Beaufort Gyre Exploration Project: Dispatch 7: CTD, Bongo, CTD, Bongo, CTD, Bongo

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September 12, 2018

Location: 73° 4' N 140° 23' W

Weather: -3°C (27°F), Overcast with the occasional snow flurry, seas slightly choppy, Northeast winds at 3 knots, seawater temperature 0.5°C (33°F)

Sea Ice: None

Today we powered through three CTD stations, CB-22, CB-23a, and CB-27. At each station, we also completed one or two “bongo” casts for zooplankton. The bongo and CTD rosette teams have hit their strides and are firing on all cylinders. The sheer number of samples and data collected in the last 24 hours is astounding. The JOIS/BGOS expedition produces incredibly detailed data sets that give these scientists the ability to ask and then answer complex research questions about the Arctic environment.

I promised in a previous dispatch to go into a bit more detail about the CTD rosette. First of all, we know that it measures Conductivity, Temperature, and Depth, but why are those parameters important? Well, these three parameters measure the “weather of the ocean”. The primary measurements that your local weather forecaster uses are air temperature, pressure, and humidity. This gives them a good idea of what the atmosphere is doing and what type of weather is on the way. While there are definitely more sophisticated instrumentation and additional measurements used in modern weather forecasting, those three are the basic foundation. Salinity, temperature, and depth form the basic foundation of oceanographic “weather”. One might think that the ocean is one big body of water, but changes in salinity, density, temperature, and depth actually create distinct layers of water that scientists can track across time and space. With the CTD information one can calculate a water’s density and salinity, and those measurements then give one an idea of the different layers of water present and how currents might move between these layers and across different areas of the ocean.

In addition to CTD, the rosette is outfitted with sensors for pressure, dissolved oxygen, chlorophyll, colored dissolved organic matter, photosynthetically active radiation, and an altimeter (there are also velocity and turbulence meters too, but that will be a separate dispatch). The pressure sensor records depth, which is critical to know for all the other measurements. Dissolved oxygen (DO) measures the amount of oxygen in the water. DO is what fish and other marine life “breathe”, and low DO at certain depths can suggest pollution or another problem. I am from Texas originally, and the Gulf of Mexico is famous for a “dead zone” caused by critically low DO levels, as a result of nutrient pollution from the Mississippi River. Chlorophyll is used to measure the primary production of phytoplankton. Phytoplankton are the plants of the ocean, and the base of the food chain. So, it is important to know how much primary production is occurring.

Colored dissolved organic matter measurements help determine the origin of the water in the ocean. Dissolved organic matter (DOM) is present in all water bodies and has many different sources. The DOM found in rivers worldwide is often quite colored because it has the remains of land-based plants that have pigments in their leaves (some of which produce those beautiful fall colors you see). On the other hand, DOM from ocean phytoplankton has much less color. Thus, CDOM can give you an idea of where the ocean water one is measuring came from. Did it come from a terrestrial river that flowed into the ocean? Or is it ocean water that has been around for years and years?

The altimeter measures the depth of the CTD rosette from the seafloor. This is critical information for the CTD operator as he or she is working with the crew of the CCGS Louis S. St-Laurent to lower the rosette to a height 10 meters above the bottom. Finally, photosynthetically active radiation (PAR) measures the incoming light in the photosynthetic wavelengths. Not all of sunlight’s wavelengths support photosynthesis. Knowing PAR helps scientists estimate how much phytoplankton growth (primary production) can occur at a certain depth.

Whew, well I think that is enough science for now! As I mentioned before, numerous water samples are taken from the bottles on the rosette after each cast. I will follow-up soon with another dispatch outlining what samples are taken and why. But up next tomorrow, we have one of three mooring operations from WHOI. You can look forward to a detailed report of what kind of work it takes to place instruments at sea for two years of continuous measurements.

Last updated: September 14, 2018