

The Tropical Atmosphere Ocean Array (TAO) Refresh - New Capabilities and Value Added

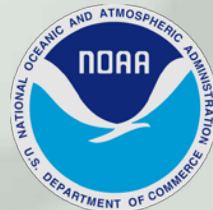
Richard H. Bouchard¹, Landry J. Bernard III^{1,2},
Raymond R. Beets³, Karen R. Grissom¹, and
Kathleen O'Neil¹



¹NOAA/NWS/National Data Buoy Center (NDBC)

²University of Southern Mississippi (USM)

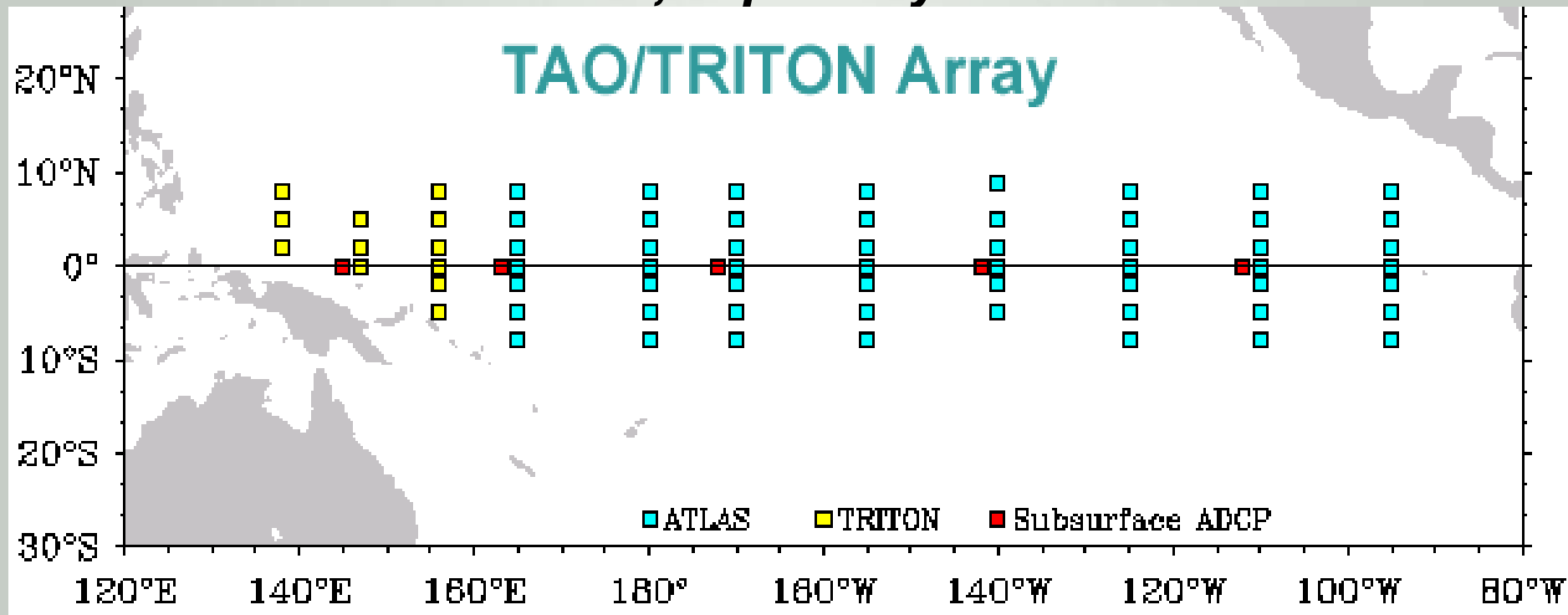
³Pacific Architects & Engineers (PAE)





