

# WHAT ARE THE ENVIRONMENTAL COSTS AND BENEFITS OF ARGO FLOATS?

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## EUROARGO

EUROPEAN RESEARCH  
INFRASTRUCTURE CONSORTIUM  
**FOR OBSERVING THE OCEAN**



# WHAT ARE **ARGO FLOATS** AND THEIR **BENEFITS?**

Argo is the first global  
real-time in situ observing  
network in the history  
of oceanography.

- Argo is a fleet of about 4000 autonomous floats, deployed all over the world's oceans and seas.
- They carry sensors to report temperature, salinity and can also be equipped to measure up to 6 biogeochemical parameters (oxygen, chlorophyll a, suspended particles, downwelling irradiance, nitrate, and pH).
- Argo floats perform measurements while actively going up and down the water column, from the surface to various depths. The results of these vertical surveys are called "profiles" and are analyzed by oceanographers.
- They provide an unprecedented free and open quality-controlled dataset for climate change research and ocean monitoring.



**800 - 1,000  
FLOATS**  
DEPLOYED/YEAR



**120,000  
TEMPERATURE,  
PRESSURE AND  
SALINITY  
PROFILES/YEAR**



**DATA  
REPORTED  
EVERY  
10 DAYS**



**FLOAT  
LIFETIME OF  
~5 YEARS**



**2 DECADES  
OF ARGO PROGRAM**

~12,000 end-of-life floats  
are now probably lying on the  
seabed  
Collectively, they would cover  
less than a football pitch.

The large number of Argo floats raises concerns about their environmental impact. This leaflet assesses these impacts by weighing the risk in relation to other human activities to the benefits of the valuable information solely provided by Argo floats.



# THE POSITIVE IMPACTS OF **ARGO FLOATS** ON THE **ENVIRONMENT** AND **SOCIETY**



Argo floats produce free and open-sourced data



## For weather, climate and ocean prediction

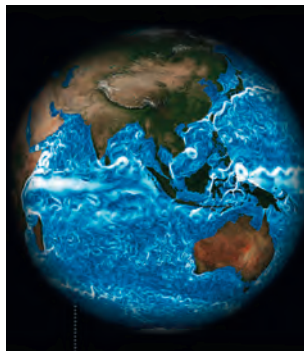


The data are used by operational services:

Argo data improve the accuracy of the ocean forecasts and are critical for developing reliable seasonal to decadal climate predictions. Argo is a game changer in terms of ocean observations.



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## For climate change mitigation

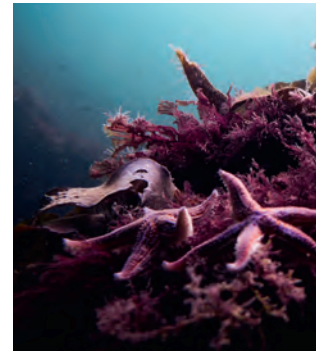


Scientists use these data for societal benefit:

One of Argo's most important scientific contribution is a huge improvement in the estimation of heat stored by the oceans – key for understanding global warming, rising sea levels and ocean health.



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## Positive impacts on the environment and society

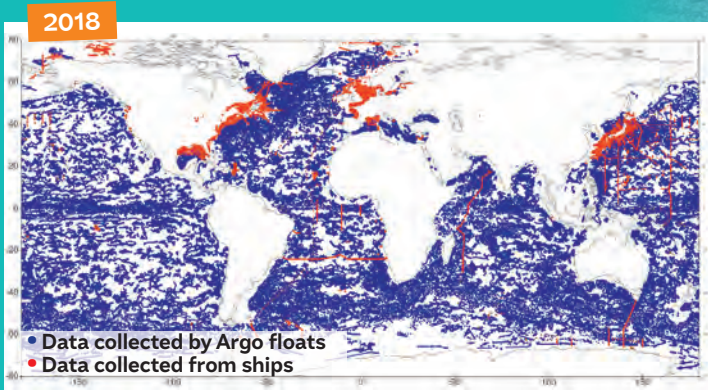
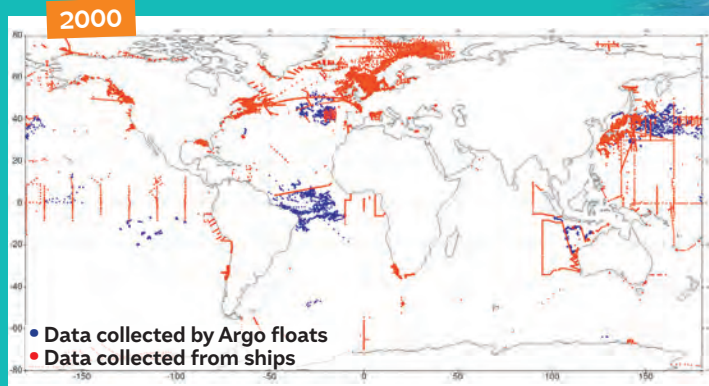
Contribution to 2 of the 17 Sustainable Development Goals (SDGs) adopted by all United Nations Member States in 2015.





