Sustaining a Moored Ocean Observing System: The Future of the TAO Array within the Tropical Pacific Observing System
TAO Program History

1984
ATLAS Design
PMEL begins development of array for ENSO & climate research following 1982-83 El Nino.

1994
Array Complete
10 year build-out under the international TOGA program and development NextGen ATLAS.

1996
R/V Ka’imimoana
NOAA Ship Ka’imimoana commissioned to service array east of 165E.

2005
Transition to NDBC
The array is declared operational by NOAA and transitioned from PMEL to NDBC.

2011
TAO Refresh
The impending obsolescence of the technology results in an NDBC TAO Refresh, complete in 2011.
Data availability is coupled to the number of days at sea servicing buoys.

Last Ka’ cruise
The Tropical Pacific Observing System

Satellite Observations:
- SST
- SSH
- Ocean Color
- Wind
- Salinity

In situ Observations:
- VOS
- Drifters
- Tide Gauges
- XBT
- Buoys
- ARGO
- Go-SHIP
- Emerging Tech.

The intersection of Science, Technology, Research and Operations
TPOS 2020: GOMO Role

- Supported/advocated the integrated vision of TPOS 2020 Project
- Advanced TPOS as a agency priority
- Facilitate cross NOAA Line Office Collaboration, OAR:NWS & PMEL:NDBC
- Lead/coordinate the NOAA TPOS Working Group (TWG)
- Lead coordination of NOAA Implementation Plan Team (aka Tiger Team)
- Sponsored a series of pilot projects on in-situ technology to contribute to TPOS 2020
Autonomous Surface Vessels: Saildrone

Moored Buoys: Direct Covariance Flux System

Moored Buoys: Ocean Boundary Layer

Profiling Floats: Rain, Wind, & BCG

Profiling Floats: BCG, bio-productivity, CO2 fluxes, & hypoxia

Profiling Floats: Improvements to technology

TPOS Pilot Projects
"Enhanced Ocean Boundary Layer Observations on NDBC TAO Moorings"

1. West Pac warm pool (2S 165E)
2. Ekman divergence (2S 140W)
3. ITCZ (8N 165E)
4. Edge of warm pool (0 180)
5. SPCZ (8S 180)
6. Strong Eq trades (0 155W)
7. Cold tongue front (2N 125W)
8. Core cold tongue (0 110W)
New Technology and Observations: The Redesign of an Array

Basic TAO Refresh
- Wind AT/RH
- SST/SSC
- 20 T
- 40 T
- 60 T

Basic TAO Recap (Tier 1)
- Wind, AT/RH, rain, BP, SWR/LWR
- SST/SSC
- 10 T
- 15 T
- 20 T
- 25 T
- 30 T
- 40 T
- 50 T
- 60 T

TAO Recap (ADCP)
- Wind, AT/RH, rain, BP, SWR/LWR
- Real-time current profile from ~11 m - 315 m
TAO/TPOS Enhancements: Diurnal cycles

West Pacific Station

East Pacific Station

Masich et al., 2021
TPOS Enhanced DCFS Mooring

Deployment
• Date: October 4, 2019
• Location: 0°, 165°E

Instrumentation
• 3-axis Sonic Anemometer
• 3-axis Motion Package
• Solar and IR Radiometers
• Redundant RH/T_{air} Sensors
• Barometer
• Rain Gauge
• T_{sea} and Salinity Sensors
• ADCP/ADV Daisy-chain

Real-time Delivery of
• Direct Covariance Surface Stress and Buoyancy Fluxes
• Radiative Fluxes
• Bulk Sensible and Latent Heat Fluxes
• Net Heat Flux
• Near Surface Currents
• Ocean Current Profiles

Edson et al., 2020
Enhanced Ocean Boundary Layer Observations on NDBC TAO Moorings

Pil: Karen Griscom (NCGA/AMOC/OSI), William Keafer (NCGA/AME), Meghan Cronin (NCGA/OAE), and Jessica Maseich (NMC/NOAA/NEO)

Description

NOAA’s Pacific Marine Environmental Laboratory and National Data Buoy Center installed Acoustic Doppler Current Profilers on Tropical Atmospheric Ocean moorings at nine sites across the tropical Pacific. These sensors measured velocity in the near-surface ocean between seven meters and 65 meters depth, typically at the “blow split” in the water column for observations of ocean currents.

JGR Oceans

Diurnal Cycles of Near-Surface Currents Across the Tropical Pacific

Jessica Maseich, William S. Keafer, Meghan F. Cronin, Karen R. Griscom

First published: 02 April 2021

Abstract

Solar radiative heat and wind-forced momentum can be trapped at the surface and transmitted into the ocean interior via a daily descending thermal layer that mixes heat and momentum downsweeps. Here, we characterize the extent of this mechanism across the tropical Pacific via seven mooring deployments spanning the eastern and western tropical Pacific and the inter-Tropical and South Pacific Convergence Zones. We find during SPURS with the inclusion of an infrared hygrometer to make fast-response measurement of latent and sensible heat fluxes from the buoyancy flux. This expansion well and additional batteries. Efforts are currently underway to reduce the power power platforms.

Forcing, CPU-Operating-Temp Effects at the rod7_0203_000 Regular challenge: Spectrally

view issue TOC

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Transition Research to Operations

- GOMO facilitate the transition of technology to operational status
- Revitalize observing system backbone based upon a series of GOMO-funded TPOS pilot projects and TPOS
- Garnered support for TPOS science recommendations as described in the TPOS 2020 Final Report
TPOS: The Path Forward

- Recapitalize TAO to modernize & provide value-added new technologies - Reconfigured “backbone” array
- Observations to advance understanding of ENSO and tropical Pacific physical and biogeochemical variability.
- Work with national/international ocean observing programs to implement the TPOS recommendations on observations, data management, & models/DA
- Build community consensus on future of Tropical Pacific – new TPOS Governance
Thank You

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