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

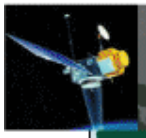
2. Data System of Tropical Buoy Array

3. Role of Tropical Buoy Array
   - Research and Societal Benefit –

4. Way forward

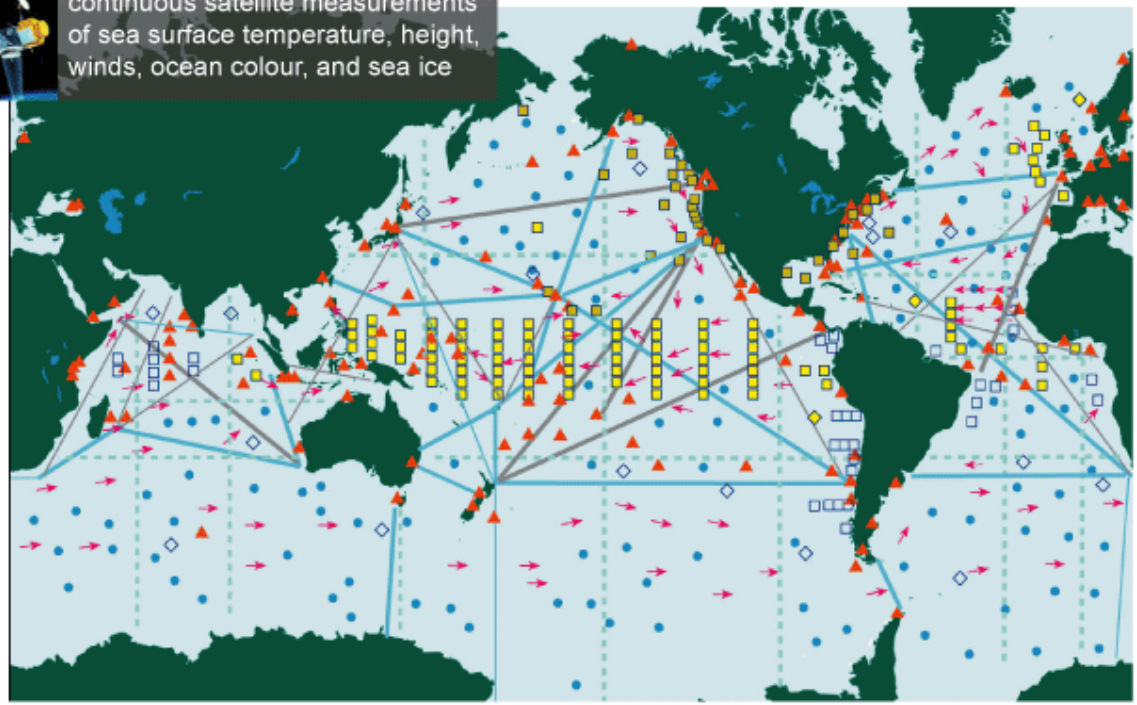
Initial Global Ocean Observing System for Climate