# WHY **ARGO FLOATS** ARE THE BEST OPTION TO MONITOR THE OCEAN?

Prior to the advent of the Argo program the ocean was not adequately monitored.



Positions of measurement points (temperature, pressure and salinity profiles) collected with research vessels or Argo floats.



Research vessels (sampling with “CTD casts”) are the other platforms able to sample wide areas of the subsurface ocean with high quality observations of temperature and salinity.

To collect the equivalent amount of data to Argo data using research vessels would require more than 15,000 days of dedicated ship time each year. Those ships could cost over \$750M to operate (much more than the \$100M Argo annual costs). This would result in over 1 billion kg of additional CO<sub>2</sub> emissions to the atmosphere per year.

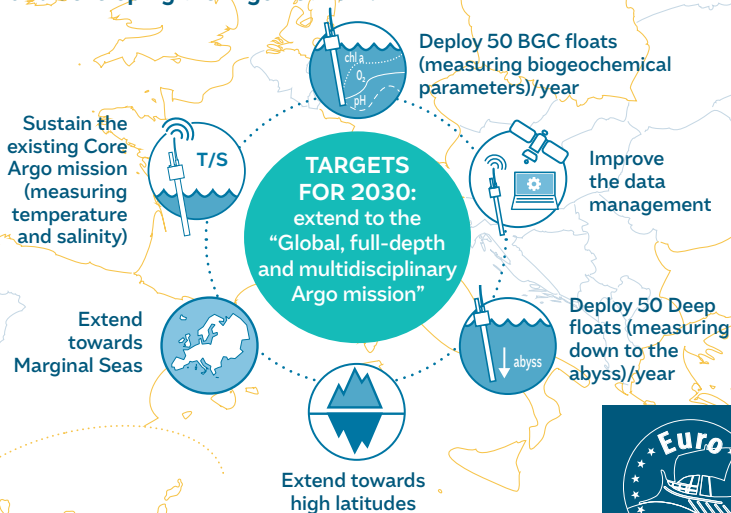
Presently there is no method of observing the subsurface global ocean that is less environmentally damaging and more cost effective than Argo.



# WHAT IS EURO-ARGO?

**Euro-Argo sustains and optimises the European contribution to the international Argo program, providing, deploying and operating nearly 25% of the float network.**

- The Euro-Argo ERIC is composed of 12 countries, and its coordination is managed by the Euro-Argo ERIC Office, hosted by Ifremer (France).
- The Argo international program's success is mainly due to the high degree of international cooperation behind the initiative and European partners have played a crucial role in setting up and developing the Argo network.



