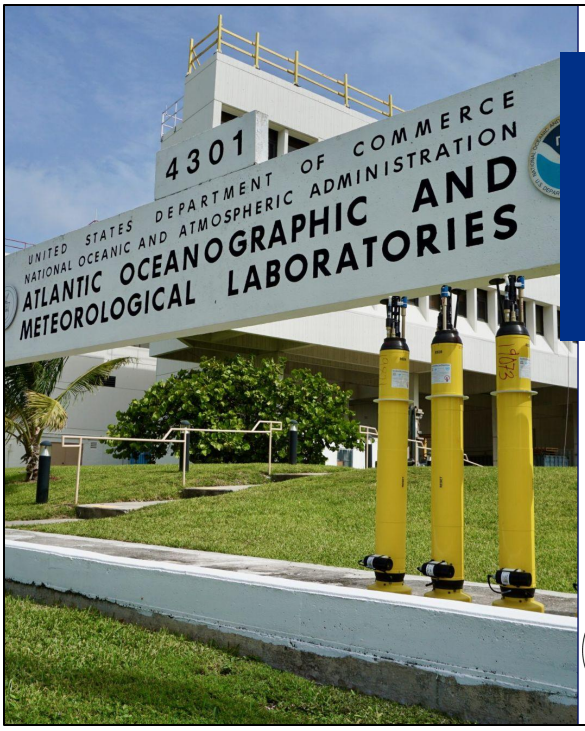

AOML Argo and Drifter Data Assembly Centers (DACs)

Presenter: Candice Hall, AOML Argo PI and DAC Manager

Atlantic Oceanographic & Meteorological Laboratory
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

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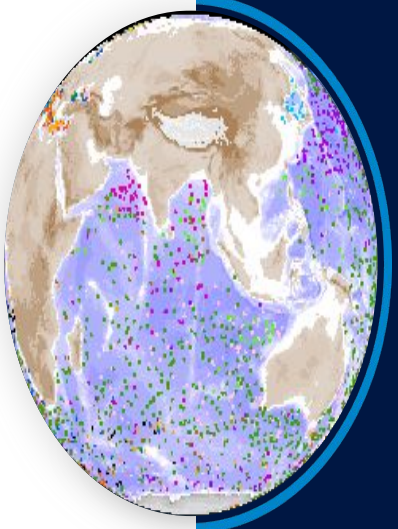
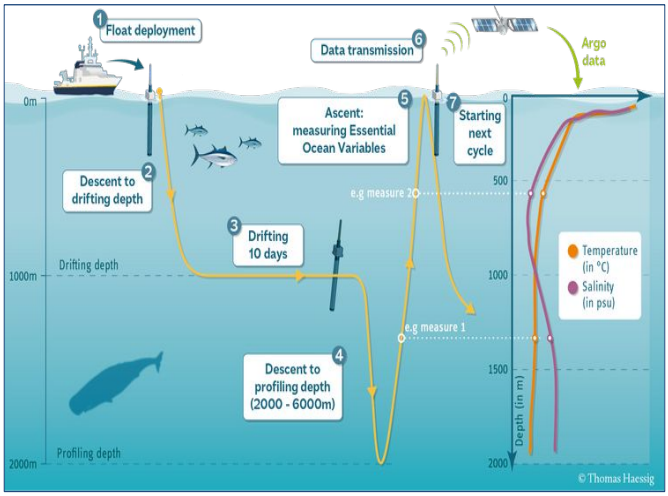
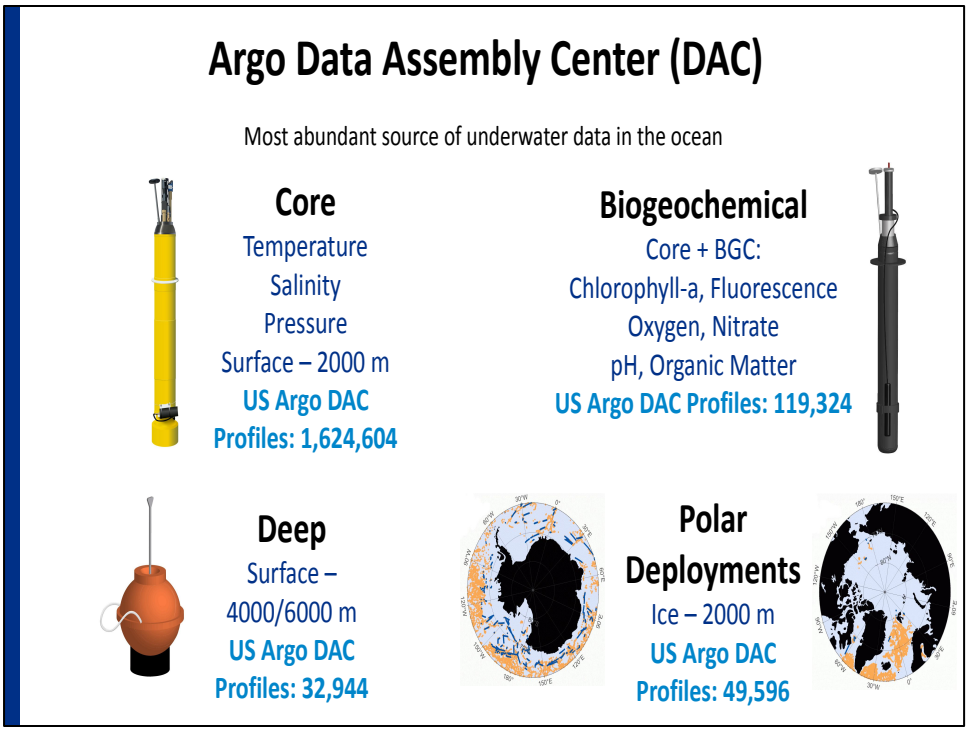


Argo Data Assembly Center (DAC)

Argo Program: International program that works to understand the ocean to improve ocean and weather forecasts.

