NATIONAL DATA BUOY CENTER

The Next Evolution of the TAO Array: The Implementation of a TPOS Co-Designed Observing System

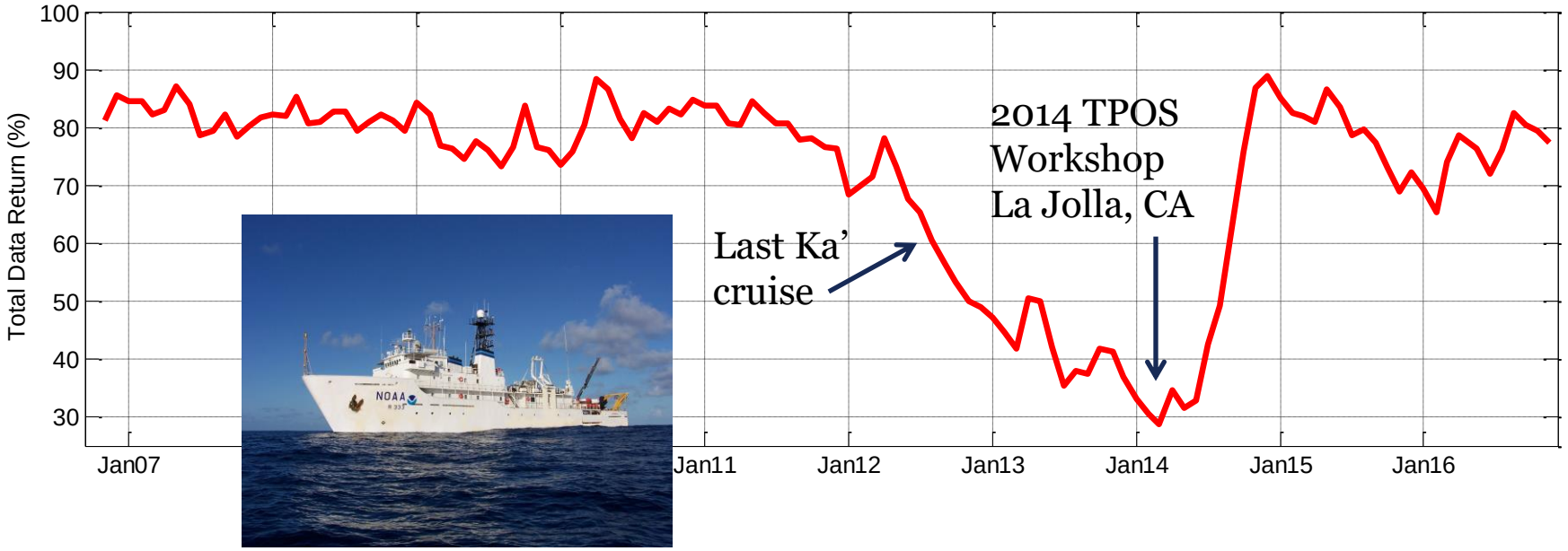
DBCP- 38 Science and Technology Workshop
1 November, 2022

Karen Grissom, Steven DiNapoli, Kevin Kern, James Elliott, and William Burnett

NOAA/NWS/National Data Buoy Center, Stennis Space Center, MS 39529 USA

NATIONAL DATA BUOY CENTER

The Problem



- How to increase longevity of observations to compensate for an era of reduced ship time.
- Improve our understanding of the feedback interaction between zonal winds and equatorial thermocline that distinguishes the Tropical Pacific and allows ENSO to develop.
- Resolve the variation in oceanic mixed-layer that have systemic effects on heat and momentum transfer.
- Improve reliability and longevity of observations.

