

Overview of Tropical buoy array

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** Global Ocean-Climate Observations Climate Program,
NOAA

Out Line

1. **Tropical Buoy Array in Global Ocean Observing System**
2. **Data System of Tropical Buoy Array**
3. **Role of Tropical Buoy Array
- Research and Societal Benefit –**
4. **Way forward**

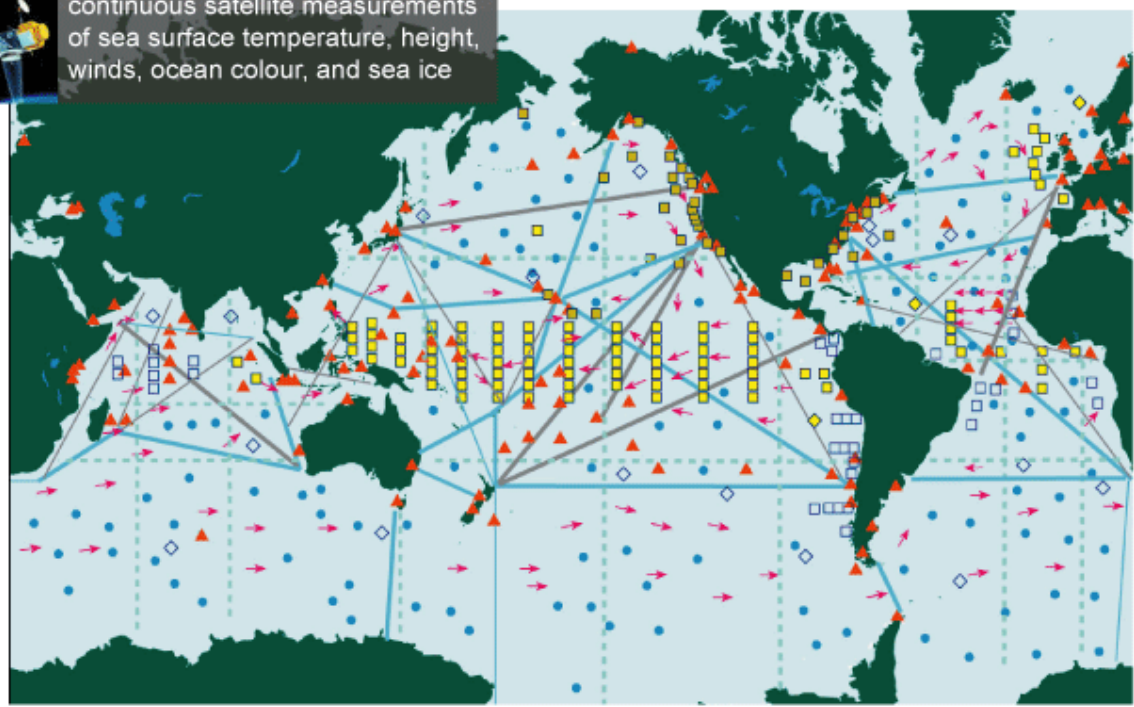
Initial Global Ocean Observing System for Climate

Status against the GCOS Implementation Plan and JCOMM targets

continuous satellite measurements of sea surface temperature, height, winds, ocean colour, and sea ice

Total *in situ* networks **65%**

March 2012



87% Surface measurements from volunteer ships (VOSclim)
200 ships in pilot project



100% Global drifting surface buoy array
5° resolution array: 1250 floats



62% Tide gauge network (GCOS subset of GLOSS core network)
170 real-time reporting gauges



81% XBT sub-surface temperature section network
51 lines occupied



100% Argo profiling float network
3° resolution array: 3000 floats



43% Repeat hydrography and carbon inventory
Full ocean survey in 10 years

Reference time series **24%**
58 sites



48% Global reference mooring network
29 moorings planned



79% Global tropical moored buoy network
119 moorings planned

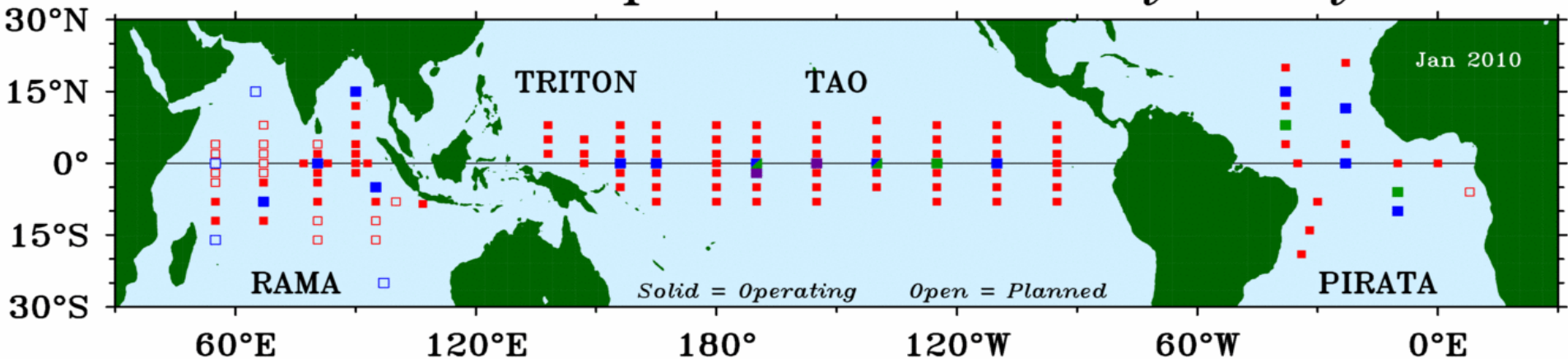


- A total of 8483 *in situ* platforms are maintained globally.
- Of these, 4207 are supported by NOAA.