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.**

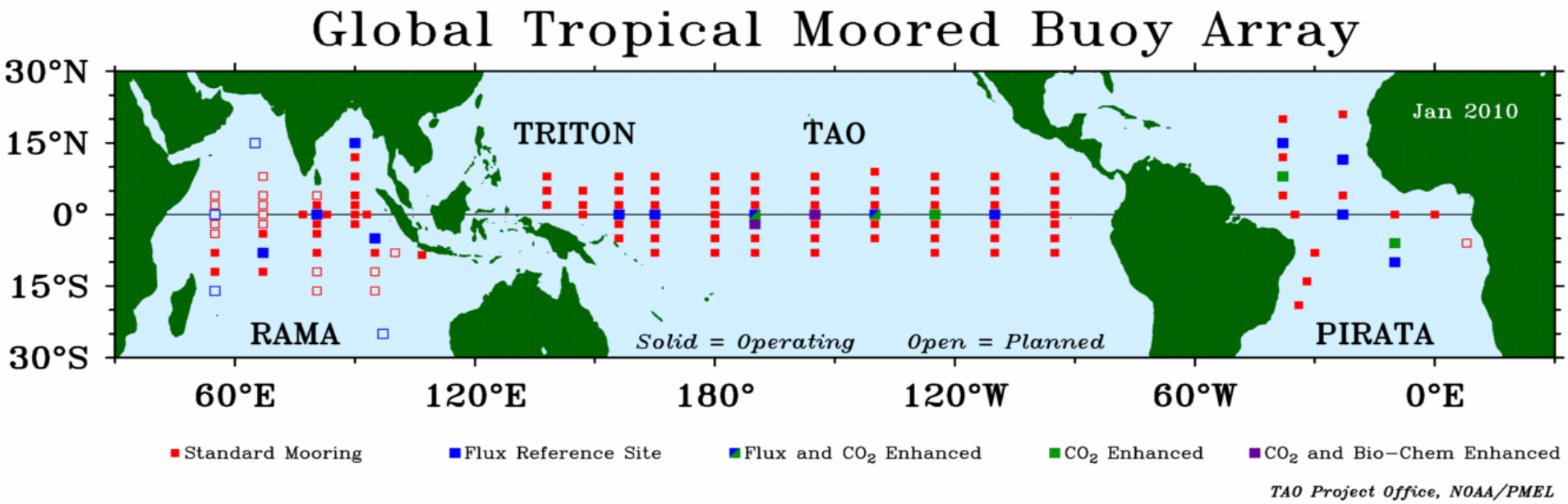
GCOS

GOOS

jcomm OCEANOGRAPHY & MARINE METEOROLOGY

1. Tropical Buoy Array in Global Ocean Observing System

- Equatorial buoy network -



Indian Ocean

RAMA array

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

Pacific Ocean

TAO/TRITON Array

Atlantic Ocean

