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The Role of U.S. In Situ Ocean Observation Networks: A Case Study of the Atlantic Meridional Overturning Circulation

A climate *tipping point* generally refers to a "critical threshold" in an Earth system that when crossed can cause the system to shift into a new state. Scientists contend that crossing a tipping point may result in a new long-term or permanent state from which the system may be unable to rebound, even if the trigger for crossing the threshold is reversed. One potential tipping point is the "collapse" (i.e., significant slowdown or weakening) of the Atlantic Meridional Overturning Circulation (AMOC; *Meridional* meaning north-south). AMOC is an important component of the global conveyor belt, which transports heat, carbon, and nutrients throughout the world's ocean basins. Some scientists, foreign government entities (e.g., Nordic Council; French Ministry of Armed Forces), and financial institutions are exhibiting increased interest in understanding whether AMOC will slow down during the 21st century. Significant slowing of AMOC may impact the global climate system with far-reaching consequences. For example, a reduction of AMOC's flow strength may cause sea-level rise across the U.S. East Coast; shift precipitation patterns in Africa and Asia; and produce more winter storms in Europe.

To study short- and long-term changes to the ocean and climate system, such as AMOC, scientists rely on sustained global in situ (i.e., in place) ocean observation networks (e.g., buoys, floats, moorings). The National Oceanic and Atmospheric Administration (NOAA) and National Science Foundation (NSF) manage and support many of these sustained global ocean observations, making up a large portion of the global in situ ocean observations. The U.S. contribution is outsized compared to the contribution of other countries, as it deploys ocean instruments in undersampled regions, such as locations for monitoring AMOC.

During the second Trump Administration, both NOAA and NSF have announced plans that would impact AMOC monitoring activities. At issue for Congress is whether to continue supporting established federal in situ ocean observation networks or to provide direction regarding the elimination or restructuring of certain observation networks to align with other U.S. ocean priorities. NOAA's and NSF's plans to scale back and terminate certain ocean observation networks may raise several questions for Congress. Congress also may consider transferring global ocean observation networks to other federal agencies or to foreign science-focused entities, or pursuing public-private ocean observation partnerships.

AMOC

AMOC is a system of northward-flowing warm surface waters and southward-flowing cold deep waters within the Atlantic Ocean (**Figure 1**). As AMOC transports warm, salty waters northward via the Gulf Stream, evaporation and sea ice formation leave salt behind, resulting in cold, dense waters in the North Atlantic. When these dense North Atlantic waters sink (a process known as *thermohaline circulation*), they form deep-water currents that drive the global conveyor belt. According to modeling studies, an AMOC tipping point could be triggered by a freshening of North Atlantic waters (i.e., less salty waters) due to increased polar ice melt. Further warming and freshening of the North Atlantic could make these waters more buoyant, thereby inhibiting thermohaline circulation. Some scientists suggest that evidence for cooling North Atlantic waters indicates a weakening AMOC (i.e., AMOC is delivering less heat to the region). Other scientists find that other evidence suggests AMOC "could weaken but not collapse."

Figure 1. AMOC Portion of the Global Conveyor Belt

Source: NOAA, "What is the Atlantic Meridional Overturning Circulation (AMOC)?"

Notes: Illustration of northward-flowing warm surface currents (red) and southward-flowing cold deep-ocean (blue) currents.

Selected U.S. Ocean Observations

The United States manages and supports several global ocean observation networks, some of which have provided decades' worth of data that show changes in AMOC flow and North Atlantic conditions over time.

NOAA's Global Ocean Observing System

NOAA provides 53% of the total in situ ocean observations that compose the Global Ocean Observing System (GOOS), an international network for sustained long-term ocean data for weather and climate prediction. NOAA's contribution to GOOS includes maintaining and funding observing networks, such as buoys and shipboard observations.

For example, NOAA contributes observations to GOOS through the Argo Program and Global Drifter Program, two

networks that collect ocean data while equipment drifts with global ocean currents. Within the Argo Program, NOAA "maintains about half of the global fleet," which is composed of more than 4,000 profiling floats. A goal of the Argo Program is to observe decadal-scale changes in the transport of heat and salinity by ocean circulation. NOAA's Global Drifter Program is the primary component of the international GOOS global drifter array. NOAA maintains more than 1,000 satellite-tracked surface drifting buoys. The buoys measure sea surface temperatures and ocean current velocities; some measure salinity and barometric pressure as well.

