

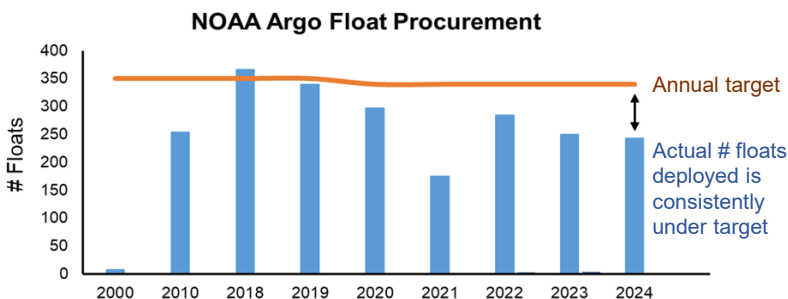
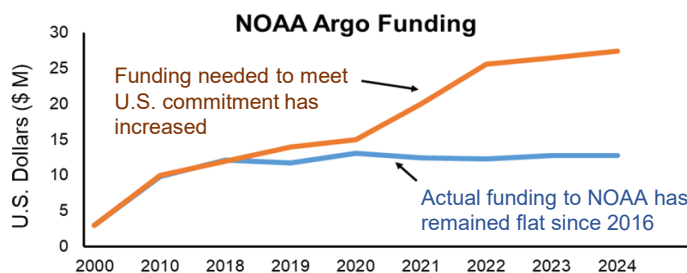
# Ocean Climate Research at Risk: A Case for the Argo Program

The Argo Program is essential for observing and understanding our ocean and climate. Established in 1999, the international Argo Program today supports a global array of approximately 4,000 robotic profiling floats. Argo is the **largest *in situ* ocean observation program in the world** and provides the most abundant source of data across all ocean observing platforms. Drifting with ocean currents, each float collects a vertical profile of upper ocean temperature and salinity from the surface to a depth of 2,000 meters every 10 days and transmits the data in real-time via satellites to be used for ocean, climate, and weather forecasting. **Argo enables constant monitoring of our ocean**, providing critical data to understand the ongoing changes in our ocean and accurately predicting future ocean warming and sea level rise.

## Argo is in critical need of support.

Annual Argo float deployments have declined by ~20% since 2016, threatening the future of ocean research, monitoring, and prediction.

- Flat-funding to the U.S. Argo Program has struggled to keep pace with increases in Argo float costs associated with inflation and supply-chain disruptions.
- Decreased ship operations during the COVID-19 pandemic have been slow to recover, making it more difficult to maintain Argo deployments.
- International partners lack sustained funding for the global Argo Program.



**The U.S. is a global leader in the Argo Program.** Argo is a global model for international collaboration, with 30+ countries deploying around 800 floats each year and many other nations contributing logistical support and ship access. Through NOAA’s Global Ocean Monitoring and Observing Program, **the U.S. supports 50% of the Argo array.** Prioritizing funding to the U.S. Argo Program is necessary to overcome the reduction in Argo observations and **maintain U.S. leadership in ocean observing.**



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# Argo's essential role in ocean and climate science

**The Argo Program transformed the way we study our ocean and climate.** The ocean covers 71% of Earth's surface and profoundly influences our weather and climate. Argo initiated an era of global ocean monitoring with high-quality *in situ* ocean observations available in real-time from vast areas of the ocean where data from other means (moorings, research cruises, data buoys, and satellites) are sparse. Argo has been referred to as "one of the scientific triumphs of the age" by the New York Times<sup>[2]</sup> and is endorsed by the World Meteorological Organization as a central part of the Global Ocean Observing System<sup>[3]</sup>.

- 140,000 ocean profiles produced per year since 2012, and over 2.4 million ocean profiles delivered to date<sup>[4]</sup>, **4x as many ocean profiles as every other ocean observing tool combined.**
- Over 6,000 scientific publications use Argo data<sup>[5]</sup>, **indicating its value to ocean and climate research.**
- The cost of the global Argo Program is estimated at \$40M annually with each profile costing around \$200<sup>[6-8]</sup>, **one of the most cost effective ocean observing tools available.**

*"The Argo project has revolutionized physical oceanography and climate science, providing a unique snapshot of our changing oceans and now stands on the cusp of a major expansion into new dimensions of the ocean."* — World Meteorological Organization<sup>[3]</sup>

## Ocean Heat & Sea Level Rise



Image Credit: NOAA

Ocean warming expands seawater and is a direct cause of sea level rise. Argo has greatly improved estimates of global ocean heat storage and projections of coastal inundation, providing early flood warnings to at-risk communities.

## Weather & Climate



Image Credit: NOAA

Operational forecasting centers around the world rely on Argo data to inform predictions of weather, precipitation, drought, hurricanes, and maritime safety over seasonal-to-decadal and regional-to-global scales.

## Ocean Ecosystem Health



Image Credit: NOAA

Argo floats are now being developed with additional sensors to measure biology and chemistry in order to improve understanding on ocean carbon uptake, acidification, productivity, and ecosystem health.

## Outreach & Education



Image Credit: Euro-Argo ERIC

Argo provides educational opportunities to K-16 students through the Adopt-A-Float program<sup>[9]</sup>, which has enabled thousands of classrooms across the U.S. and abroad to learn more about our global ocean.

## Supporting Argo ocean observations is a national priority

Understanding patterns, trends, and the state of the global ocean helps us understand our changing ocean and its impact on the environment, and Argo is a crucial component in this effort. Prioritizing support of the U.S. Argo Program is necessary to 1) overcome challenges of flat-funding and inflation, 2) ensure continuity of the Argo fleet, and 3) maintain NOAA leadership in global ocean observing. Further investment is needed to usher in a new era of Argo advancements to collect additional ocean variables, including biogeochemical measurements and full ocean depth, both of which are critical to better predict and mitigate the societal and economic impacts of our changing oceans and climate.

**References:** [1] [OceanOPS Argo Dashboard](#); [2] [Gillis, 2014](#); [3] [World Meteorological Organization, 2019](#); [4] [Zhang et al., 2022](#); [5] [UCSD Argo Program: Argo Bibliography](#); [6] [UCSD Argo Program: About](#); [7] [Rienzi, 2021](#); [8] [Jayne et al., 2017](#); [9] [GO-BGC Adopt-A-Float](#)



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