Why Observe the Global Ocean?

Because of its integral role in the Earth system, the ocean is an intrinsic part of our lives, whether we live on the coast or hundreds of kilometres inland. It is therefore in everyone's interest that the ocean is monitored, explored and understood and that future changes can be predicted. Sustained, long-term observations have many applications that benefit us all.

Ocean Observations can be used:

- To predict and mitigate the effects of extreme weather events (flooding, droughts), coastal erosion, sea level rise and natural disasters (earthquakes, tsunamis).
- To understand and predict the effects of climate change on ecosystems, through changes in migration patterns, shifts in species' geographic distribution, coral reef bleaching, and effects of ocean acidification on marine organisms. These effects will in turn impact on the services and benefits we derive from healthy marine ecosystems.
- To better manage our coastal zones and protect human health by monitoring pollution, eutrophication, microplastics, noise, invasive species, algal and jellyfish blooms.
- To exploit marine resources, ranging from fish stocks to mineral resources, sources of energy, and active compounds for pharmaceutical applications, in a sustainable way that does not jeopardise the integrity of the ocean ecosystem.

Our Vision

By 2030 we will have world-wide cooperation for a sustainable, state-of-the-art global ocean observing system that serves the needs of science and society.

Our Mission

To lead innovation and development of the crucial components of the ocean observing system; to identify and contribute to the development of the key skills, capabilities and capacities needed to achieve the vision; and to work with governments, foundations and industry, to articulate the benefits to society and required funding to build and sustain the system.

POGO is a consortium of nearly 40 oceanographic research institutions from 19 countries around the world. Working with the Committee on Earth Observation Satellites (CEOS), the Global Ocean Data Assimilation Experiment (GODAE) OceanView, the Global Ocean Observing System (GOOS) of the Intergovernmental Oceanographic Commission (IOC), and many other partners, POGO leads the "Oceans and Society: Blue Planet" Initiative within the intergovernmental Group on Earth Observations (GEO). POGO also works closely with the Scientific Committee on Oceanic Research (SCOR), particularly on their joint project the "International Quiet Ocean Experiment".

Partnership for Observation of the Global Oceans (POGO)

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Observing the Global Ocean

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Partnership for Observation of the Global Oceans

The Ocean – Source of Life

The Global Ocean

covers more than two thirds of the surface of our planet with an average depth of 3.8 kilometres. This represents over 99 percent of the biome, the space in which living organisms can exist.

70% Surface | 3.8 km | 99% Biome

Biodiversity

The ocean contains an estimated one million different species of plants and animals, up to two-thirds of which have yet to be named and described.

!??

1 Million Species — known | unknown

Oxygen

Marine algae contribute half the oxygen we breathe. Without the ocean the prospects for human life on Earth would be much diminished.

O_2

50% Oxygen

Climate

By taking up carbon dioxide and absorbing heat, the ocean plays a huge role in regulating our climate and weather patterns.

