

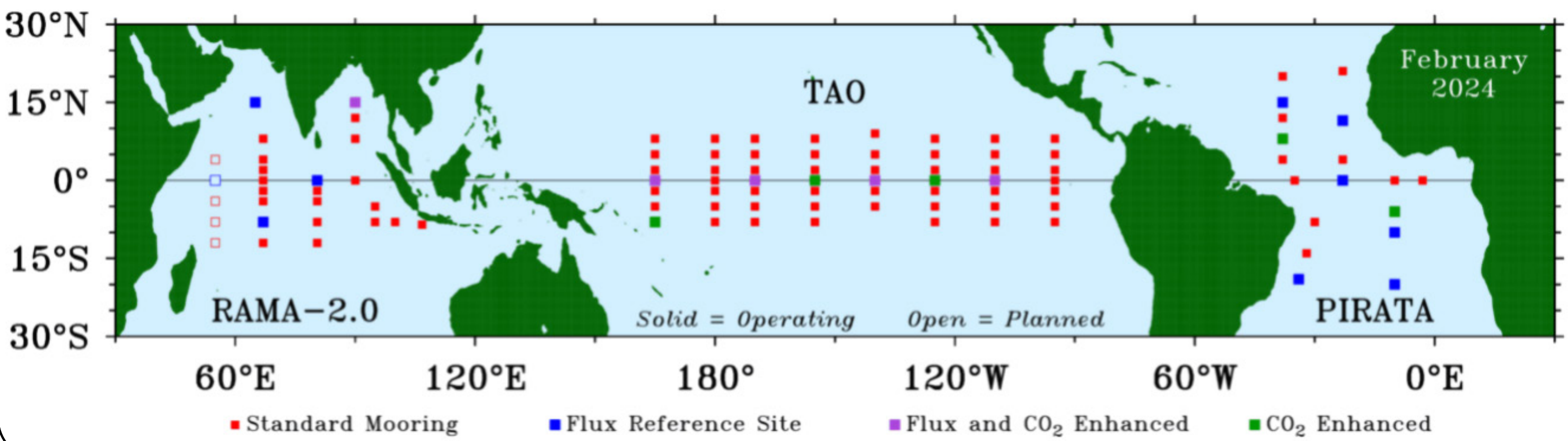