Euro-Argo ERIC  
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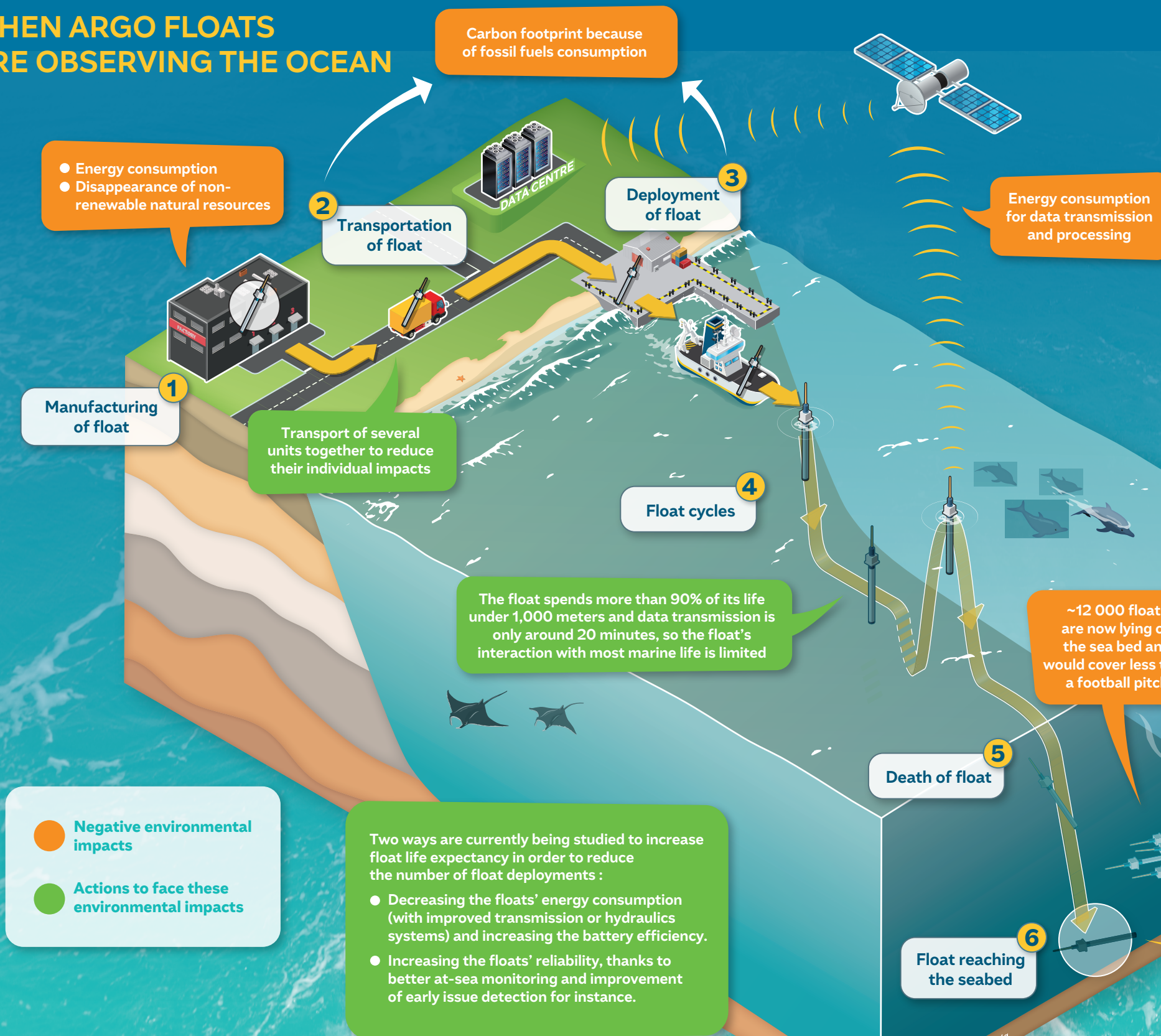




