

Enhanced monitoring for US CLIVAR
Input from the Pacific Panel

1. IMET flux mooring (20°S, 85°W)

Leader: Bob Weller

Timeline: Start date: Oct 2000
Duration: ongoing (4th deployment)
Cost: ??

Goals: Accurate time series of surface meteorology (including complete radiation, winds and moisture fluxes) and upper ocean T,S,u, in the core stratocumulus region of the southeastern Pacific. These time series enable diagnosis of the boundary layers in both ocean and atmosphere. The buoy anchors past, present and future observational programs in the stratocumulus region.

Linked modeling/analysis activities: EPIC, VEPIC/VOCALS

Archiving/access: Web page and ??

2. TAO surface salinity

Leaders: Mike McPhaden (NOAA/PMEL)

Timeline: Start date 1987
Duration 14 years at some sites
End date Oct 2004
Cost Unfunded at present

Goals: Provide time series of surface salinity at various locations in the TAO array for improved description, understanding, and prediction of El Niño and La Niña.

Linked modeling/analysis activities: Low level efforts have been underway for the past several years at NCEP to develop an real-time salinity analyses for ENSO forecast model initialization. Data have been used in many scientific publications over the years and are useful for model validation.

Archiving/access: PMEL and JAMSTEC

Linkages/partnerships: Some sensors left over from TOGA-COARE days have been provided by IRD and PMEL to continue measurements along 165E.

TRMM provided some funding beginning in the mid-1990s to provide surface salinity at mooring sites with TRMM-supported rainfall. NASA/TRMM support ended in FY 2002. PACS/EPIC supported salinity and rainfall during its field phase 1999-2003 along 95W, but the EPIC field phase ended this year. JAMSTEC's western Pacific TRITON moorings all have salinities at 12 levels in the upper 750 m.

Comments: At present, there are 25 TAO sites and 12 TRITON sites with SSS. None of the TAO sites has dedicated funding. The technology exists to equip all 55 TAO sites with SSS sensors. A plan to do this was submitted and approved by the NASA Aquarius mission team in FY 01 and NOAA/OGP agreed in principle to fund the array time prior to launch. Under the original scenario (before schedules slipped), implementation would have begun in FY 03. Estimates (from three years ago) were that capital costs to initiate the program would be about \$350K and recurring annual costs would be \$100K. These numbers would need to be revisited based on what we have learned since 2001 and how processing requirements and equipment costs have changed.

3. TAO rainfall monitoring

Leaders: Mike McPhaden (NOAA/PMEL)

Timeline:

Start date	1997
Duration	6 years at some sites
End date	Oct 2004
Cost	Unfunded at present

Goals: Provide time series of rainfall at various locations in the TAO array for improved description and understanding of oceanic rain rates and fresh water fluxes on diurnal to interannual time scales.

Linked modeling/analysis activities: The rain data have been used principally for TRMM validation and scientific analyses. Research has focussed mainly on defining time statistics of rainfall variability, and how variations in surface fresh water fluxes affect ocean salinity.

Archiving/access: PMEL and JAMSTEC

Linkages/partnerships: As an outgrowth of TOGA-COARE, NASA/TRMM provided funding beginning in the mid-1990s to expand rainfall and surface salinity measurements at several TAO mooring sites. PMEL switched from optical gauges used in COARE to simpler and lower cost RM Young siphon gauges at that time. TRMM support for this program ended in FY 2002 after several years of successful data collection. PACS/EPIC supported salinity and rainfall during its field phase 1999-2003 along 95W, but the EPIC field phase

ended this year. JAMSTEC's western Pacific TRITON moorings all have optical rain gauges.

Comments: At present, there are 25 TAO sites and 12 TRITON sites with rain sensors. None of the TAO sites has dedicated funding and will be phased out at the end of FY 04 if no new sources are found. At least some of these sites should be continued as part of a surface salinity enhanced monitoring program and/or as part of reference flux time series stations (if either of those efforts were to be funded).