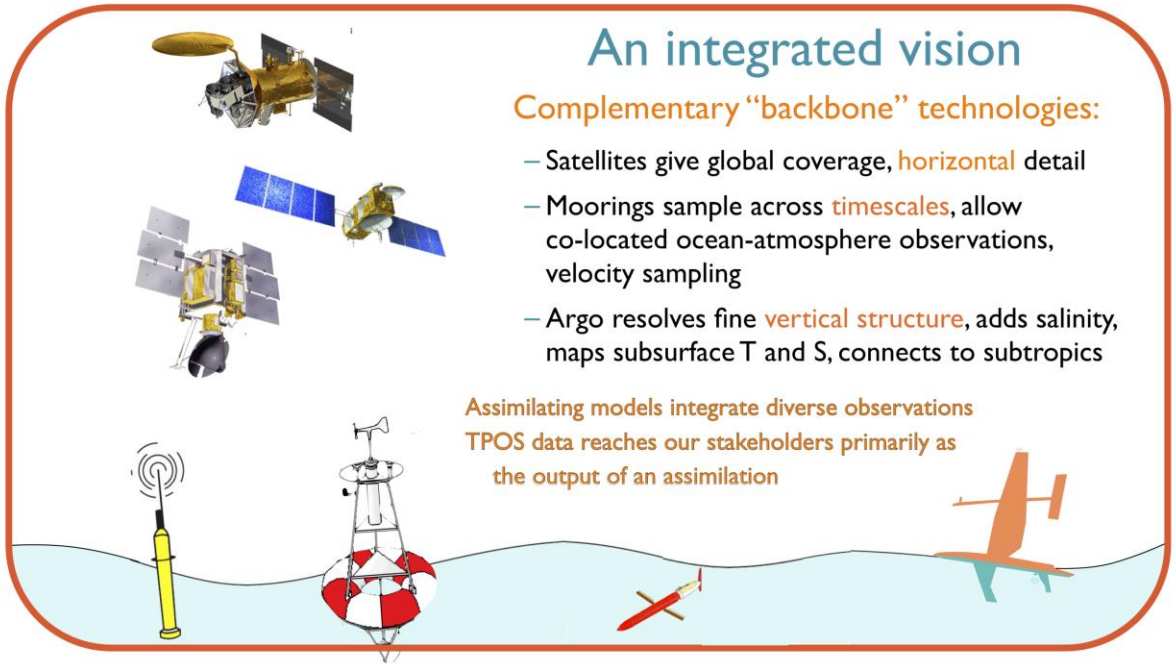
NATIONAL DATA BUOY CENTER

The Plan

TPOS 2020 Tropical Pacific Observing System

Recapitalize the TAO array to modernize the system and provide observational enhancements as described in the TPOS 2020 Final Report, including:

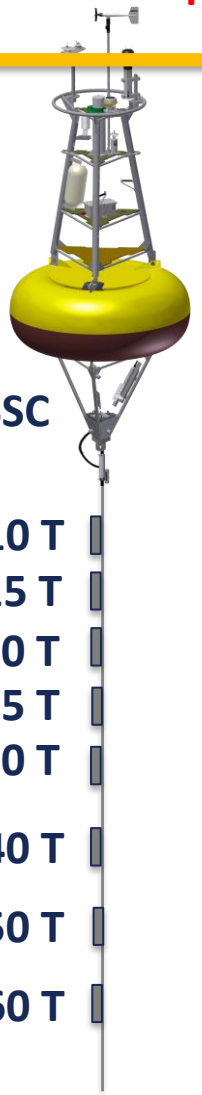
1. **Mitigate technology obsolescence** (payload & sensors)
2. **New value-added technologies and observations** (TPOS pilot projects)
    a. Real-time currents
    b. Additional ML measurements
    c. Enhanced meteorological sampling
3. **Reconfigured "backbone" array**
    a. Fewer but more capable moorings
    b. Meridional expansion



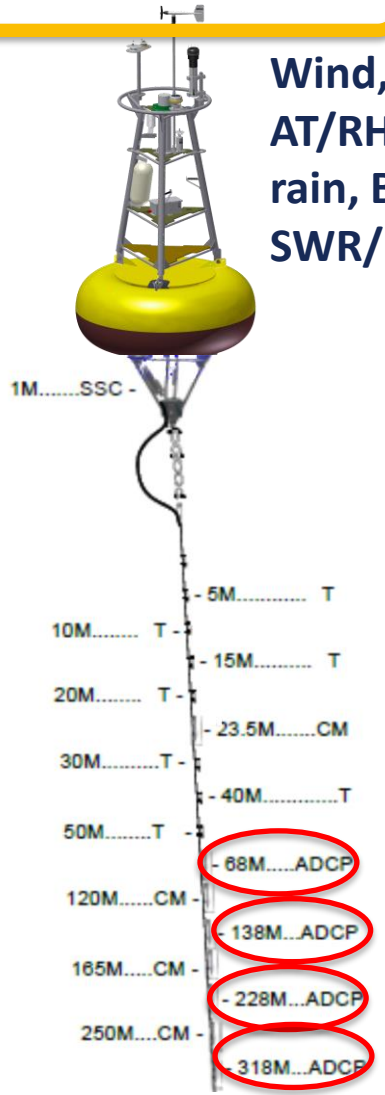
New Technologies and New Observations

Basic TAO Refresh

Basic TAO Recap (Tier 1)



TAO Recap (ADCP)