NOAA maintains another component of the international GOOS network, the Western Boundary Time Series (WBTS). WBTS monitors flow rates and other properties of currents in the western subtropical North Atlantic. Since 1982, NOAA has measured the transport of the Florida Current, part of the Gulf Stream, using a decommissioned submarine telecommunication cable, ship surveys, and moorings. NOAA's observations under GOOS provide direct information about changes in the flow velocities of currents that make up AMOC. Its observations also provide indirect information—such as changes in North Atlantic water temperature and salinity—on deep-water formation, the driving force of the global conveyor belt.

NOAA's FY2027 budget request states that monitoring AMOC informs "how the deep Atlantic is affecting coastal oceans and northern hemisphere weather." At the same time, the Administration proposes to reduce AMOC observing and monitoring capabilities, including "significant reductions" to the Argo Program and Global Drifter Program. NOAA has proposed retrieving or transferring decommissioned "observing equipment" between FY2028 and FY2031; whether WBTS, Argo floats, and drifter buoys would be included is unclear.

NSF's Ocean Observatories Initiative

The Ocean Observatories Initiative (OOI), a research program funded and managed by NSF, is composed of arrays deployed at different sites—both within and across ocean basins—for specific observation purposes. The OOI had five arrays as of May 2026. Each array is composed of hundreds of sensors deployed on moored surface platforms and autonomous gliders. For more than a decade, these arrays have collected oceanographic data that inform how ocean conditions have changed over time.

In May 2026, NSF announced that it had "initiated descoping" of the OOI, after proposing to decommission OOI "to focus on higher priority investments" in FY2026 and FY2027. NSF's descoping plan involves a "phased recovery and removal of all in-water infrastructure" from four of the five arrays over the next 15 months. (NSF plans to retain the Regional Cabled Array, located offshore of Oregon.) One of the OOI arrays, Global Irminger Sea Array, is located offshore of Greenland, a site of "deep-water formation." Experts contend this array "is a critical site for understanding and forecasting changes in [AMOC]." NSF plans to recover the Global Irminger Sea Array during summer 2027. On June 18, 2026, NSF paused its plans to remove and descope OOI arrays in response to congressional and other stakeholder concerns.

Considerations for Congress

According to scientists, U.S. policy and funding changes to sustained in situ ocean observations can impact how federal and nonfederal scientists detect emerging ocean risks. For example, a 2026 study found that removing the U.S. observations from GOOS would increase the error in estimating ocean warming, a metric important for studying changes in AMOC, by about 160%. Ocean observation networks provide the data required to predict short- and long-term ocean and weather changes, which could affect the U.S. economy and national security.

Congress may consider the potential benefits and consequences of termination or scaling back of U.S. ocean observation networks. The Heritage Foundation has advocated disbanding or consolidating federal ocean research programs that have contributed to "climate alarmism." Given the scale of the global ocean, some scientists contend that different observing technologies from numerous sources are required to study the ocean system. During a House hearing in the 119th Congress, some Members proposed that NOAA work with the private sector to fill ocean observation gaps. In response, a witness echoed the value of public-private partnerships while acknowledging that "there is no scenario where private industry could simply take over."

Congress has taken note of some of the Administration's actions related to U.S. ocean observations. On June 17, 2026, the Senate passed S. 4822, which would block the removal of OOI. In response to stakeholder concerns, NSF said on June 18 that it "will not proceed with further removal or descoping;" NSF reportedly plans to convene an expert panel to determine OOI's future. It remains unclear if it would cost more to remove OOI and other U.S. ocean observation networks than continuing to maintain them throughout their intended design life.

As of June 18, 2026, NSF states it is seeking a sustainable pathway for maintaining the OOI. Congress may determine whether the sustainable path is to maintain the status quo or to transfer OOI to another entity, among other potential options. For example, to maintain the status quo, Congress could require NSF to maintain OOI in statute and appropriate funds specifically for the program. As another option, Congress could direct NSF to transfer OOI to another agency, such as NOAA. That option would likely run counter to other Trump Administration priorities, as it has proposed to eliminate and/or transfer some NOAA ocean observation programs in FY2026 and FY2027. (Congress rejected some of these proposals in FY2026.) A third option could be to direct NSF to sell or transfer ownership of certain federally owned assets within OOI, such as those in the Global Irminger Sea Array, to an interested foreign recipient. Maintaining use of OOI, whether by NSF or another entity, would eliminate network recovery costs and allow federal and nonfederal scientists to continue monitoring AMOC.

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