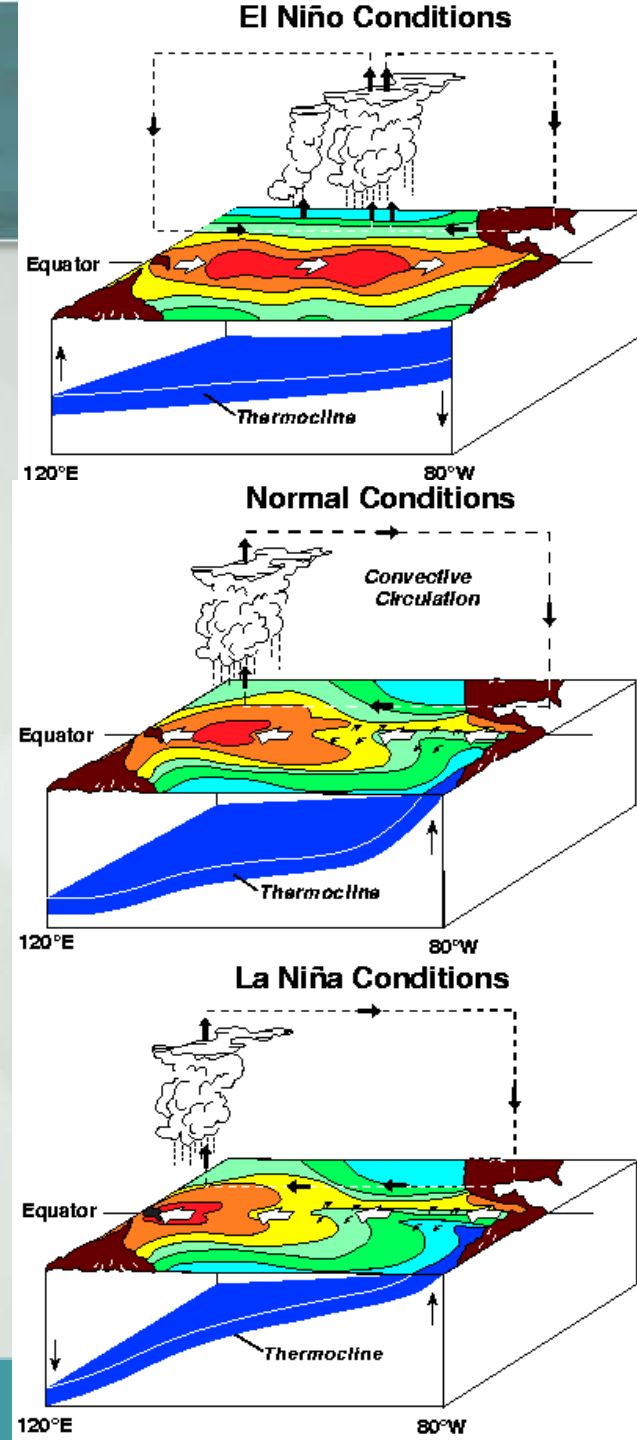
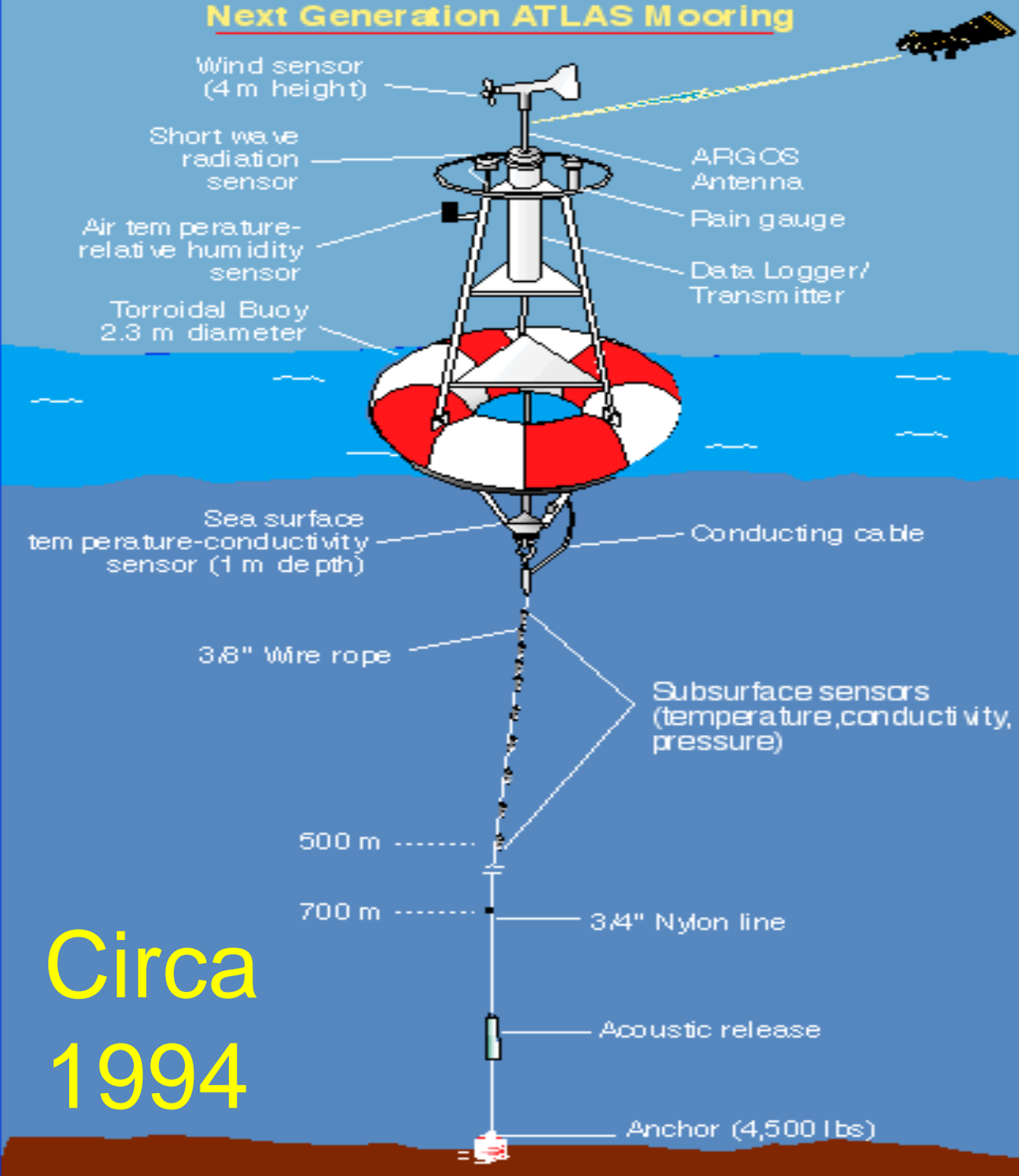
Tropical Atmosphere Ocean (TAO)