1. Tropical Buoy Array in Global Ocean Observing System

- Equatorial buoy network -

Global Tropical Moored Buoy Array



■ Standard Mooring ■ Flux Reference Site ■ Flux and CO₂ Enhanced ■ CO₂ Enhanced ■ CO₂ and Bio-Chem Enhanced

TAO Project Office, NOAA/PMEL

Indian Ocean

RAMA array

Research Moored **A**rray
for African-Asian-
Australian **M**onsoon
Analysis and Prediction

Pacific Ocean

TAO/TRITON Array

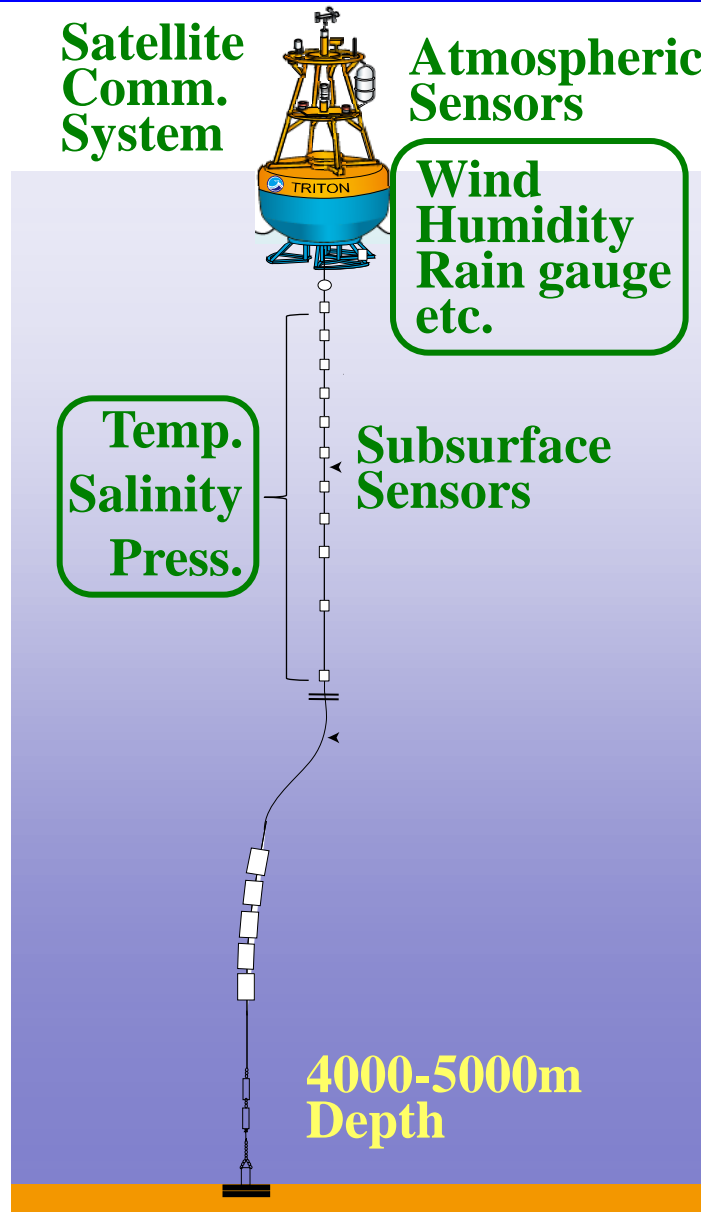
Pilot **R**esearch Moored
Array in the **T**ropical
Atlantic
→ **P**rediction and
Research Moored
Array in the Atlantic

Atlantic Ocean

PIRATA Array

1. Tropical Buoy Array in Global Ocean Observing System

- Moored Buoy Observing System -



Buoy deployment Operation



**Mooring Buoy operation;
requires man-power & ship-time**

2. Data System of Tropical Buoy Array

Tropical Atmosphere Ocean project

Home Project overview **Data display and delivery** El Niño & La Niña Site Map

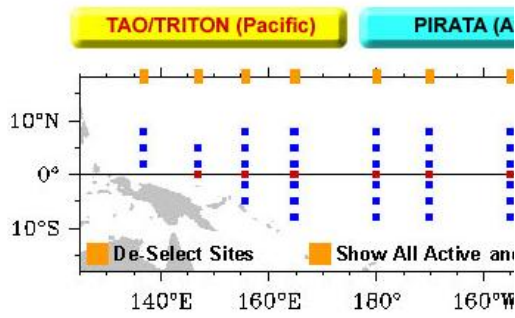
T.A.O. Data display and delivery Find

TRITON Web
 Triangle Trans Ocean Buoy Network
 The mooring array in the tropical western Pacific and eastern Indian Ocean
 TRITON buoys have been deployed since 1998



Data Delivery · Sitemap
 Time Series · Section · TS Diagram · Availability

To select mooring sites, click orange boxes to select line which sites are selected. Solid squares show where all squares show where some are available. Empty squares do not use the **Back Button** in your browser frame. You page. You may want to [resize your browser](#) Mac



