Introduction to Biogeochemical Ocean Properties

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Learning Outcomes

- Learn about the ocean properties that are measured by Argo floats
- Understand why those properties are important to oceanographers

Comprehension Activities:

- *About-a-Float* & *What has my float been up to lately?* worksheets

Other helpful links

- Ocean Properties, Adopt-a-Float, France:
  http://www.monoceanetmoi.com/web/index.php/en/topics/ocean-properties
- Measured Variables, BGC-Argo:
  https://biogeochemical-argo.org/measured-variables-general-context.php
- Glossary of common terms:
  https://sites.google.com/view/adopt-a-float-ca/learning-materials/glossary

Ocean characteristics

When you visit the ocean – for example, at the beach or on a boat – you probably notice a few characteristics of the ocean.

Can you think of any right now?

Ocean characteristics

You might have thought about the *temperature*, *saltiness*, *colour*, and even some of the *plants* and *animals* that you find in the ocean. Maybe you reflected on how these characteristics differ between different locations or seasons?

To scientists, these characteristics are the *properties* of the ocean that can be measured and quantified, using instruments, experiments and models.

Ocean properties

Ocean properties can be classified as those that are biological, geological, or chemical (biogeochemical) or physical. Here are some examples.

Biogeochemical properties:

- **Oxygen and Carbon dioxide levels**
- **Acidity**
- **Phytoplankton abundance**
- **Nutrient concentrations**

Physical properties:

- **Temperature**
- **Salinity (saltiness)**
- **Depth (pressure)**

What ocean properties do Argo floats measure?

Measuring ocean properties

Argo floats contain mini electrical instruments, called *sensors*, that measure some biogeochemical and physical ocean properties.

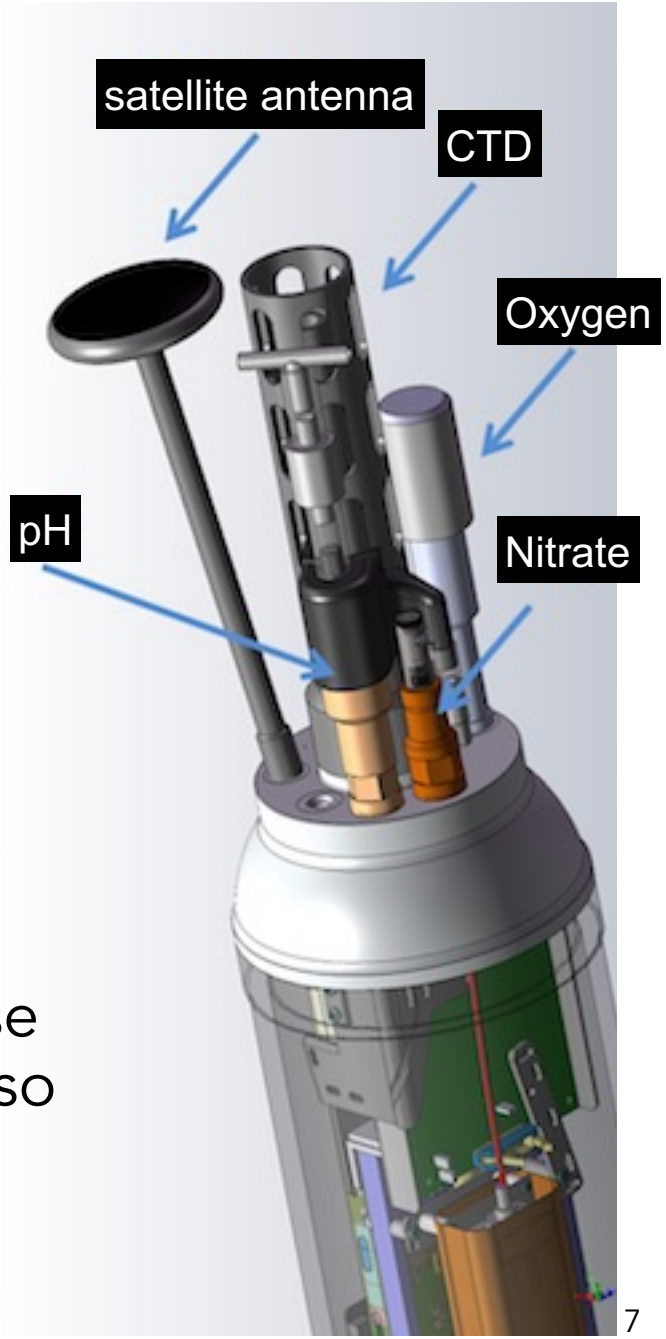
BGC-Argo floats contain a CTD to measure temperature, salinity and depth, and other sensors to measure biogeochemical properties.