To provide real-time atmospheric and ocean data for improved detection, understanding and prediction of weather and climate, especially El Niño and La Niña



- 55 TAO buoy sites and 4 Acoustic Doppler Current Profiler sites (NDBC)
- 12 TRITON buoy sites and 1 ADCP site (JAMSTEC (Japan))

Next Generation ATLAS Mooring

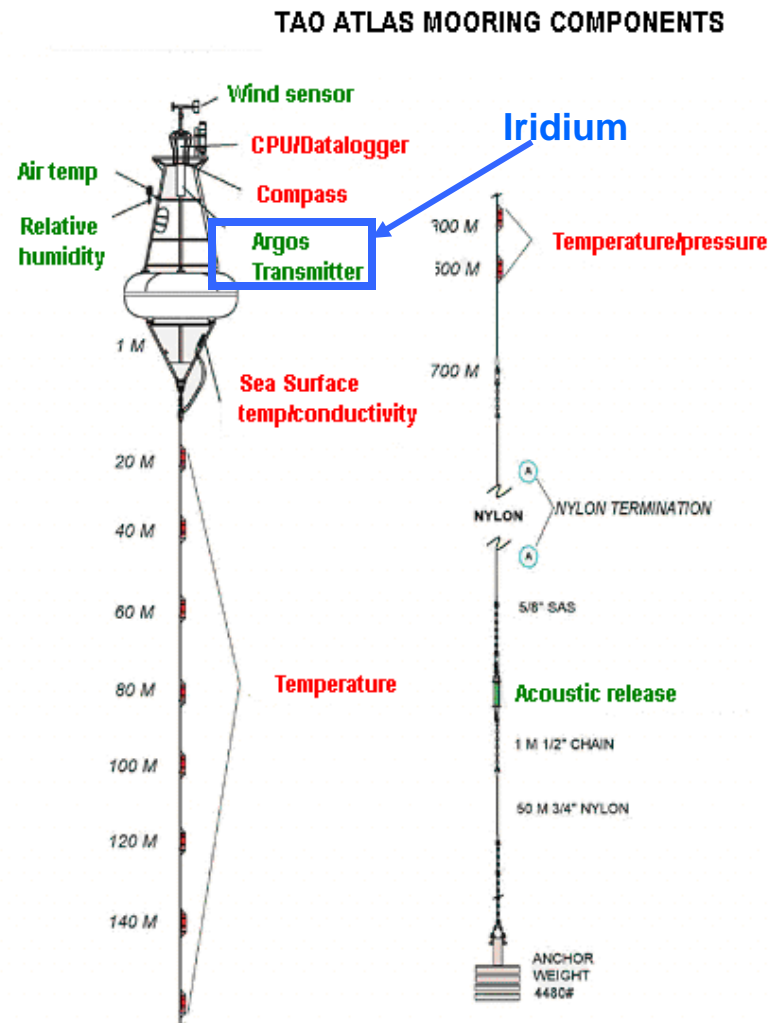


TAO Timeline

- 1982-83: Strongest El Nino of 20th Century went undetected until peak
- 1985-1994: Tropical Ocean-Global Atmosphere (TOGA) program. 70 moorings at conclusion.
- 1995: TAO succeeds TOGA; Part of the Climate Variability and Predictability (CLIVAR) program, the Global Ocean Observing System (GOOS), and the Global Climate Observing System (GCOS)
- 2002: NOAA Administrator endorses Recommendations of NOAA Program Review Team to transition; NOAA Line offices, OAR and NWS, prepare Transition Plan
- 2005-2007: Transition from NOAA Research to Operations at NDBC (Bouchard *et al.*, 2007)
- 2007-2010: Development & Testing TAO Technology Refresh (Crout *et al.*, 2011)
