
A BGC float deployed in the Indian Ocean.

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# 2 BGC ARGO: A FULL-SIZE LAB INSIDE A TINY FLOAT

**The Argo floats have already revolutionised physical oceanography. Now, a new wave of floats equipped with biogeochemical sensors will do the same for marine ecology.**

In 2004, Hervé Claustre helped deploy several Argo floats in the Pacific Ocean. When this research director at the French National Center for Scientific Research (CNRS) saw the data collected by these autonomous instruments, he had an epiphany. "What if we could add optical or oxygen sensors on these floats to study marine life?," thought Hervé Claustre, who's now part of Argo France and an expert of the Euro-Argo ERIC Scientific and Technical Advisory Group (STAG). As soon as he got back to France, he started developing projects to implement biogeochemical – or BGC – sensors on Argo floats. Since then, Hervé Claustre has co-pioneered a new wave of Argo floats called BGC Argo. Today, deploying around 1 000 BGC Argo floats by 2030 is one of the main ambitions of OneArgo, a United Nations endorsed set of actions to create a global and multidisciplinary Ocean Observing array.

**BGC Argo floats carry 6 additional sensors**

"One single BGC float is like a tiny research vessel that will operate autonomously for five to six years and send its data every 10 days," Hervé Claustre says. A float also costs a lot less than the simplest and shortest research vessel campaign. On top of the temperature and salinity sensors already found on Core Argo floats, a BGC Argo float carries six additional sensors for sampling oxygen, pH, nitrates, chlorophyll, suspended particles, and light.

"The idea is to understand how climate change impacts on marine ecosystems, their biodiversity and functioning," explains Emanuele Organelli, a marine ecology researcher from the Italian National Research Council (CNR), working today for Argo Italy, a member of the Euro-Argo consortium. Dramatic changes in the marine ecosystems have repercussions on living marine resources, such as fisheries all around the world. By better understanding global marine ecosystems, scientists can better advise policy makers on the urgent actions needed to anticipate and mitigate these potentially dramatic effects on marine resources.

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Emanuele Organelli trained the students on how to deploy, operate and recover a BGC float.

## WHAT IS ARGO?

Argo is an international programme that collects information from inside the ocean using a fleet of robotic instruments that drift with the ocean currents and move up and down between the surface and down to 6 000 metres deep. Each instrument, called float, spends almost all its lifetime below the surface.

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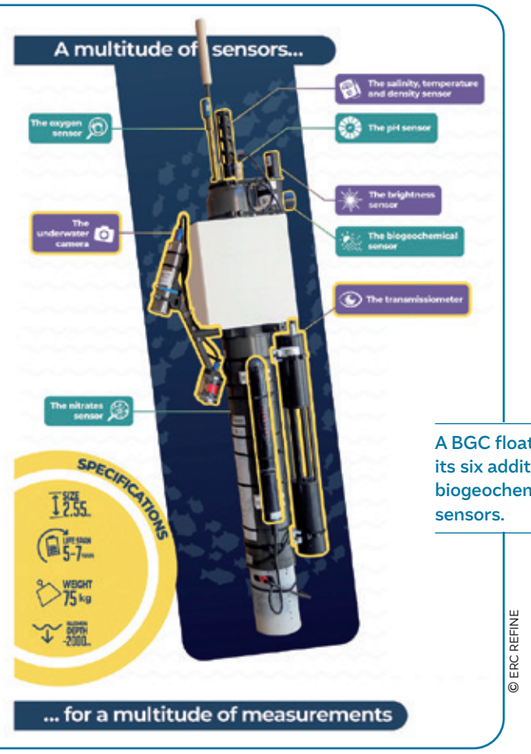
A BGC float at the Ifremer facility, in the unique 20-metre depth pool tank where Argo floats are tested.

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A BGC float with its six additional biogeochemical sensors.

The BGC floats provide the tools to collect a wide array of key data for marine ecology: oxygen sensors can detect regions where oxygen is scarce. As the oceans are getting warmer, their circulation is getting weaker. Consequently, there are less exchanges between oceans and the atmosphere, and less oxygen entering oceans in certain areas. pH sensors can measure ocean acidification. The excess carbon dioxide from human activity is absorbed by the oceans and then transformed into acid via a chemical reaction in the water. This phenomenon has dire consequences for marine life.