4. TAO radiation monitoring

Leaders: Mike McPhaden (NOAA/PMEL)

Timeline: Start date 1997
Duration 6 years at some sites
End date Oct 2005
Cost Shared between DOE and PMEL

Goals: Provide time series of shortwave radiation at TAO moorings along 165E for improved description and understanding of radiative fluxes on diurnal to interannual time scales.

Linked modeling/analysis activities: The radiation data have been used principally for scientific analyses. Research has focused on defining diurnal to interannual variations in incoming shortwave radiation, implications of those variations for the surface radiation balance, and the effects of short wave fluxes on the upper ocean heat balance.

Archiving/access: PMEL, JAMSTEC, and DOE/ARM

Linkages/partnerships: DOE/ARM provided funding beginning in the 1997 to expand shortwave radiation measurements at all TAO mooring sites along 165E as part of a long-term ARM western Pacific field program. This support was used to develop a sensor interface and shortwave logging protocols for NextGeneration ATLAS buoys, to build up an inventory of Eppley pyranometers, and to implement the measurement program along 165E. Direct DOE/ARM support for this program ended in FY 2003 after several years of successful data collection. Measurements will continue for at least two more years using the existing inventory and calibration support provided by the National Renewable Energy Laboratory in Boulder, CO.

Comments: At present, there are 4 long-term shortwave radiation measurement sites maintained along the equator (110W, 140W, 170W, 165E) independent of

the DOE/ARM effort. Also, JAMSTEC maintains shortwave sensors on all 12 of its TRITON sites in the western Pacific. Shortwave sensors were maintained on all moorings along 95W as part of the 1999-2003 PACS/EPIC field phase which ended this year.

Proposed activities:

1. Kuroshio Extension air/sea flux mooring

Leader: Meghan Cronin, Chris Meinig, Chris Sabine (NOAA/PMEL)

Timeline: Start date: June 2004
Duration: 2 years (hope to continue)
End date: June 2006 (if not extended)
Cost: \$300K (first two years)

Goals: to monitor the air-sea heat, moisture, momentum, and CO₂ fluxes in the Kuroshio Extension recirculation gyre as a NOAA contribution to the network of Global Eulerian Observatory (GEO) sites.

Linked modeling/analysis activities: The first two years overlap with the Kuroshio Extension System Study (KESS). The mooring will be integrated into the KESS observational array, and will have substantial cost leveraging through KESS (shiptime, mooring operations personnel, etc.). It is our hope however that this mooring will become a GEO site and will act as a reference time series station.

Archiving/access: Data would be freely available through PMEL-maintained data delivery webpages and ftp sites. Telemetered data would be withheld from GTS during the first 2 years. This policy would be reviewed after that period.

Linkages/Partnerships: There are strong linkages with KESS, NOAA OGP Climate Observation and Services Program, the U.S. Oceans Integrated Ocean Observing System, and the NOAA Global Carbon Cycle Program.

2. Mindanao Current mass/heat flux monitoring

Leader: B. Kessler (NOAA/PMEL), Y. Kuroda (JAMSTEC), R. Davis (Scripps)

Timeline: Start date: Early 2005 (?)
Duration: 6 months (testing period)
Cost: \$69K for year 1 testing

Goals: to test monitoring the mass and heat transport of the Mindanao Current using ocean gliders. The MC is the major unsampled piece of the tropical-extratropical circulation.

Linked modeling/analysis activities: The broadscale observing network (especially Argo and altimeter) will be adequate to monitor the interior ocean circulation and provide data for assimilation into prediction models. The crucial missing piece for simulation of equatorial thermocline evolution is the mass and heat flux of the low-latitude western boundary currents.

Archiving/access:

Linkages/Partnerships: This is possible only through partnership with JAMSTEC, which is providing ship/technician time and joint analysis.