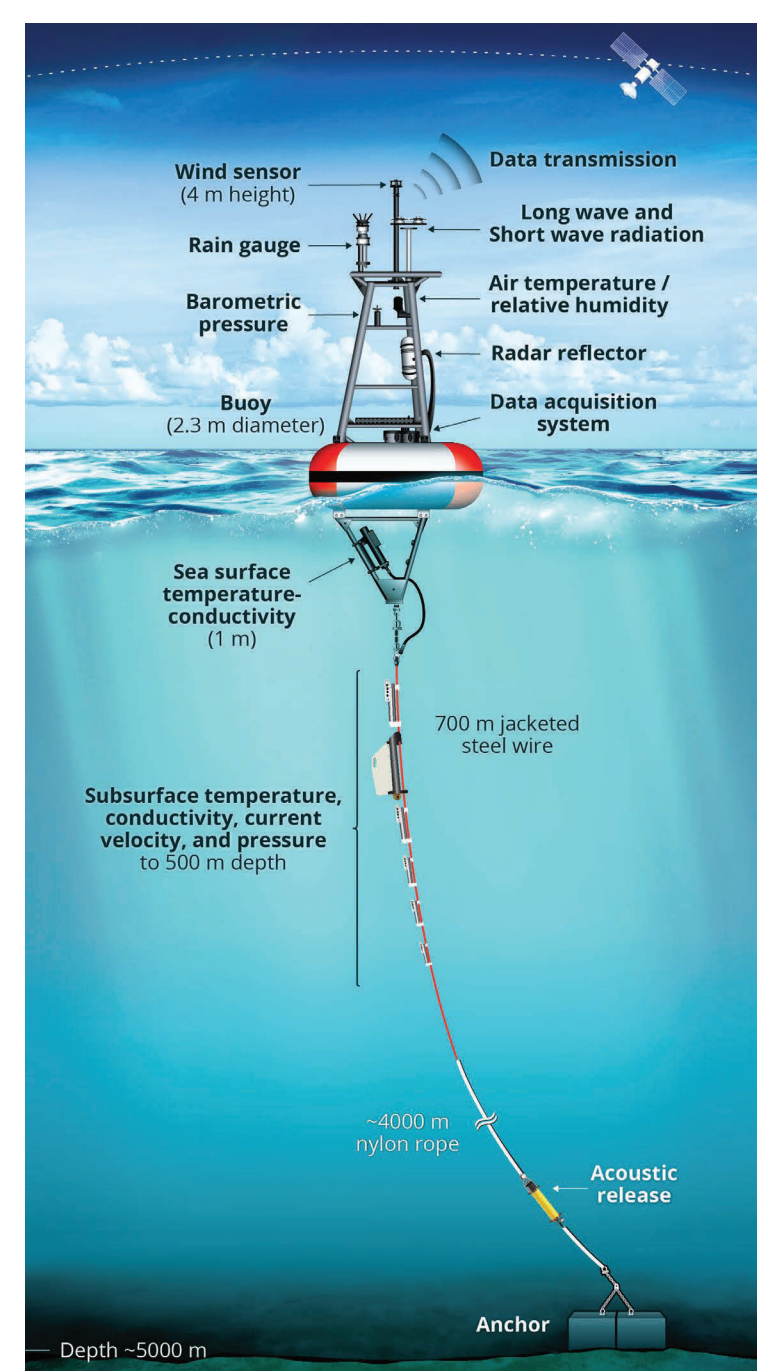
# Global Tropical Moored Buoy Array

