

# When diving animals help us to observe the oceans: the MEOP data portal

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**Seals help gather information on some of the harshest environments on the planet, through the use of miniaturized ocean sensors glued on their fur. The resulting data – gathered from remote, icy seas over the last decade – are now freely available to scientists around the world from the data portal <http://www.meop.net>.**

The Polar oceans are changing rapidly as a result of global warming. Ice caps in Antarctica and Greenland are melting, releasing large quantities of freshwater into surface waters. The winter sea ice cover is receding in the Arctic and in large areas of the Southern Ocean, which promotes further warming. Southern winds are intensifying for reasons that are not fully understood. To understand the changing marine environment, it is necessary to have a comprehensive network of oceanographic measurements. Yet, until recently, the harsh climate and remoteness of these areas make them extremely difficult to observe. Diving marine animals equipped with sensors are now increasingly filling in the gaps.



**Figure 1:** Weddell seal carrying a SRDL-CTD instrument that collects temperature and salinity profiles while the animal is at sea (Credits: D. Costa).

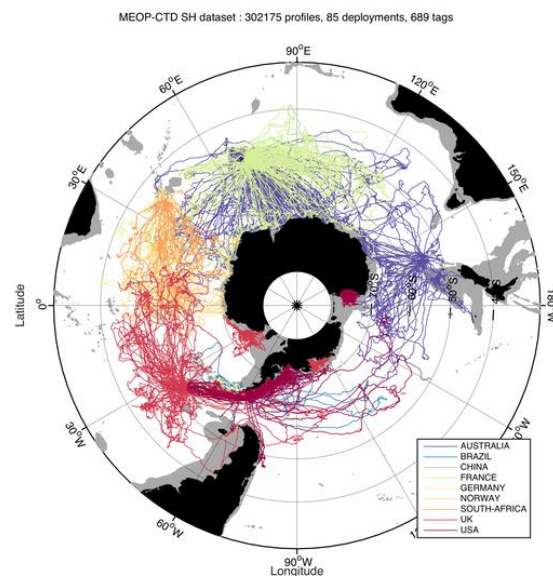
## When diving animals help us to observe the oceans

Since 2004, hundreds of diving marine animals, mainly Antarctic and Arctic seals, were fitted with a new generation of Argos tags developed by the Sea Mammal Research Unit of the University of St. Andrews in Scotland (Fig. 1). These tags can be used to investigate simultaneously the at-sea ecology (displacement, behaviour, dives, foraging success...) of these animals while collecting valuable oceanographic data (Boehme et al. 2009). Some of these species are travelling thousands of kilometres continuously diving to great depths ( $590 \pm 200$  m, with maxima around 2000m). The overall objective of most marine animal studies is to assess how their foraging behavior responds to oceanographic changes and how it affects their ability to acquire the resources they need to survive. But in the last decade, these animals have become an essential source of temperature and salinity profiles, especially for the polar oceans. For example, elephant seals and Weddell seals have contributed 98 % of the existing temperature and salinity profiles within the Southern Ocean pack ice. The sensors are non-

invasive (attached to the animal's fur, they naturally fall off when the animal moults) and the only devices of their kind that can be attached to animals.

### **MEOP: an international data portal for ocean data collected by marine animals**

The international consortium MEOP (Marine mammals Exploring the Ocean Pole-to-pole), originally formed during the International Polar Year in 2008-2009, aims to coordinate at the global scale animal tag deployments, oceanographic data processing and data distribution. The MEOP consortium includes participants from 12 countries (Australia, Brazil, Canada, China, United Kingdom, United States, France, Germany, Greenland, Norway, South Africa and Sweden). The MEOP consortium is associated with GOOS (Global Ocean Observing System), POGO (Partnership for Observation of the Global Oceans), and SOOS (Southern Ocean Observing System). At the European level, the European Animal-Borne Instrument (ABI) EuroGOOS Task Team is about to be launched to facilitate and promote the use of animal-borne instruments. Over 300,000 oceanographic profiles (i.e. representing 1/3 of the total number of Argo profiles) collected by marine biologists have already been made freely available to the international community through the MEOP data portal (Fig. 2). This so-called MEOP-CTD database is a significant contribution to the observation of the world ocean that can be used to conduct regional Polar studies.



**Figure 2:** Distribution of hydrographic data in the MEOP-CTD database for the Southern Ocean sector (source: meop.net).

### **The MEOP-CTD database of animal-derived temperature and salinity profiles**

An increasing number of studies now show the importance of these remote and inaccessible parts of the ocean, which are so difficult to observe. For example, more than 90% of extra heat in the Earth system is now stored in the oceans and the Southern Ocean in particular is a key site for understanding the uptake of heat and carbon. MEOP provides several thousand oceanographic profiles per year helping us to close gaps in our understanding of the climate system. Instrumented animals complement efficiently other existing observing systems, such as Argo buoys, providing data in sea-ice covered areas and on high-latitude continental shelves. Recent published work (Roquet et al. 2013; Roquet et al. 2014) has shown how important such observations are in predicting ice cover and mixed layer depth in large parts of the oceans where the observations were made. The inclusion of these data should improve significantly the quality of the projections provided by ocean-climate models. All these data are now available into a format file (Argo standard format) easily usable by oceanographers and accessible via the MEOP portal where it can be freely and easily downloaded by users (national data centers, researchers...) with a guaranteed quality level. This database is updated on an annual basis, and it has already been integrated into major oceanographic data centres including NODC, BODC and Coriolis.

### **References**

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