CO_2

30% — CO_2 emitted by humans since the beginning of industrialisation

90% — Storage of increase in energy in the climate system over the last 40 years

Resources

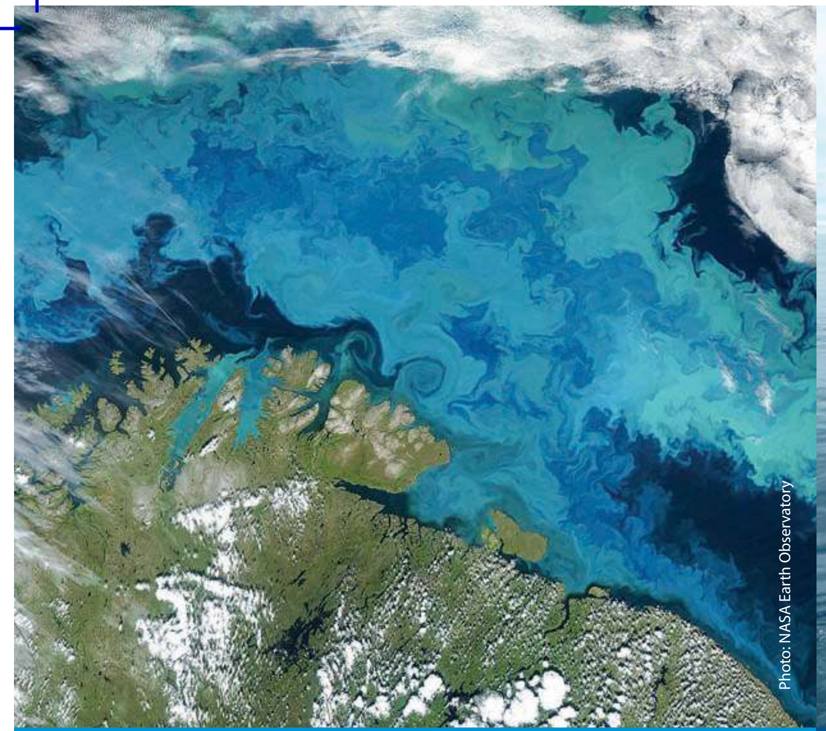
The ocean sustains the world's economy by providing food, minerals, energy, medicine, a means of transport and a place for recreation.

Transport | Food | Minerals | Medicine

Home

45%

Almost half of the world's population lives by the coast. Many developing nations, particularly small island developing states, rely on the ocean to sustain their livelihoods.



Satellite remote sensing

Shades of blue and green explode across the Barents Sea.
The colour was created by a massive bloom of phytoplankton.

Remotely Operated Vehicles (ROV)

Eyes and arms in the deep sea: With the capability of diving to depths of up to 6,000 metres, **ROV KIEL 6000** can reach 95 percent of the global sea floor.

Autonomous Underwater Vehicles (AUV)

The AUV ABYSS is used to map the sea floor in high-resolution. Its on-board equipment can also collect physical data from the water column, take photographs and measure subsea geophysical signals.

Conductivity Temperature Depth (CTD) instruments

A rosette water sampler collects water samples from different depths. Valuable physical, chemical and biological data for a variety of questions concerning marine research are obtained from these deployments.

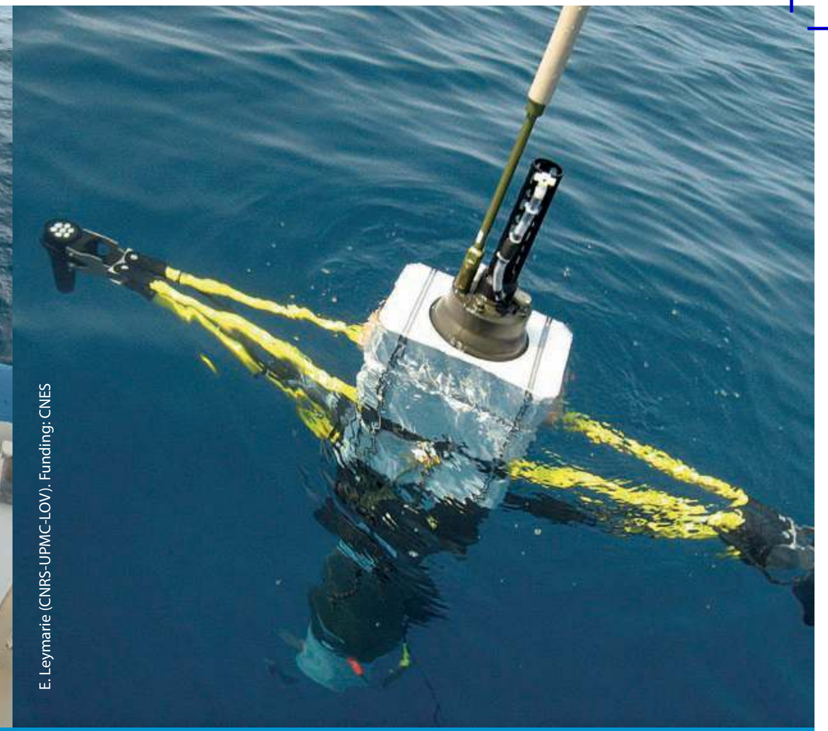
Moored autonomous instruments

Deep-sea moorings are deployed at different depths to record various physical and chemical parameters for extended periods. These vertically installed measurement chains allow long-term measurements at critical points in the oceans.