PMEL has led a nearly 50-year multi-national effort to design, build, and evolve a moored buoy observing system in the global tropics to address NOAA and OAR mission goals

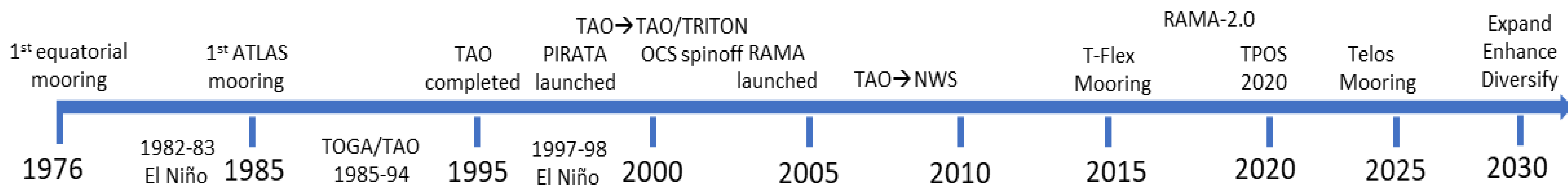
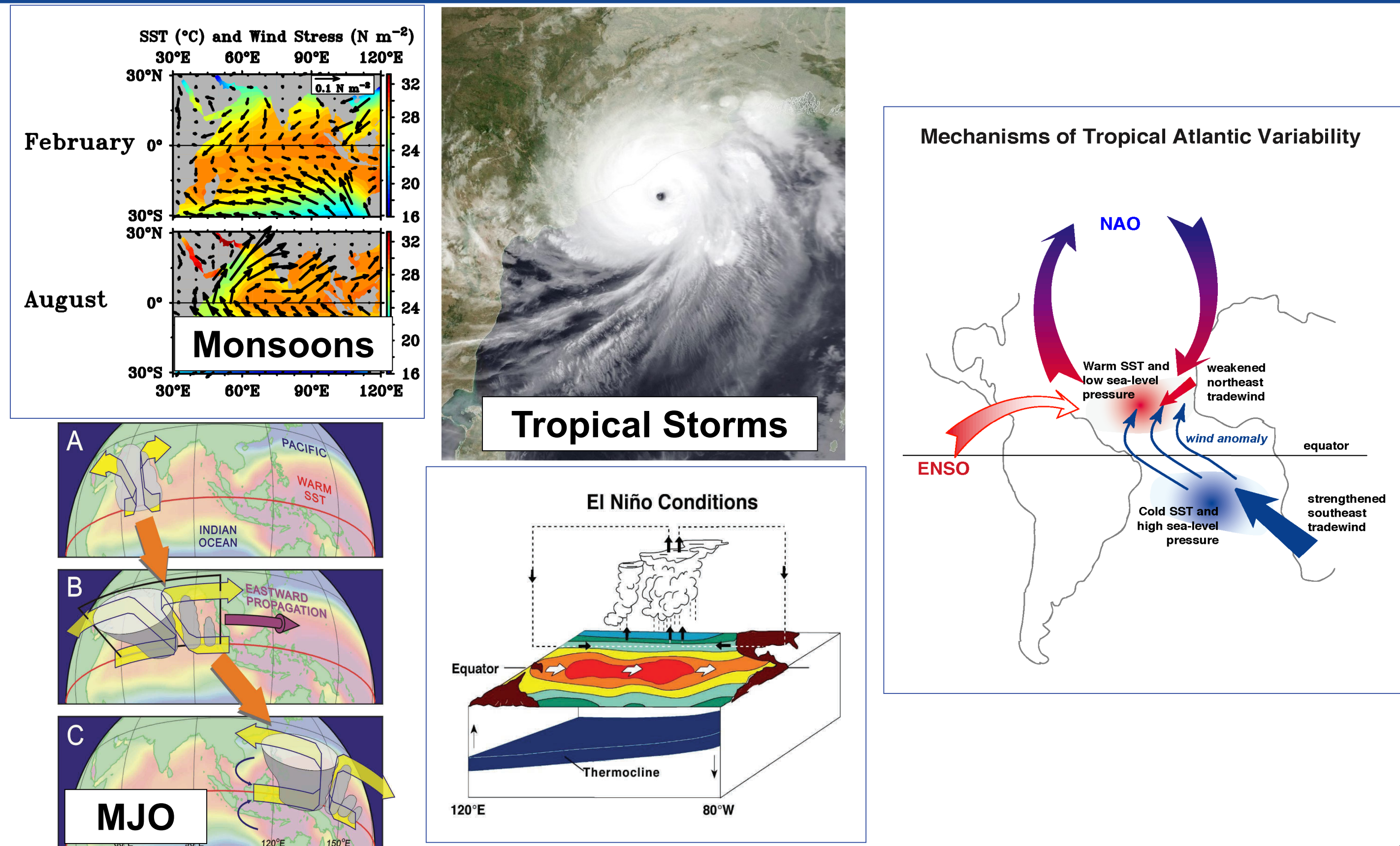
## 1. Mission goals addressed:

**NOAA:** Building a climate-ready Nation

- OAR:** 1) Explore the Marine Environment;  
 2) Detect Changes in the Ocean and Atmosphere;  
 3) Make Forecasts Better;  
 4) Drive Innovative Science