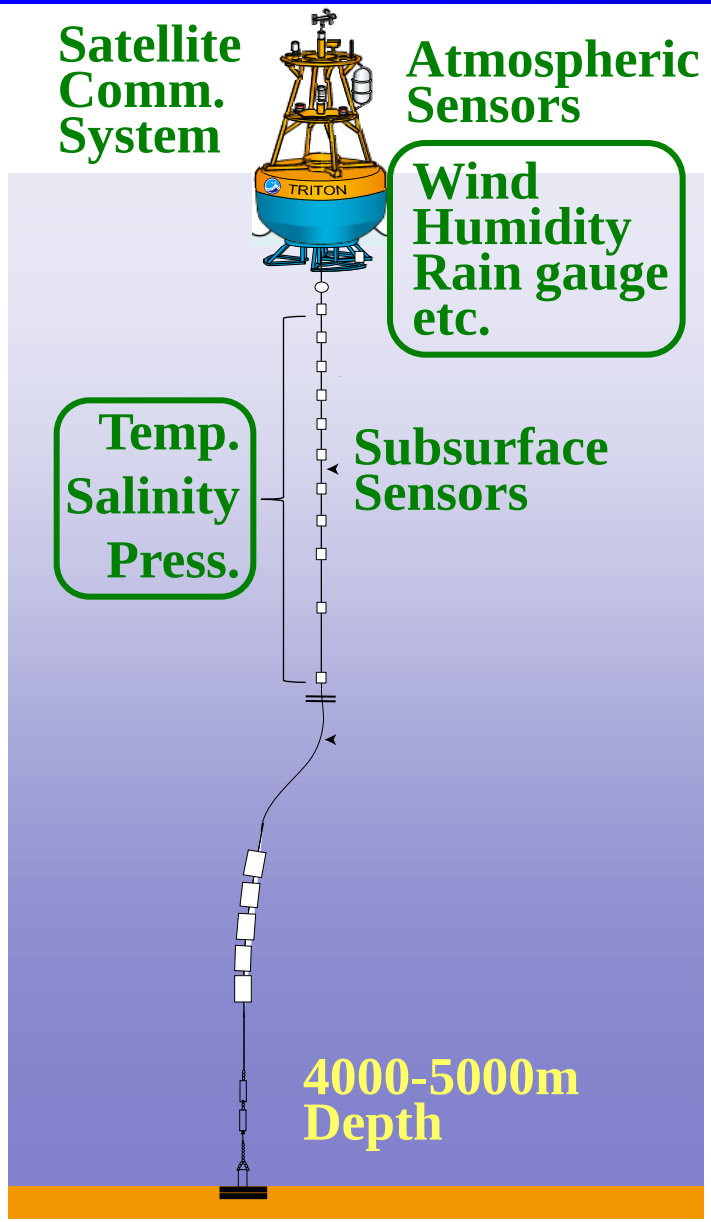
PIRATA Array

Pilot **R**esearch Moored **A**rray in the **T**ropical **A**tlantic

→ **Prediction and Research Moored Array in the Atlantic**

1. Tropical Buoy Array in Global Ocean Observing System

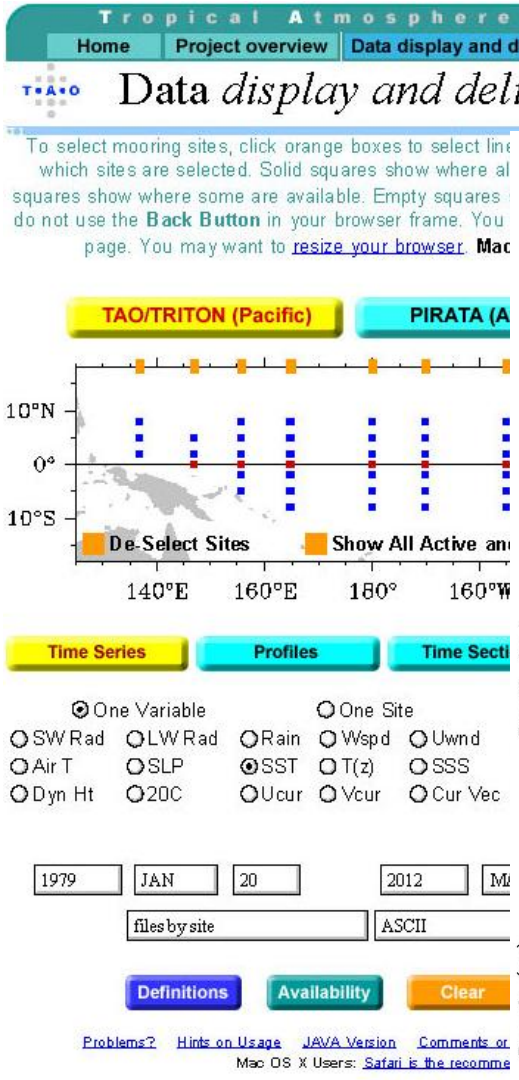
- Moored Buoy Observing System -

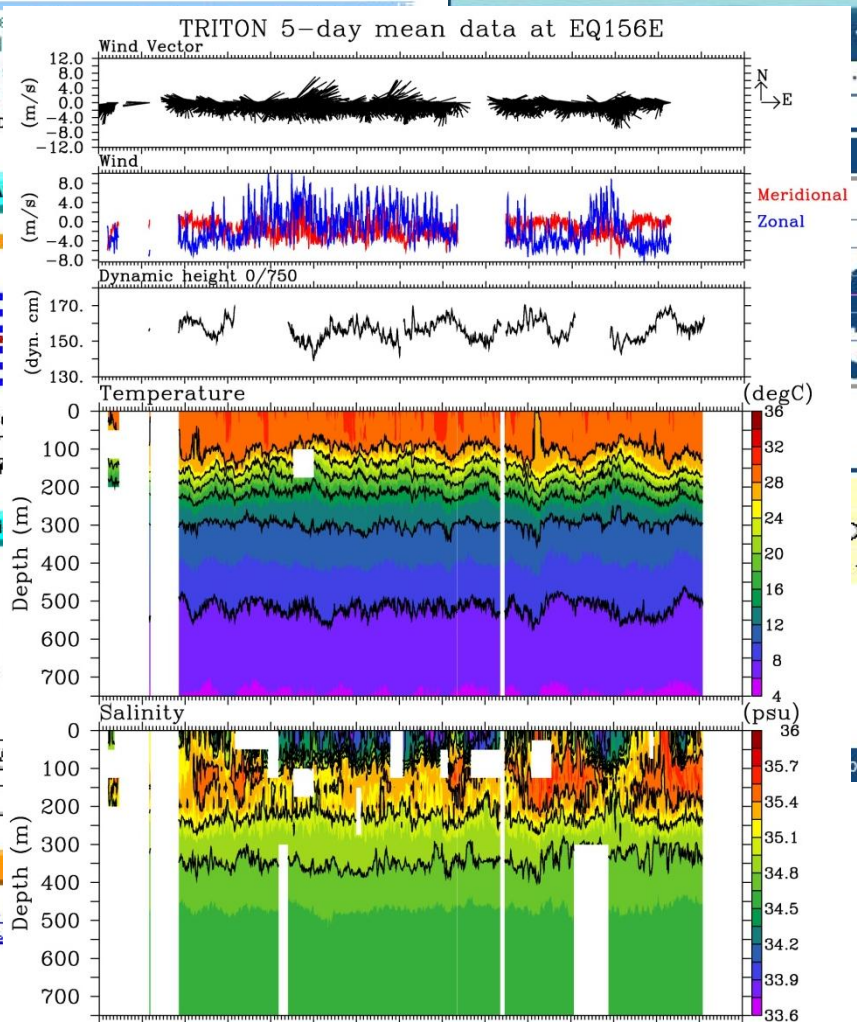