Moving autonomous instruments

Argo: Continuous measurements by Argo floats have allowed the collection of vast amounts of new ocean data in only ten years –more than was ever attained by all ship-based expeditions before.

Deep Argo: A new generation of floats that can dive to 6,000 metres depth for a better understanding of the mean ocean circulation, water properties and their decadal variations in many regions.



ProVal: New autonomous profiling float conceived by the Laboratoire d'Océanographie de Villefranche (LOV) to validate ocean color satellite products.

Methods

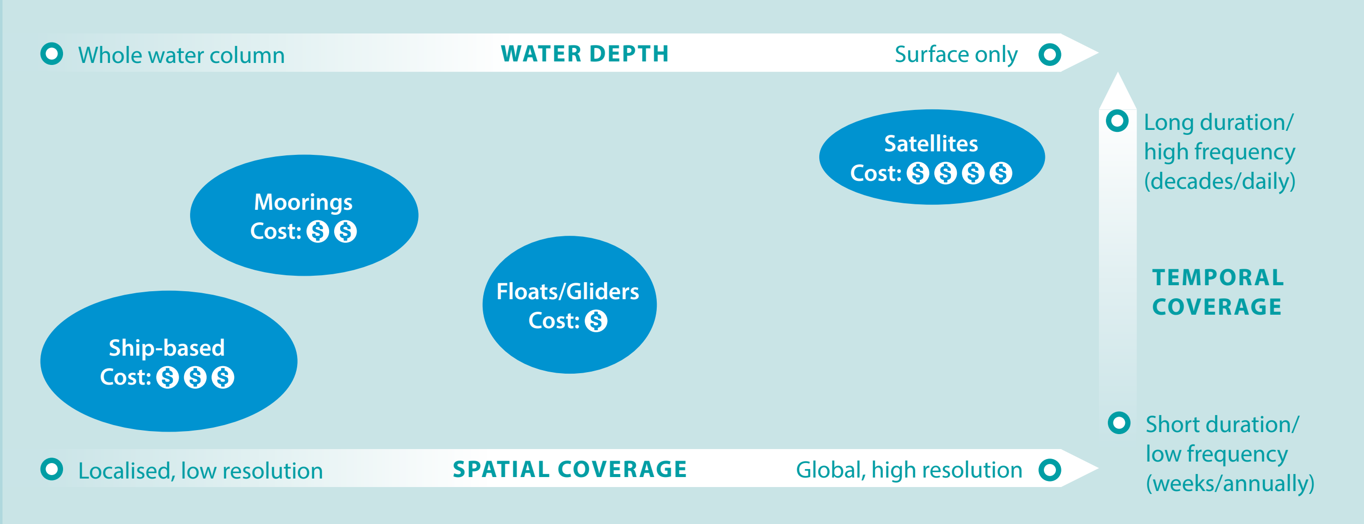
How can we observe the oceans?

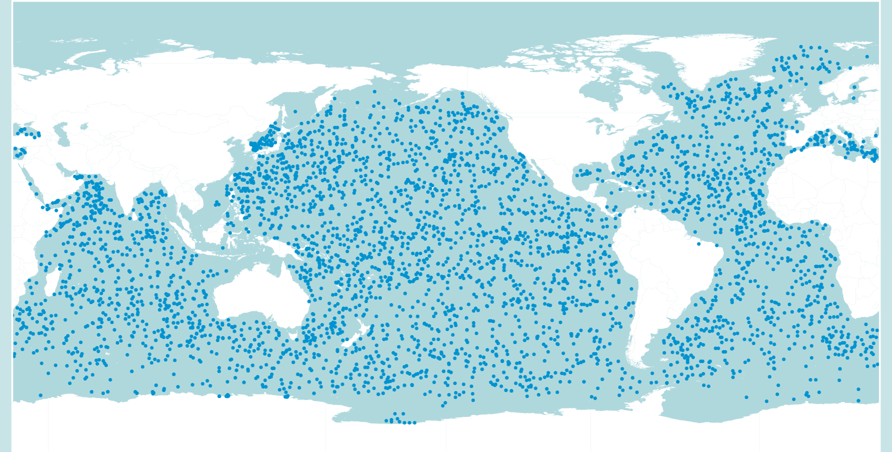
1. From space:
Satellite remote sensing provides serial snapshots of vast areas of the surface ocean, available in near-real time. Parameters that can be measured from space include sea surface temperature, salinity, sea level, surface waves, ocean colour, and ice cover. In situ measurements are required for calibration/validation of data.