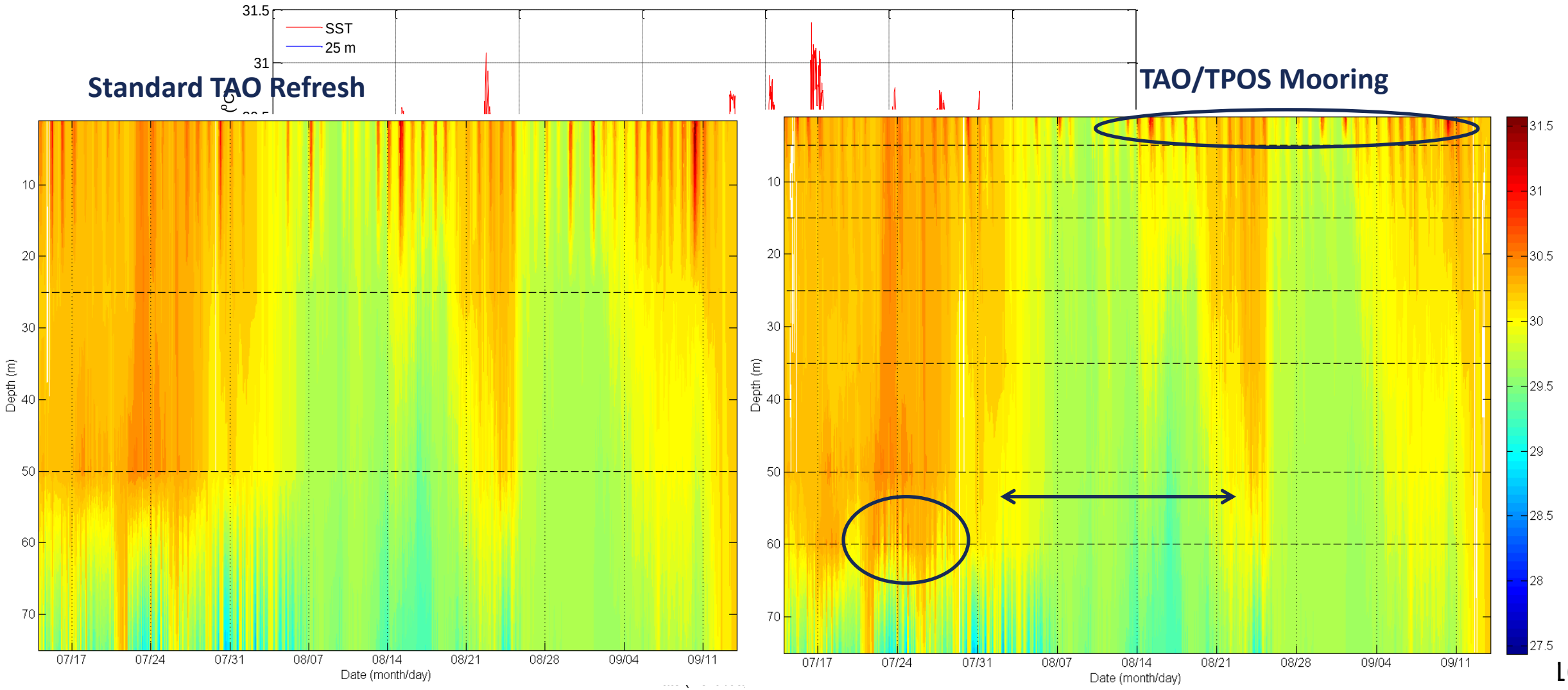
Real-time current profile from ~11 m - 315 m

TAO SM+ Payload

-Dist. Processing
-XML Format
-Wireless Comms
-10 min Transmit
-Backchannel access