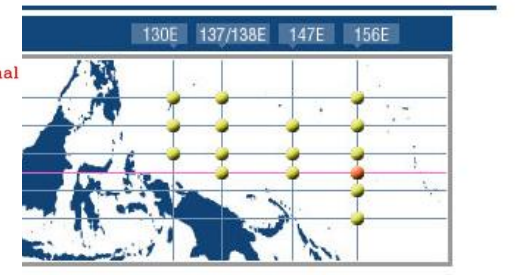
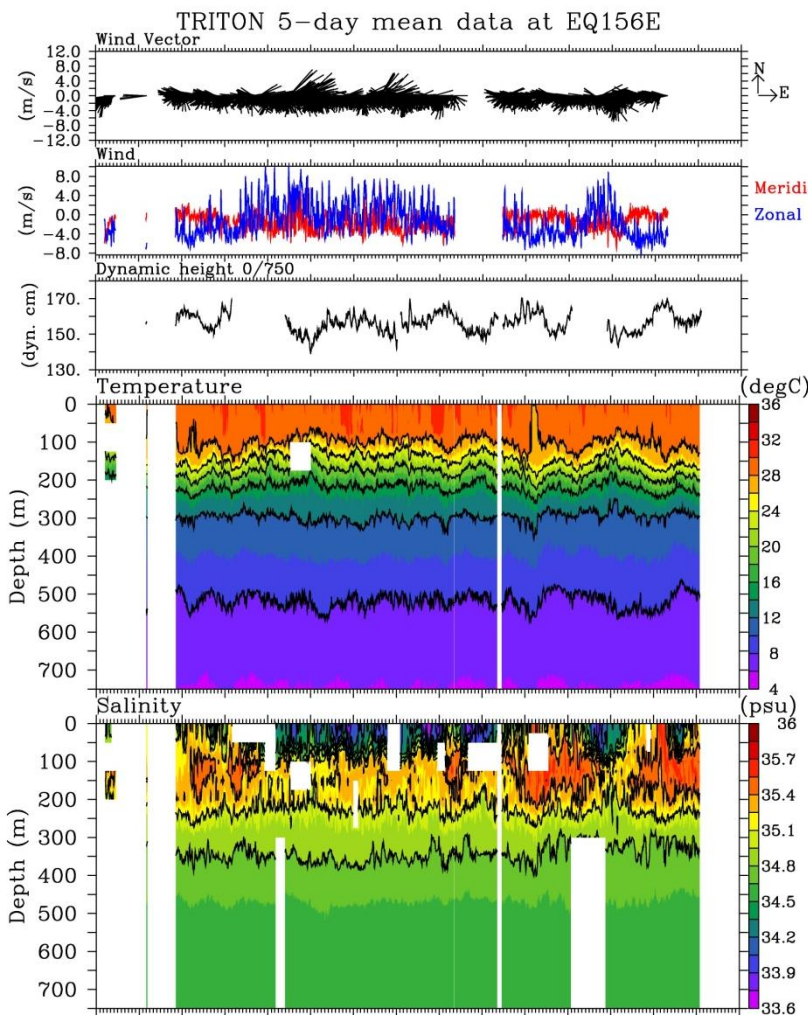
- Time Series Profiles Time Secti
- One Variable One Site
- SW Rad
 - LW Rad
 - Rain
 - Wspd
 - Uwnd
 - Air T
 - SLP
 - SST
 - T(z)
 - SSS
 - Dyn Ht
 - 20C
 - Ucur
 - Vcur
 - Cur Vec

1979 JAN 20 2012 M

files by site ASCII

Definitions Availability Clear

[Problems?](#) [Hints on Usage](#) [JAVA Version](#) [Comments or](#)
 Mac OS X Users: [Safari is the recomme](#)



Monthly

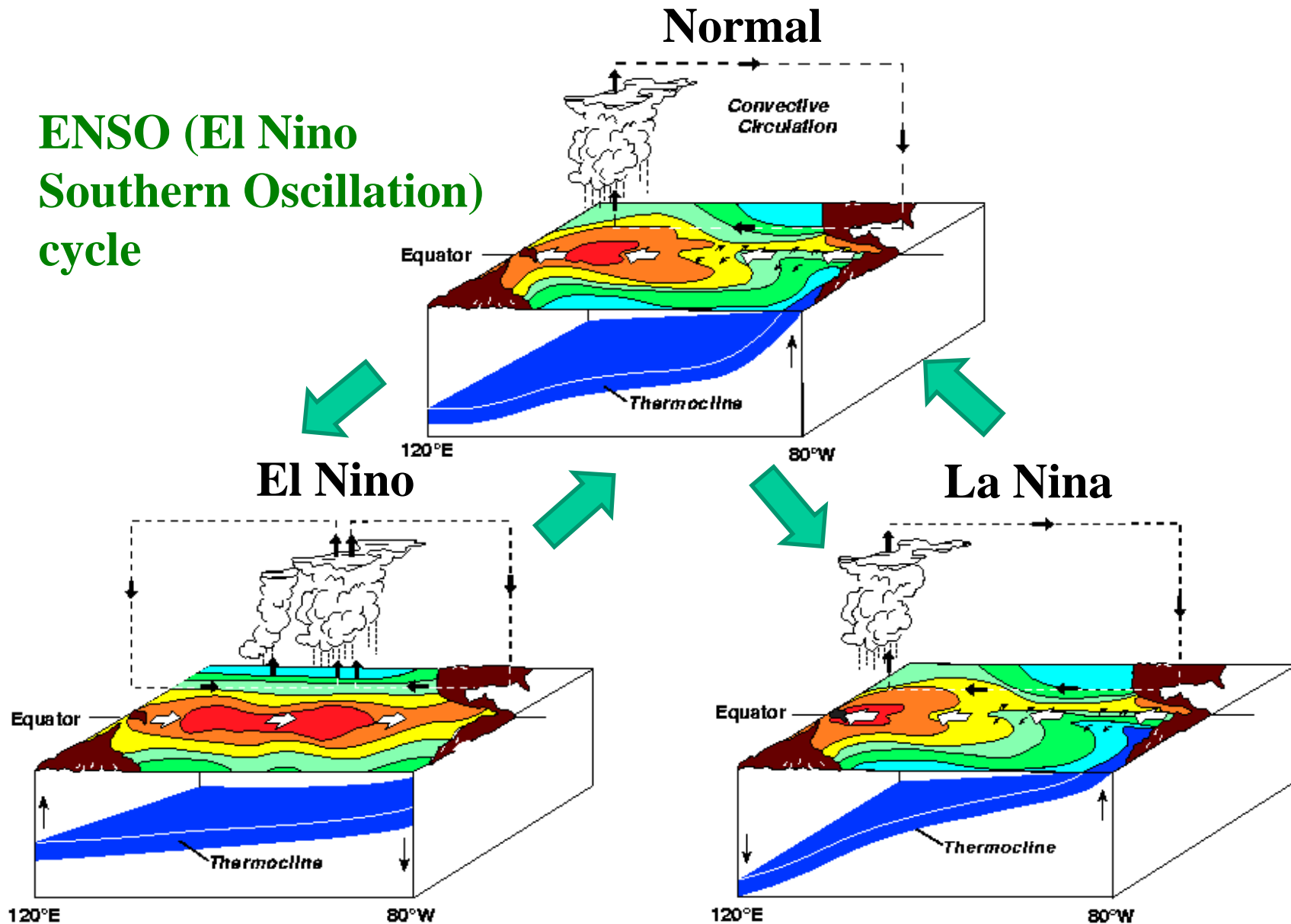
- def. def.