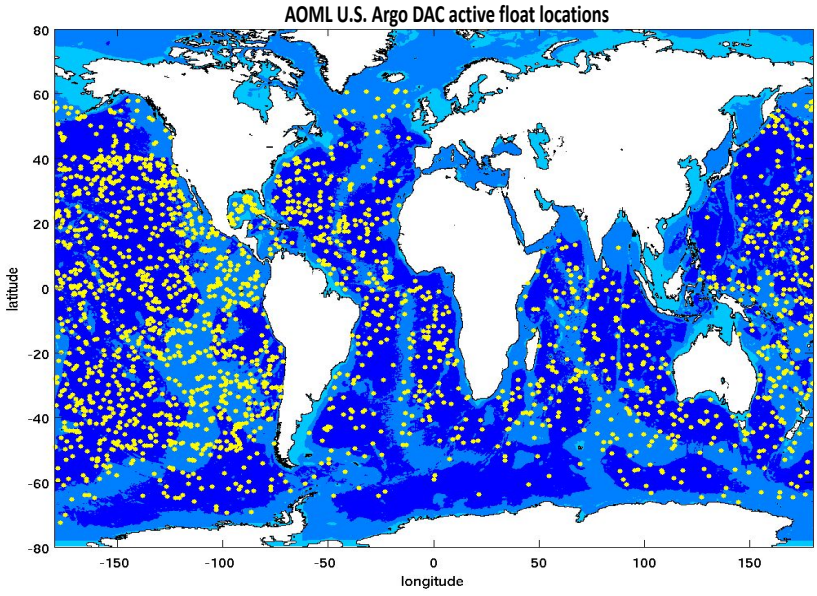
Resident, Autonomous, Robotic Systems





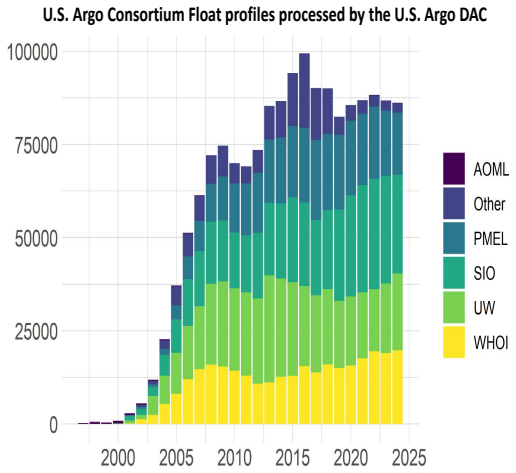
Distribution Notes:
Argo data are now the most abundant source of underwater temperature, salinity and pressure profiles in the ocean.
Deep Argo profiles now go all the way to the ocean floor which will help further our understanding of ocean environment and the movement of water around the world.
The biogeochemical data coming from BGC Argo program will help scientists monitor and manage the ocean resources, the carbon cycle, ocean acidification and ocean color.

Argo Data Assembly Center (DAC)



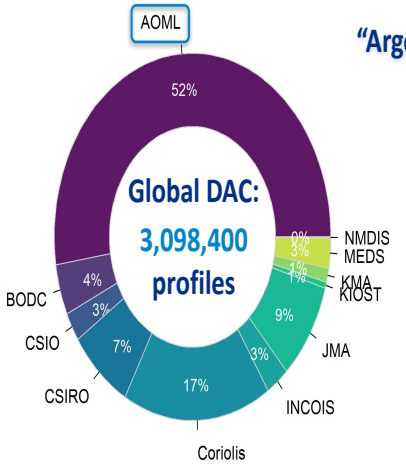
U.S. Argo DAC Activities

- All U.S. Argo data to 2 Global DACs; the Global Telecommunications System (GTS); the official NOAA Archives at the National Centers for Environmental Information (NCEI)
- Size: 2.7 TB
- Continually adapts DAC system:
  - New floats types
  - New data formats
  - New QC methodologies
  - New Argo requirements
- Represent U.S. Argo DAC within the International Argo Steering and Argo Data Management Teams.



Distribution Notes:
Server Size: 2.7 TB (not incl. mirror systems at AOML and Amazon Web Services cloud)

U.S. Argo DAC Team at AOML



"Argo, the 'crown jewel' of ocean observing systems, turns 25!!"

Ref: NOAA News, Dec. 11,2024

1999 - 2024: U.S. Argo DAC - Contains 9,201 floats and 1,743,928 profile files

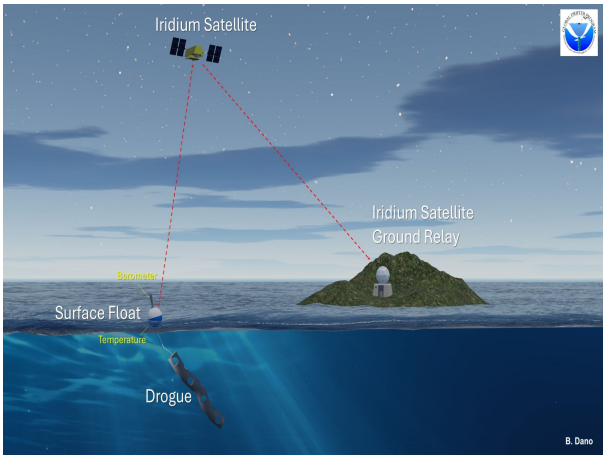
2-3 hour latency from float to user.