NATIONAL DATA BUOY CENTER

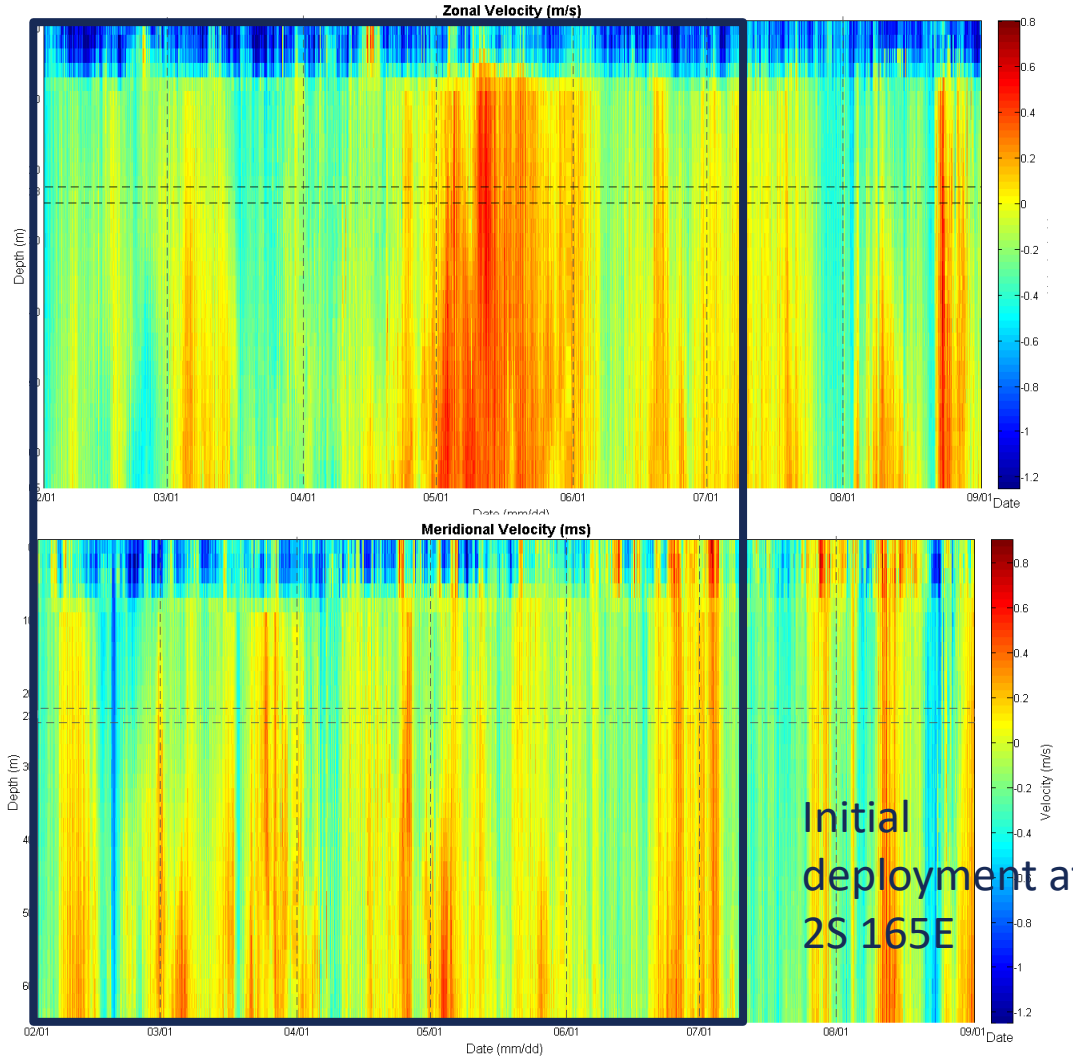
Additional ML Observations



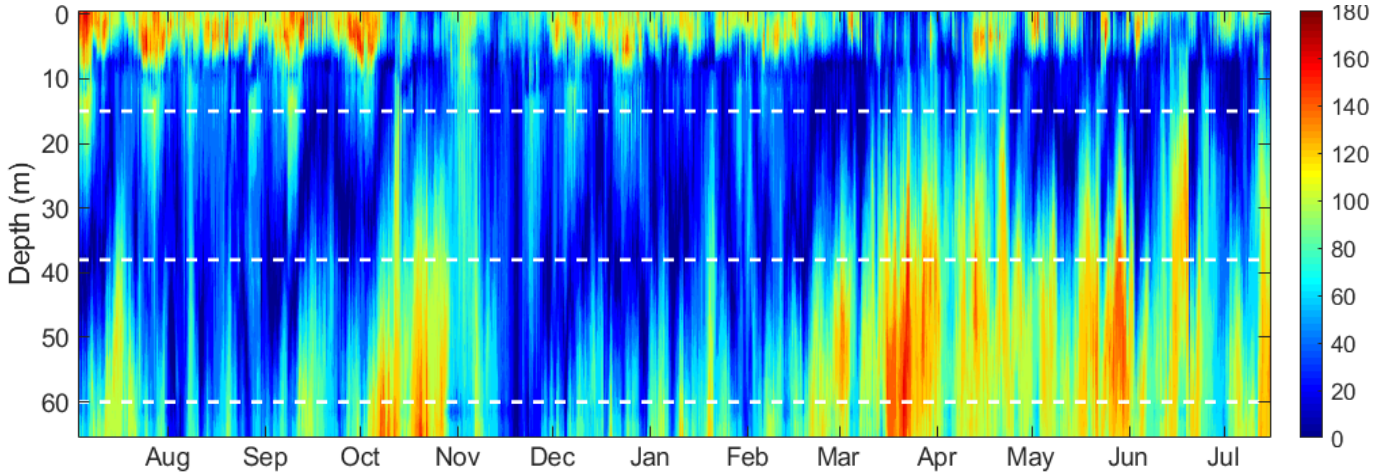
NATIONAL DATA BUOY CENTER

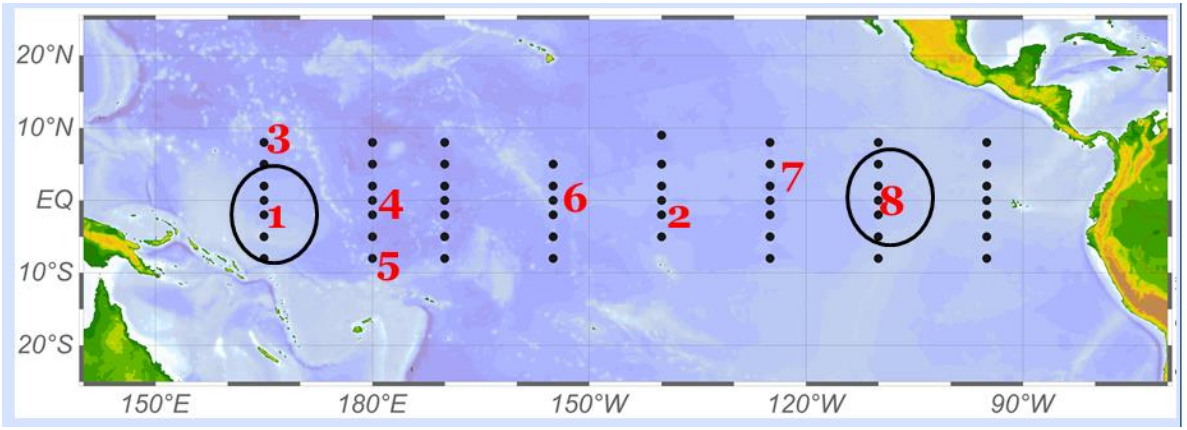
Real-Time Current Velocity

TPOS Pilot Project: 10 deployments 2016-2020



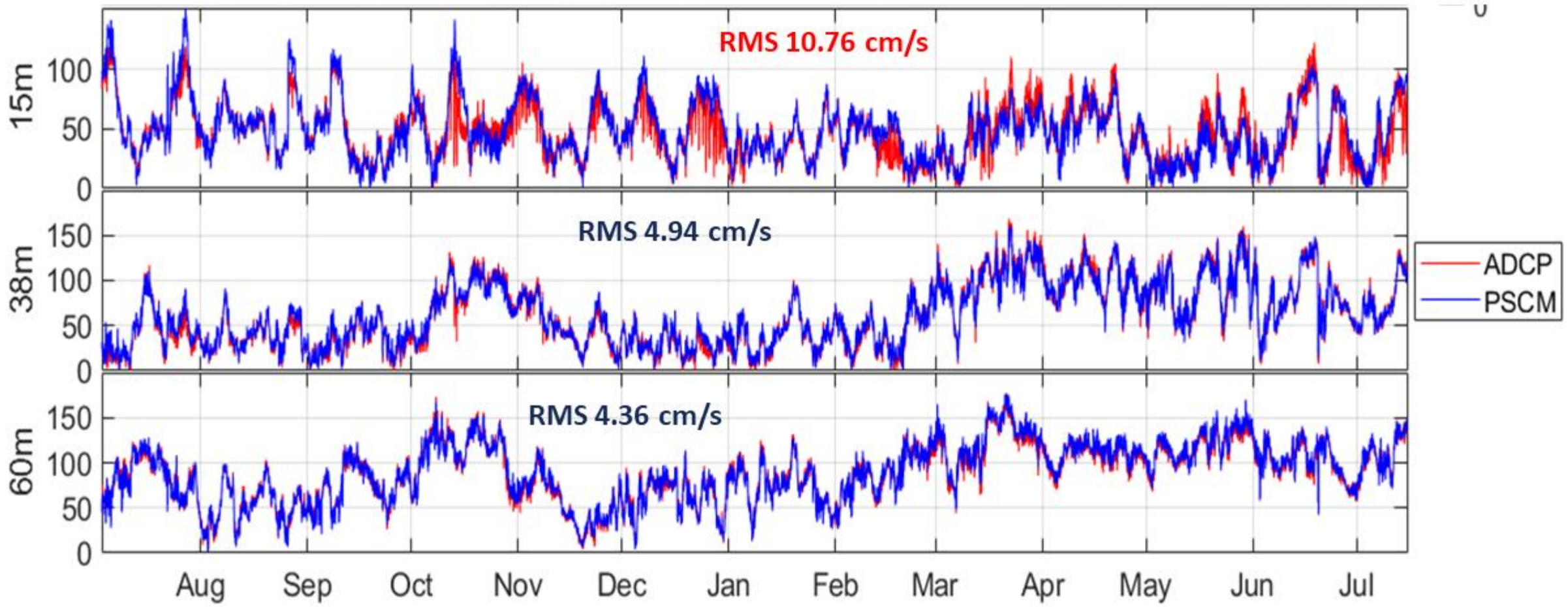
Final deployment at 0 110W



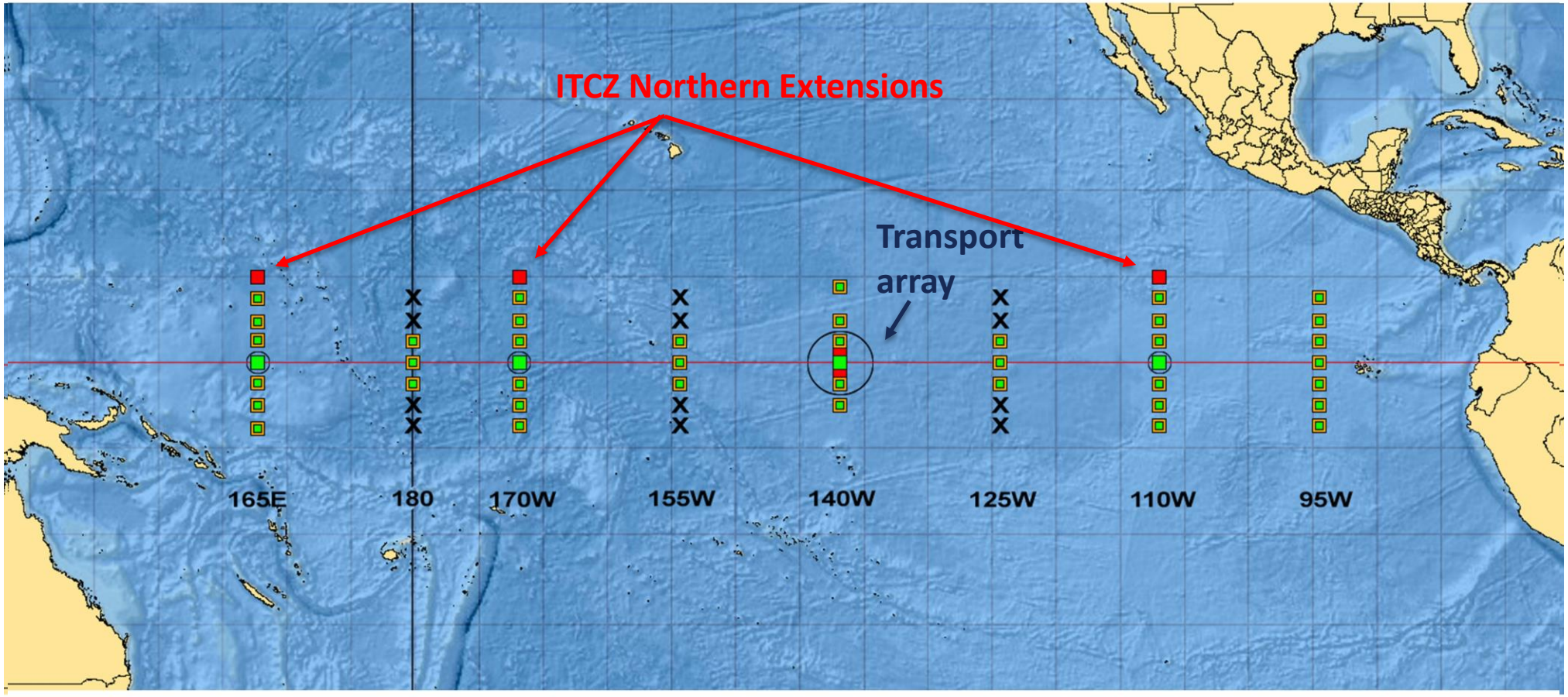