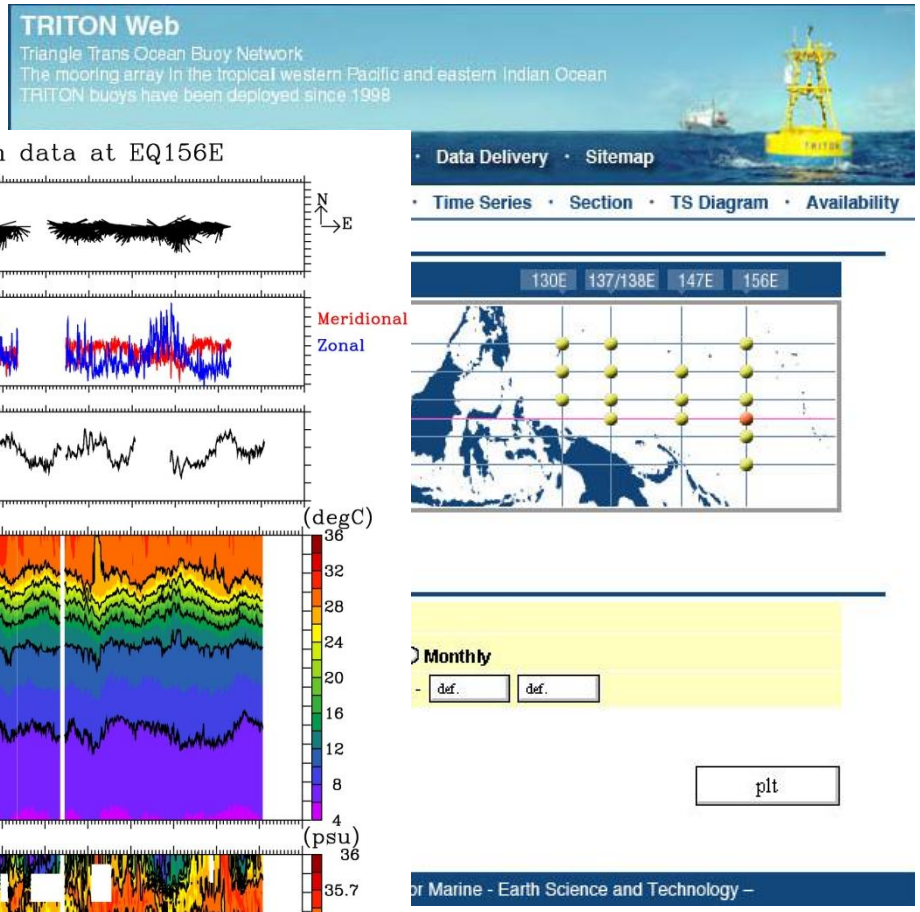
Buoy deployment Operation

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

2. Data System of Tropical Buoy Array

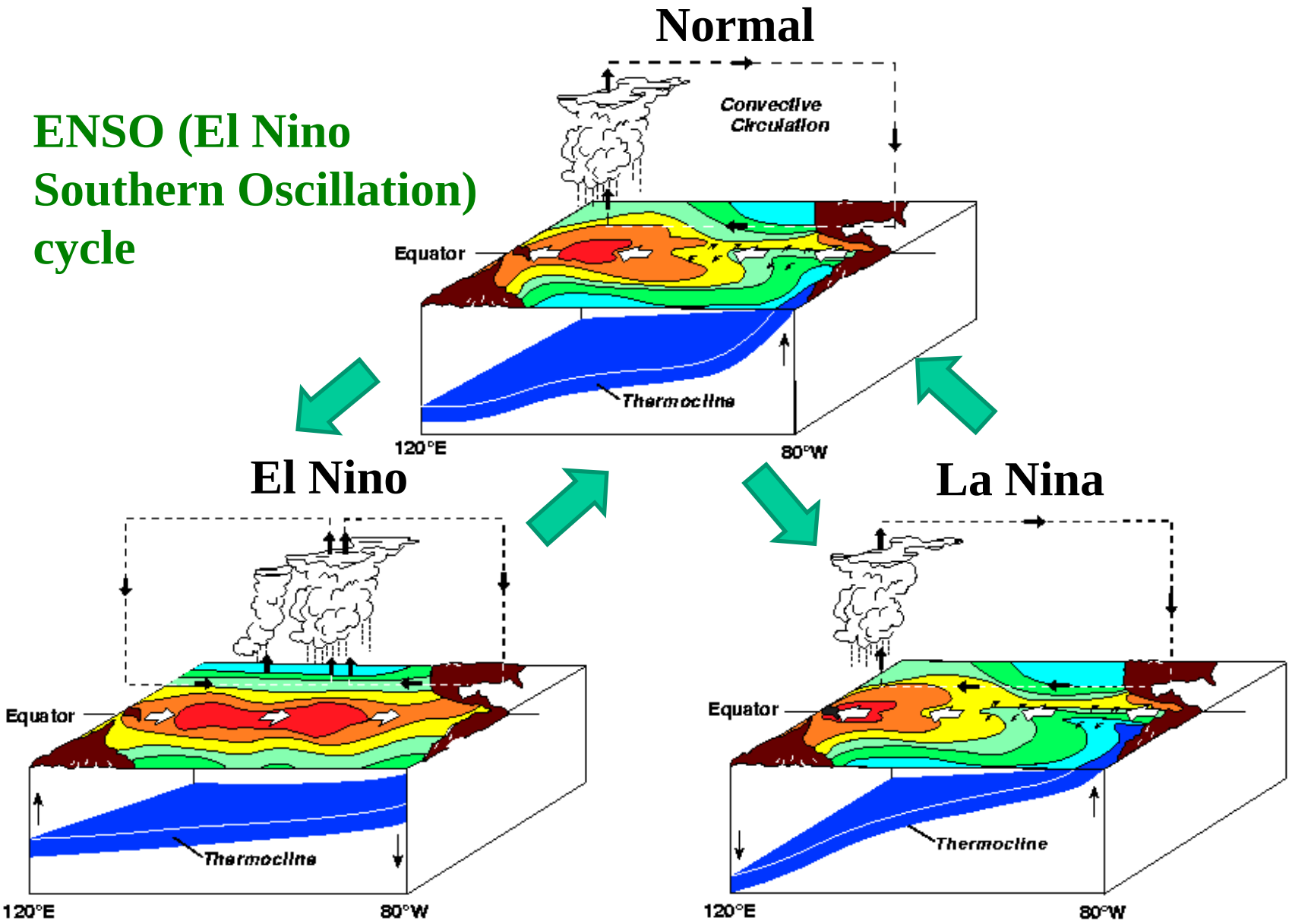






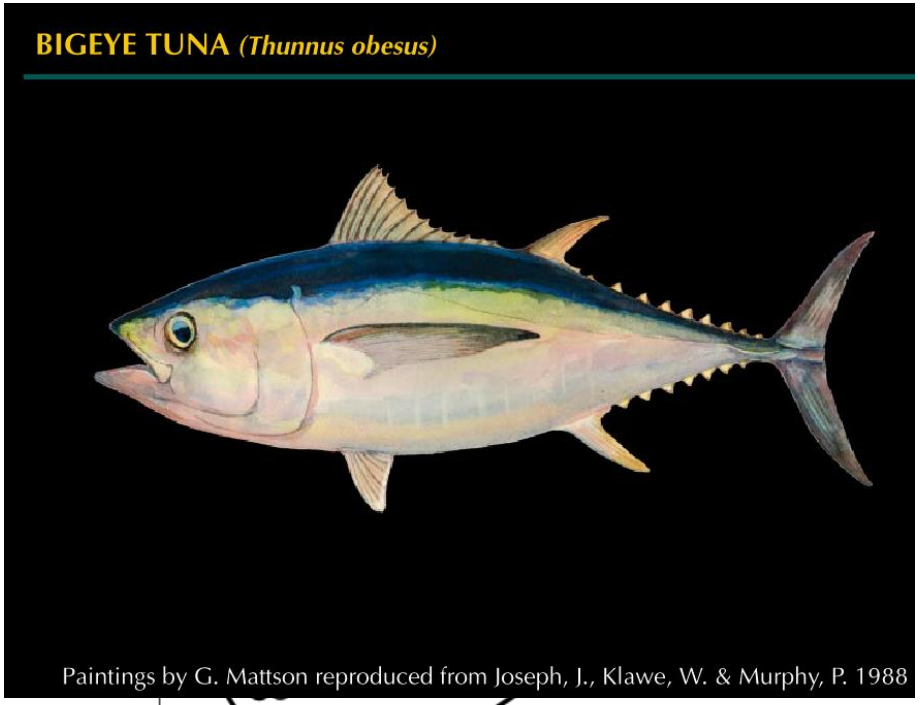
- El Nino/La Nina Conditions -

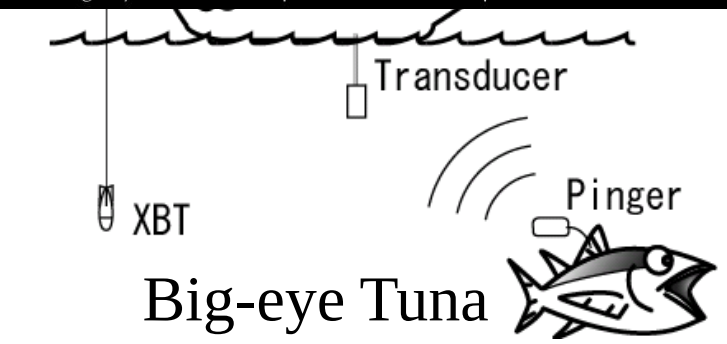
ENSO (El Nino Southern Oscillation) cycle