2024: 87,115 U.S. Argo float Core profiles

Drifter Data Assembly Center (DAC)

The Global Drifter Program Mission: A gridded array of ~1,300 satellite-tracked surface drifting buoys to track mixed layer currents, sea surface temperature, atmospheric pressure, winds, waves, and salinity.

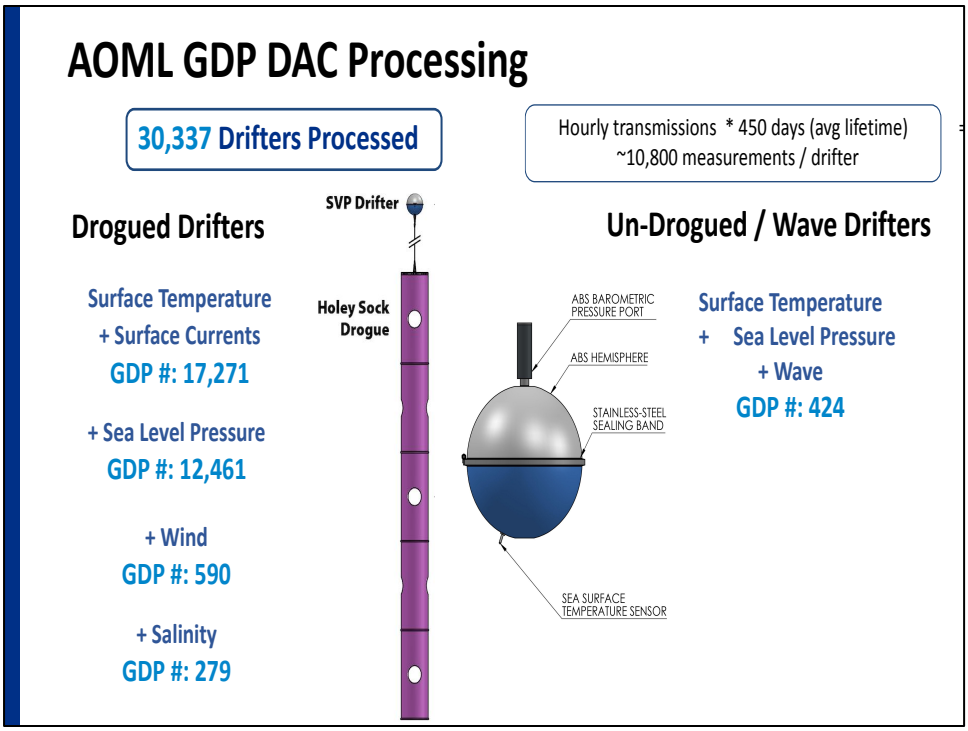
Resident, Autonomous, Robotic Systems



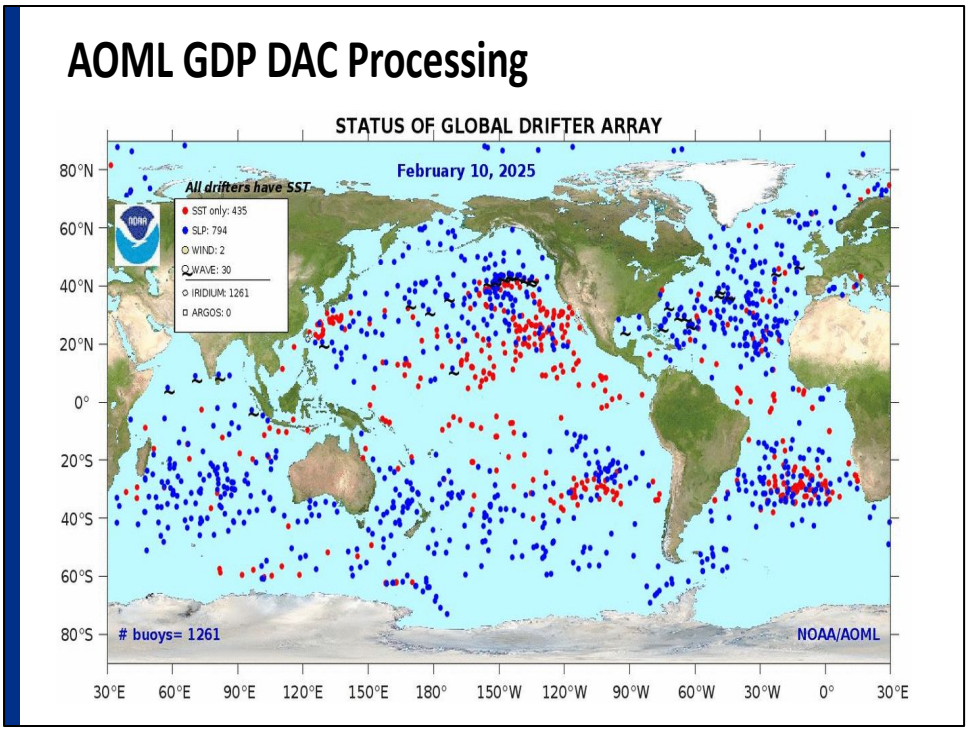
Distribution Notes:

The 1st GDP mission is to maintain a global array of approximately 1300 drifting buoys. The array is was designed to enable 5x5 degree global coverage within the open ocean.