NATIONAL DATA BUOY CENTER

Velocity Profile Validation



The Reconfigured TAO Array



Existing TAO Recap Enhanced Stations

New TAO Recap Enhanced Stations

X Omitted Stations

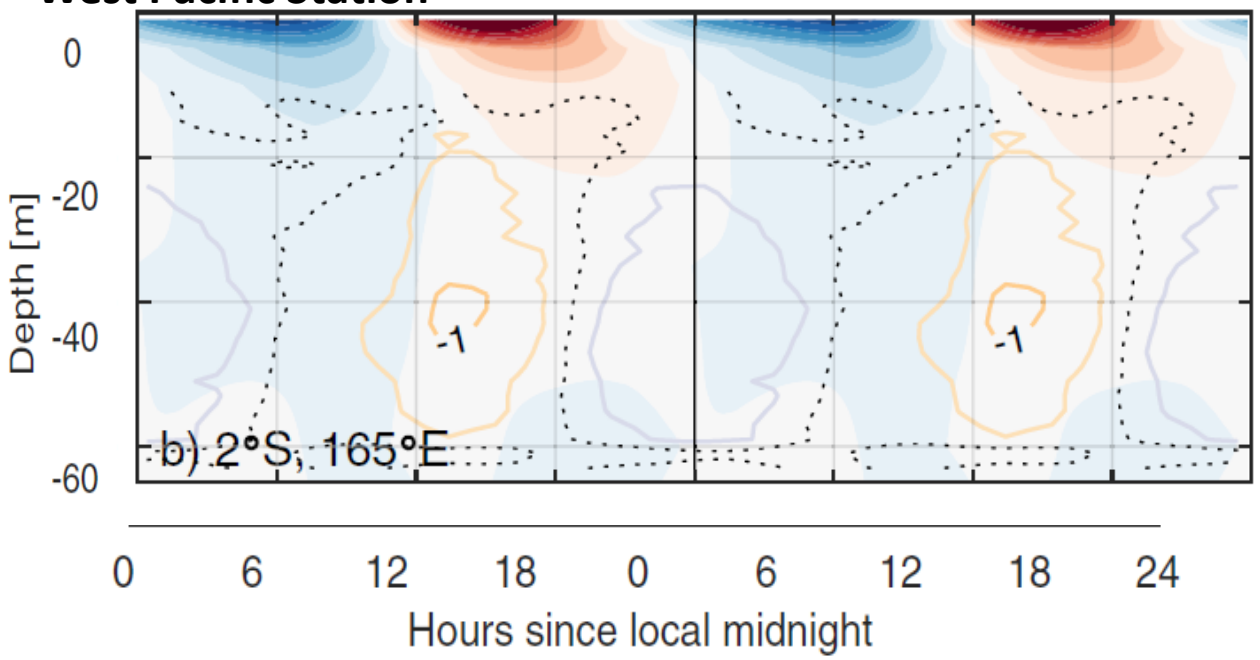
FLUX Stations

ADCP Stations

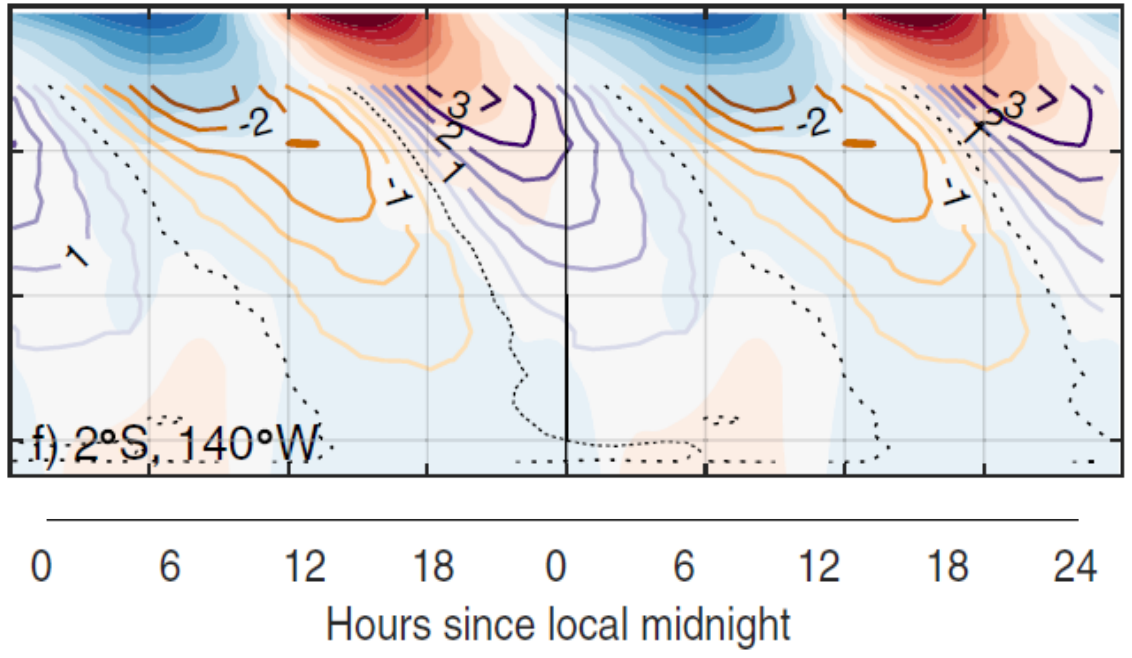
NATIONAL DATA BUOY CENTER

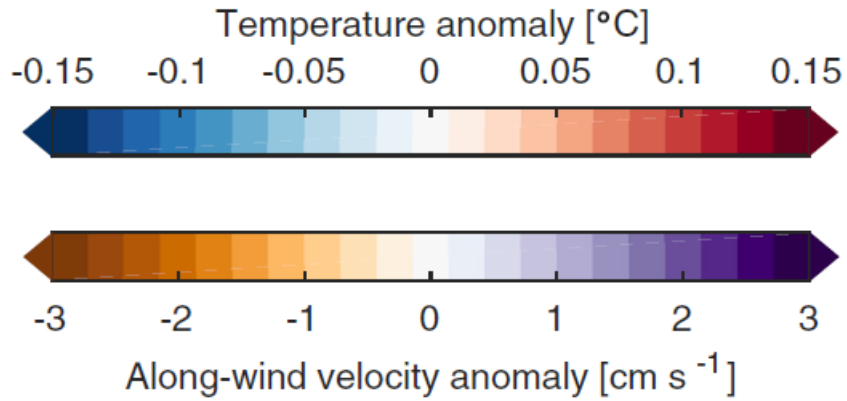