## 2. Observing Natural Phenomena:



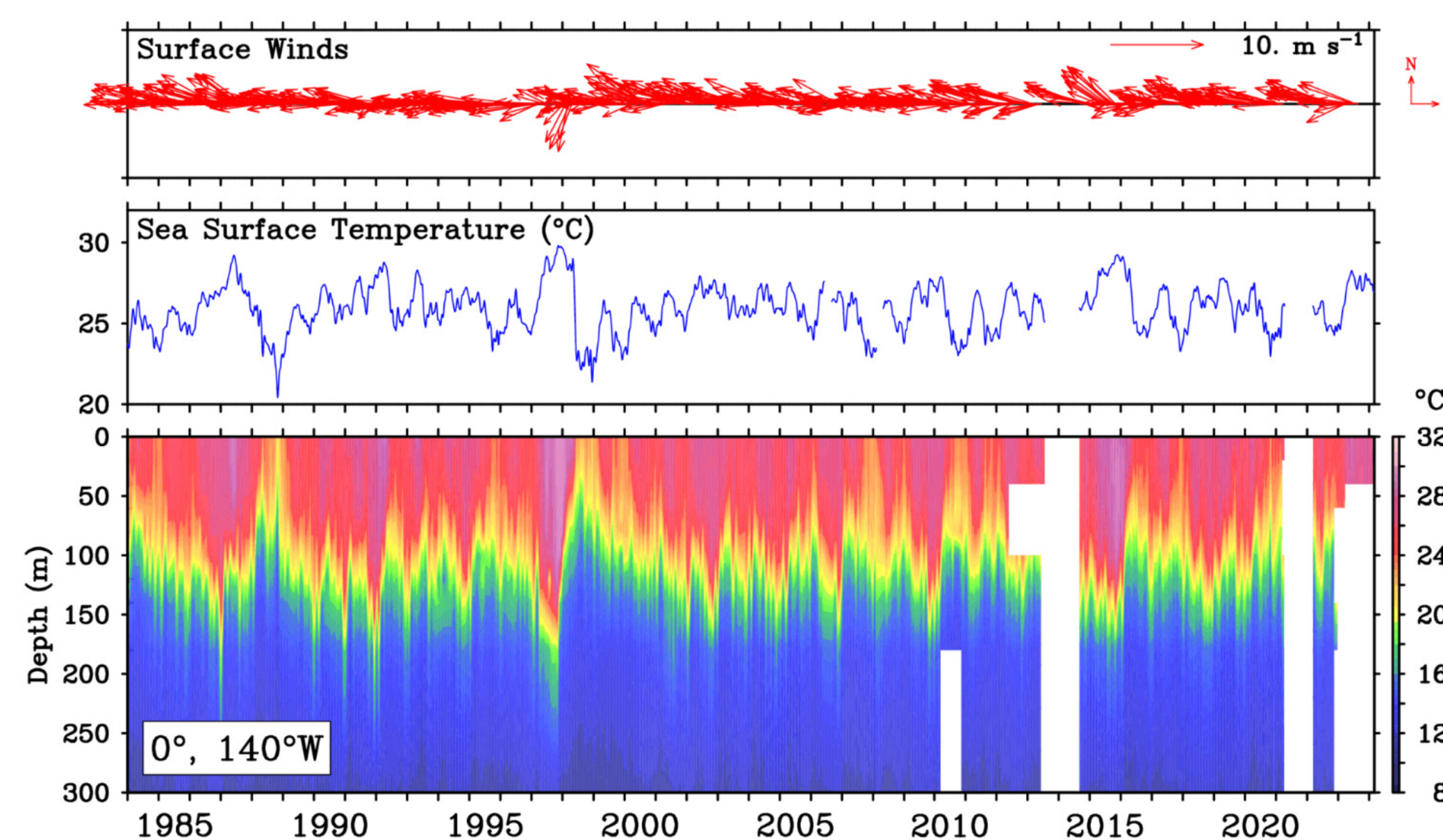