2. From ships:
One-off surveys and repeat measurements at fixed stations or on predefined sections: sample analyses, Conductivity Temperature Depth (CTD) instruments, Remotely Operated Vehicles (ROV) and Autonomous Underwater Vehicles (AUV).

3. Using moored autonomous instruments:
Instruments attached to moored buoys are useful for providing continuous oceanographic and atmospheric measurements at fixed points, often in remote parts of the ocean. They are powered by solar energy and transmit the data to shore via satellites.

4. Using moving autonomous instruments:
New technologies have been developed over the last two decades that allow continuous measurements to be made by drifting and self-propelled instruments covering vast areas of the oceans. Whereas surface drifters only take measurements at the surface, Argo floats go down to 2,000 metres depth, and are currently being developed further so they can take measurements down to 6,000 metres depth. Gliders are operated from shore and can move both horizontally and vertically in the water column.





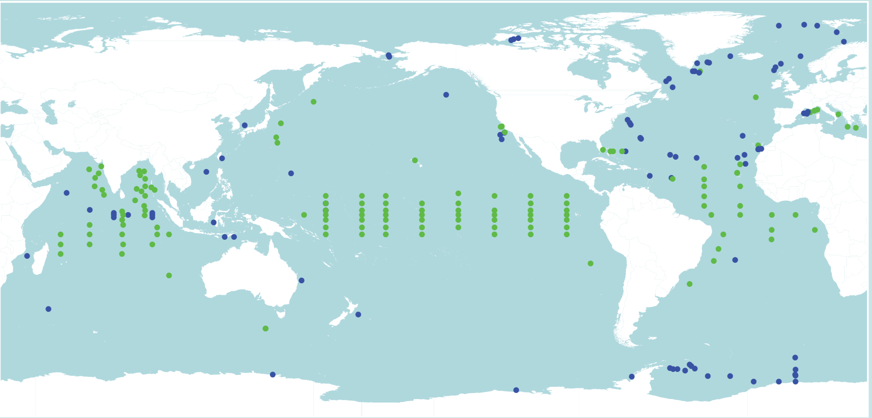
Positions of the 3.881 Argo floats as of June 2015

Argo

is a network of over 3,800 drifting floats that measure temperature and salinity down to 2,000 metres depth, around the world ocean. This network is a vital component of the Global Ocean Observing System. Deep Argo floats are currently being developed that can dive to 6,000 metres depth.

- www.argo.ucsd.edu

Examples What has already been achieved?

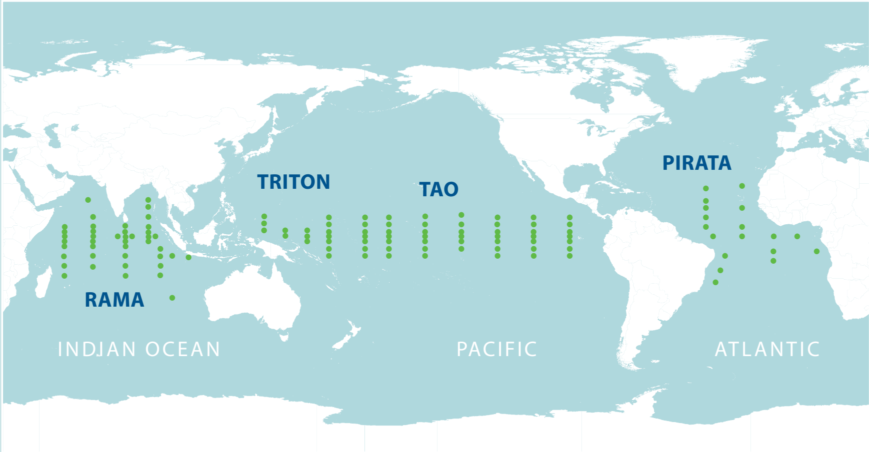


Positions of the 284 data stations of the OceanSITES network as of September 2014.
Green dots: stations sending real-time data, blue dots: delayed-mode data