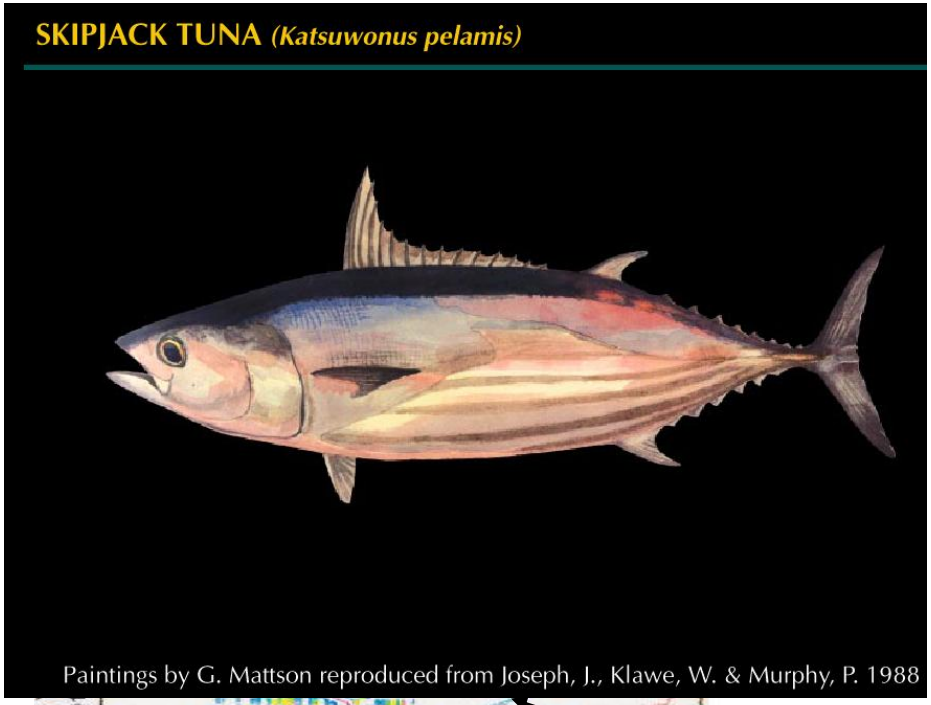
- ENSO vs. Fisheries -

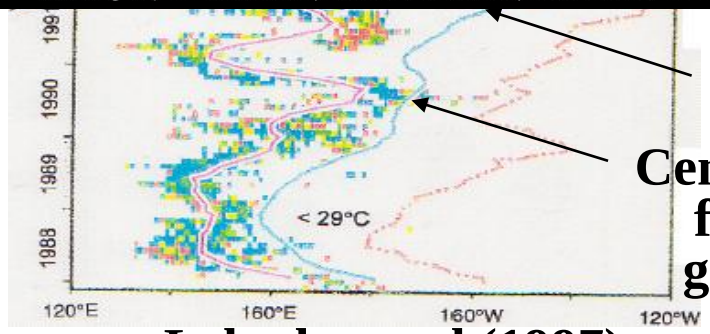
Ex. 1: Habitat of Big-eye Tuna in oceanic structure (eastern TP)





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



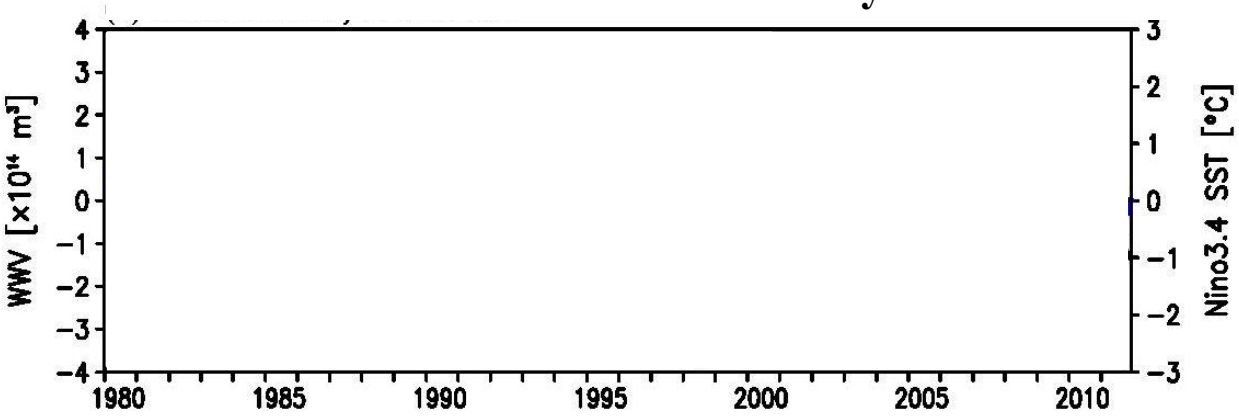


Lehodey,et al.(1997)

