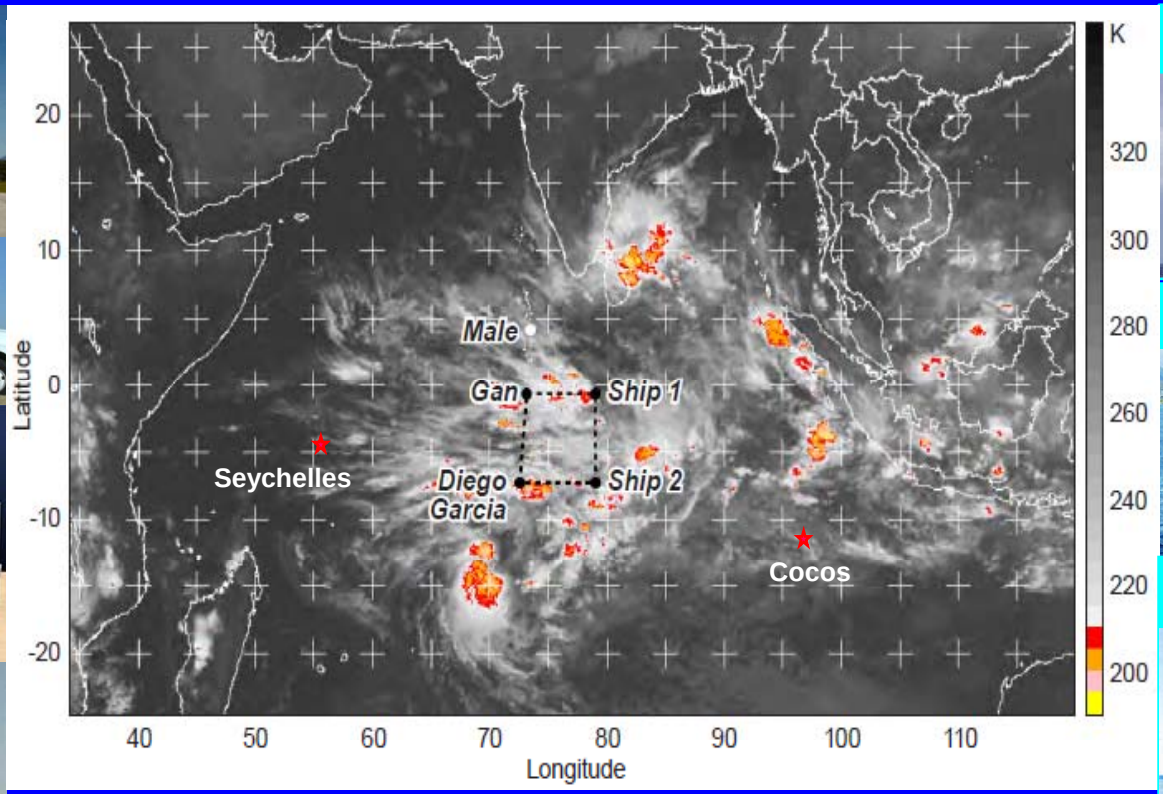
What we should do in CINDY / DYNAMO

A Key for Success of Campaign …

We must get data of "moisture including convective systems" and "ocean surface conditions" by forming an appropriate configuration for an enough period to capture an entire life cycle of MJO convection.

Namely, first priority for field phase is that we will try to form a "quadrilateral" array for an enough observation period "4 months (Oct – Jan)".