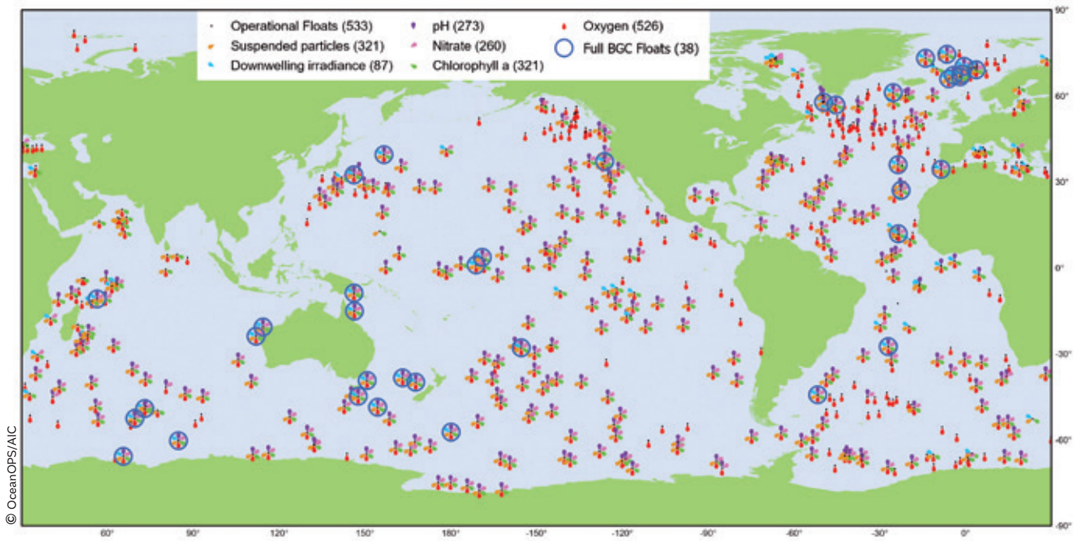
## WHAT IS AN ERIC?

The European Research Infrastructure Consortium (ERIC) is a specific legal form that facilitates the establishment and operation, on a non-economic basis, of Research Infrastructures with European interest. The ERIC membership is made up, on a voluntary base, of EU Member States and associated countries. By 2022, 24 research infrastructures have been established as ERIC in fields as various as Energy, Environment, Health & Food, Physical Sciences & Engineering, and Social & Cultural Innovation. Euro-Argo ERIC was created in 2014 to coordinate and foster the collaboration between national Argo programmes.

Nitrates, chlorophyll and light sensors are used to monitor phytoplankton, microscopic marine algae. It is an essential component of the food chain, being its first link: phytoplankton is consumed by zooplankton, microscopic drifting animals, and zooplankton is the main food source of small fish and other marine animals. Moreover, the quantity and types of phytoplankton thriving in one region give a lot of information about the local ecosystem. Each type, or community, of phytoplankton modifies the intensity and color of marine lightscapes. With light sensors, scientists can identify these colors and study the diversity of such communities. Scientists can also assess phytoplankton biomass in a particular area by measuring chlorophyll and suspended particles in the water. In the long run, they should be able to deduce the distribution of phytoplankton communities all around the planet. That, in turn, will help them assess how healthy marine ecosystems are and how sustainable harvest of living marine resources is in different regions around the planet.

If the Core Argo floats have shaken up the world of physical oceanographers, the BGC Argo mission represents an even bigger leap for marine biologists. For Emanuele Organelli, the fact that he and his European colleagues can get data all year long is a game-changer as it will help scientists better understand life cycle through seasons. “Though it remains essential, sampling from research vessels may be biased towards calm seasons for sailing,” the Italian researcher notes. Free and instant access to *in situ* data is also unprecedented for marine biologists who usually expect 2-or-more-years embargos on research data. “Sharing all this information this way with colleagues in Europe and around the world makes science more accessible than ever,” Hervé Claustre says. “It is the beauty of Argo and one of the reasons why this international programme succeeds more than any other.”

The French senior scientist feels like he’s been doing a totally different job since he started working with BGC Argo. “I spent the first half of my career filtering cube metres of water in a lab,” he recalls. “Today, I’m a ‘couch sea explorer’: I get tons of *in situ* data from Tahiti or the Arctic from the comfort of my living room, and I sometimes make discoveries I really didn’t expect.”

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Latest locations of the 533 operational BGC floats in May 2023 and the sensor types they are equipped with.

## FIND OUT MORE

- **Video “Euro-Argo: Transforming Global Ocean Observation”:** https://youtu.be/im4HVIK4hVU
- **Biogeochemical (BGC) Argo:** biogeochemical-argo.org
- **BGC Argo Mission:** https://argo.ucsd.edu/expansion/biogeochemical-argo-mission/**“Observing the Global Ocean with Biogeochemical-Argo”, H. Claustre et al., 2020,** https://doi.org/10.1146/annurev-marine-010419-010956
- **OneArgo: Owens et al. (2022) “OneArgo: A New Paradigm for Observing the Global Ocean”, Marine Technology Society Journal,** https://doi.org/10.4031/MTSJ.56.3.8, 2022

The article was produced by Anh-Hoa Truong, an independent scientific journalist/ INUA Prod in close collaboration with Marine Bollard (Euro-Argo ERIC) and Lillian Diarra (Mercator Ocean International).
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https://www.eu4oceanobs.eu/oceanobserving-awareness/ocean-observing-awareness-euro-argo/

## THEY CONTRIBUTED TO THIS ARTICLE:

**HERVÉ CLAUSTRE**
Oceanographer and Expert of Euro-Argo ERIC Scientific and Technical Advisory Group (STAG)
BGC international Argo co-Lead
LOV/Sorbonne Université (SU)/CNRS, Argo France/Euro-Argo ERIC

**EMANUELE ORGANELLI**
Bio-optical Oceanographer
CNR, Argo Italy/Euro-Argo ERIC