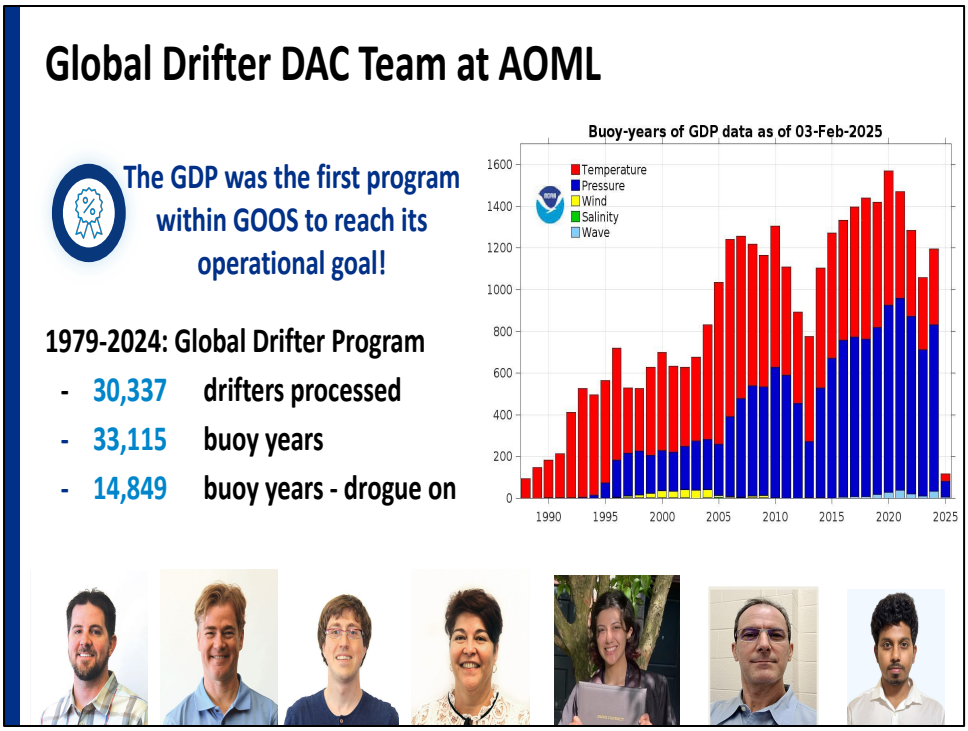
The 2nd component of the GDP mission is to provide scientific quality data to the public.



Distribution Notes:
Average drifter lives ~450 days. At 10,800 transmissions per drifter, that's nearly 328 million drifter profiles since the programs inception! (~327,639,600 transmissions is the calculated total)
Drogued drifters that measure SST and SLP are the 'core' component of the program. Wind, Salinity and Wave drifters (which are Un-drogue) are more specialized drifters used to target unique experiments and extreme events - such as targeted hurricane research to track intensification.



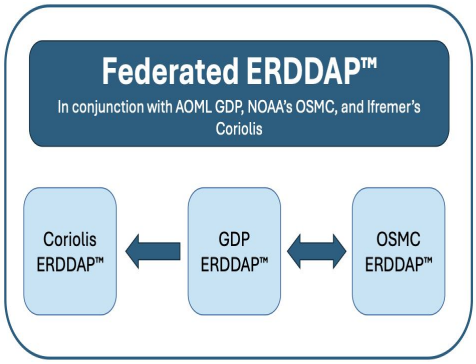
Distribution Notes:
GDP is tasked with maintaining a global array of ~1300 drifters, with 5x5 degree coverage. Due to strong surface currents, combined with convergent/divergent zones (ie., western boundary currents, equatorial currents, N. Pacific Gyre, etc.), the GDP continuously seeks deployment opportunities, to reseed the array in high value locations.



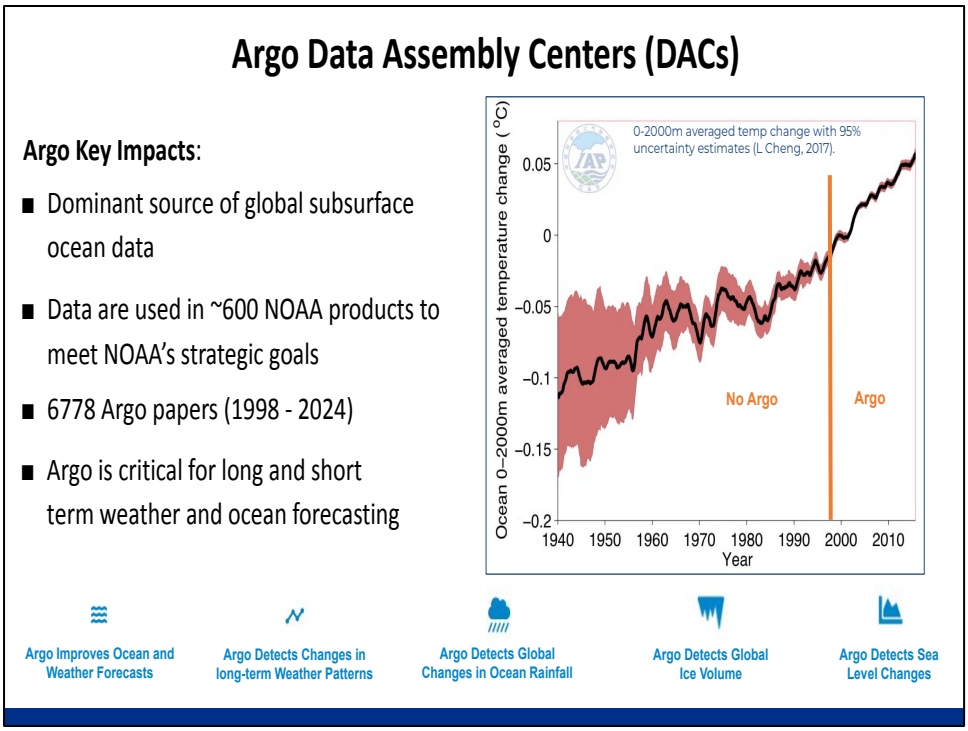
Distribution Notes:
In Sept, 2005, the GDP became the first program with GOOS to reach its operational goal! The histogram shows the evolution of the array and the magnitude of each measurement in buoy years.
Drogue years are an important distinction (from buoy years), as drogue presence more accurately allows us to measure ocean current velocities and surface particle dispersion.