Core-Argo floats only contain a CTD.

Measuring ocean properties

The sensors on BGC Argo floats measure the following properties:

- **Oxygen**
- **Nitrate (a nutrient)**
- **pH (acidity)**
- **Chlorophyll and bio-optical properties (both indicators of phytoplankton abundance)**
- **Temperature, Salinity, Depth**

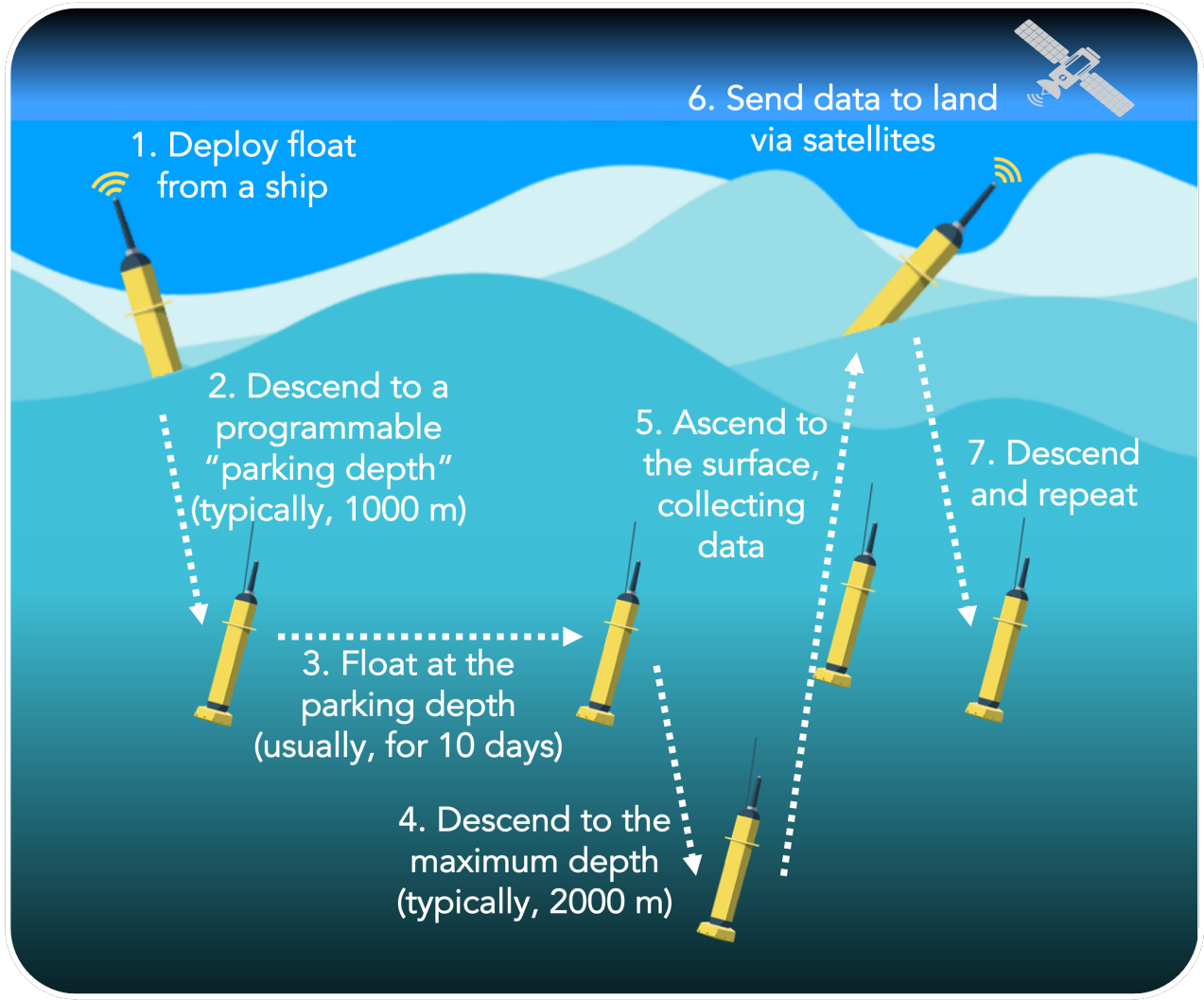


As you'll see later by exploring your own Argo data, these ocean properties vary throughout the ocean – that's why so many Argo floats are necessary!

