# The Tropical Atmosphere Ocean (TAO) Project

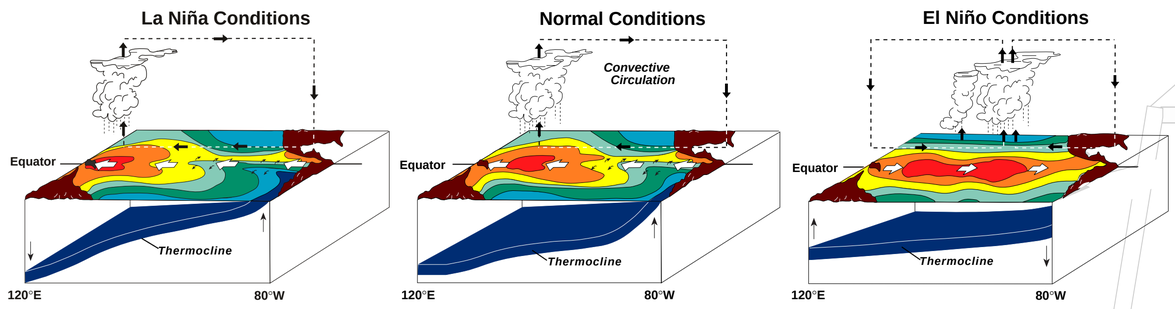

**Michael J. McPhaden**
**NOAA/Pacific Marine Environmental Laboratory**
**Seattle, Washington**
**http://www.pmel.noaa.gov/tao/**


***Mission: To provide real-time data from moored ocean buoys for improved detection, understanding, and prediction of El Niño and La Niña***

*"Observing systems have been fundamental in alerting the world to the [1997-98] El Niño....The array of moored buoys stretching across the Pacific Ocean...has been an invaluable source of data for monitoring and modelling the event."*

*--G. O. P. Obasi, Secretary General*
*World Meteorological Organization*
*June 1998*

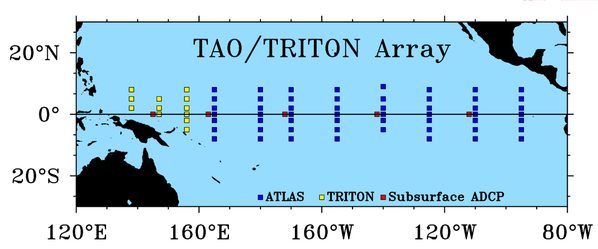
## ENSO



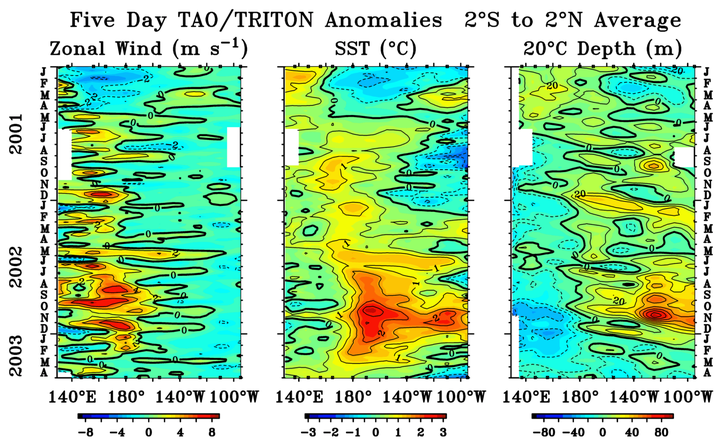

The El Niño/Southern Oscillation (ENSO) cycle is the most prominent year-to year climate fluctuation on Earth. Warm (El Niño) and cold (La Niña) phases of the cycle recur with a periodicity of roughly 3-7 years. These climate swings have significant impacts on global patterns of weather variability, Pacific marine ecosystems, commercially valuable fish species, and the global carbon cycle.