plt

3. Role of Tropical Buoy Array

- El Nino/La Nina Conditions -

ENSO (El Nino
Southern Oscillation)
cycle



3. Role of Tropical Buoy Array

- ENSO vs. Fisheries -

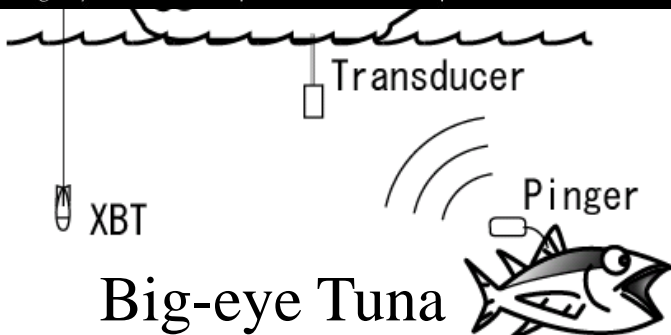
Ex. 1: Habitat of Big-eye Tuna in oceanic structure (eastern TP)

Ex.2: Fishing ground migration of Skipjack Tuna with ENSO

BIGEYE TUNA (*Thunnus obesus*)



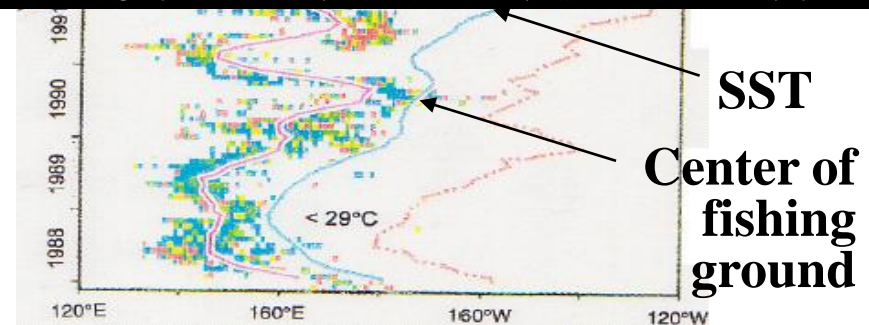
Paintings by G. Mattson reproduced from Joseph, J., Klawe, W. & Murphy, P. 1988



SKIPJACK TUNA (*Katsuwonus pelamis*)



Paintings by G. Mattson reproduced from Joseph, J., Klawe, W. & Murphy, P. 1988

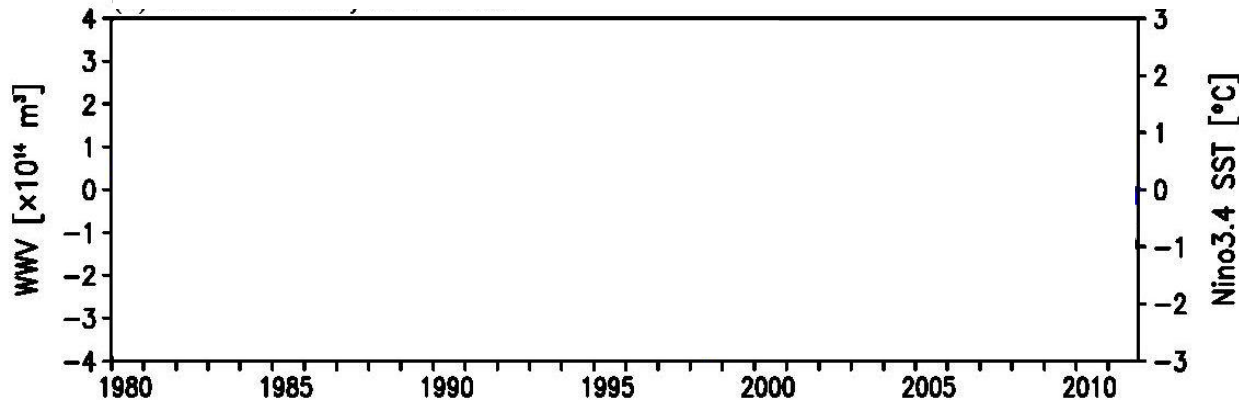


Lehodey, et al. (1997)

3. Role of Tropical Buoy

- Precursor of El Niño; Warm Water Volume on Equator -

Warm Water Volume (5N-5S, 120E-80W) and NiNO 3.4 SST Anomaly

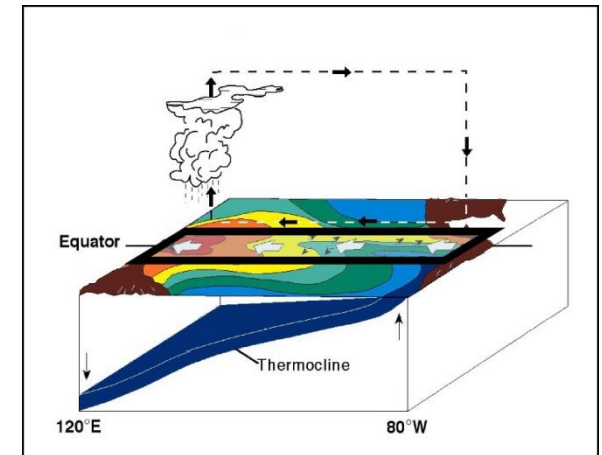


Warm Water Volume (WWV): An Index for Upper Ocean Heat Content

Meinen & McPhaden, 2000

WWV

SST



- Build up of excess heat content along equator is a necessary precondition for El Niño to occur.

