



ADOPT-A-FLOAT, CANADA

INTRODUCTION TO BIOGEOCHEMICAL OCEAN PROPERTIES

Lesson goals:

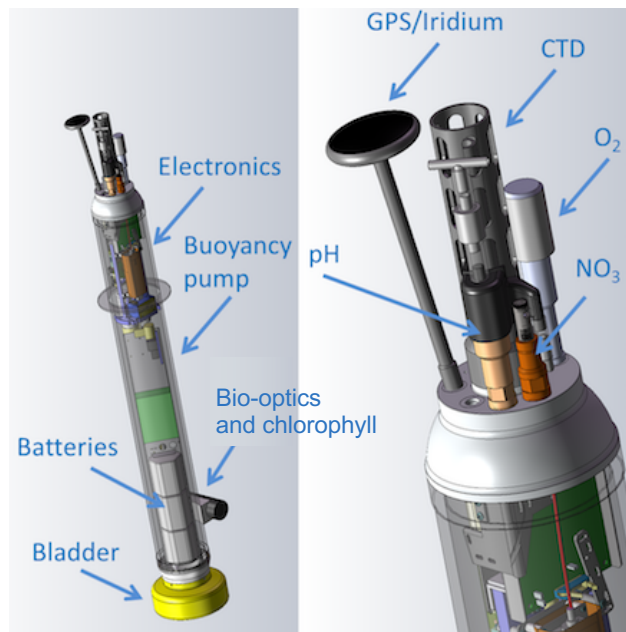
- Learn about ocean properties that are measured using Argo floats
- Describe how and why floats measure these properties

Introduction to BGC Ocean Properties

Biogeochemical Argo floats contain miniaturized electrical sensors that measure the following biogeochemical properties.

- Oxygen
- Nitrate
- Chlorophyll
- Bio-optics
- pH

The floats also contain a CTD, which provides data on the conductivity (an indicator of salinity), temperature and depth within the ocean.



A diagram of a BGC-Argo float, showing different miniaturized sensors, and the properties that they measure.

Oxygen is a gas that is produced during photosynthesis by phytoplankton and other plants. Most marine animals, in turn, require oxygen to breathe. Oceanographers are interested in studying the abundance of oxygen in the ocean because it

informs them about rates of phytoplankton growth and photosynthesis, and if an ocean region is hospitable to other marine organisms, like fish.

Nitrate is a nutrient that is essential for phytoplankton growth. Phytoplankton require nitrate to build chloroplasts, the essential organelle of photosynthesis, and other proteins and cellular structures that are necessary for their growth. Studying nitrate distributions helps oceanographers understand where and when photosynthesis occurs, and how much organic matter recycling occurs below the ocean surface.

Chlorophyll is a pigment found in phytoplankton and other plants that helps them to absorb light and conduct photosynthesis. Oceanographers consider chlorophyll abundance to be an indicator of phytoplankton biomass. **Bio-optical** measurements also provide information on the type and abundance of phytoplankton and other organic particles, collectively referred to as particulate organic carbon. Measurements of chlorophyll and particulate organic carbon are important for helping oceanographers understand photosynthesis, and the ocean's ability to store carbon.

The acidity of the ocean is represented by measurements of **pH**. pH values vary on a scale from 0-14. High numbers indicate basic conditions, and low numbers indicate acidic conditions. Overall, the ocean is slightly basic, with an average pH of ~8.1. However, pH is highly variable, and is an important indicator of ocean acidification and climate change.