AOML GDP DAC - Recent Activities

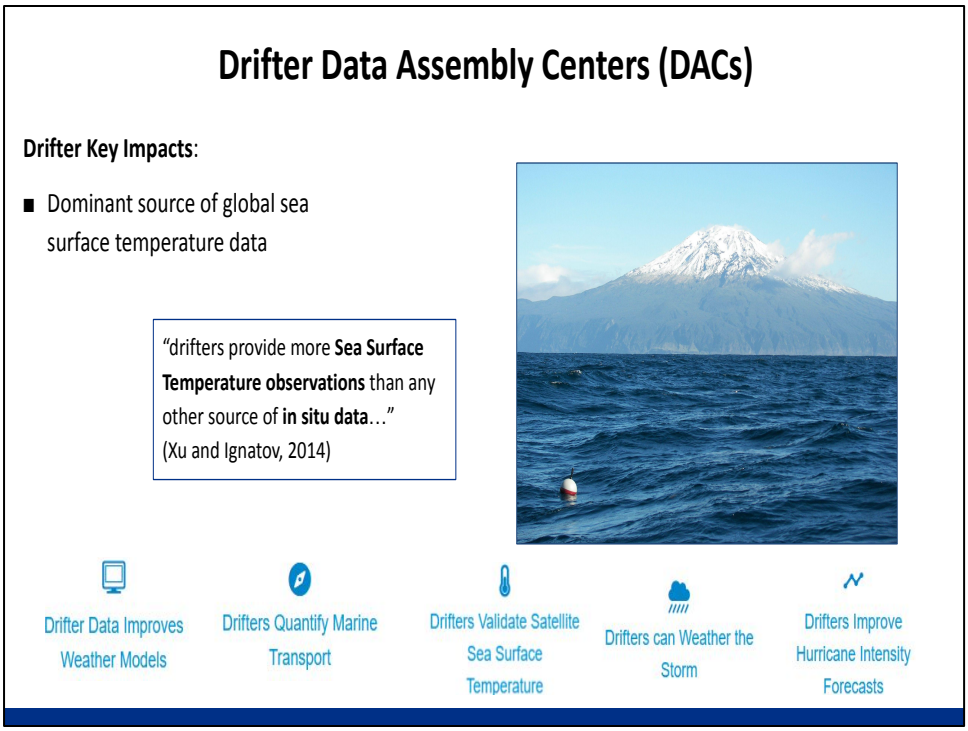
- QC and data dissemination of NOAA and international drifter data
- Continued development of real time and delayed mode processing to enhance the user experience and streamline data accessibility
- 2023: Federated ERDDAP server to better distribute AOML GDP products and datasets
- 2024: Formal Data Service Agreement with NCEI to archive and disseminate hourly and 6-hour QC datasets.



Distribution Notes:
GDP DAC is a global repository of drifter data and responsible for QC and dissemination of ALL (15m drogued) drifter data.
AOML worked with colleagues at NOAA PMEL Ocean Systems Monitoring Center and Coriolis, at Ifremer, the AOML GDP DAC to create a federated system that has eliminated version control issues, expanded the accessibility of QC drifter data, and is now able to offer additional products.



Distribution Notes:
Over the past 50 years, the oceans have absorbed more than 80% of the total heat added to the air/sea/land/cyrosphere climate system (*Levitus et al, 2005*). As the dominant reservoir for heat, the oceans are critical for measuring the radiation imbalance of the planet and the surface layer of the oceans plays the role of thermostat and heat source/sink for the lower atmosphere. This highlights how critical our sub-surface Argo float measurements are as we track the heat transfer between the ocean depths and our atmosphere.

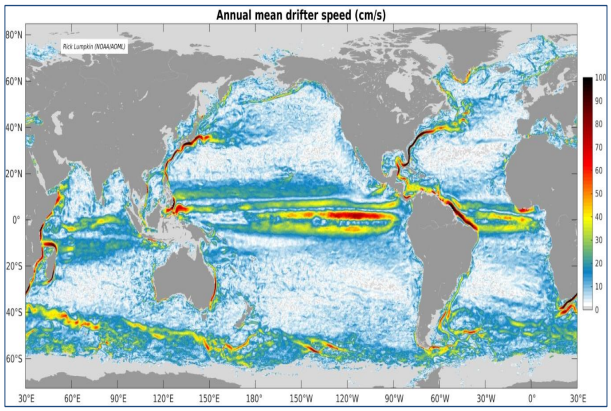


Distribution Notes:
~1300 SST observations per hour, which provides the greatest source of in-situ SST measurements across all ocean observing platforms.