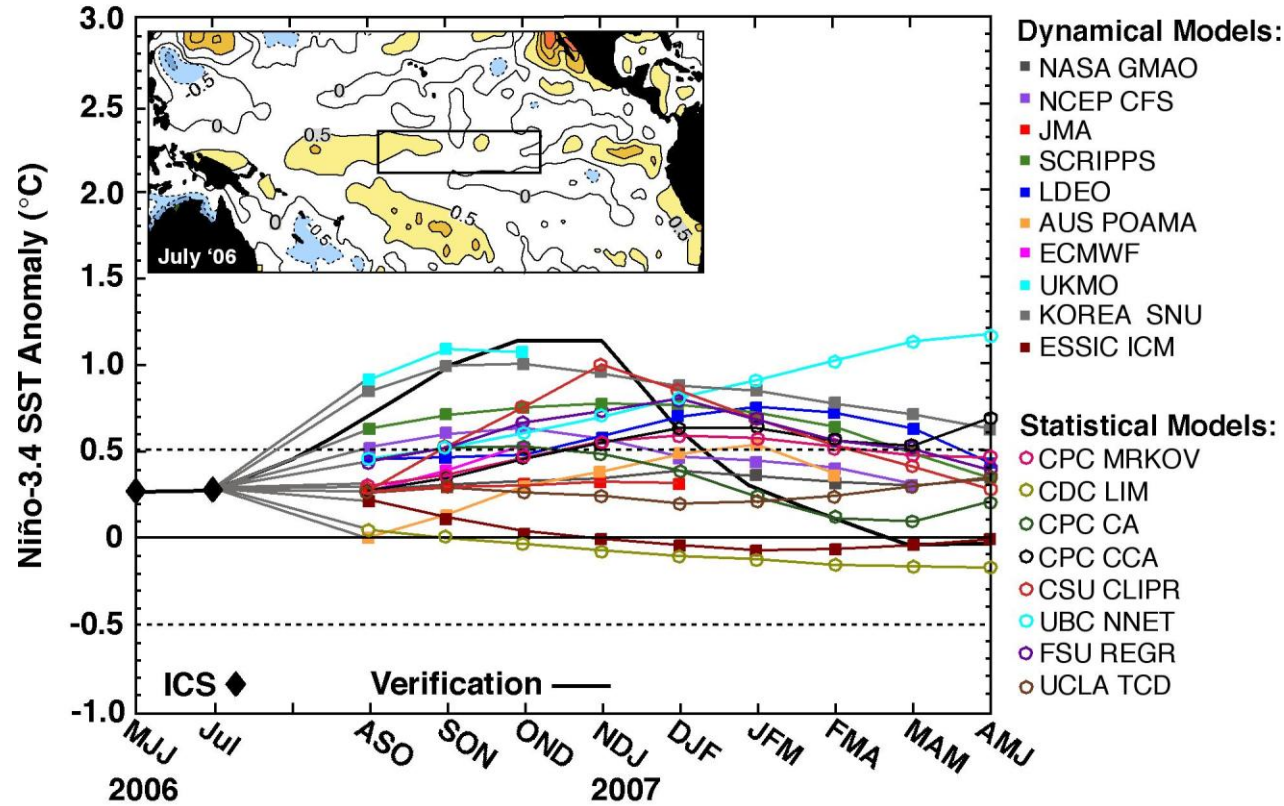
- El Niño purges excess heat to higher latitudes, which terminates the event.

- The time between El Niños is determined by the time to recharge.

3. Role of Tropical Buoy Array

- Status of ENSO Predictions (2006 El Nino case) -

Model Forecasts of ENSO



Compiled by the International Research Institute for Climate and Society

NOAA-NCEP

ENSO-neutral conditions are expected to continue for the next one to three months, with a 50% chance that weak El Niño conditions will develop by the end of 2006.

10 Aug 2006

JMA

El Niño Monitoring Report No.167 (Aug. 10 2006)

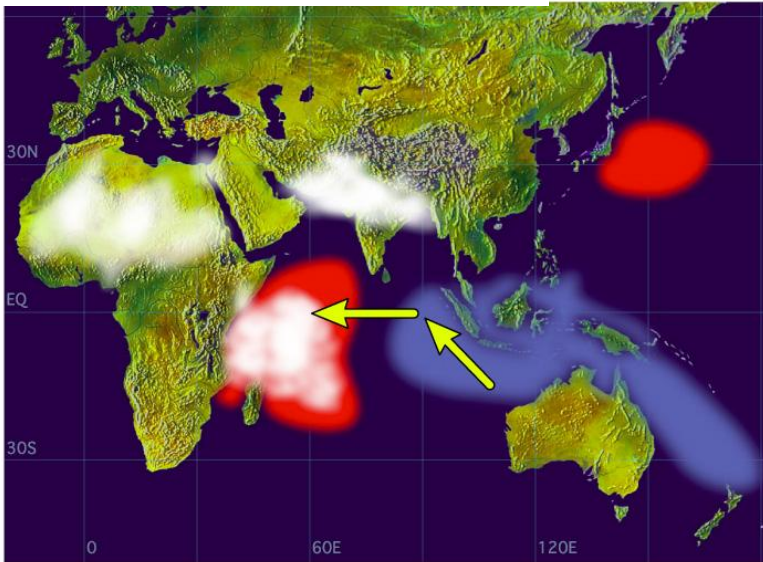
SST in El Niño monitoring area is expected to be near normal and the probability of developing El Niño is low in coming 6 months.

This El-Niño was effected by intra-seasonal atmospheric forcing.