Proposed Observation Network for CINDY2011 / DYNAMO



Japan / Mirai

U.S. / Roger Revelle

India / Sagar Kanya

France/Marion Dufresne

Seychelles

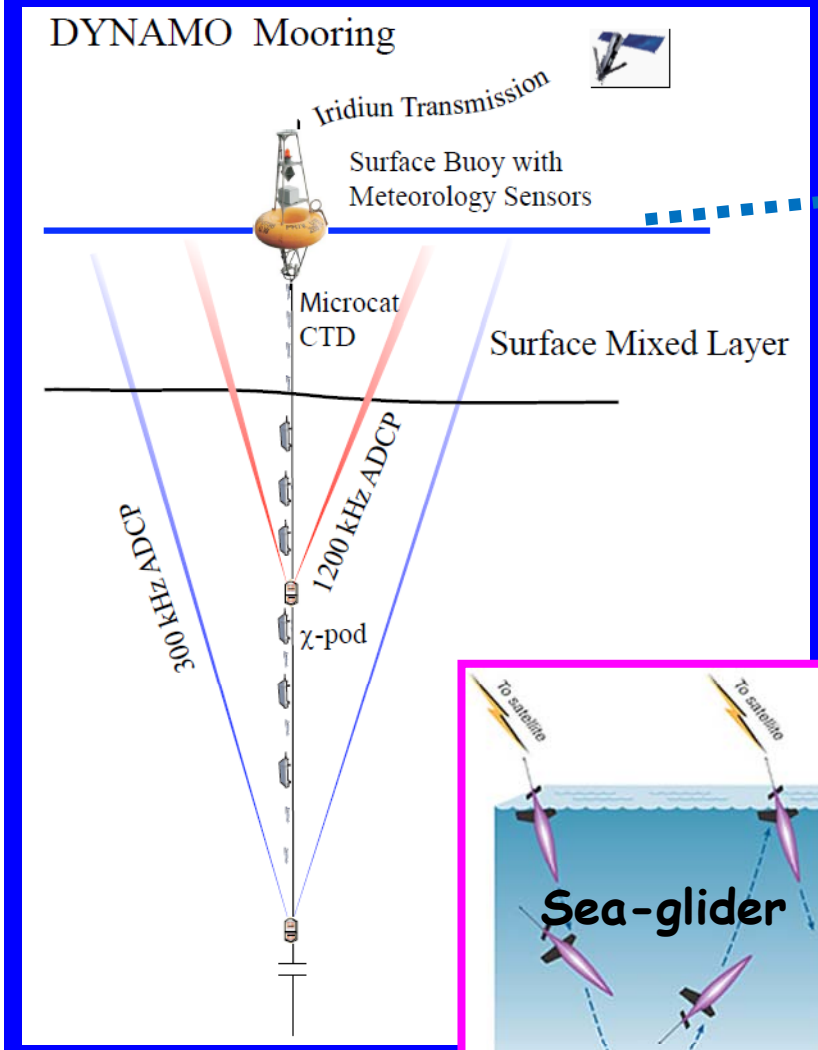
Gan

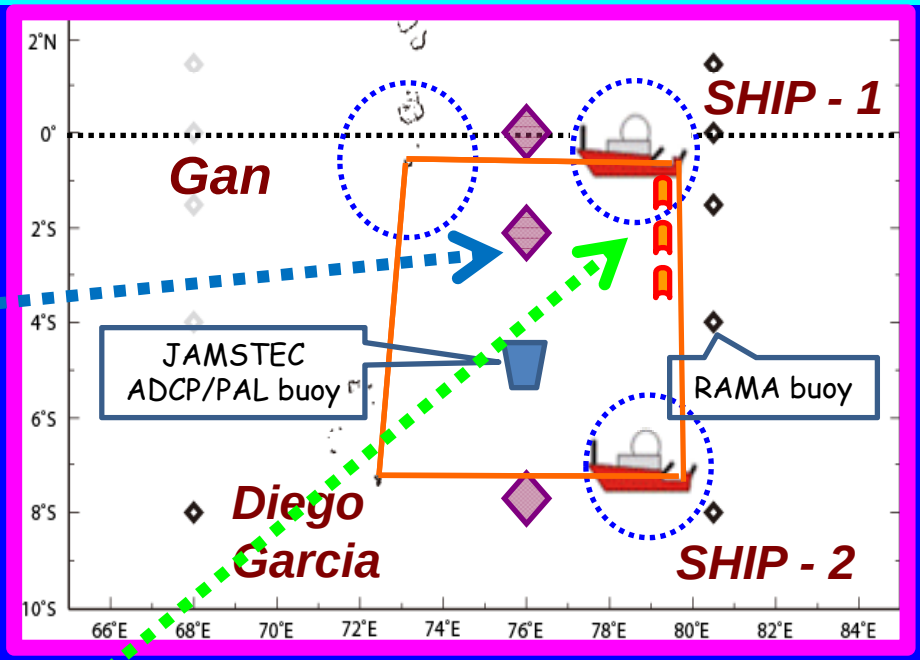
Diego Garcia

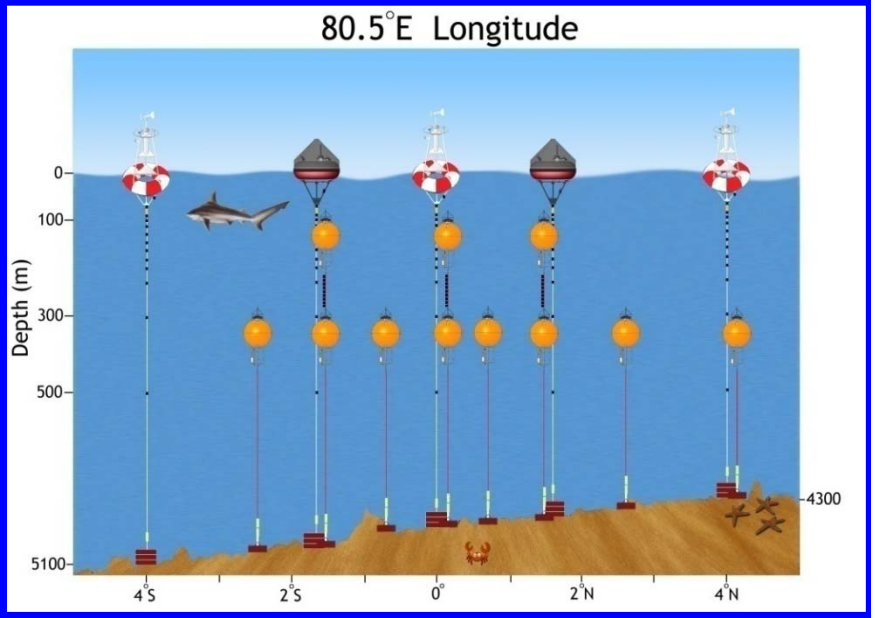
Cocos

Two ship sites at (0, 80E) & (8S, 80E) will be occupied by 3 (or 4) ships with rotation from Oct 2011 through Jan 2012. Radiosonde as well as radar and other atmospheric measurement systems will be deployed at island sites.