Measuring ocean properties

Argo floats measure these properties automatically. Floats collect data when they ascend to the surface from their deepest location in the ocean.

One set of measurements is called a ***profile***. When the float reaches the surface, it transmits its profile data back to land via a satellite (e.g.,Iridium) signal.



How do oceanographers describe ocean properties?

(hint: how do you describe how tall you are?)

Units of measurement

When you describe your height, you might say something like "I'm 5 *feet*, 4 *inches*".

Here, *feet* and *inches* are important units of measurement that describe how tall you actually are.

Without the units, the number is somewhat meaningless!

Units of measurement

Similarly, ocean properties have specific units of measurement. For the properties measured by Argo floats, the units are:

Depth	Meters (m)
Temperature	Degrees Celsius (deg.-C)
Salinity	Absolute salinity scale
Chlorophyll and bio-optics (phytoplankton abundance)	Milligrams per cubed-meter (mg/m3)
Oxygen	Millimoles per cubed-meter (mmol/m3)
Nitrate	Millimoles per cubed-meter (mmol/m3)
pH (acidity)	pH scale from 0-14

What do you think the different ocean properties tell oceanographers about the ocean?

Let's look at some properties that are measured using BGC-Argo floats …

Why are temperature and salinity important?

Temperature	Temperature reflects warmth or cold in the ocean. Just like on land, temperature affects which plants and animals live in different ocean regions. Temperature also impacts ocean currents, and biogeochemical ocean properties.
Salinity	At some point in your life, you've probably tasted seawater, and noticed how salty it is. Well, salinity is a measurement of the ocean's saltiness! Like temperature, salinity distinguishes different parts of the ocean and impacts ocean currents.

How do temperature and salinity vary?

Temperature	Temperature varies by season, by latitude, and with depth.
Salinity	Salinity varies by closeness to rivers and with depth in the ocean. Salinity is also affected by rainfall.

What part of the ocean do you think is the warmest? Coldest?

Do you think the ocean is saltier near a river, or in the middle of the ocean?

Why are biogeochemical properties important?

Chlorophyll and Bio-optics	Chlorophyll and bio-optical measurement provide oceanographers with information on the abundance of phytoplankton in the ocean. Phytoplankton are tiny organisms that perform photosynthesis and serve as food for other marine organisms.
Oxygen	In the ocean, oxygen is produced by phytoplankton during photosynthesis. Like us, fish and other marine organisms, including bacteria, require oxygen to live.
Nitrate	Nitrate is a *nutrient* that is essential for phytoplankton growth – without it, phytoplankton cannot perform photosynthesis!
pH	pH is an indicator of ocean acidity, which is an important property that determines if an ocean region is hospitable to specific plants and animals.

How do biogeochemical properties vary?

Like temperature and salinity, biogeochemical properties vary by season and location in the ocean. Many are also affected by climate change!

Now that you're equipped with some knowledge on ocean properties, you can find out for yourself how these properties vary.

Check out the other lessons, data tools, and tutorials on the Adopt-a-Float website to get started.

Interactive Maps

See where your float (and hundreds of other Argo floats) has been lately in these interactive mapping tools.

Source: Euro-Argo. Source: Argovis.

Data explorer tutorials

Follow these step-by-step guides to learn how you can visualize, download and analyze your float's data.

https://sites.google.com/view/adopt-a-float-ca/learning-materials
https://sites.google.com/view/adopt-a-float-ca/data-explorer

Main points

- The ocean is characterized by many biogeochemical and physical properties, which vary significantly in time and space throughout the ocean
- Argo floats measure some of those properties using mini sensors
- Different properties reflect different things about the ocean's health