

Bering Sea temperatures and their relationship to walleye Pollock fisheries: a feasibility study of year-round near-real time data acquisition

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Project Summary

The purpose of this project is to conduct a feasibility test to determine the usefulness of near real-time temperature data from the Bering Sea to commercial fishers, fisheries managers and the science community. It is anticipated that knowledge of Bering Sea bottom temperatures and vertical profiles of temperature will help determine fishing locations more efficiently, and will be important to fisheries managers and the science community.

Near-real time data of bottom and water column temperatures has been acquired using custom-designed profiling floats sampling temperature, pressure, position and a suite of engineering variables.

Polar Profiling Floats (PPFs) are free-drifting floats that measure the temperature of the water column, and were developed at Woods Hole Oceanographic Institution (WHOI) by PI P. Winsor and Breck Owens based on the general design of the ARGO float. The PPFs are programmed to, after initial release, acquire vertical profiles of ocean temperature from the surface to the bottom. Once on the bottom, they will remain stationary, acquiring temperature and pressure data every four hours for five days. This phase in the float cycle thus mimics a fixed bottom-anchored mooring. After five days of recording bottom temperatures, the floats change their buoyancy and rise to the surface while taking continuous temperature measurements. At the surface, the floats obtain a GPS reading to document their current position and all stored temperature data are transmitted by Iridium satellite communication to the PIs. After completed data transmission the floats sink to repeat the five-day cycle.

A challenge with using profiling floats in ice-covered regions, such as Bering Sea in winter, is the need for the floats to surface through a lead or other open water to transmit data. For this study, we will use the protocol developed by PI Winsor and Breck Owens (WHOI). In this case, floats are programmed so that when they surface in open water within the sea ice, data are transmitted to shore via Iridium satellite communication. In ice covered seas, a PPF will attempt communication, and if unable to do so because of ice, descend for another five-day cycle.

Preliminary Results

Two PPFs were built at WHOI and tested for several cycles in their 10-m deep test tank. The floats were delivered to UAF in September 2009 where PI Winsor preformed pre-deployment checks by communicating with the floats via the floats com ports. The floats were shipped to Dutch Harbor and deployed with the help of Jack Pound and Craig Cross on the Starbound on September 11th at 57° 56.5N and 168° 41.2W and 57° 55.6N and 168° 38.9'W, respectively. The floats were deployed along the 70-m isobaths within the main area for Pollock fisheries.

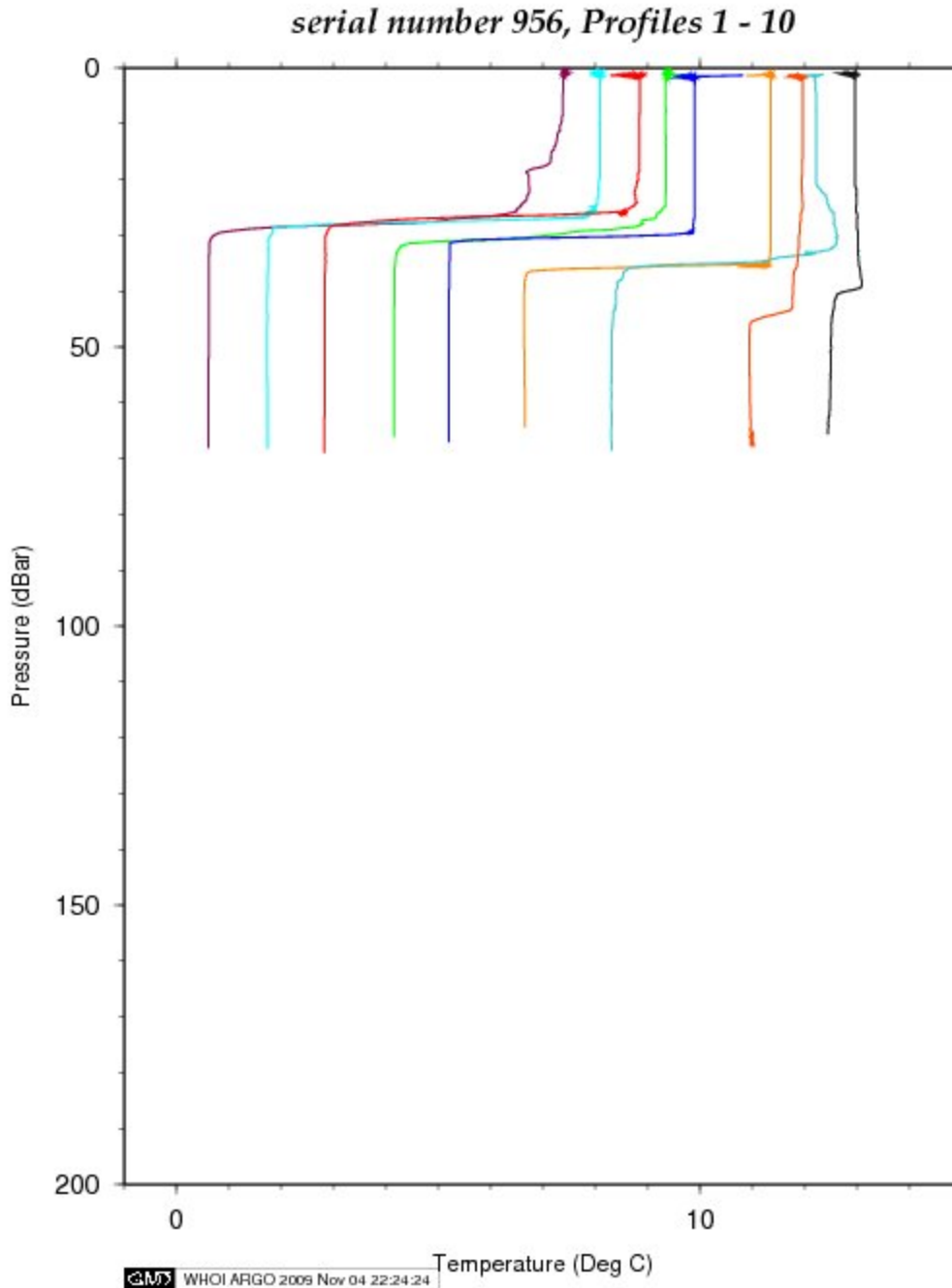


Figure 1. Consecutive vertical profiles of temperature as a function of pressure from float #20360. First profile is to the left and last reported profile (November 4th) to the right. Notice how strong autumn winds have eroded the strong vertical stratification present in earlier profiles and mixed the water column completely down to ~ 40 m depth.

We are encouraged that the float deployment went well and that we have received data back. One of our primary concerns was that the floats might get stuck in bottom mud as they sit at the bottom for five days. This does not seem to have occurred so far. Fig. 1 above shows example of real-time data generated by one of the PPF floats (unit# 20360). The vertical temperature profiles

are recorded as the float ascends to the surface after each five-day period at the bottom. The profiles in Fig. 1 have been shifted horizontally for easy viewing, and shows highly stratified conditions on September 21st (first profile on left) continuing until last week when strong autumn storms mixed the water column down to ~40 m depth (resulting in warming of the bottom water as warm surface water was mixed down).

Outlook

We will continue to analyze and monitor the data from the PPF floats. Our hope is that at least one of two floats will stay active until the sea-ice cover extends over the project area in order to access the floats capability to operate in ice covered conditions. We are currently developing a website that will display all float data (physical and engineering) in real time for fisheries, scientists and decision makers. So far, we are excited about the data generated and that this relatively high-risk project is moving along.