CINDY2011/DYNAMO - Proposed Oceanic Buoy Network

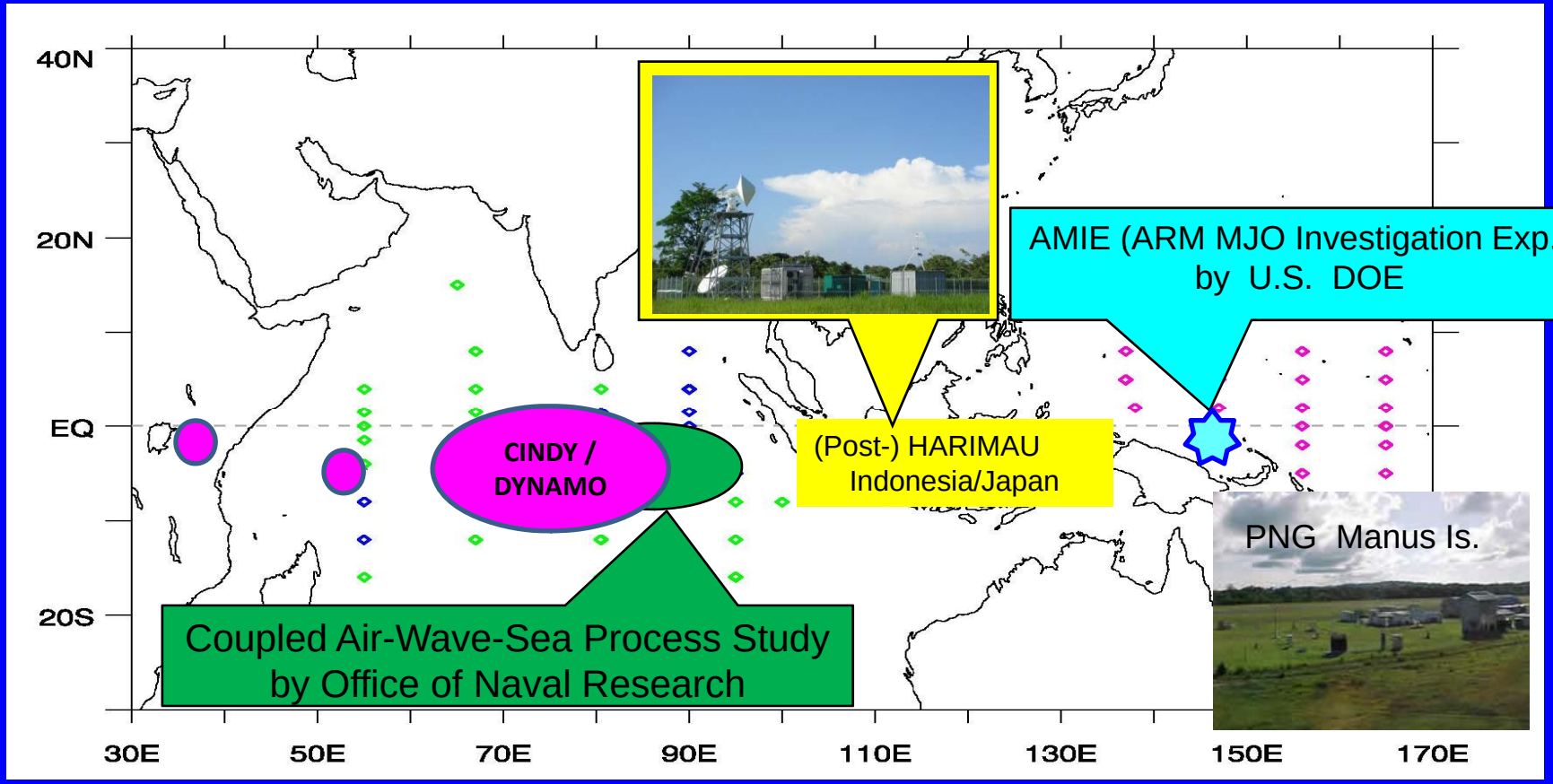






Beyond CINDY2011 / DYNAMO

Other several field campaigns are also planned to take place in correspondence with CINDY/DYNAMO. Collaboration among all campaigns allows us to fully capture the entire life cycle of MJO-convection from Indian Ocean to central Pacific.



Observation Period

Long-term Monitoring by IndOOS (RAMA, Argo, …), Satellites, etc.

6 Mo

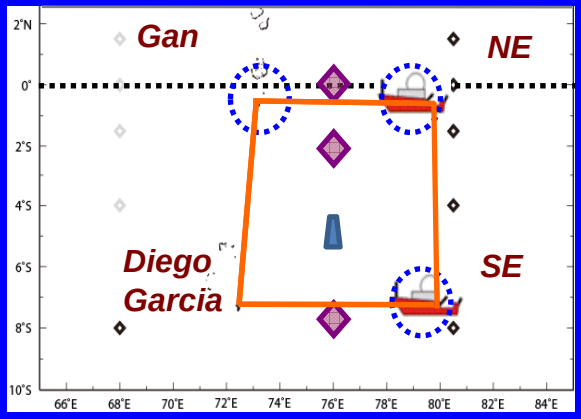
Extended Obs Period
Land-based sites (SMART-R, AMF2, etc.)

4 Mo

Intensive Obs Period
Sounding & Radar array
Ship, Land-based, Buoys, Floats, etc.

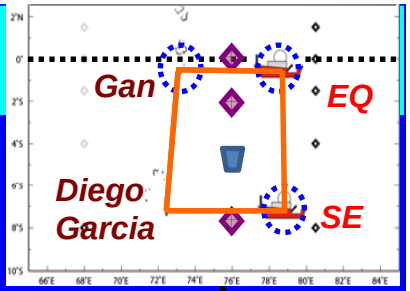
Special Obs Period
Enhanced Sounding & Radar Observations

1.5 – 2 Months



Sep Oct Nov Dec Jan Feb Mar Apr

Ship Rotation Plan - Ver. "0"



OCT | NOV | DEC | JAN

8/30 9/25 9/28 10/30 11/3 11/24 11/27 1/3 1/9 2/3

EQ

US

US

35 days

India

Any ?