- **October 5, 2010: TAO Refresh Commissioned for Operational Use**
- 2014: Complete Replacement of Remaining 24 ATLAS by TAO Refresh

TAO Technology Refresh

- Previous Developments:
 - 1984: NOAA Research develops ATLAS (Autonomous Temperature Line Acquisition System) mooring.
 - 1994: Next Generation ATLAS
- During the Transition Planning in 2003, a major concern was the impending obsolescence of the existing technology in the TAO array (Moersdorf, 2004).
- An increasing number of components were being discontinued



Current
Available from commercial vendors, some with PMEL modifications

Obsolete
PMEL design with components no longer commercially available

Refreshed Instruments

- New: Compass, Interface for Rain Gauge and Radiation Sensors, and Commercial Off-The-Shelf (COTS) Subsurface CTD Sensors
- The New Instrumentation is Cost-effective and Robust
- COTS are Widely Used, Understood, and Interchangeable across Programs.
- However, the Change in Communications Has the Biggest Impact on Users

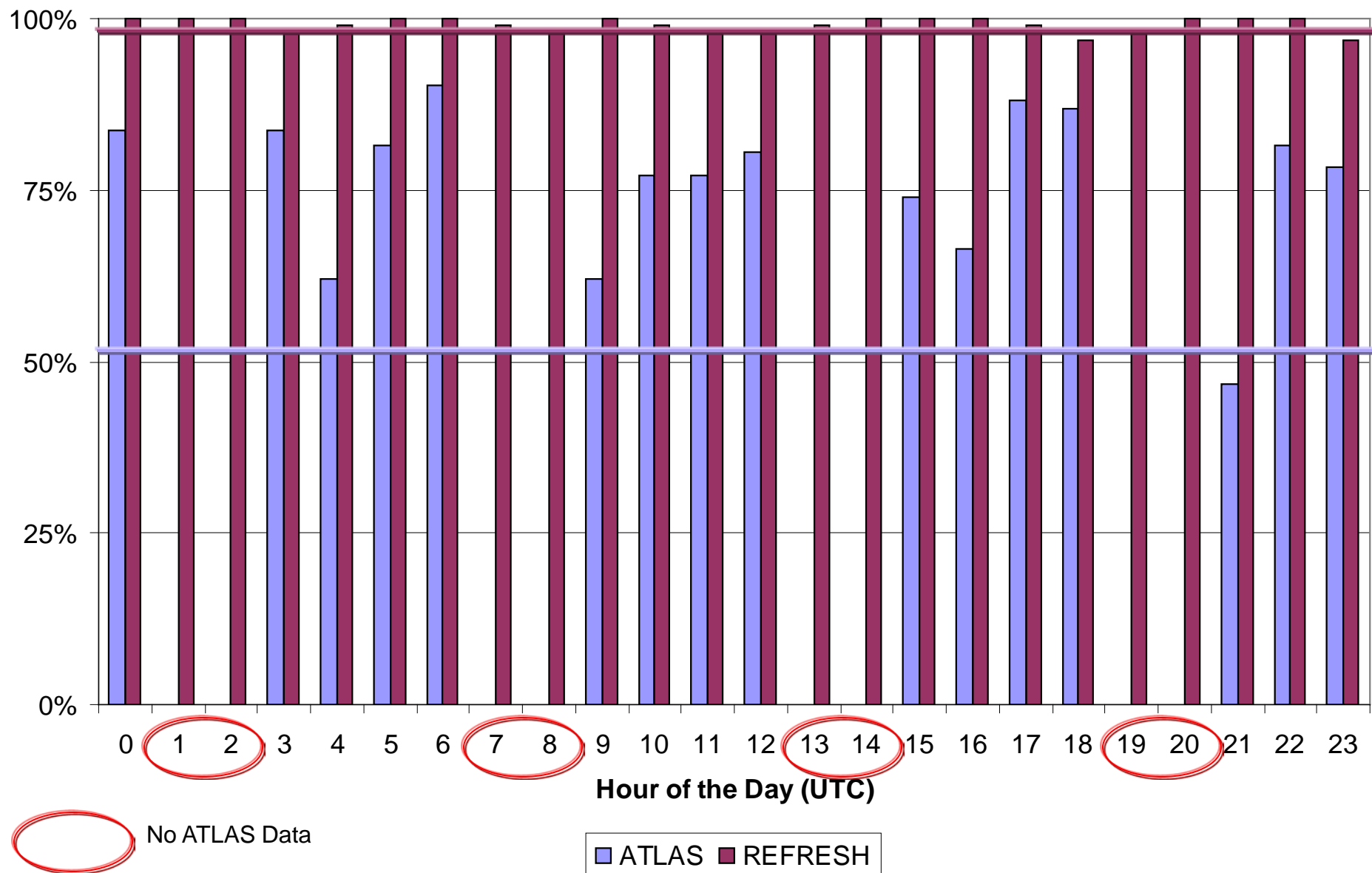
Communications and Datalogger Improvements