# ENVIRONMENTAL IMPACTS OF ARGO FLOATS

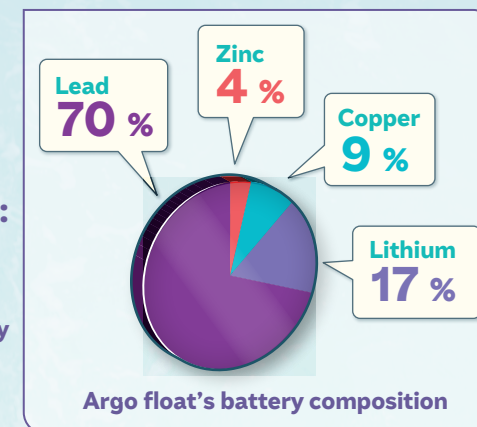
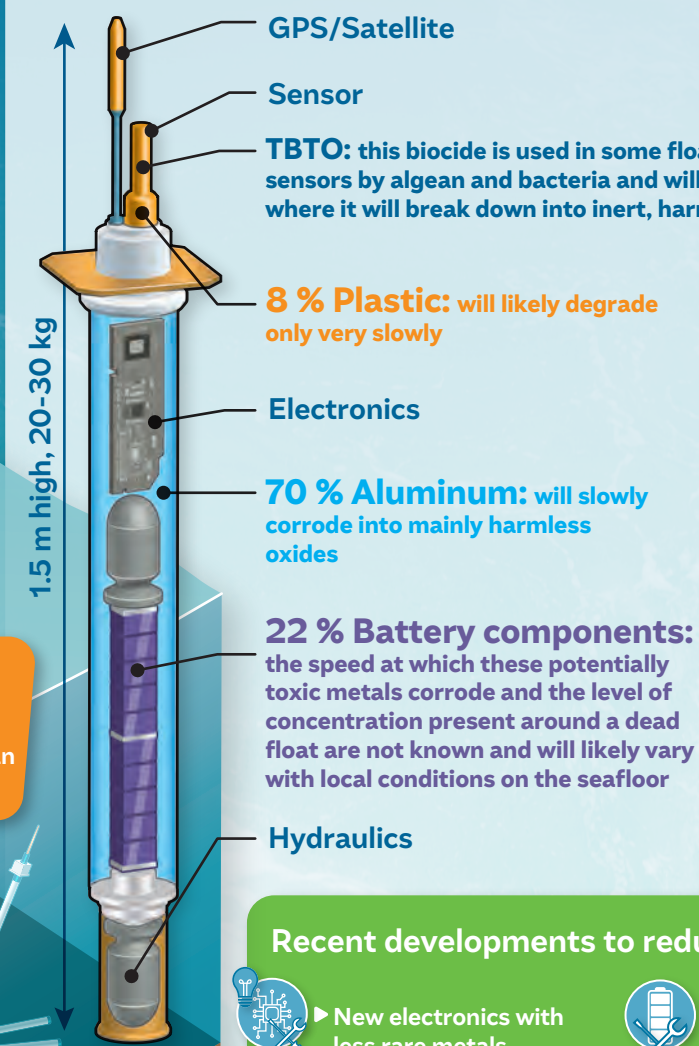


## WHEN ARGO FLOATS ARE OBSERVING THE OCEAN



## WHEN ARGO FLOATS REACH THE END OF THEIR LIFE

When their batteries are exhausted, Argo floats can't reach the surface anymore and they drift in the ocean. At this point, sea water fills the hull and starts its corrosive action. The float eventually sinks to the seafloor, mostly over deep abyssal regions. Decomposition processes will take place over the course of a number of years. Some elements from the battery will then spill to the surrounding sea water.



### Recent developments to reduce the environmental impact

- ▶ New electronics with less rare metals
- ▶ Better choice of some electronics/mechanical components
- ▶ Optimisation of the profiler energy consumption, via the mechanical, electronic and software design
- ▶ Very high-capacity battery technology, which allows maximum energy storage in minimum volume
- ▶ Less and less polluting material
- ▶ Evolution towards no TBTO for every float
- ▶ The impact of dead floats can also be limited by using or designing recovery systems

## SMALL AMOUNTS OF CHEMICAL COMPONENTS DILUTED IN THE OCEAN

Given the generally slow corrosion rates in the deep ocean, the speed of abyssal currents, the strength of nearbottom turbulence, and the large distances between floats (~300 km), a significant, local, short-term concentration of dissolved metal salts originating from a float seems unlikely.

The chemical species injected into the abyssal waters generally represent negligible amounts in comparison to the natural and anthropogenic fluxes of these substances. It would take over 176,000 years of Argo operations to inject the same amount of aluminum into the ocean that is employed annually to produce soda drink cans and a single year of the human contribution of plastic to the ocean is equivalent to 4.4 million years of the input from Argo.

By weight, the amount of chemical components released into the ocean by Argo floats is equivalent to:

**COPPER: 90 kg ~80**

**ALUMINIUM: 17,000 kg ~70,000**

**LITHIUM: 180 kg ~65**



## POSITIVE IMPACTS ON THE ENVIRONMENT

Argo is a game changer in terms of ocean observations. Argo floats collect about 120,000 surface-to-2,000 meters profiles of temperature, pressure and salinity per year. Presently there is no method of observing the global subsurface ocean that is more cost effective and less environmentally damaging than Argo.