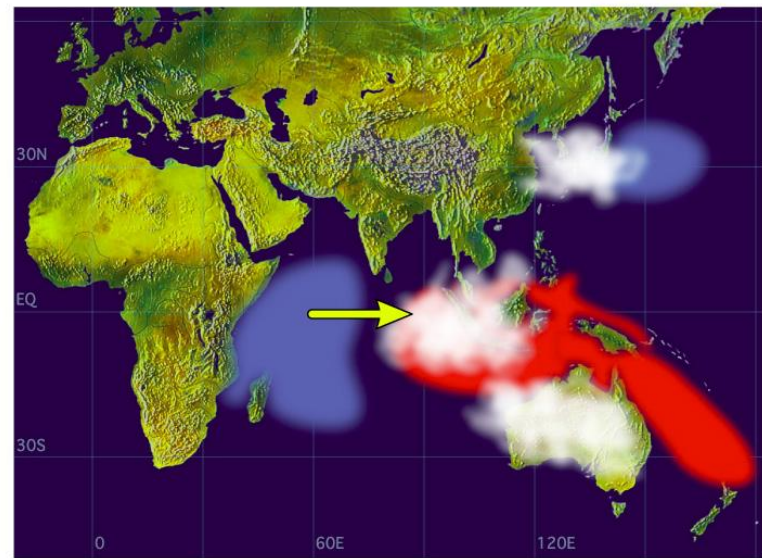
3. Role of Tropical Buoy Array



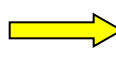
- Indian Ocean Dipole Mode (IOD) Phenomenon -