Drifter Data Assembly Centers (DACs)

Drifter Key Impacts:

- Dominant source of global sea surface temperature data
- Primary source of surface (upper 15m) ocean circulation data

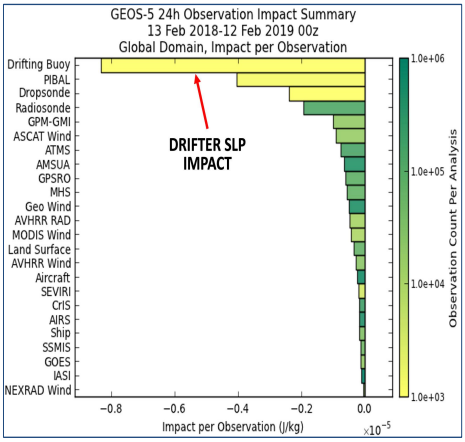


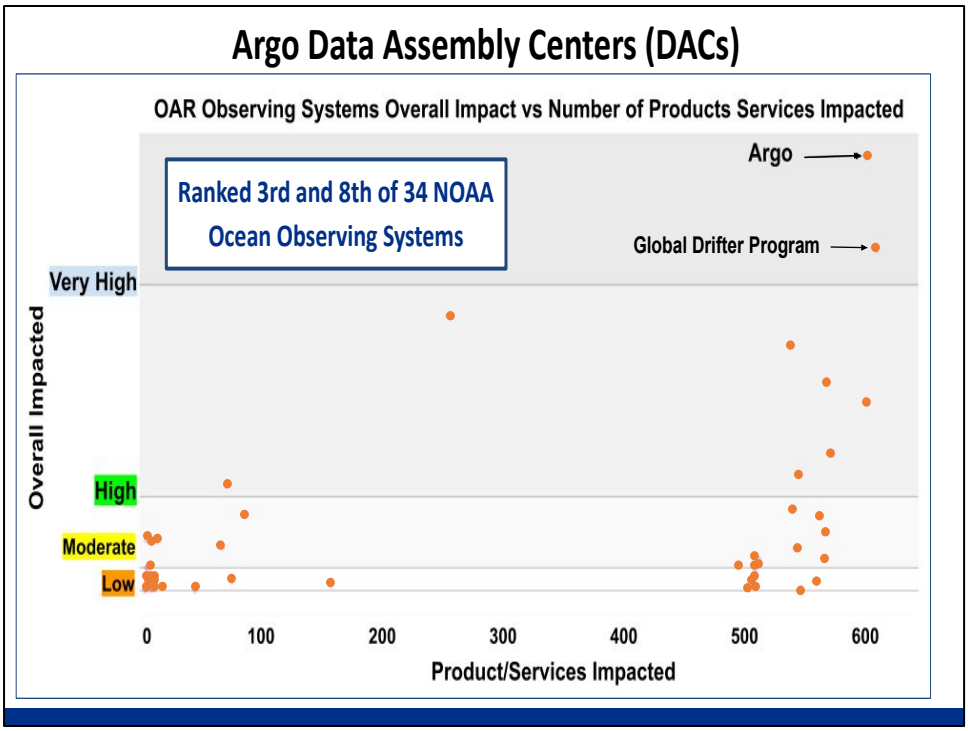
- ❑ Marine Debris Transport
- ❑ Resource Transport / Species Migration
- ❑ Larval Fish Disbursement
- ❑ Disaster Relief / Mitigation

Drifter Data Assembly Centers (DACs)

Drifter Key Impacts:

- Dominant source of global sea surface temperature data
- Primary source of surface ocean circulation data
- Sea Level Pressure data is a key component of marine weather forecasting

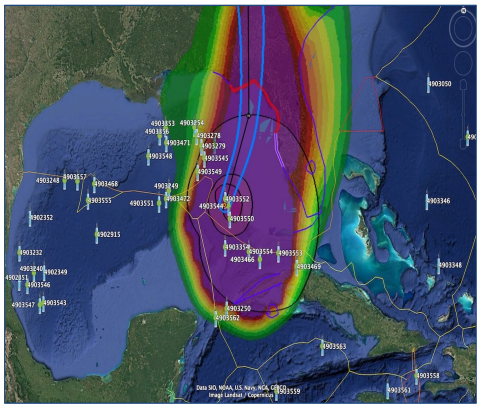




Distribution Notes:
TPIO has created a tool called the NOAA Observing System Impact Explorer (NOSIE) that uses the NOAA Observing System INtegrated Analysis (NOSIA) Value Tree to calculate the impact an observing system has if it was removed from all products in the Value Tree. Overall, the Argo float program has a Very High (1.76%) NOAA-wide impact, and to put this to scale, the GOES-R program has the highest impact of all observing systems with a 4.76% NOAA-wide impact. Argo is ranked 3rd out of 34 the observing systems/programs that measure ocean observations (spreadsheet), behind NOAA Ships and National Water Level Observation Network. The Global Drifter Program also has a Very High (1.39%) NOAA-wide impact. The Global Drifter Program is ranked 8th out of 34 the observing systems/programs that measure ocean observations.

NOAA Observing System Impact Explorer (NOSIE) slidedeck was created by TPIO Lead Meredith Wagner and goes in depth about how the NOSIE tool works. The NOAA Observing System Integrated Analysis (NOSIA) is the analytic framework consisting of a model, tools, and methodologies, all designed to analyze the capability, cost, overall impact, and value of NOAA observing system architectures. This framework was developed to inform and support the NOAA Observing Systems Council (NOSC) and other decision-makers about NOAA's observing system portfolio, as prescribed by NOAA Administrative Order (NAO) 212-16.