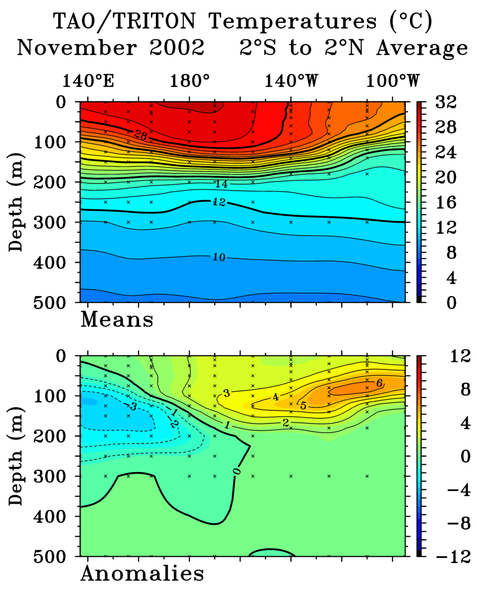
## TAO/TRITON Array

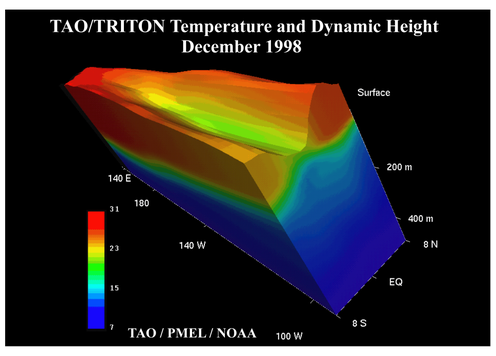
The TAO/TRITON array of over 70 deep ocean moored buoys is jointly maintained by the Japan Marine Science and Technology Center (JAMSTEC) and NOAA's Pacific Marine Environmental Laboratory (PMEL). The array, formerly known as TAO, became TAO/TRITON in January 2000 when JAMSTEC TRITON moorings were first introduced. Over 900 ATLAS moorings, designed and built by PMEL, have been deployed in the tropical Pacific since the inception of the array in 1985.




## Observing the Tropical Pacific



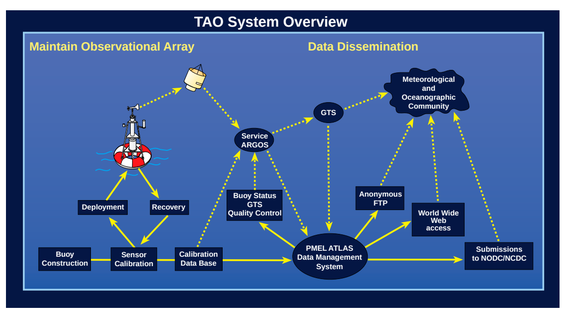




TAO/TRITON data are essential for detecting, describing, and assessing El Niño and La Niña conditions in the tropical Pacific.

## NOAA Ship Ka'imimoana

NOAA has dedicated the *Ka'imimoana* to provide most of the ship time needed (typically 275 days per year) to maintain the TAO portion of the array. The *Ka'imimoana* also provides a platform for shipboard measurements that complement and enhance the moored time series measurements.

