Evolution of the TAO Data Analyst

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INTRODUCTION
As the Tropical Atmospheric-Ocean (TAO) array has evolved over the years in support of El Niño and the Southern Oscillation, so has the TAO Data Analyst’s duties. The major transition began when operational responsibility of the TAO program transferred from the National Oceanic and Atmospheric Administration’s (NOAA) Pacific Marine Environmental Laboratory (PMEL) to NOAA’s National Data Buoy Center (NDBC) in 2008. Prior to the transition, PMEL had designed, deployed, and maintained the Autonomous Temperature Line Acquisition System (ATLAS) buoys for the TAO program. With the transfer of the program, NDBC made it a priority to upgrade the technology. The TAO Refresh system uses commercial off-the-shelf components and has increased the frequency and volume of meteorological and hydrographic data available. The Legacy ATLAS buoys, transmitting data via Argo, typically reported less than 100 data points per buoy per day. Refresh buoys, by contrast, use the Indian satellite network for transmission that allows for hourly receipt of high-resolution data (over 2,000 data points per buoy per day) with 10-minute averaging.

CONTENTS
1) TAO buoy and sensor lifecycle
2) Improved QC and identification of vandalism events
3) Record maintenance of all aspects of the buoy lifecycle
4) Delayed-mode analysis of data downloaded from retrieved sensors
5) Planning future projects for the TAO Data Analyst position

1) BUOY AND SENSOR LIFECYCLE

Pre-Deployment
- Databases: TAO Analysts track all equipment used in several databases collaborating with several departments at NDBC.
- Quality Checks: Sensors must work independently, as part of a system, and must compare well to a reference test station (see below).

Deployment/Recovery
- Logs provided by technicians in the field show what, where, and when sensors were deployed/recovered. Discrepancies between logs and previous records become an immediate priority for the TAO Data Analyst to rectify.

2) IMPROVED REAL-TIME QUALITY CONTROL

Improved Data → Increased Visualization → Increased Awareness
- Surface Data: Identification of rare events, climatic cycles, and other air mass changes
- Sub-Surface Data: Identification of ocean current movement, upwelling, and vandalism signatures
- Erroneous Data: Errors, trends, extreme spikes, and drift measurements

3) RECORD MAINTENANCE

Routine Tasks
- Daily: Review anomaly data, identifying failing sensors and vandalism events, and keeping track of any changes to the status of TAO buoys
- Weekly: Performance statistics and data release status of the TAO buoy array, updates on any TAO systems in the pre-deployment mode, and deployment/service/recovery of active TAO buoys
- Monthly: TAO array deployment information and average data availability statistics for both active TAO buoys and every sensor trio

Periodic Tasks
- Pre-deployment: Review Buoy Deployment Plans for each buoy scheduled for deployment, including analysis of sensor performance compared to a reference system
- Deployment: Review deployment/service/recovery logs sent by technicians, and compare them against database records
- Post-deployment: Trip Reports to summarize deployments/service/recoveries, archiving data downloaded directly from TAO buoy sensors for future QC and processing

4) DELAYED-MODE ANALYSIS

- Raw data downloaded and processed directly from sensors upon recovery
- >95% data increase
- Replacing real-time under-subsurface measurements with sensor downloads improves quality of data archives
- ADCP (Current) and CTD data processing opportunity
- Increased Data Volume → Improved Data Quality

5) PLANNING FOR THE FUTURE

- Further increase data quality and quantity for TAO data users
- Enhance QC capabilities aimed at increased volume of data
- Streamline delayed-mode QC and processing (Standard, Flux, ADCP, CTD)

ACKNOWLEDGEMENTS
We would like to thank Karen Groom for her leadership and vision, which has resulted in the upgrade of the TAO buoy array with Refresh technology. We would also like to thank Robert Ware for his invaluable contributions to the TAO Team’s array of record-keeping and analysis tools. Finally, we would like to thank Ryan Beets, our former Lead TAO Analyst, for his mentorship and patience in educating the current TAO Team in all manner of TAO data quality control.