9/23 (10/27)(10/28) 12/2 35 days 1/16 2/8

SE

Japan

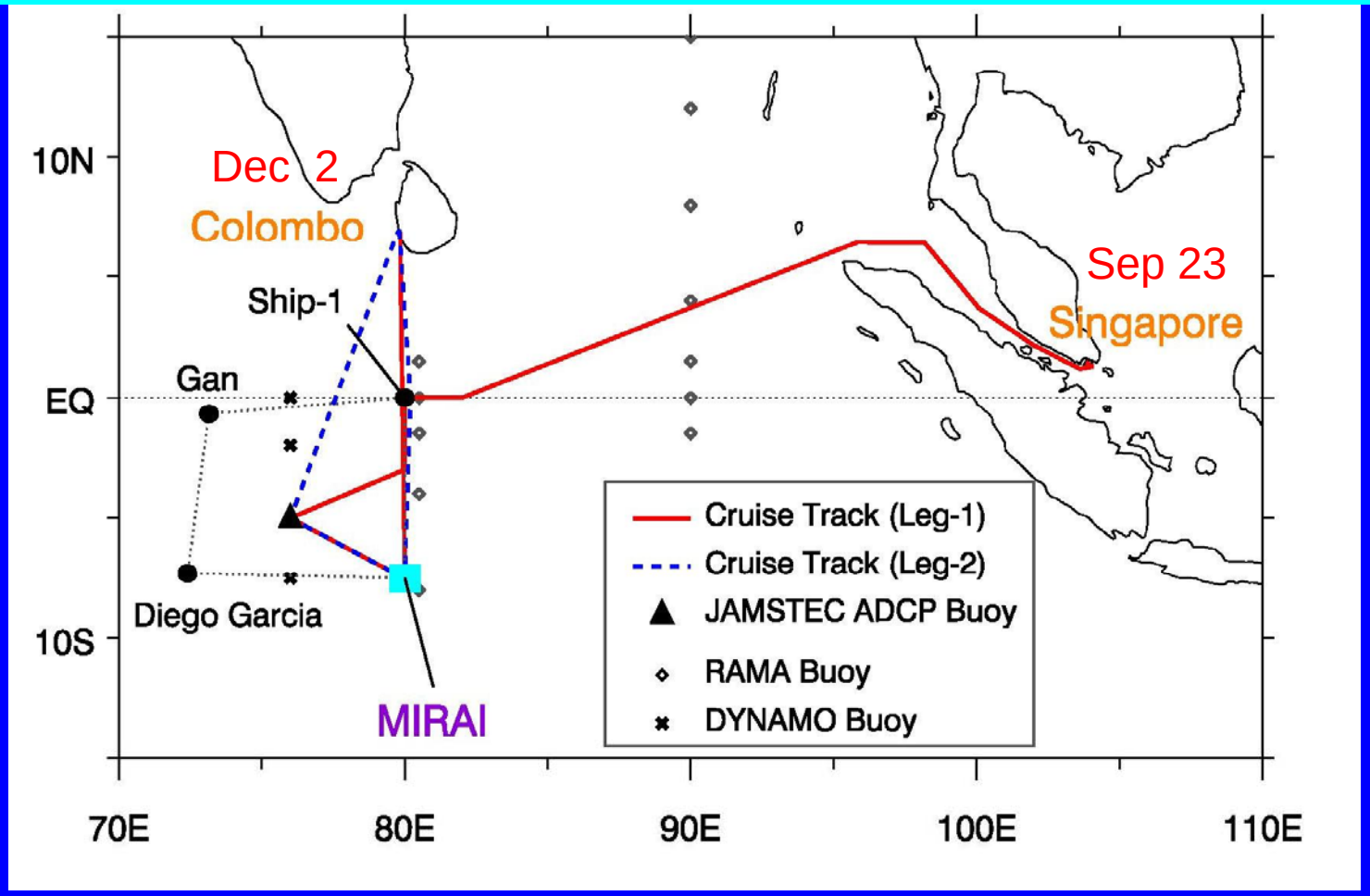
India

France

Japan : Fixed US : preliminary India : submitted France : submitted

Stationary cruise Buoy cruise

R/V MIRAI Cruise Plan



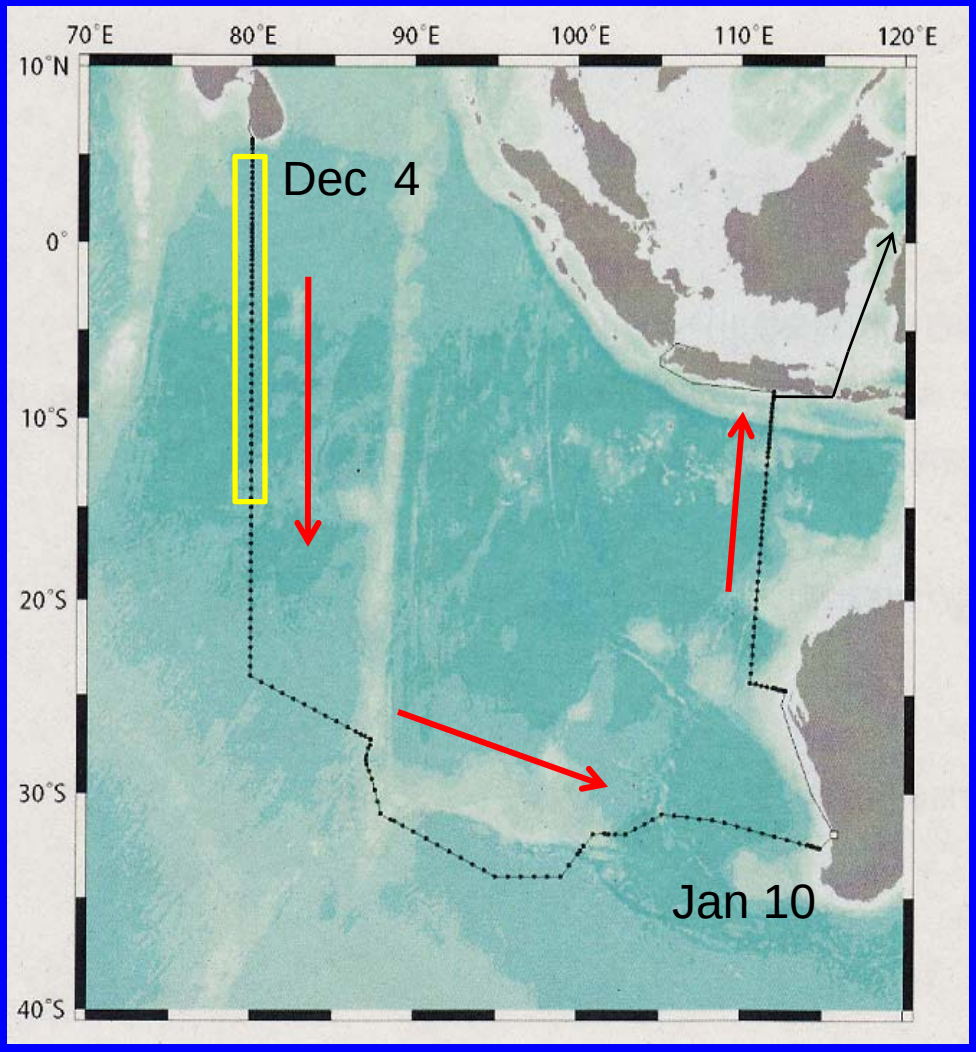
Sep. 23	Lv Singapore	Start of Mirai CINDY Cruise
Sep. 27	Ar (0, 80E)	Start to deploy Sea-gliders
Sep. 29	Ar (5S, 76E)	Deploy ADCP/PAL buoy
Oct. 1	Ar (8S, 80E)	Start Stationary Observation

Call at Colombo (6 days break in October)

Nov. 28	Lv (8S, 80E)	End of Stationary Observation
Nov. 29	Ar (5S, 76E)	Recover ADCP/PAL buoy
Dec. 2	Ar Colombo	End of Mirai CINDY Cruise

Ship time
71 days in total
On station;
53 days in Leg – 1 & 2

Mirai Cruise after CINDY



WOCE-type Repeat Hydrography Cruise

Dec 4	Lv	Colombo
		Leg-1 along 80E
Jan 10	Ar	Fremantle
Jan 11	Lv	Fremantle
		Leg-2
Feb 7	Ar	Hachinohe, Japan

Major Observations :

CTD casting down to the sea bottom with water sampling.

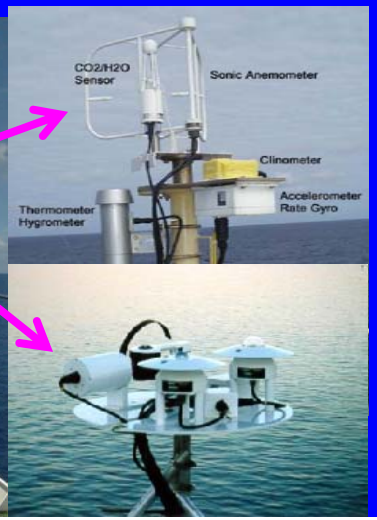
Biogeochemical analyses will be done.

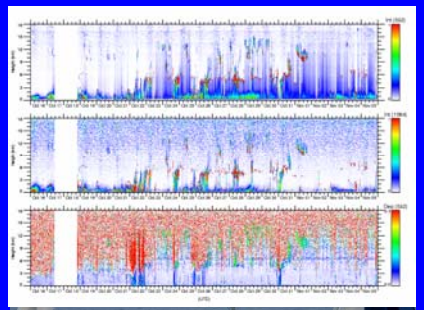
Continuous meteorological measurements (Doppler radar, radiosonde, surface met, etc.) will be carried out during her cruise along 80E. It remains CINDY area about 1-2 weeks.