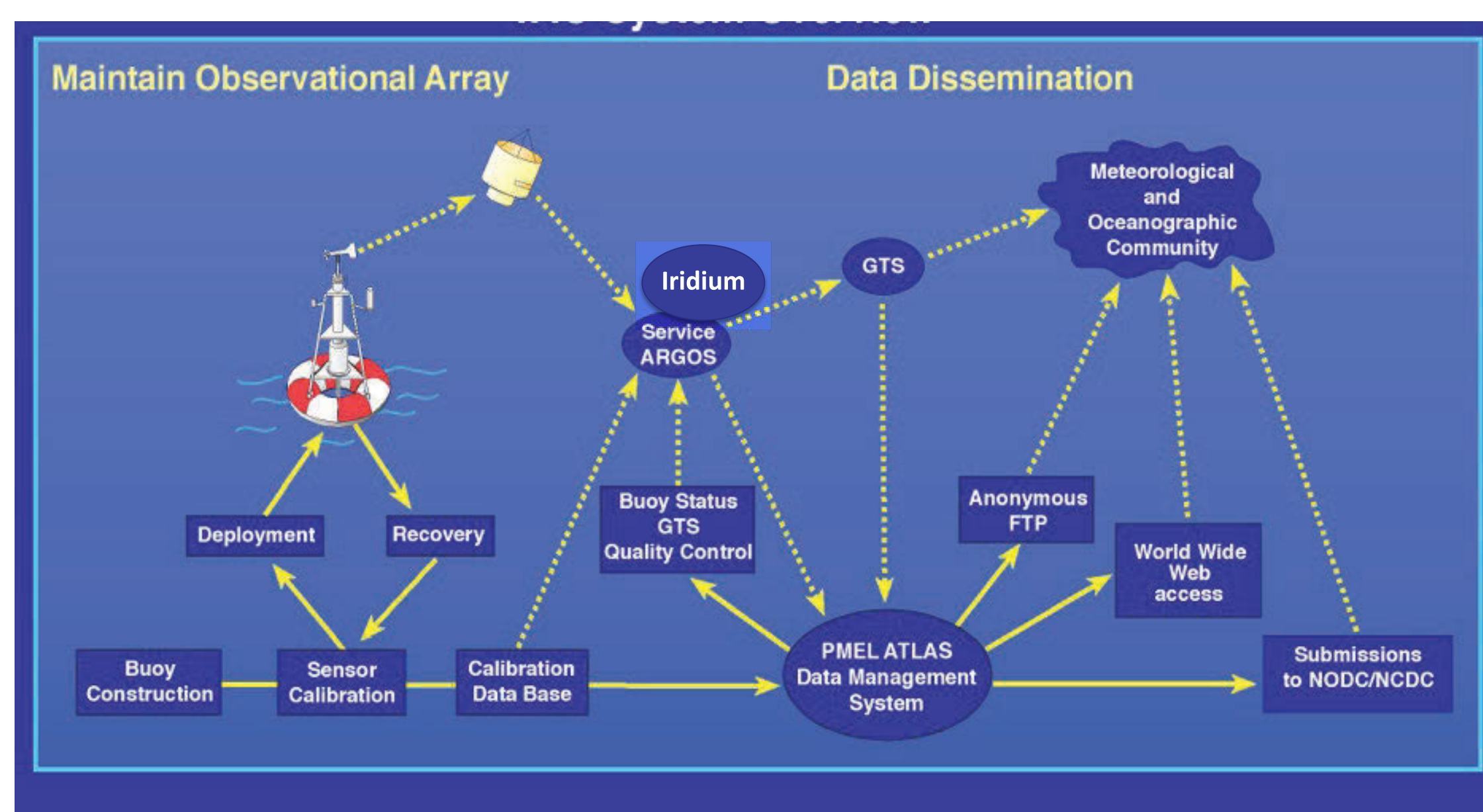
**GTMBA Operations 1976-2023:**