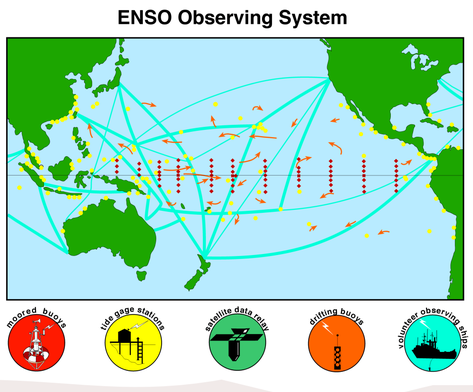
## Data Dissemination



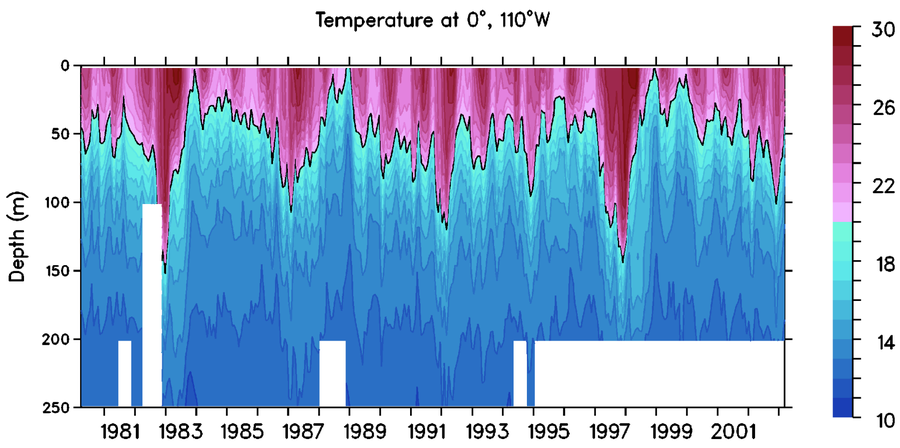

Real-time TAO/TRITON data are distributed via the Global Telecommunications System and the World Wide Web. TAO and TRITON instrumentation and data processing protocols are essentially identical, so the two data sets are merged into a seamless TAO/TRITON data stream at PMEL. The TAO Web pages provide user friendly access to the combined data sets, graphical displays, and information on El Niño and La Niña.

## The ENSO Observing System

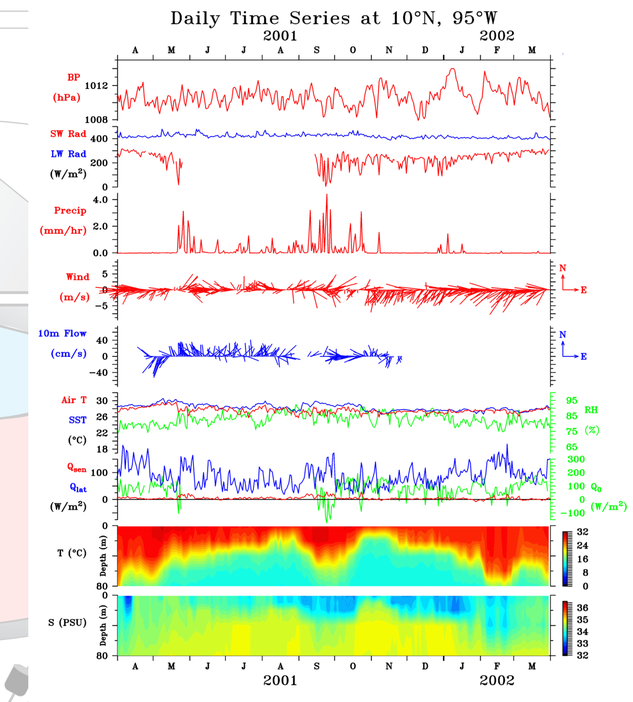
The TAO/TRITON array is a key element of the multi-national ENSO Observing System, comprised of ocean-based measurements and a constellation of earth observing satellites.

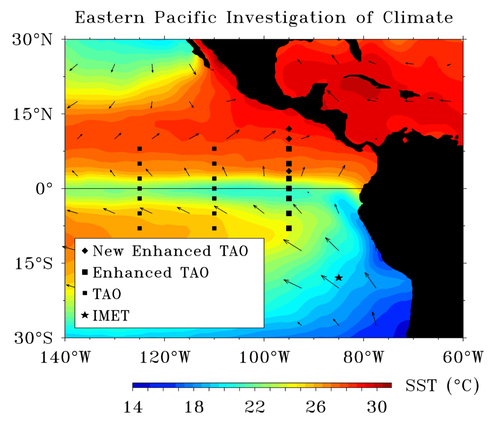



## Research




TAO/TRITON time series provide critical data sets required for improving our knowledge about the ENSO cycle and for related problems in oceanography and climate science. TAO/TRITON data are distinguished by their basin scale coverage, decade and longer record lengths, fine temporal resolution, and high quality.