Atmospheric Observations

* C-band Scanning Doppler Radar (Vol. scan = every 10 min)
* Radiosonde (Vaisala RS92-SGP, every 3 hours for 60-days)
* Surface Meteorology, Turbulent Flux, Solar/IR Radiometer
* Skin-SST (Infrared Radiometer, Sea-snake floating thermistor)
* GPS-derived Precipitable Water Vapor measurement
* Ceilometer
* Disdrometer

* Stable Water / Water Vapor Isotope	(by JAMSTEC)
* Sky Radiometer	(by U. Toyama)
* Multi-axis Differential Optical Absorption Spectroscopy	(by JAMSTEC)
* LIDAR	(by NIES, Japan)
* 95-GHz FMCW Vertical Pointing Cloud Radar	(by Chiba U.)
* Video-sonde	(by Yamaguchi U, 10-15 times)
* Snow-white (or CFH) water vapor sonde	(by Hokkaido U, 10-20 times)





Oceanic Observations

* CTD (every 3 or 6 hours down to 500 m depth)
  with water sampler for biogeochemical analysis (Nutrients, Chl-a, pH)
  with LADCP (by IPRC)
* Micro-structure Profiler
* Shipboard ADCP
* Sea Surface Monitor (T, S, DO, Chl-a)
* Argo (Ascent once per day from 500 m parking depth) x 1
  + standard Argo (10-day cycle, 2000 m parking) x about 5
* Sub-surface ADCP mooring with PAL (Passive Aquatic Listener) at 5S, 76E
* Sea-gliders (EQ, 1.5S, 3S along 80E by UK/UEA group) x 3

Basic Operation during Stationary Observation

23 Z

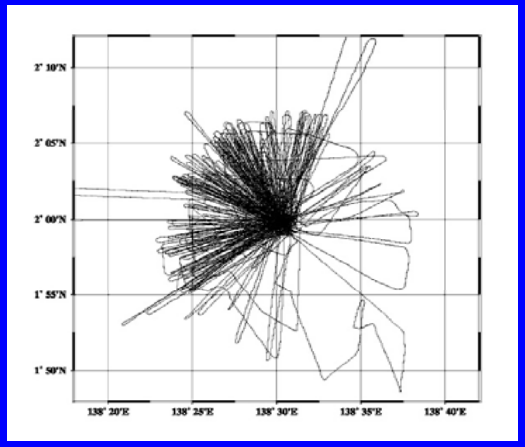
Radiosonde

CTD + LADCP

Microstructure

00 Z

Drifting



01 Z

Cruising upwind for turbulence measurement

02 Z

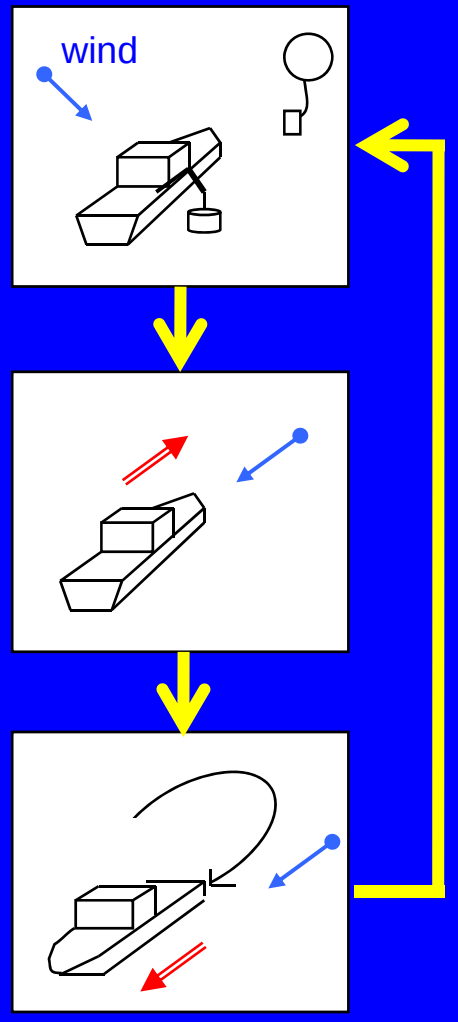
Return to original point

Radiosonde

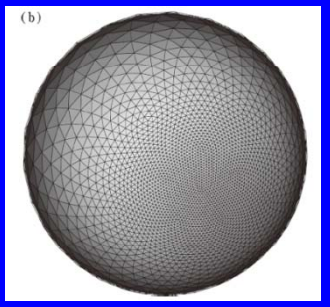
CTD + LADCP

Microstructure

03 Z



Numerical Model Studies in Japan



Forecast

* stretch-NICAM
  1 week forecast using NICAM with stretched icosahedral grid
* CReSS (Cloud Resolving Storm Simulator) by Nagoya Univ.
* MRI-NHM (Meteorological Research Institute - Non Hydrostatic Model)

Simulation / Hindcast

* "NICAM" Global Cloud Resolving Model (7 / 14 km run)
  http://nicam.jp/hiki/
* WRF-based Regional Model by Kyoto Univ.

