3 DELVING INTO THE ABYSS WITH DEEP ARGO

With a new generation of floats that can reach the bottom of the sea, scientists could soon close the global ocean's heat budget.

With more than 4 000 Argo floats patrolling around the globe, we are getting a clearer than-ever picture of the state of our seas. Until recently though, these floats could not descend below 2 000 metres. As a result, they've managed to monitor only about half of the ocean volume. Today, a new generation of floats named Deep Argo floats can delve where no other autonomous Ocean Observation instruments have been on a global scale: the abyss. As they descend to 4 000 or 6 000 metres and then ascend, the Deep Argo floats sample groundbreaking data with a focus on climate change.

Romain Cancouët, operational engineer at Euro-Argo ERIC, testing a Deep Argo float at the Ifremer facility, in the unique 20-metre depth pool tank.

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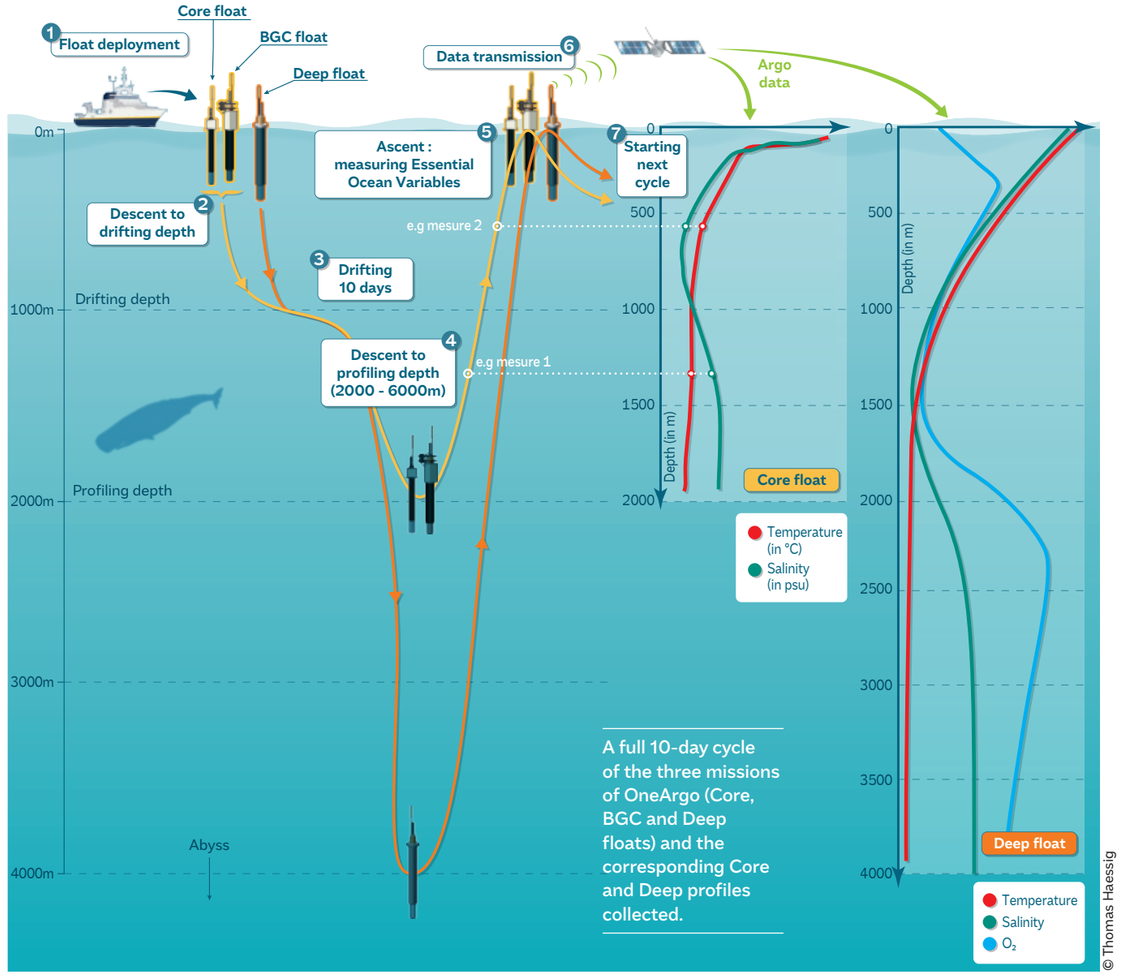

A full 10-day cycle of the three missions of OneArgo (Core, BGC and Deep floats) and the corresponding Core and Deep profiles collected.

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A Deep Argo float tested at the hyperbaric chamber of Ifremer facility, to reproduce the extremely high pressures of the abyssal zone.

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Deep Argo floats at Ifremer facility.

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"More than 90% percent of the excess heat produced by human activity is stored in the oceans and we estimate that 10 – 15% of this heat is stored below 2 000 metres," explains Virginie Thierry, a physical oceanographer for Argo France, one of the 13 members of Euro-Argo ERIC (the European Research Infrastructure Consortium coordinating European contributions to the international Argo programme). With Deep Argo floats, researchers will be able to accurately measure the global ocean's average temperature and its variations.

They will also have the opportunity to study which regions or which ocean layers are more impacted by global warming. Furthermore, when the oceans get warmer, their volume increases, inducing a sea level rise. "It is vital that we quantify the role of the deep sea in sea level rise," Virginie Thierry says. Deep Argo floats will also be invaluable assets for ocean modeling. Ocean models are computer simulations of the perpetuous motion and circulation of the water masses of the oceans. They are essential to study our oceans and their influence on our global climate. According to Damien Desbruyères, another physical oceanographer collaborating with Euro-Argo, "these floats will bring a new source of data, and help evaluate, thus improve our current models and how they represent deep ocean currents in particular."

When they ascend above 2 000 metres depth, the Deep Argo floats observe the same physical parameters as traditional Argo floats, also called Core Argo floats, making Deep Argo a natural extension to the international Argo programme. Scientists like Damien Desbruyères, Virginie Thierry and their European and international peers are working together to extend the Core Argo floats with their Deep Argo counterparts. They have their work cut out for them though. Pressure at a 4 000 metres depth is 400 times higher than at the surface. By overcoming the challenge of very accurately correcting the impact of the high pressure on the sensors, we can track the signals of climate change at these depths, since the variations of temperature is of the range of 1/1 000th of degree Celcius there.

By 2030, the Deep Argo researchers and engineers' community hope to maintain 1 200 operational Deep Argo floats around the globe. That would represent one fourth of the whole Argo floats tally. This is one of the priorities of OneArgo, a United Nations Decade of Ocean Science for Sustainable Development endorsed set of actions to create a global and multidisciplinary Ocean Observing array. Its goal is to upgrade the Argo array into a truly global network that could study the polar and marginal seas, include biogeochemical measurements as well as, in the case of Deep Argo, explore the full ocean depth.

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.

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.

FIND OUT MORE

- Video "Euro-Argo: Transforming Global Ocean Observation": https://youtu.be/im4HVIK4hVU
- Deep Argo: argo.ucsd.edu/expansion/deep-argo-mission
- 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

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