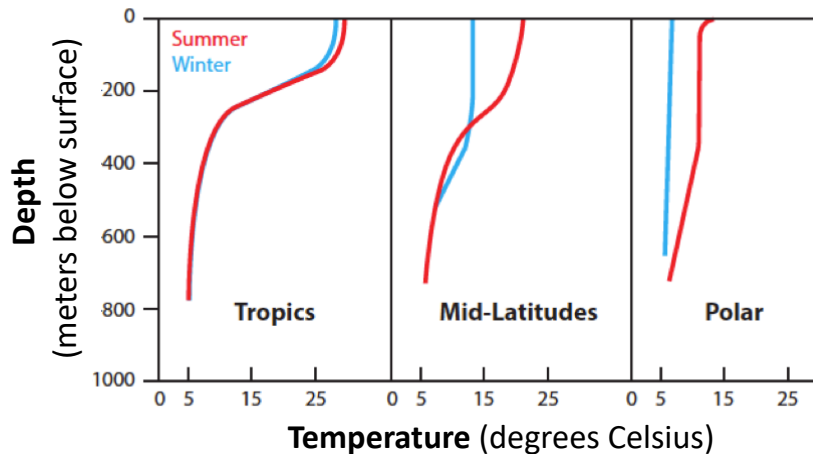
Temperature and **salinity** (saltiness) are physical characteristics of the ocean that are important for setting the **density** of seawater. Density, the mass of water per unit volume, is important because it affects

ocean currents and vertical water movements. Collectively, these three physical properties help oceanographers understand the heat and freshwater content of the ocean and determine water movement.

Argo floats measure these properties autonomously over their life cycle (https://adopt-a-float.ocean.dal.ca/float_cycle_crop.png). The floats collect data when they ascend from their deepest location in the water column (usually 2000 m) to the surface. One set of measurements over this depth range 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.

As you'll see by exploring your own BGC-Argo data, all of these ocean properties vary throughout the ocean. They change significantly by season, depth in the ocean, closeness to land, and are also affected by climate change. And this level of variability is why hundreds of BGC-Argo floats are necessary – so that oceanographers can better understand how these properties change in all ocean regions.

Check out the additional resources listed below, and follow other web links, to discover more about the biogeochemical ocean properties that BGC-Argo floats measure.



An example of temperature variability in different ocean regions.

Additional resources

Measured Variables, BGC-Argo:

<https://biogeochemical-argo.org/measured-variables-general-context.php>

Adopt-a-Float data access tutorial:

<https://sites.google.com/view/adopt-a-float-ca/data-explorer#h.d0zwmwzkd14sh>

Glossary of common terms:

<https://sites.google.com/view/adopt-a-float-ca/learning-materials/glossary>

Fleet monitoring and data visualization:

<https://dataselection.euro-argo.eu/>

Name: _____

Date: _____

Read the materials above and complete the following table.

Ocean properties measured by biogeochemical Argo floats:

| <i>Property & unit of measurement</i> | <i>Why it's important</i> | <i>How it's measured</i> | <i>How it varies</i> | <i>Example profile</i> |
|--|--|---|---|------------------------|
| <p>Temperature</p> <p>(degrees Celsius)</p> | <p>Temperature reflects warmth or cold in the ocean. It distinguishes different parts of the ocean, impacts ocean currents, affects which plants and animals can live in different regions, and controls the distributions of other biogeochemical ocean properties.</p> | <p>Temperature is measured by a device called a thermistor, located on the CTD.</p> | <p>Most noticeably, temperature varies by season, by latitude, and with depth in the ocean. In general, the surface ocean near the equator is warmest, and deep water or water near the poles is coldest. Ocean temperature also increases as the whole planet warms in response to climate change.</p> | |
| <p>Salinity</p> | | | | |

| <i>Property & unit of measurement</i> | <i>Why it's important</i> | <i>How it's measured</i> | <i>How it varies</i> | <i>Example profile</i> |
|---|---------------------------|--------------------------|----------------------|------------------------|
| Oxygen | | | | |
| Nitrate | | | | |
| pH (acidity) | | | | |

| <i>Property & unit of measurement</i> | <i>Why it's important</i> | <i>How it's measured</i> | <i>How it varies</i> | <i>Example profile</i> |
|---|---------------------------|--------------------------|----------------------|------------------------|
| <i>Chlorophyll</i> | | | | |
| <i>Particulate organic carbon</i> | | | | |