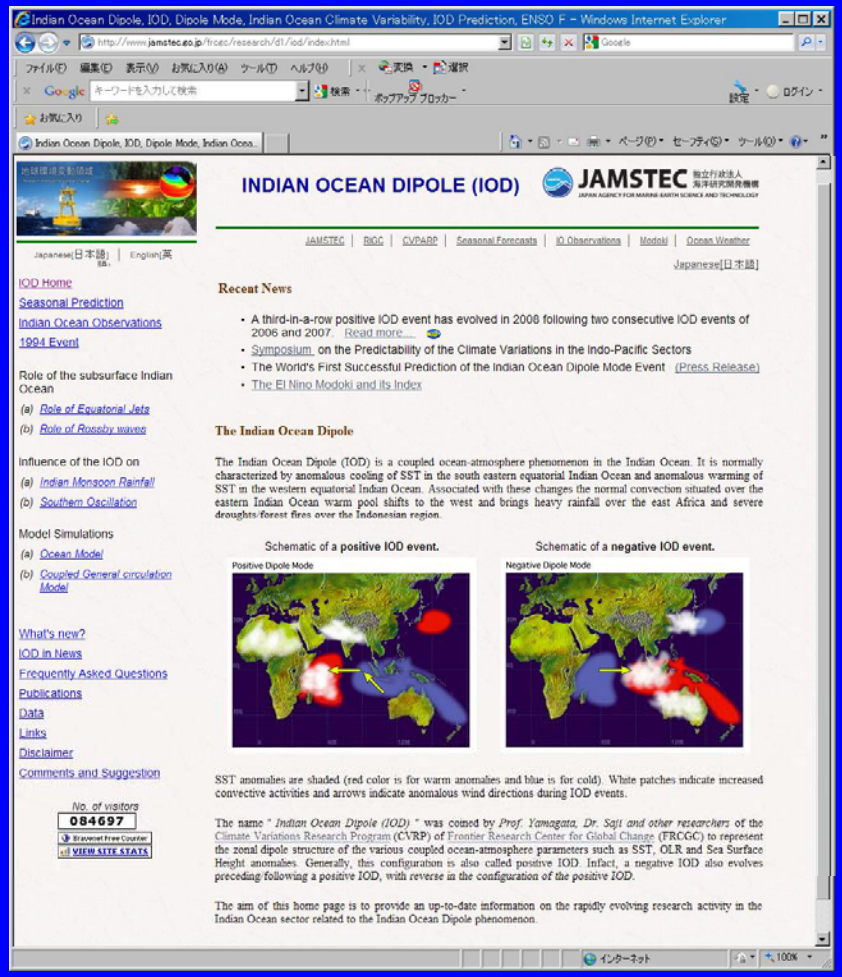
Reanalysis

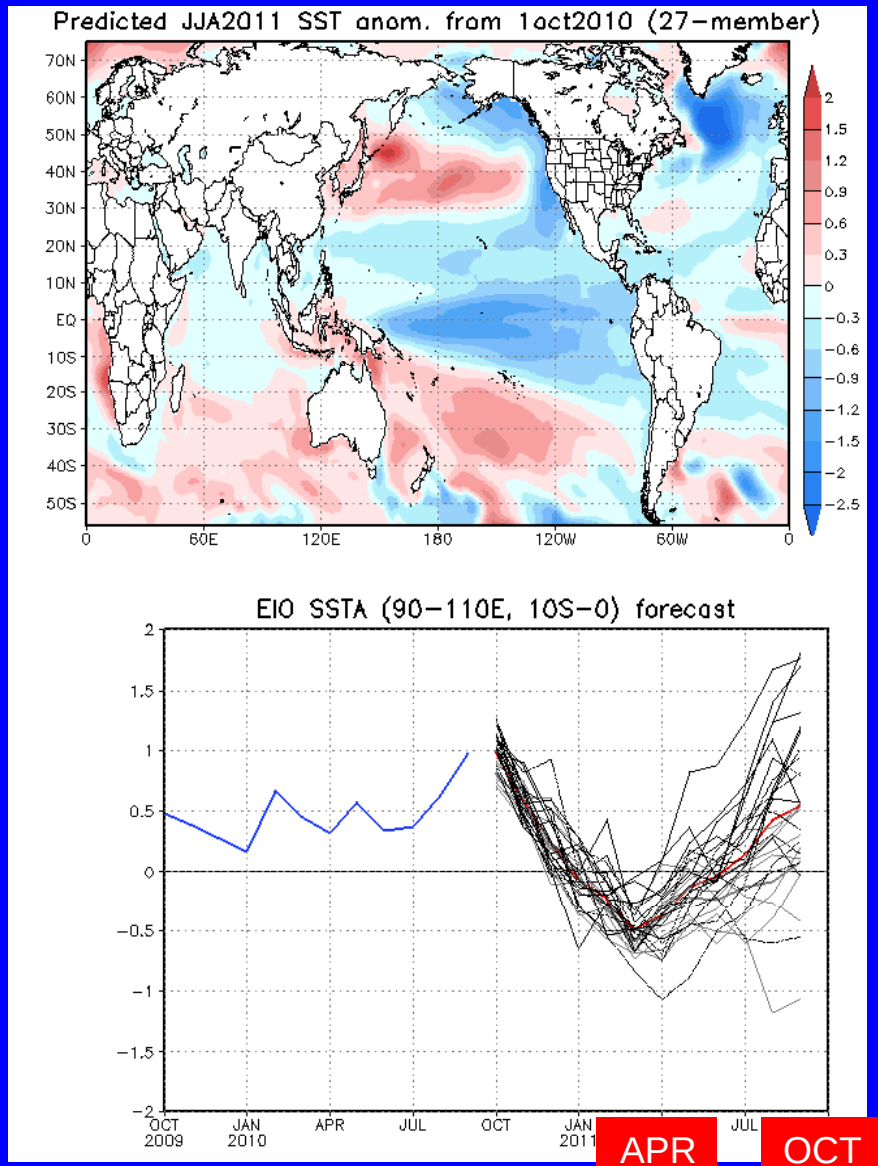
* ALERA (AFES LETKF Experimental Ensemble Reanalysis)
  http://www.jamstec.go.jp/esc/afes/alera/

SINTEX - F (Scale Interaction Experiment - FRCGC)

Global Ocean-Atmosphere Fully Coupled GCM

SINTEX-F conducts ENSO and IOD forecast.
At present, the most reliable forecast of IOD
ex. Luo et al. (2008, GRL)