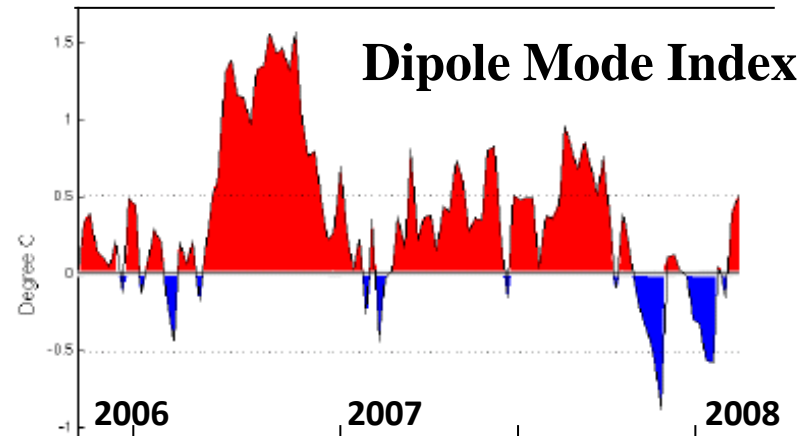
Positive Dipole Mode



Negative Dipole Mode



-  Warm SST
-  Cool SST
-  Wind



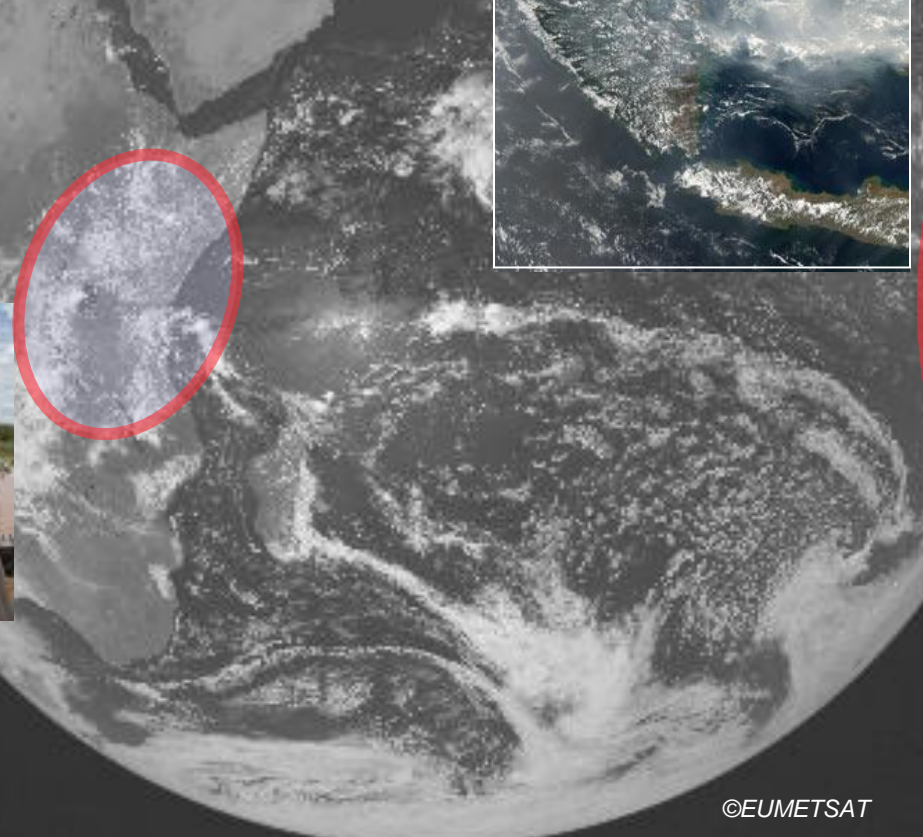
3. Role of Tropical Buoy Array

- Effects of IOD in 2006 -



Indonesia, Australia

Drought, Forest fires,



*Kenya, Somalia,
Floods,*

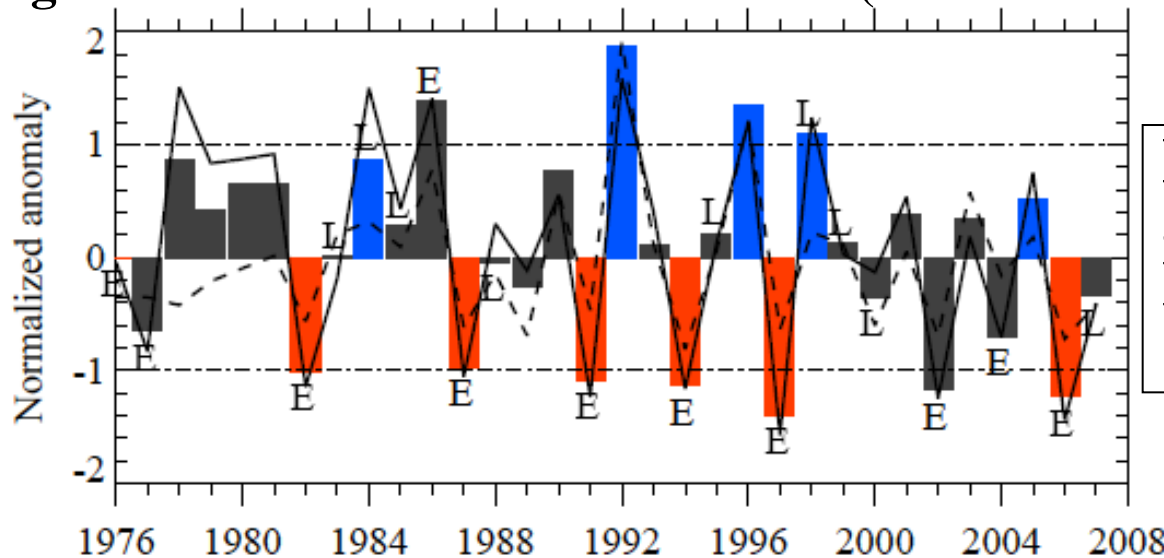


3. Role of Tropical Buoy Array

Climate variability with ENSO+IOD

Interannual Rainfall variability in Jakarta

Aug.-Oct. rainfall variation 1976-2008 (in/around Jakarta 9 stations)



Bar: Rainfall amount **Red/Blue; IOD(+)/IOD(-) year**, E/L; El Niño/La Niña year
Solid Line: Rainfall days (>2mm/day) Hamada et al. 2012

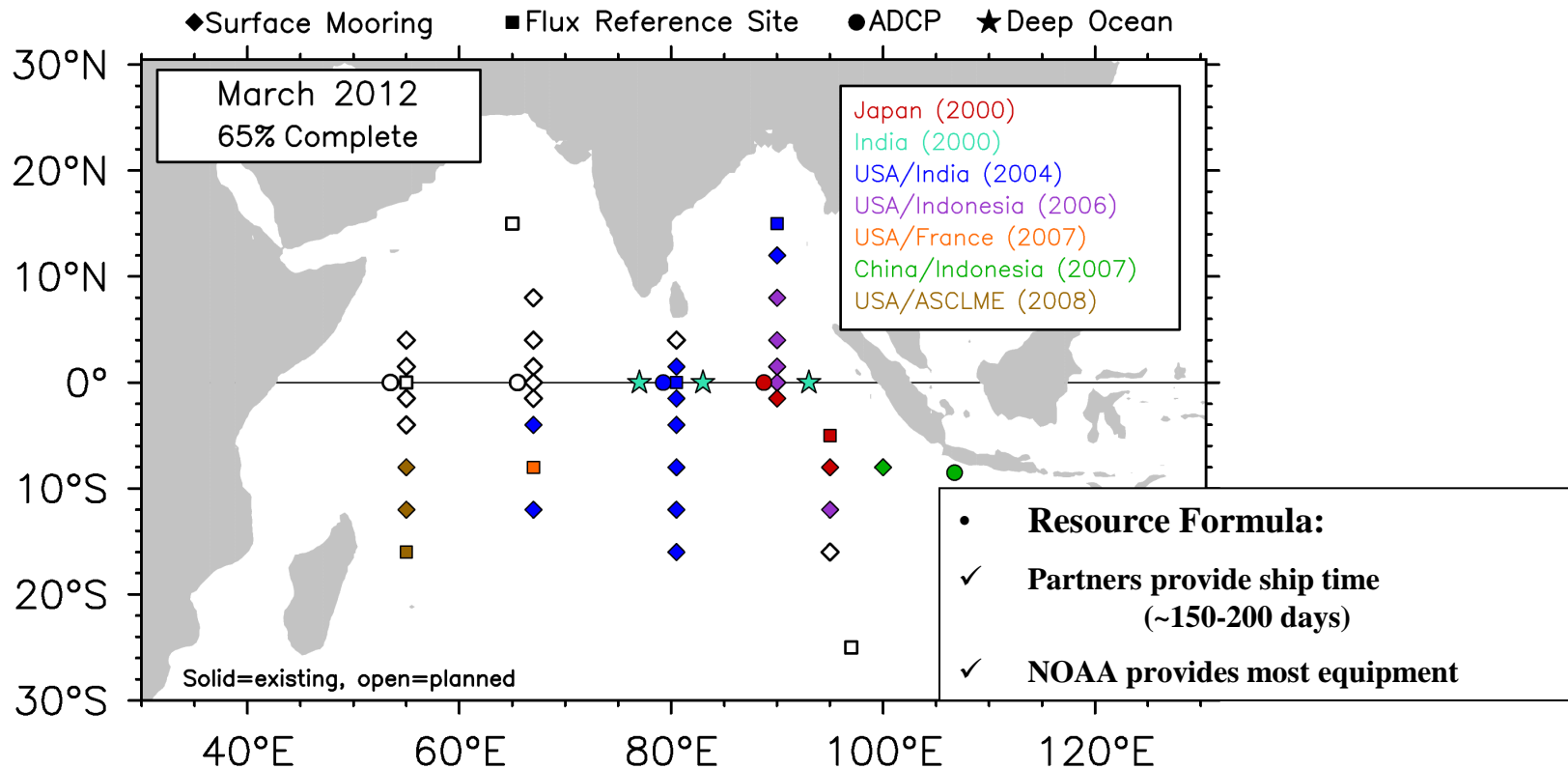
➤ Western Indonesian Maritime Continent

Dry summer/autumn in El Niño year is intensified clearly by IOD(+)

4. Way forward

- RAMA: Present Status -

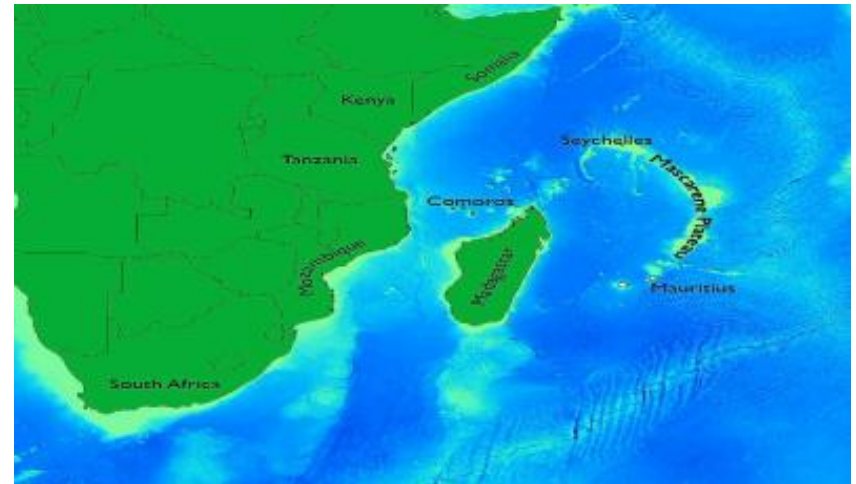
Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction (RAMA)