- ATLAS depends on Limited Availability and Bandwidth of NOAA Polar Orbiting Satellite Communications and Post-release Quality Control
- TAO Refresh uses Iridium Satellite Communications and an NDBC–developed Datalogger that Provide:
 - 24x7 Temporal Coverage & Less Latency
 - High-Resolution Data Available in Real-Time:
 - Data Preserved in Case of Instrument Loss, and
 - Detect Events in Real-Time, and Begin to Address Long-standing Problem of Vandalism (e.g., McPhaden, 1995)
 - Direct Delivery to NDBC for Pre-release Quality Control and Active Data Management

TAO Refresh Value-Added

- ATLAS Provided a Daily Average and a Few Hourly Reports; Full-resolution Awaited Recovery of Instruments
- Refresh Provides Users with Full Data Set in Real-time Allowing Users to:
 - Apply Specialized QC
 - Compile Averages and Statistics Tailored for their Application
 - Know the Number of Degrees of Freedom in Compilations

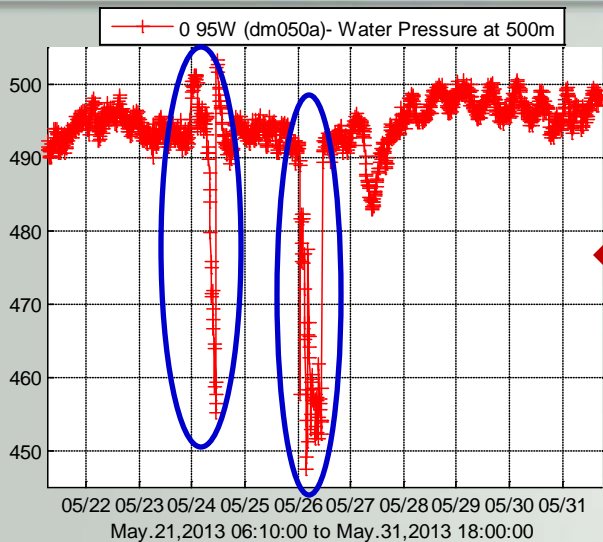
Co-located RT Data Availability 1 Oct – 31 Dec 2009



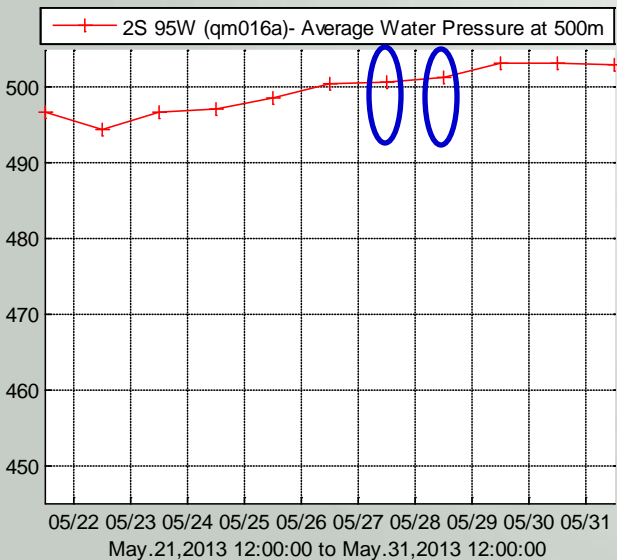
Real-Time Event Detection and Corroboration