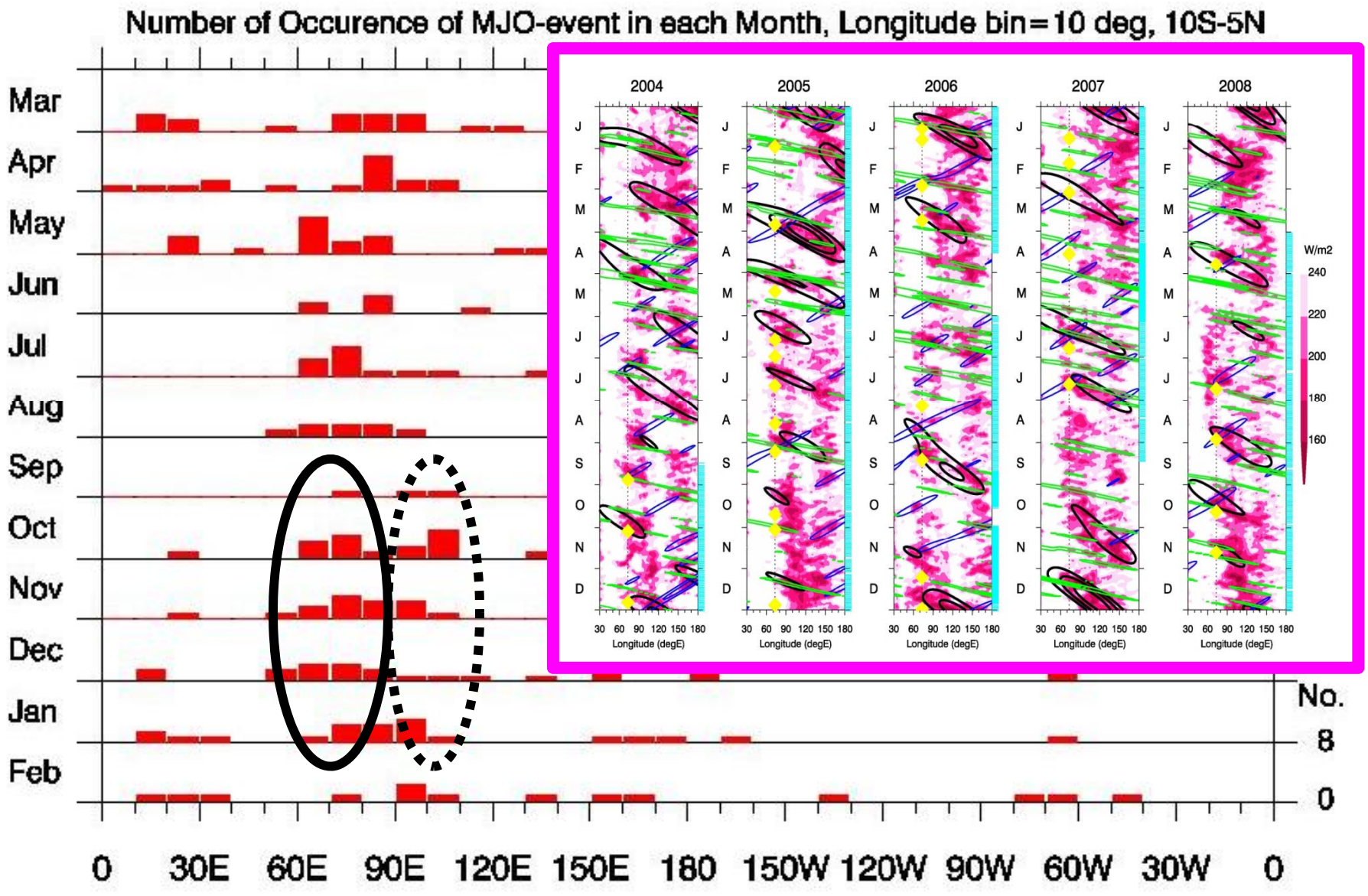




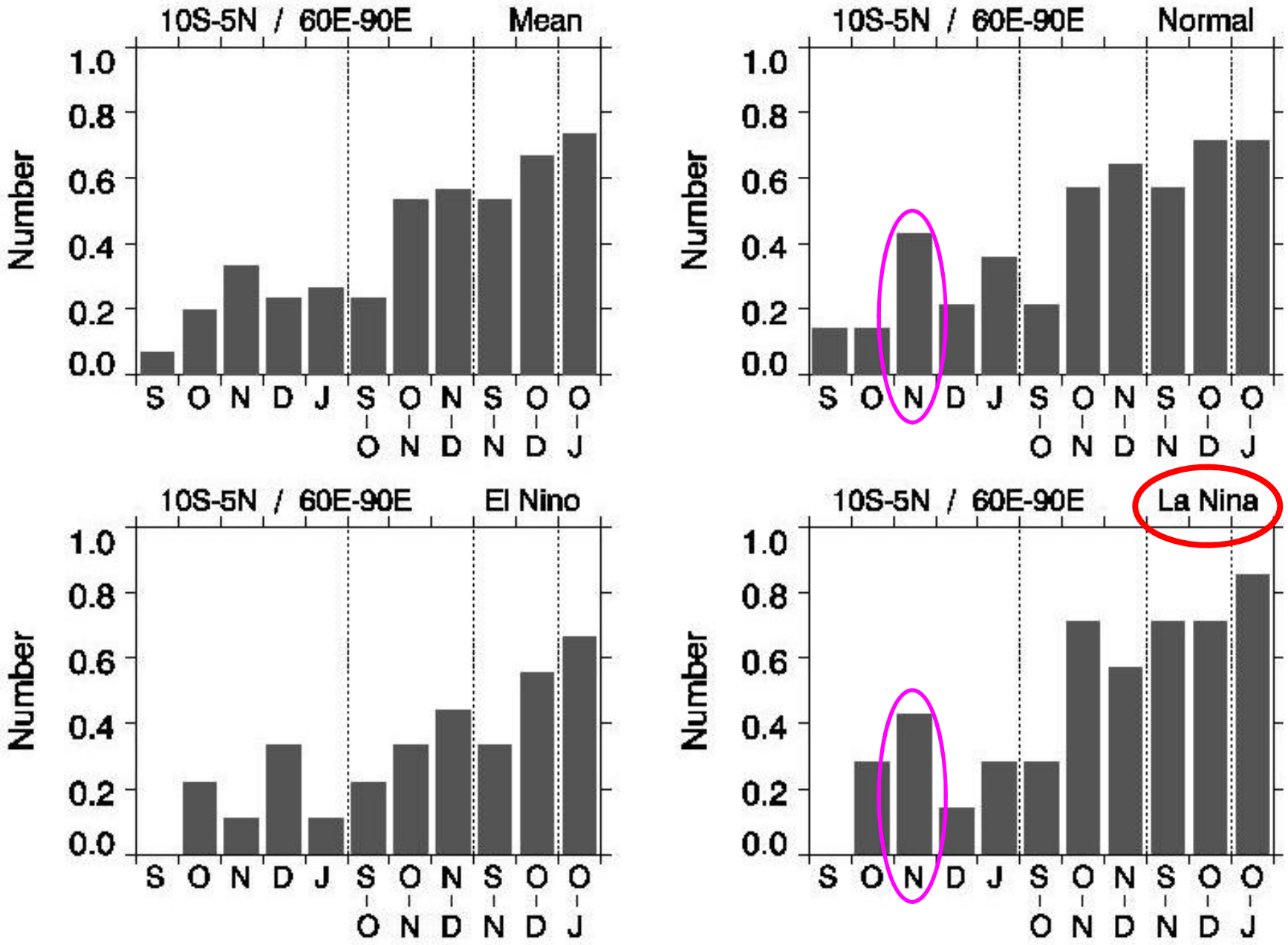
http://www.jamstec.go.jp/frcgc/research/d1/iod/index.html

Courtesy: Dr. Luo / JAMSTEC

No. of MJO event Occurrence (1979 - 2008)



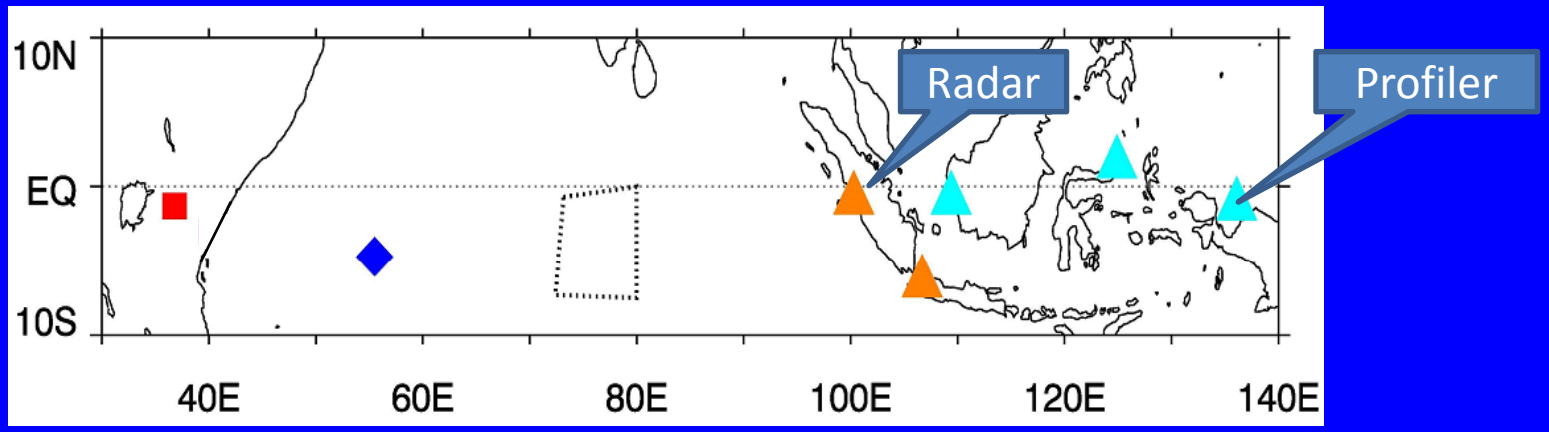
Possibility of Capturing MJO in IO in different ENSO phase



Current Status in Relevant Countries (1/2)

Indonesia

Radar network deployed in the Indonesia maritime continent (as a part of HARIMAU project) will be operated during the campaign, and those data will be available from BPPT to CINDY community. In addition, one month intensive observation in Indonesia is also planned by JAMSTEC and BPPT.