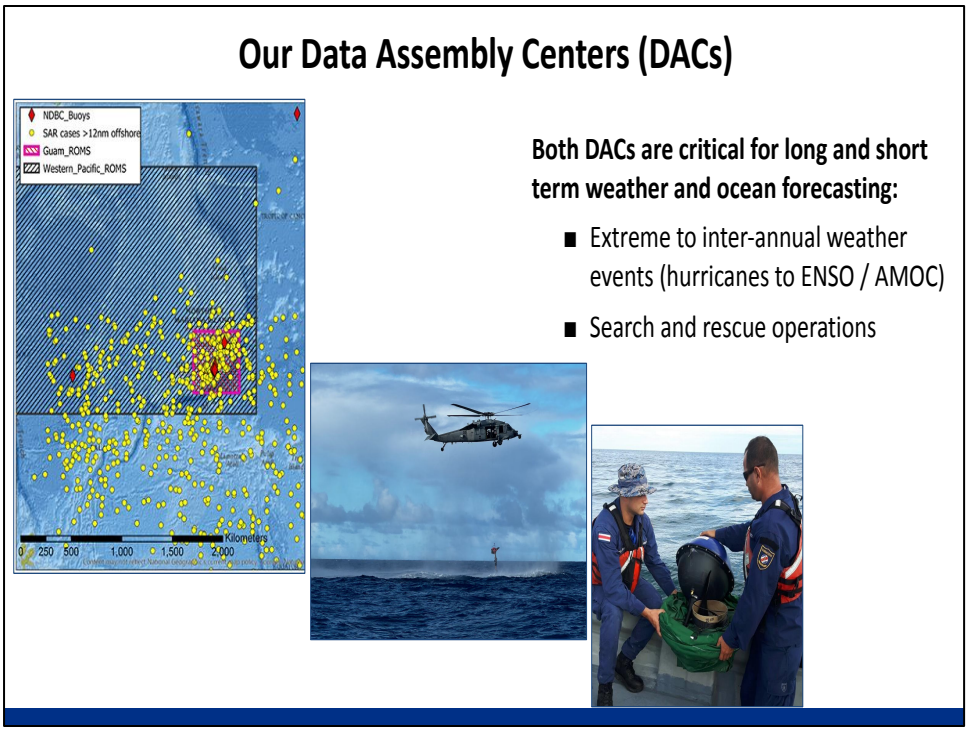
Our Data Assembly Centers (DACs)



Both DACs are critical for long and short term weather and ocean forecasting:

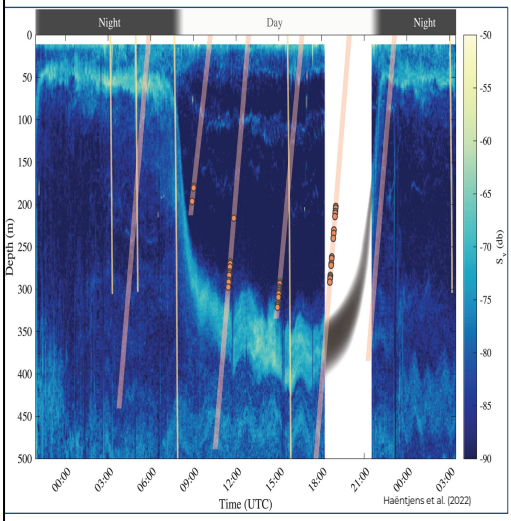
- Extreme to inter-annual weather events (hurricanes to ENSO / AMOC)

Distribution Notes:
El Niño-Southern Oscillation(ENSO)
Atlantic Meridional Overturning Circulation (AMOC)



Distribution Notes:
In addition to search and rescue missions, argo floats and drifters have also been used extensively in recovery missions. The photo on the bottom right pertains to a mission in Central America, where drifters were used to identify the precise location of a plane crash within the region. Debris from the crash was found, so drifters were used to “recreate” the possible trajectories of these items, thus identifying their origin/crash site.

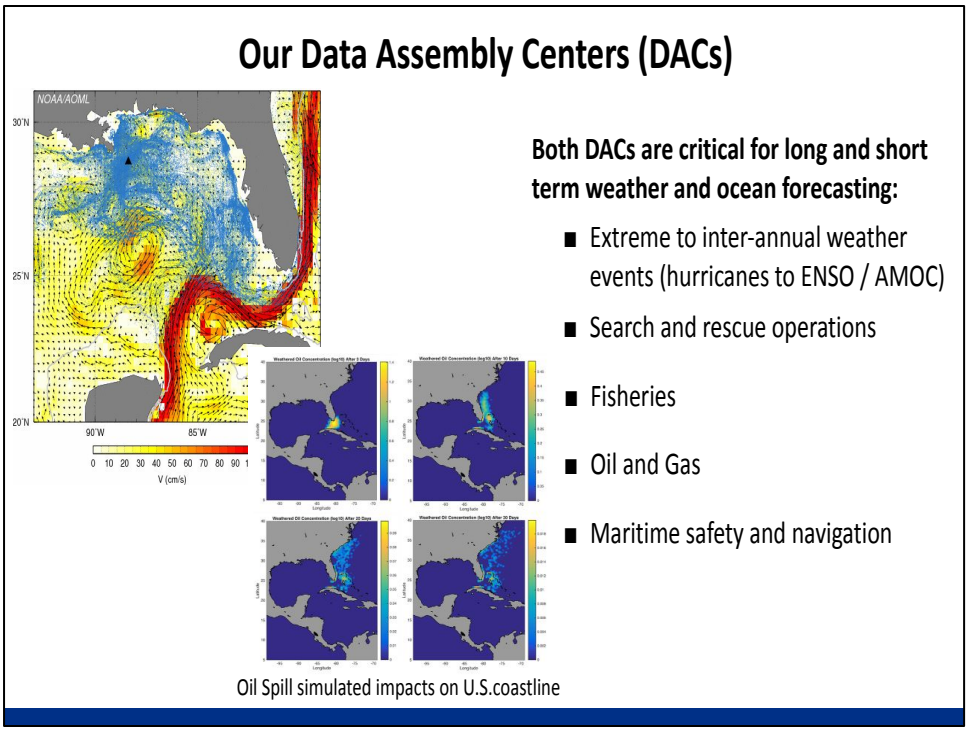
Our Data Assembly Centers (DACs)



