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Beaufort Gyre Exploration Project: Dispatch 24: Deep Canada Basin

Luc Rainville
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When you are doing a CTD cast in the Beaufort Sea, the first few hundred meters are quite exciting: the surface water is very fresh, then there usually is the temperature maximum of the Pacific summer water, and after another little minimum the temperature starts increasing again, compensated by a steady increase in salinity. You often see intrusions there. But after you reach the temperature maximum of the Atlantic water (between and 300 and 500 meters), some would say that it gets boring. Salinity increases slowly, temperature decreases. Do we really have to go to the bottom?

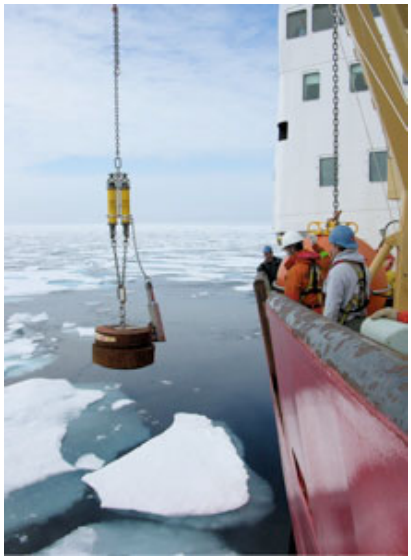
Well, when you look closely, the deep Canada Basin is actually a really cool place... After a minimum near 2400 m, the temperature starts increasing again, even when you remove the pressure effect (because water is slightly compressible, the molecules are closer to each other as pressure increases, increasing temperature slightly). It warms up for by few milli-degrees, and the bottom 1000 meters or so (from 2800 to 3800 m) are a little warmer and completely uniform. The reason for this warming is believed to be the heat released by the Earth's crust (geothermal heating). The vertical mixing and deep circulation in the Arctic ocean are so small than you can see here phenomena that are obscured by other processes in the other oceans.

But that's not to say that nothing is happening. Surprisingly, Mary-Louise Timmermans (a scientist at WHOI) and I found from a pilot study a few years ago that the step structure in the temperature profile between the homogeneous bottom layer and the temperature minimum moves vertically by 20-30 meters every 12 hours or so, and there are also lateral intrusions that bring water with different properties at these depths. Very little data have been collected at these depths, but this year we are adding instruments in the deeper part of Moorings A and D to specifically measure the variability in the deepest waters.

Steve Manganini (WHOI), along with Tim Eglinton (WHOI) and Roger François (UBC), are also very interested in the deep Canada Basin. He is adding sediment traps to the WHOI moorings, big yellow cones that will catch the particles sinking in the ocean. Collection and analysis of these particles will determine how much carbon is delivered to the deep basin and where it comes from. We are looking forward to determining if most of the sediments are associated with lateral intrusions, ice coverage, or some other exciting transport mechanism!

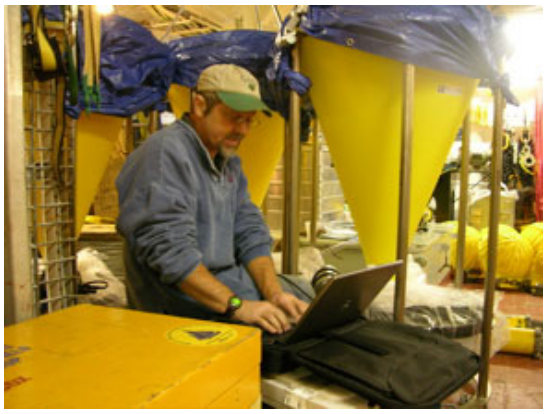
The time series of all the measurements taken on the moorings, from the top to the bottom, help understand the whole story of the circulation and water exchanges around the Beaufort Sea.

Last updated: October 19, 2015



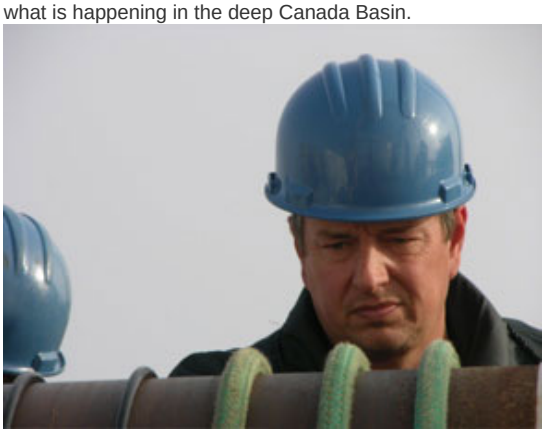
In the ice, we deploy the anchor first. The 3800 lbs anchor will hold the mooring in place for the next year. Then it can be released by activating the acoustic releases, located just above the anchor (yellow). They will be pulled to the surface by the added buoyancy, along with the bottom pressure recorded (tube on the anchor).

Steve Manganini is adding sediment traps to all four moorings this year. Hanging at 3000 m, they will catch the particles sinking in the ocean.



Steve, programming and setting up the traps in the cargo hold earlier in the cruise.

We also added about 20 instruments to the deeper part of mooring D. This array of sensors measuring temperature (pictured here with Bosun Bob Tailor), conductivity, and velocity will provide the first year-long long time series of what is happening in the deep Canada Basin.



Jim Dunn, watching over the Lebus winch as the deployment is near the end. The last of the 5/16" Jacnil wire rope (black) is attached to a green tag line. The tension on the mooring line can be up to 3000 lbs at that point!
Photos by Luc Rainville.

Mail: Woods Hole Oceanographic Institution, 266 Woods Hole Road, Woods Hole, MA 02543, USA.
E-Contact: info@whoi.edu; press relations: media@whoi.edu, tel. (508) 457-2000
Problems or questions about the site, please contact webdev@whoi.edu