4. Way forward

Effort to Enhance RAMA array by NOAA

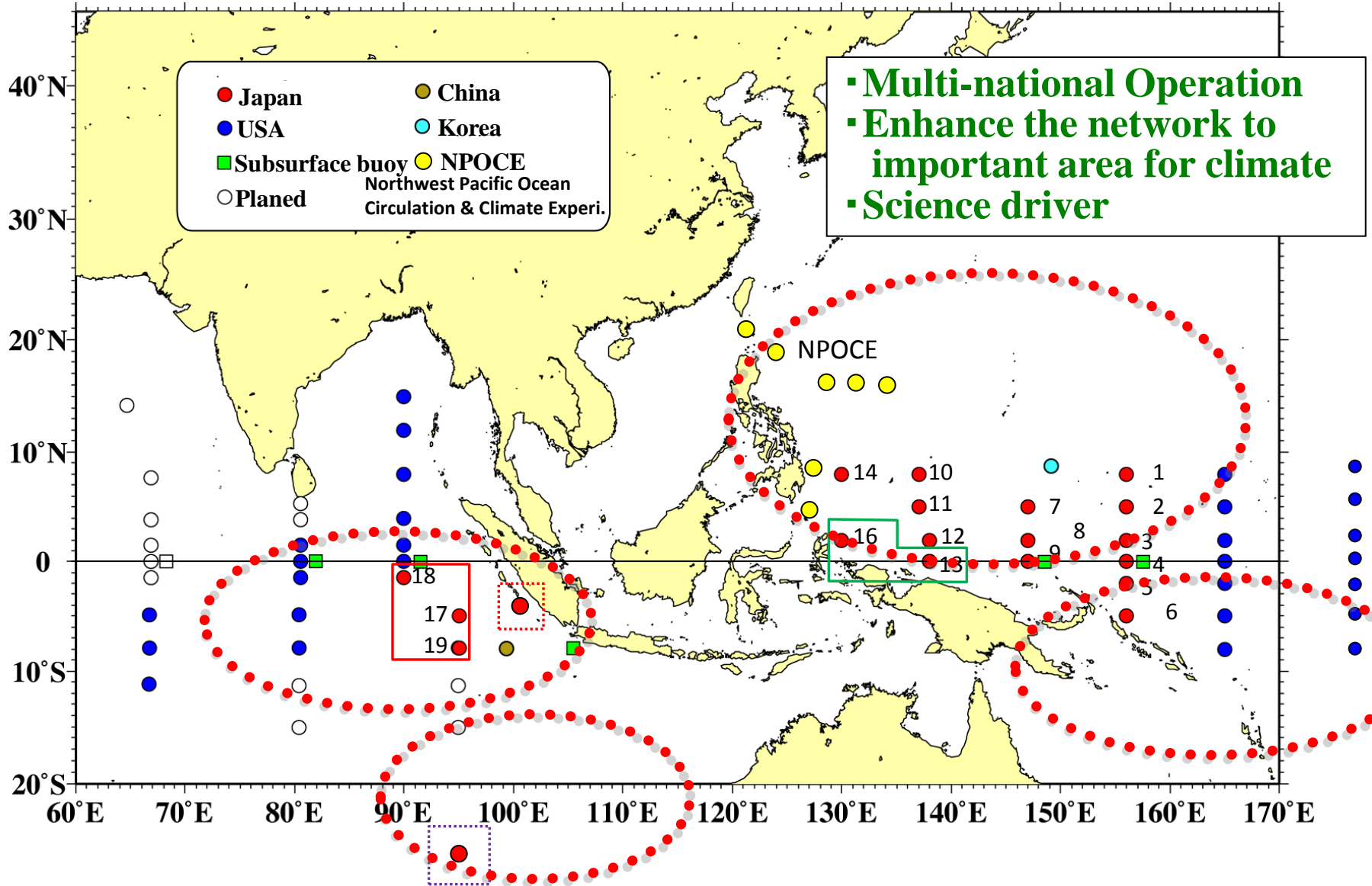
The 2nd DBCP In-Region Western Indian Ocean Capacity Building Workshop
(Mauritius May 2-6, 2011)



- Implementation and Operations of Indian Ocean Data Buoy Networks and their Applications for Enhancing Regional Predictive Capability
- Continue to Build Capacity Within Regional Institutes to Apply New Indian Ocean Observing System (IndOOS) Data, such as from RAMA and others, for Enhanced Predictive Capability for the Region,
- Demonstrate the Crucial Role of Ocean Observations for Understanding and Predicting Regional Weather, Ocean and climate,

4. Way forward

Enhancement of Tropical Moored Buoy Network



Summary

- 1. Tropical buoy array is an inevitable component for ocean observing system for climate.**
- 2. The observed data in real-time & delayed-mode are fully disseminated so as to meet societal and research requirement.**
- 3. Long-term monitoring is vital to understand the nature of multi-year variation of ENSO for societal benefit.**
- 4. Enhancement of RAMA array is desirable for better understanding and prediction of world climate variation.**
- 5. Multi-national alliance is essential to sustain or enhance the tropical moored buoy array.**

A silhouette of a telecommunications tower is visible in the lower-left corner of the image. The tower has a complex structure with various antennas and equipment at the top. The background is a vast sky filled with small, scattered clouds, illuminated by the warm, orange and red light of a sunset or sunrise. The overall color palette is dominated by deep blues, purples, and oranges.

Thank you