Both DACs are critical for long and short term weather and ocean forecasting:

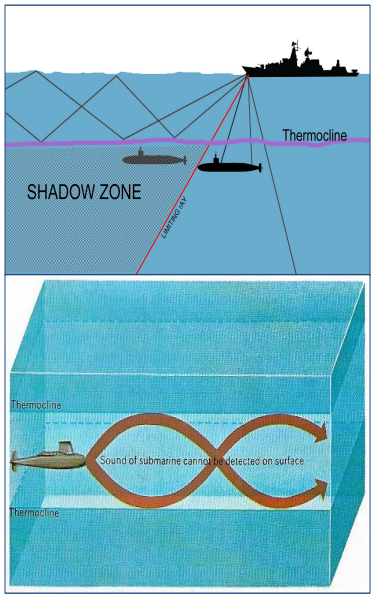
- Extreme to inter-annual weather events (hurricanes to ENSO / AMOC)
- Search and rescue operations
- Fisheries

Distribution Notes:
Argo and Drifter data are used to track marine species migratory responses to changes in the biogeochemical nature of their environments.



Distribution Notes:
Argo and Drifter data are used to create dispersion models. In the bottom right, an oil dispersion model was created (using drifter data, climatological wind records, and oil degradation calculations) to assess the impacts of a potential oil spill from a proposed drill site off the northern coast of Cuba. From this model, we determined not only the impacts to coastal communities within the US, but how such a spill would affect territorial waters and marine resources.

Our Data Assembly Centers (DACs)



Both DACs are critical for long and short term weather and ocean forecasting:

- Extreme to inter-annual weather events (hurricanes to ENSO / AMOC)
- USCG Search and rescue operations
- Fisheries
- Oil and Gas
- Maritime safety and navigation
- Military applications

Distribution Notes:

The velocity of sound in seawater is more than 4.5 times as great as it is in air but it can vary with pressure, salinity, and temperature. Sound waves passing through water in which these vary are refracted, or bent like light passing through a lens. Such refraction can take place at a thermocline – the boundary between warm surface water and cold water at depth. Submarines can make use of this effect to hide the sound of their passage from an enemy.

Future Goals

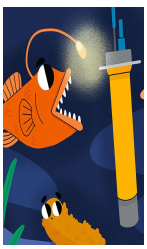
AOML U.S. Argo DAC

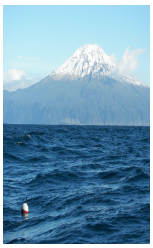
- Migrate to World Information System (WIS2.0) service from GTS
- US Argo DAC ticketing system
- Continued to development of shareable Argo DAC software packages
- Expansion of U.S. Argo DAC BGC development
- Personnel professional and skill development

AOML GDP DAC

- Enhance ERDDAP server and expand key metrics
- Automate file sharing / transfer.
- Migrate real-time drifter data to AWS






Partners
Atlantic Oceanographic & Meteorological Laboratory
U.S. Department of Commerce
Argo
GLOBAL DRIFTER PROGRAM
UNIVERSITY OF MIAMI
COOPERATIVE INSTITUTE for MARINE & ATMOSPHERIC STUDIES
NOAA GLOBAL OCEAN MONITORING & OBSERVING
GOOS
The Global Ocean Observing System
NCEI
GODAE
UC San Diego
SCRIPPS INSTITUTION OF OCEANOGRAPHY
MBARI
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Ke Kulanui o Hawai'i ma Mānoa
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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
MetService
Australian Government Bureau of Meteorology
NIOT
METEO FRANCE
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HONG KONG OBSERVATORY
Ifremer
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NOAA TEACHER AT SEA
KOPRI
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KIOST
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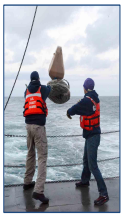
www.aoml.noaa.gov/argo/

U.S. Argo DAC Monthly Metric Reports:
https://www.aoml.noaa.gov/argo/#argooperations

AOML GDP DAC POC: **Shaun.Dolk**@noaa.gov
www.aoml.noaa.gov/phod/gdp/

AOML GDP DAC Monthly Metrics Reports:
www.aoml.noaa.gov/phod/gdp/erddap/metrics/index.php



References

- "Argo, the 'crown jewel' of ocean observing systems, turns 25!!" https://www.noaa.gov/news/argo-crown-jewel-of-ocean-observing-systems-turns-25
- Cheng, L. Improved estimates of ocean heat content from 1960 to 2015. *Science Advances*, **3** (3). DOI:10.1126/sciadv.1601545
- Xu and Ignatov, 2014. In situ SST Quality Monitoring (iQuam). *Journal of Atmospheric and Oceanic Technology*, **31**. DOI:10.1175/JTECH-D-13-00121.1

NOAA Observing Systems/Programs Ranking and Impacts Tools:

- Technology, Planning and Integration for Observation (TPIO, lead: Meredith Wagner) has created a tool called the NOAA Observing System Impact Explorer (NOSIE) that uses the NOAA Observing System INtegrated Analysis (NOSIA) Value Tree. NOSIA is designed to analyze the capability, cost, overall impact, and value of NOAA observing system architectures. This framework was developed to inform and support the NOAA Observing Systems Council (NOSC) and other decision-makers about NOAA's observing system portfolio, as prescribed by NOAA Administrative Order (NAO) 212-16.
- NOAA Ocean Observing Systems (In-Situ) Ranking spreadsheet
- GEOS-FP Observation Impact Monitoring https://gmao.gsfc.nasa.gov/products/forecasts/systems/fp/obs_impact/
- Additional Argo and Drifter assessment tool, including user comments: User of Assessments of Observing Systems