- 2947 moorings deployed
- 523 cruises
- 55 ships from 17 countries
- 14,552 sea days (~40 yrs)

## 3. GTMBA Data System:

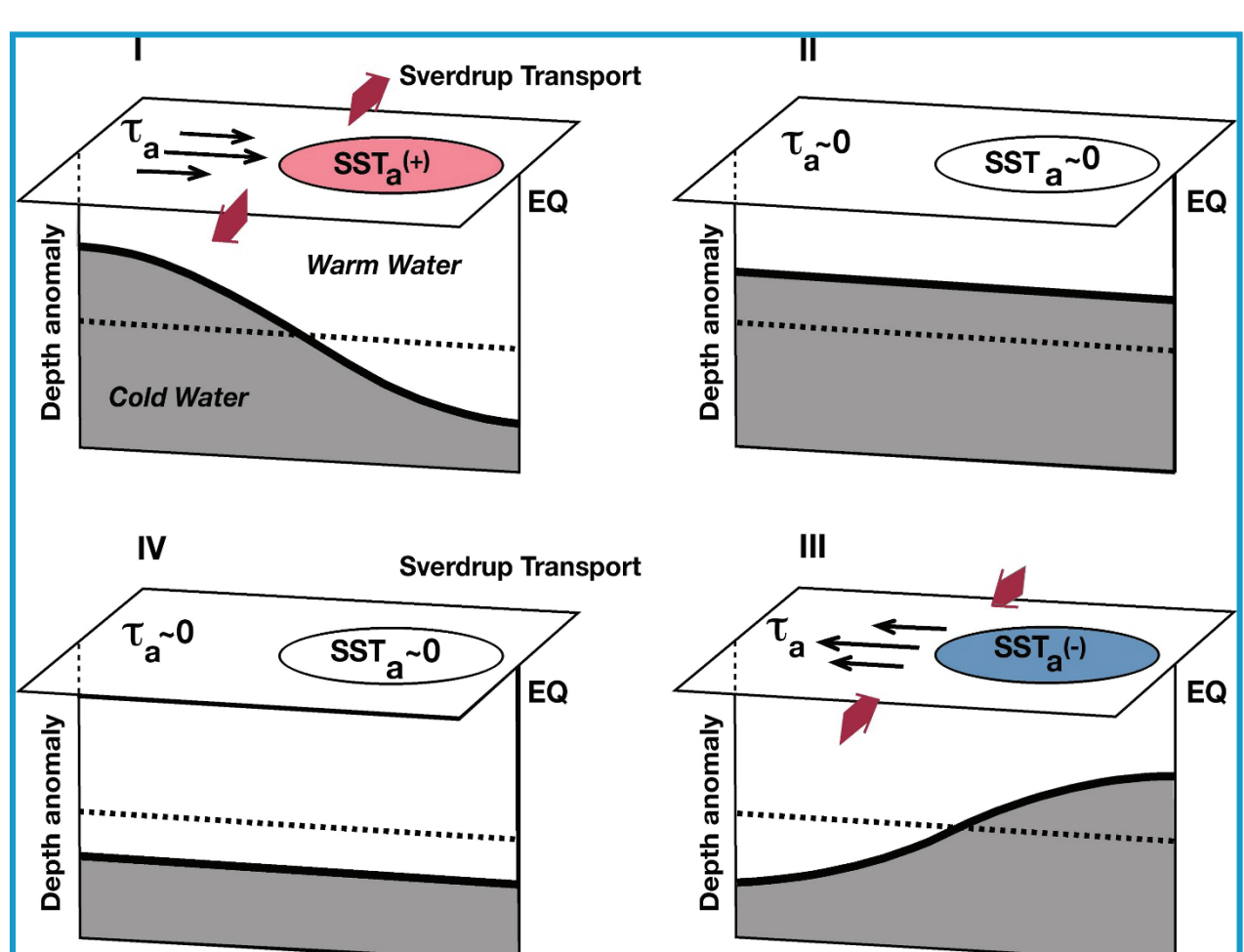
Real-time data for ocean, weather and climate operational forecasts via GTS (NCEP, US Navy, ECMWF, UKMO, JMA, Meteo-France, Brazil Met Service, Australia BoM, Indian Meteorological Dept., etc.)