3. Role of Tropical Buoy

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

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

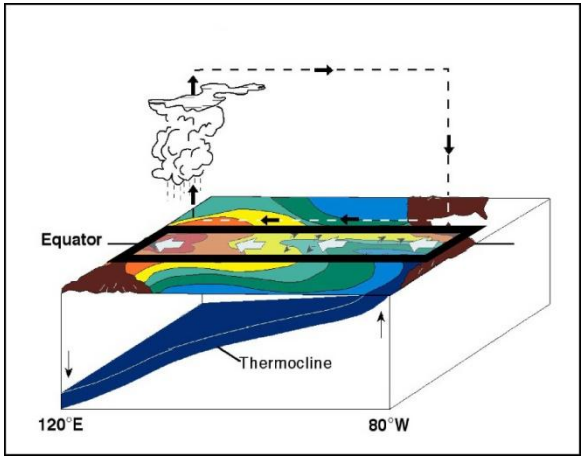


Warm Water Volume (WWV): An Index for Upper Ocean Heat Content

Meinen & McPhaden, 2000

WWV

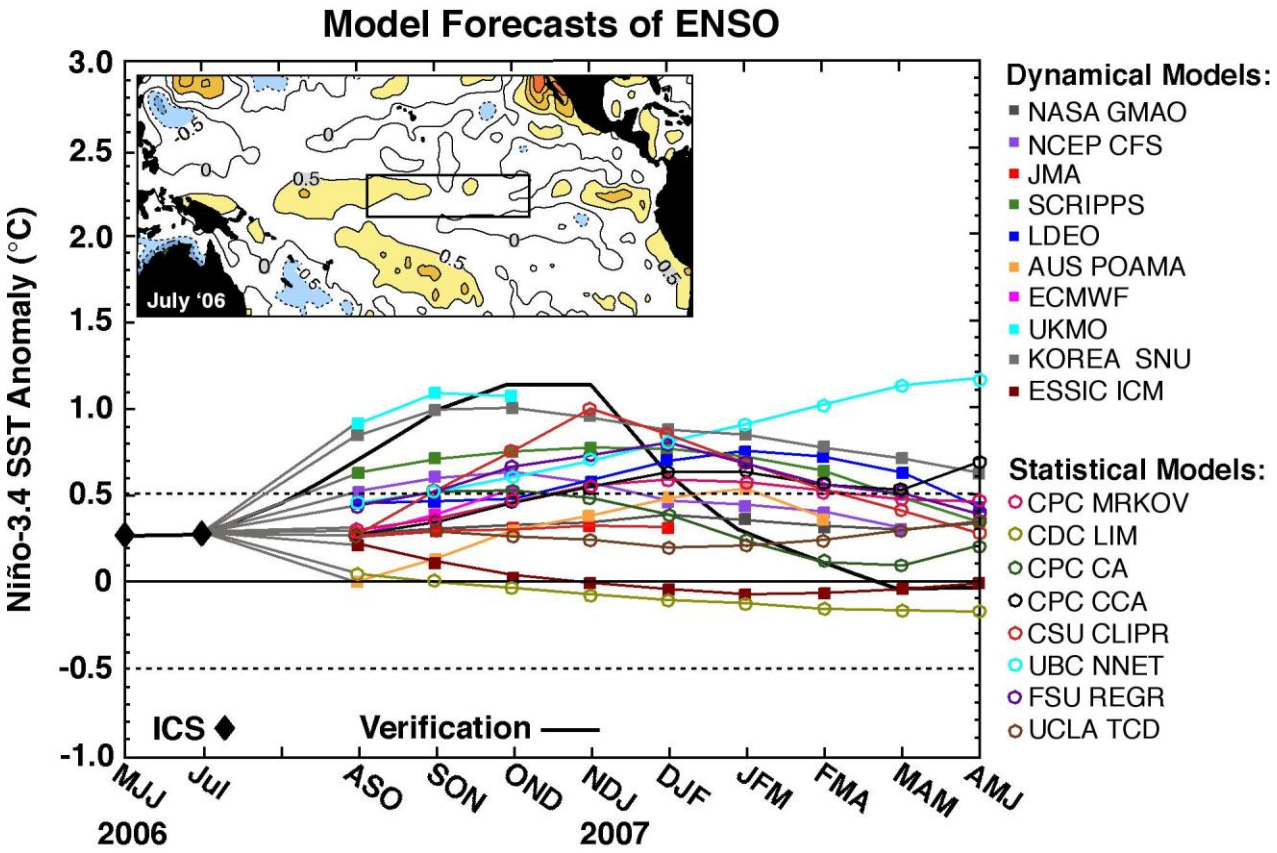
SST



- **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) -



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 Nino Monitoring Report No.167 （Aug. 10 2006）

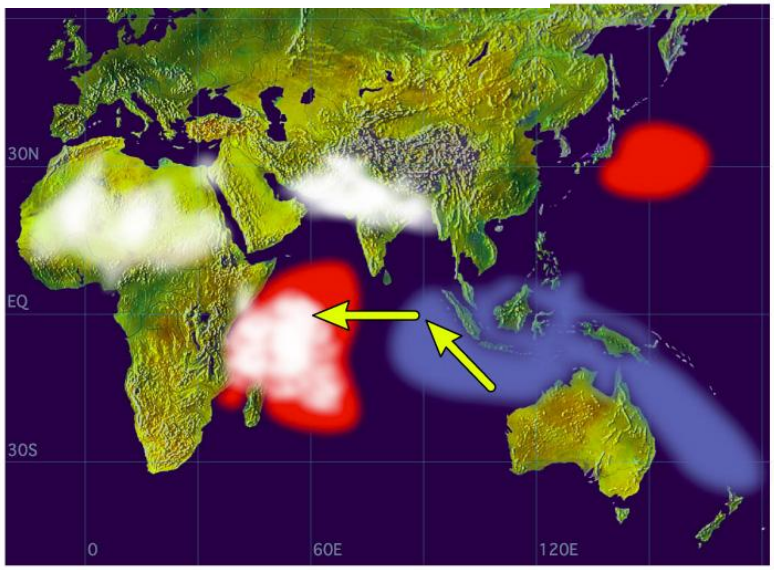
SST in El Nino monitoring area is expected to be near normal and the probability of developing El Nino is low in coming 6 months.