CAYUDE – Venezuela Flag

Purse seine fishing vessel



At 0N 95W, real-time, high-resolution (Refresh) data AND imagery confirm vessel's interference with data

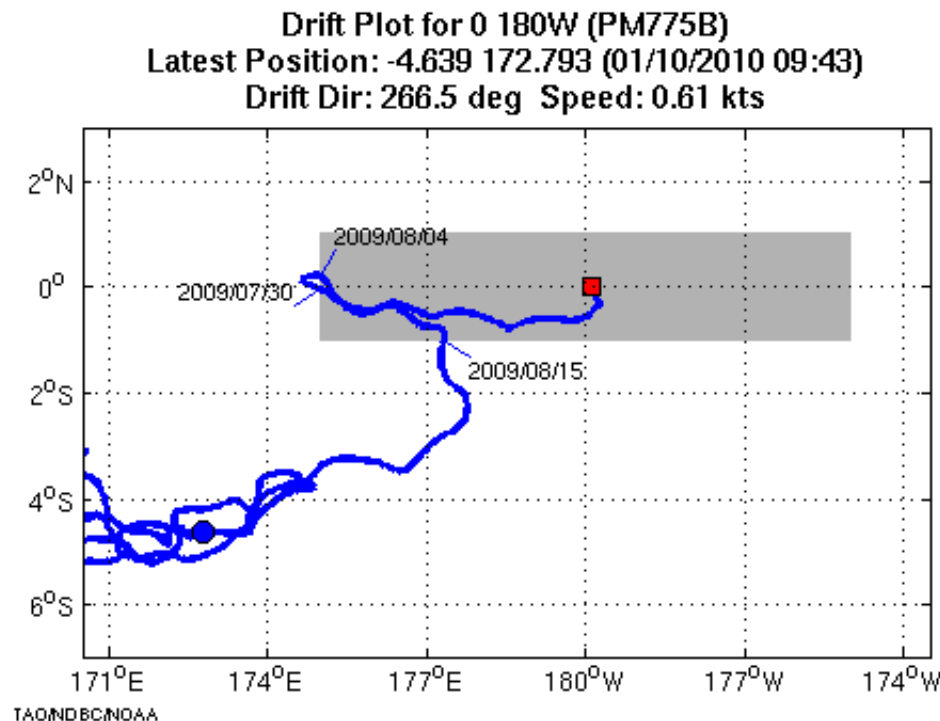


A few days later at 2S 95W, imagery show vessel in the area, but coarse resolution (ATLAS) data cannot detect event

Thinking Outside the Box

Research Did Not Release Measurements Outside of 2° x 10° Data Grid

Released as WMO 51542



**1775 Hourly Wind
and Sea Surface
Temperature
Reports from
Outside Data Grid
Box**

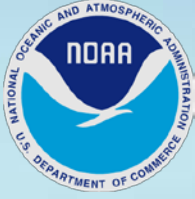
Jan 10 2010

TAO Refresh

in Summary

- Addressed Impending Obsolescence of ATLAS
- Expands User Applications with More Real-Time Measurements Tailorable to Specific Applications
- Empowers NOAA with the Documentary Evidence of Vandalism
- Refresh Completed in 2014





References

- Bouchard *et al.*, 2007, **Operational transition of the data processing, quality control, and web services of the Tropical Atmosphere Ocean Array (TAO)**, *Proc. 14th Symposium on Meteorological Observation and Instrumentation*, American Meteorological Society
- Crout *et al.*, 2011: **Refreshing the Equatorial Pacific Tropical Atmosphere Ocean Array (TAO)**, IUGG XXV Melbourne, Australia
- McPhaden, M.J., 1995. The Tropical Atmosphere Ocean (TAO) Array is Completed, *Bull. Amer. Meteor. Soc.*, 76(5), pp. 739-741.
- Moersdorf, P., 2004: **TAO Transition, Abstract of Presentation to NOAA Climate and Observing Program Annual System Review and Climate Observing System**





More Information



- <http://tao.noaa.gov>