OceanSITES

is a worldwide system of long-term, deep -water reference stations measuring dozens of variables and monitoring the full depth of the ocean. The POGO member institutions have been driving the establishment of OceanSITES, which is integral to the Global Ocean Observing System (GOOS).

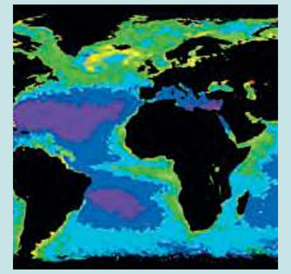
- www.oceansites.org



Global Tropical Moored Buoy Array

provides data in real-time for climate research and forecasting. Major components include the **TAO/TRITON** array in the Pacific, **PIRATA** in the Atlantic, and **RAMA** in the Indian Ocean. These arrays contribute to GOOS, as well as the Global Climate Observing System (GCOS).

- www.pmel.noaa.gov/tao/global/global.html

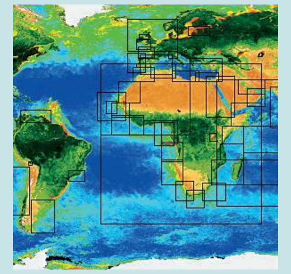


The Climate Change Initiative of ESA has produced a sixteen-year blended time series of the abundance of phytoplankton (indexed as concentration of chlorophyll) for the world ocean.

- http://cci.esa.int

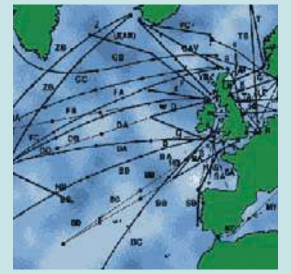
The Global Sea Level Observing system (GLOSS) has 290 sea level stations around the world for long term climate change and oceanographic sea level monitoring.

- www.gloss-sealevel.org



ChloroGIN is a globally-integrated network for observing chlorophyll concentration around the world to monitor variability in the ocean ecosystem using in situ as well as remote-sensing observations.

- http://chlorogin.org



The Continuous Plankton Recorder Survey monitors plankton abundance and commmunity structure in parts of the ocean and documents major shifts in the distribution of organisms.

- www.globalcpr.org

Outlook

Gaps and the way forward

Despite these achievements, particularly in the realm of physical (climate-related) ocean observations, progress has been stalled for almost a decade, partly because of the costs entailed especially during a period of economic down-turn for many countries. Biological and chemical observations are still lagging behind their physical counterparts. The observing system falls far short of what is needed.

However, we now stand at the cusp of a technological revolution based on autonomous and robotic observation systems, smart sensors and communication technologies. These offer new promise of more cost effective continuous presence in the ocean, making measurements all day every day, at least for some essential ocean variables.

Particular attention is needed to fill in the gaps: we know very little about the deep ocean (below 2,000 metres), and how it is being affected by the absorption of heat due to climate warming. Similarly, we need to understand how the Arctic and Antactic are being affected by climate change. While the Arctic is opening up to shipping lanes and other human activities such as oil and gas exploration, we urgently need to understand the baseline conditions so that we can evaluate any future impacts of human activities. There are even large gaps in observations in ocean basins that are relatively more accessible, such as the South Atlantic, and we need to redouble our efforts in those areas by leveraging international cooperation. Technological developments are enabling us to add new sensors to existing platforms, such as biogeochemical sensors to profiling floats.

Illustration: www.medieningenieure.de - Sabine Lüdeling

The Arctic long-term observatory FRAM is constructed to shift the frontiers of Arctic Marine Monitoring: By means of new developments and proven technologies from underwater vehicles to microsensors the observatory is going to enable the recording of physical, chemical and biological data in high temporal and spatial resolution.