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

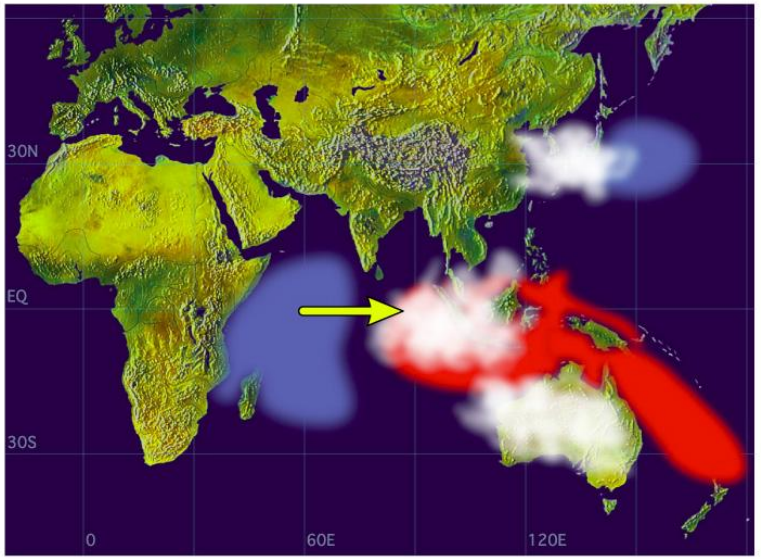
3. Role of Tropical Buoy Array

- Indian Ocean Dipole Mode (IOD) Phenomenon -

Positive Dipole Mode



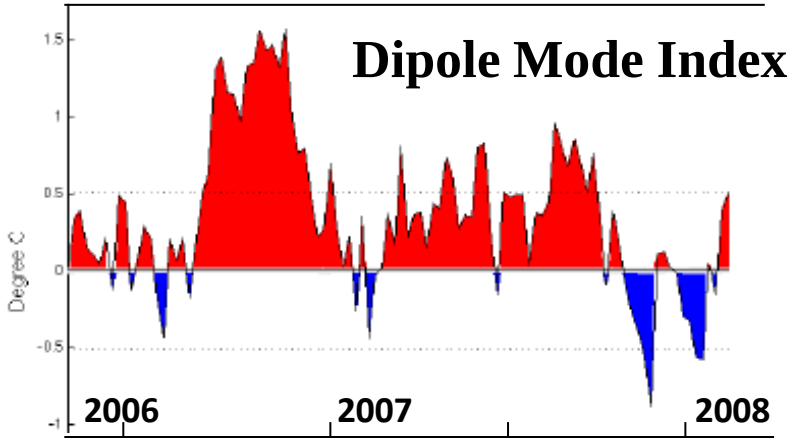
Negative Dipole Mode



Warm SST

Cool SST

Wind



3. Role of Tropical Buoy Array

- Effects of IOD in 2006 -

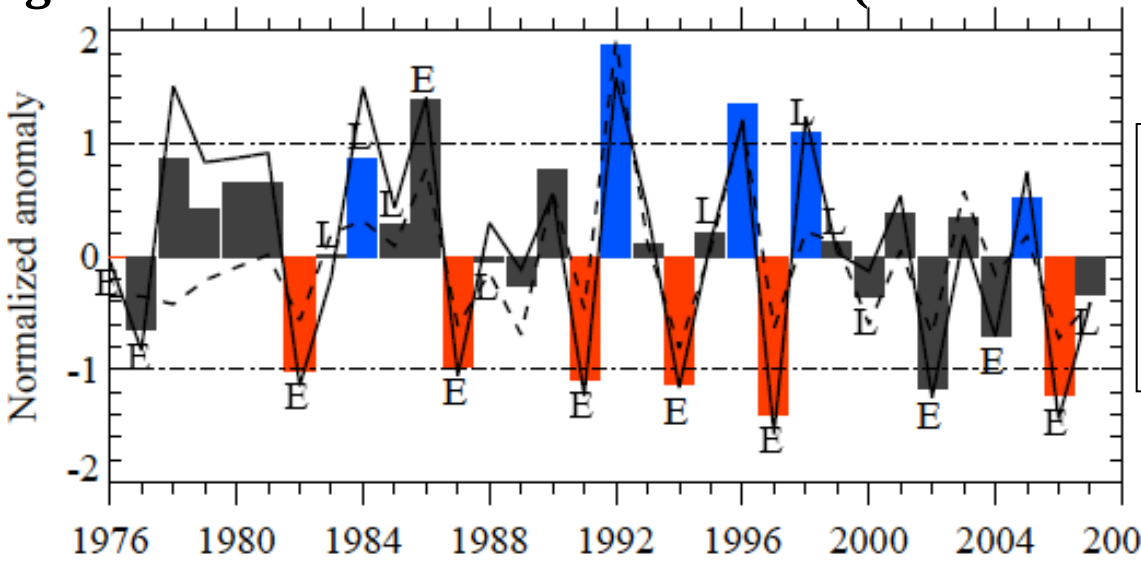
Kenya, Somalia,
Floods, ….

Indonesia, Australia
Drought, Forest fires, ….

Climate variability with ENSO+IOD

Interannual Rainfall variability in Jakarta

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



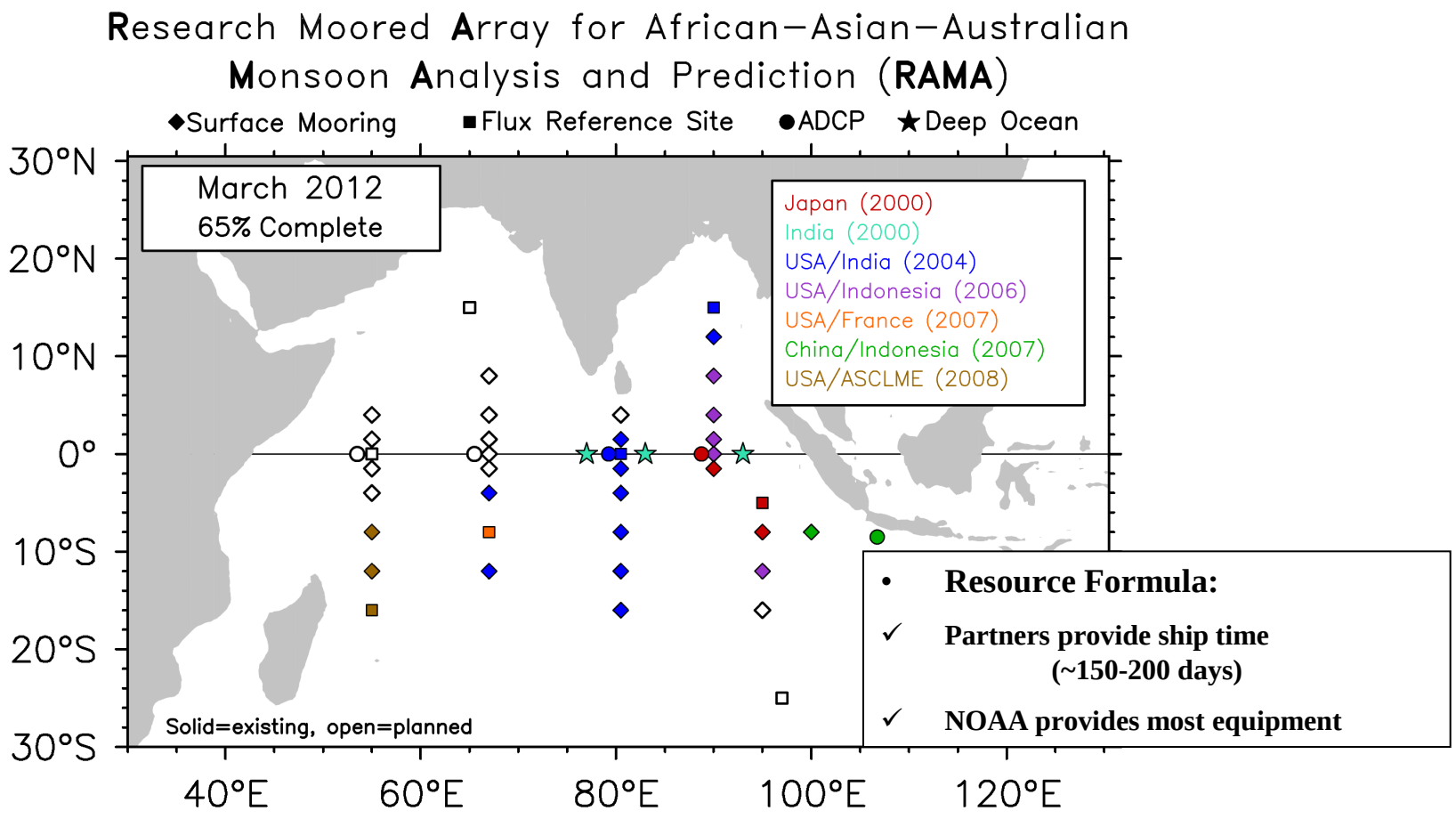
Dry summer/ autumn in ENSO+IOD year

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

➢Western Indonesian Maritime Continent
Dry summer/autumn in El Nino year is intensified clearly by IOD(+)