TAO/TPOS Enhanced Meteorological Observations

West Pacific Station



East Pacific Station

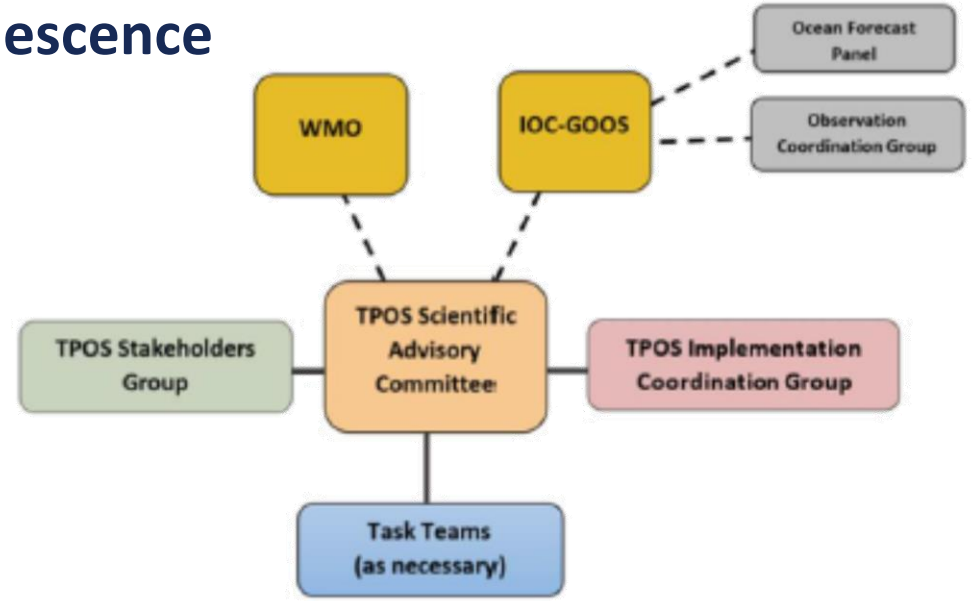




Masich, J., Kessler, W. S., Cronin, M. F., & Grissom, K. R. (2021). Diurnal cycles of near-surface currents across the tropical Pacific. *Journal of Geophysical Research: Oceans*, *126*, e2020JC016982. https://doi.org/10.1029/2020JC016982

TAO (TPOS): The Path Forward

- TAO Recap informed (co-designed) by TPOS science recommendations
- Continuing to work with national/international ocean observing programs to implement the TPOS recommendations on observations, data management, & models/DA
  - Assessing new technology to reduce sensitivity of observations to ship time (Saildrone, anti-vandalism strategies, SSS longevity)
  - Recapitalized TAO array will mitigate technology obsolescence
  - Fewer stations but value-added capabilities
    - More mixed-layer observations
    - Each station configured to measure surface fluxes
    - >1000% increase in sea-level pressure
  - New TPOS Governance




The End
For more information visit
http://tao.ndbc.noaa.gov
http://tpos2020.org
Karen.Grissom@noaa.gov