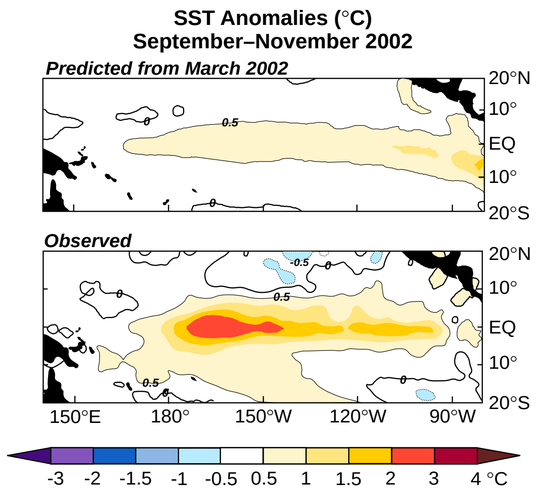



The ATLAS mooring is designed to allow for the addition of optional instrumentation in support of specialized experiments.

## ENSO Forecasting

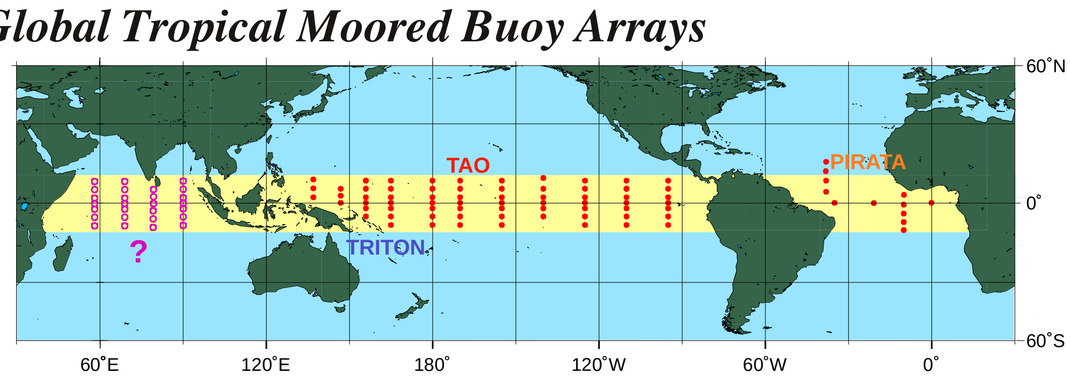
ENSO forecasts, though far from perfect, have significant skill at lead times up to one year. TAO/TRITON data are used extensively in producing oceanic and atmospheric analyses to initialize and validate ENSO forecasts. TAO/TRITON also contributes essential data for the development of numerical models and data assimilation procedures required for ENSO forecasting.




*The success of NOAA in forecasting the 2002-03 El Niño can be attributed to "…a combination of more experience watching El Niños develop, 2 decades of research, and the observation network..."*

*--Vernon Kousky, Director*
*NOAA Climate Prediction Center*
*July 2002*

## Global Tropical Moored Buoy Arrays




The TAO Project formed a partnership with France and Brazil in 1995 to develop the Pilot Research Moored Array in the Tropical Atlantic (PIRATA) and is currently active in developing plans for a multi-national Indian Ocean moored buoy array to support climate studies.

## The Future

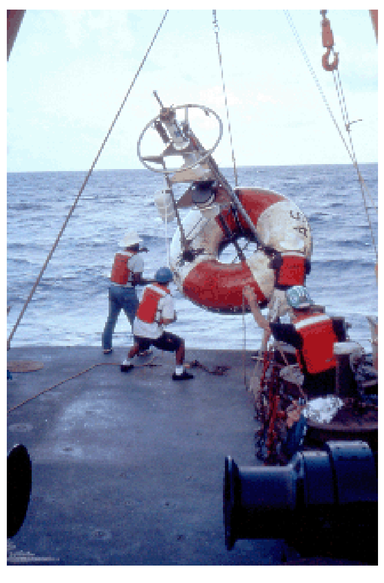
The TAO Project will continue its service to NOAA, the nation, and the world

1) by maintaining the TAO/TRITON array in partnership with JAMSTEC;

2) by enhancing and expanding its measurement capabilities where science dictates need and where technology and funding permit;

3) by coordinating with national and international measurement programs to integrate observing system capabilities;

4) by promoting the free exchange of data in support of oceanographic and climate research, operational forecasting, and climate assessments.




## Acknowledgments

The TAO Project is supported by NOAA's Office of Oceanic and Atmospheric Research and Office of Global Programs.