Seychelles

Routine radiosonde sounding is done once per day (00Z). Enhanced sounding will be conducted during the campaign; 4 times/day (Nov), 2-times/day (Oct, Dec-Jan)

Kenya

Kenya Met Department currently conducts routine radiosonde sounding once per day (00Z). During the campaign, twice daily launch is expected. JAMSTEC researchers will visit Kenya Met Dept next February to discuss this possibility.

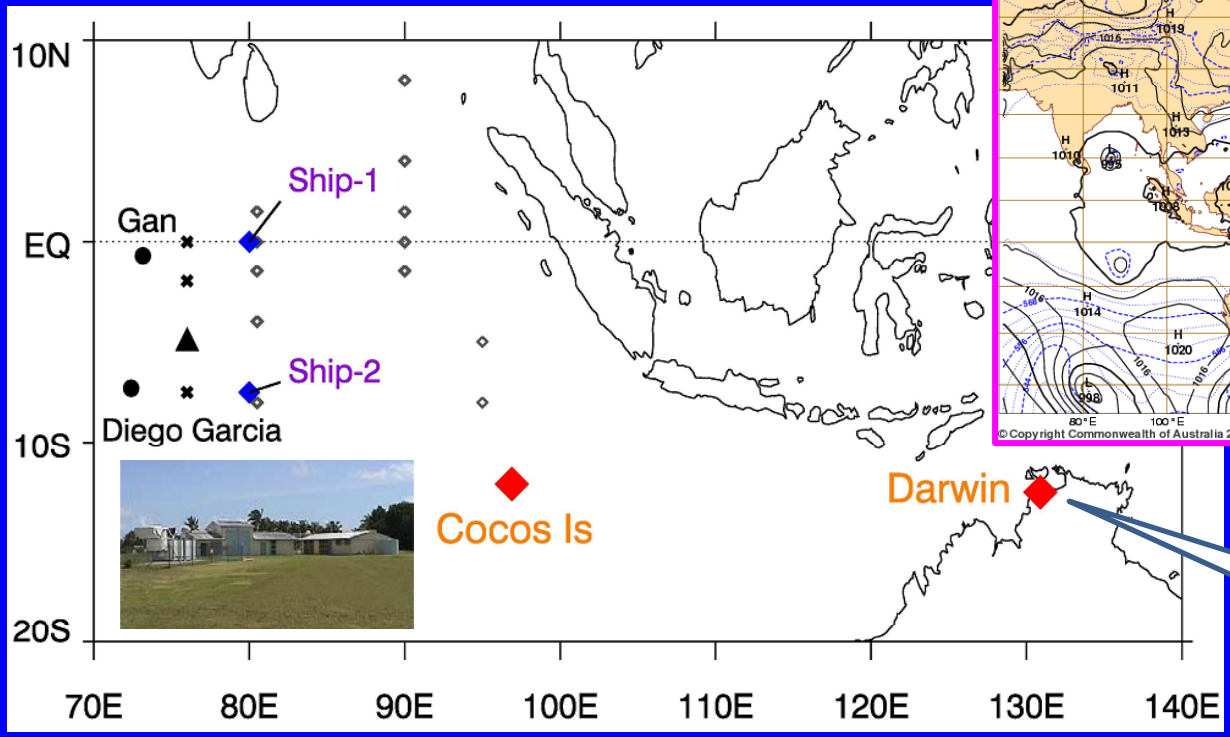
Current Status in Relevant Countries (2/2)

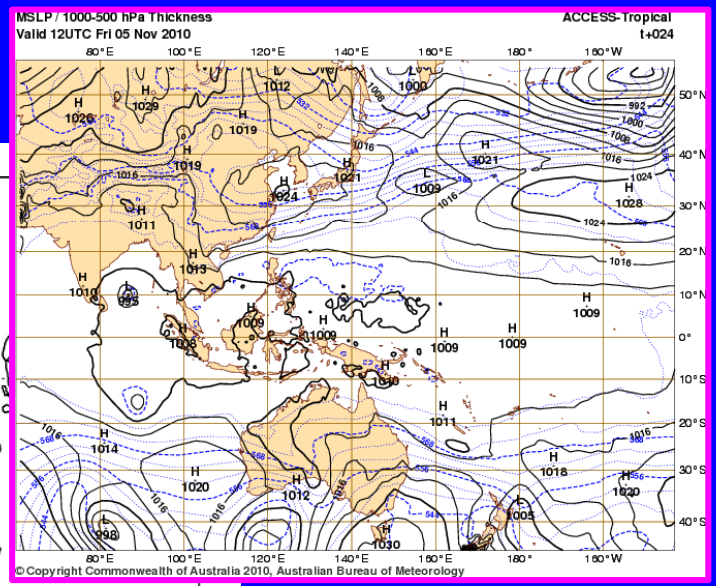
Australia

Radiosonde Sounding at Cocos Island (00 Z) and Darwin (00/12 Z).
No enhancement to 4 times / day, but Raw (high resolution) data will be possible.

Provision of High-resolution NWP product will be available. (verbal commitment)

Point of Contact : Matt Wheeler (CAWCR)





Relation to ARM site?

Current Status as of Nov 5, 2010

Japan	R/V Mirai schedule is approved. (71-day ship time from Singapore/Sep 23 to Colombo/Dec 2)
US	NSF approved DYNAMO. (But, individual proposals are under review.) DOE approved Gan Island Observation from Oct 2011 to Mar 2012.
India	Proposals for 2 cruises by R/V Sagar Kanya have been submitted. Decision will be made by Dec 2011 (or later?).
France	R/V Marion Dufresne is now under review (decided by Jan-Feb 2011) Proposal of aircraft observation has been submitted as a part of Megha-Tropiques cal/val project.
UK	Proposal for Sea-glider observations is under review. (result will be known by Dec 2010)

Enhanced radiosonde sounding are scheduled at the following countries ;
Seychelles, Kenya, Indonesia, etc.

Other participants ???