Near-real time data for research via WWW: Tens of millions of data files delivered; ~2500 journal publications

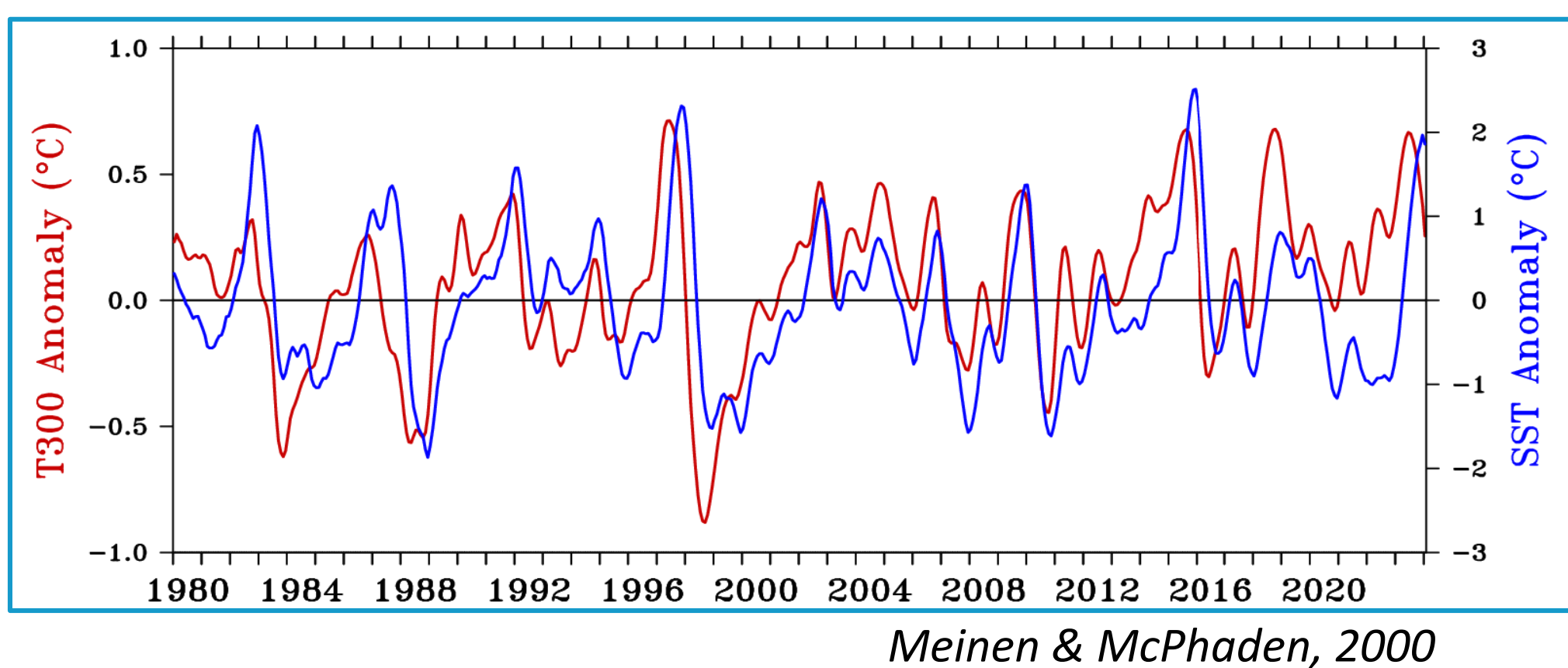


## 4. Two Fundamental Advances:

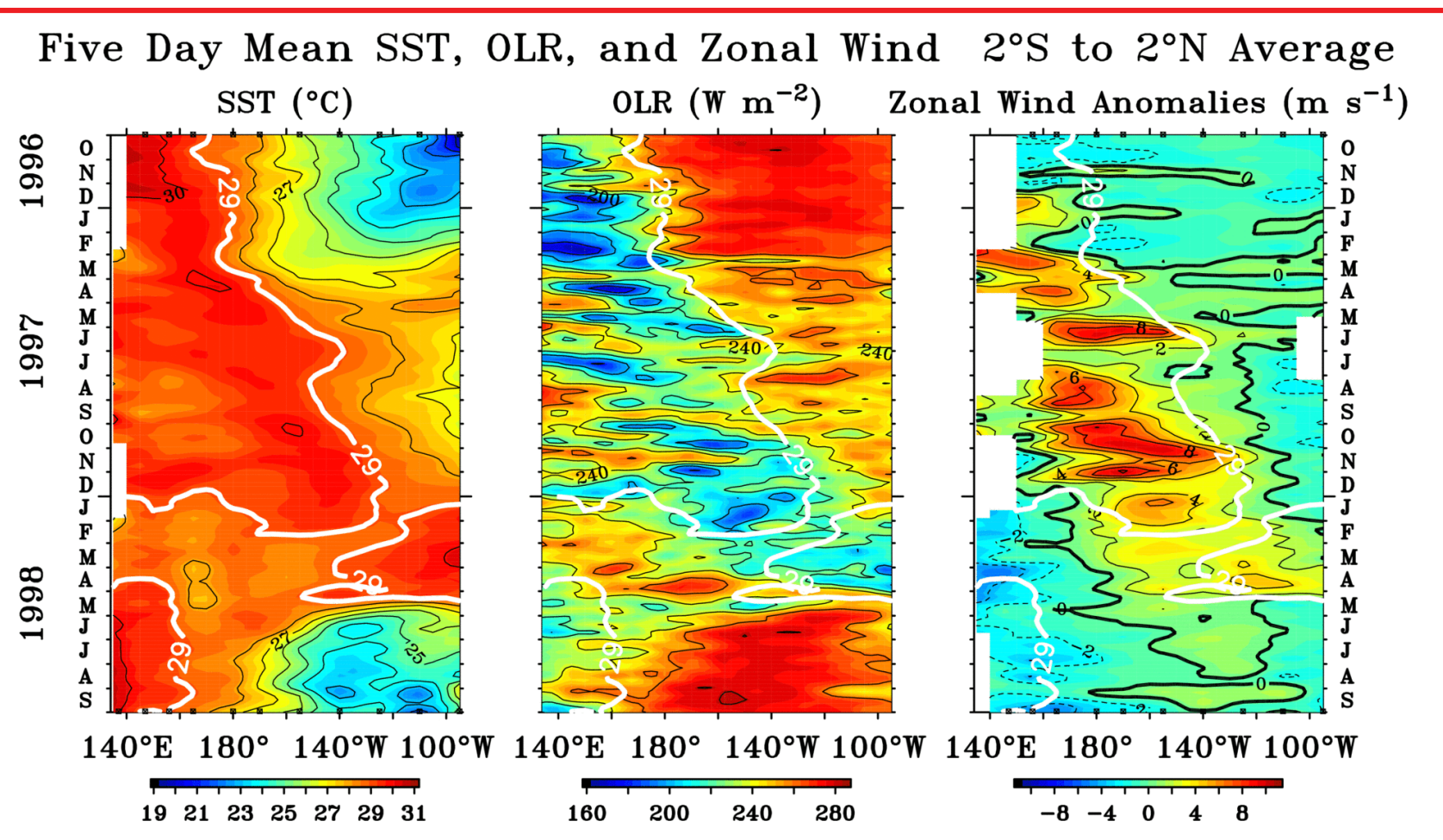
Heat content as an ENSO Predictor  
 Recharge Oscillator Theory (Jin, 1997)



A build-up of excess heat content along equator is a necessary precondition for El Niño to occur, and vice versa for La Niña



State Dependent Noise Forcing (Eisenman et al., 2005)



Stochastic forcing (e.g., short event-like wind forcing) → El Niño development; but El Niño development → More disturbed weather & more anomalous wind events

## 5. The Future:

Tropical Ocean Observing System Reviews, 2019-21

Tropical moored buoy arrays are:

- "critical"
- "essential"
- "cornerstones"

Recommendations:

- Preserve long climate records
- Expand geographic scope
- Enhance with more instrumentation
- Diversify with biogeochemical measurements

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