4. Way forward

- RAMA: Present Status-



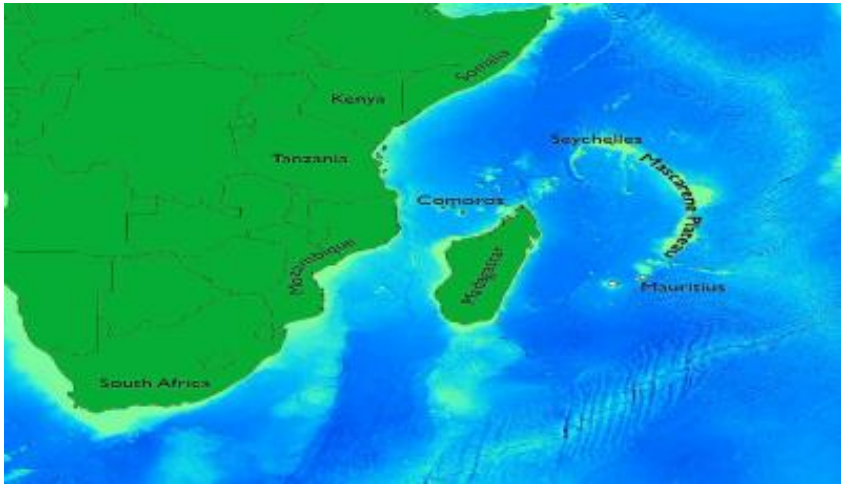
- **Resource Formula:**
- ✓ **Partners provide ship time (~150-200 days)**
- ✓ **NOAA provides most equipment**

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)



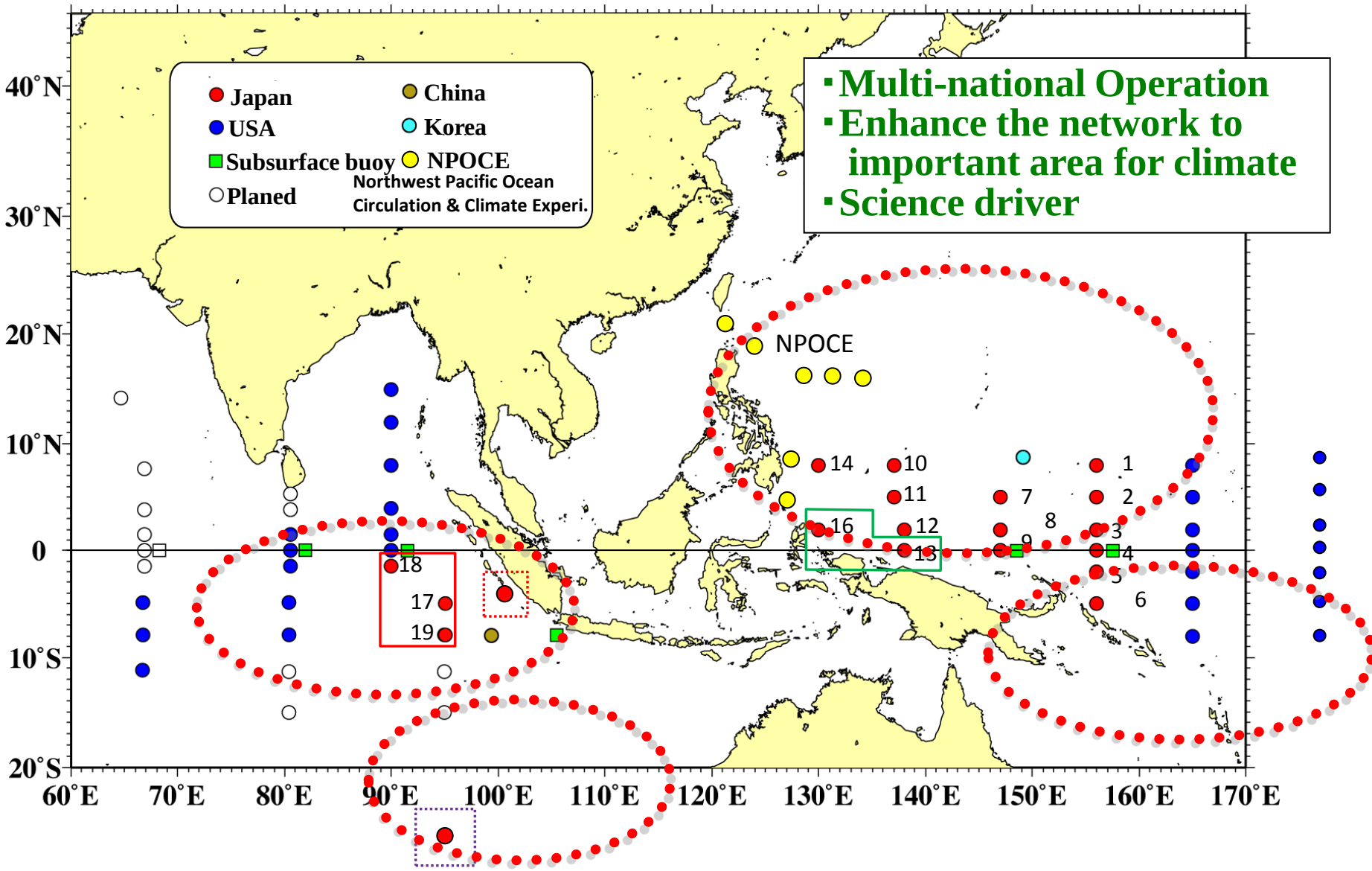
- **Implementation and Operations of Indian Ocean Data Buoy Networks and their Applications for Enhancing Regional Predictive Capability**

- **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.**


Thank you