ICES CM 2013/L:04

The Norwegian Atlantic Current Observatory (NACO)

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Summary

In this study we present the Norwegian Atlantic Current Observatory, a monitoring program using state of the art technology as autonomous Seagliders and a NACO-buoy for real time transmission of environmental data. We demonstrate the applicability of the program by using Seaglider data from two transects; the Svinøy section and the Lofoten Basin in combination with moored current meter, wind and wave data from the NACO-buoy in the core of the Norwegian Atlantic Current off Svinøy.

Introduction

The Norwegian Atlantic Current is a poleward extension of the Gulf Stream, and serves as a conduit of warm and saline Atlantic water from the North Atlantic to the Barents Sea and Arctic Ocean. This flow has been monitored in the Svinøy section using standard hydrographic methodology for more than 50 years by the Marine Research Institute and use of moored current meters by the Geophysical Institute since 1995. As an extension, the Norwegian Atlantic Current Observatory (NACO) was initiated in 2012. It is a national infrastructure program funded by the Norwegian Research Council and hosted by the Geophysical Institute, University of Bergen. It includes investments in gliders, development of glider operation capabilities and eventually offering of service to the research community. Since May 2012 NACO has been operational with Seagliders along two transects 1) The Svinøy section and 2) the Lofoten Basin along the 70th latitude; as well as the NACO-buoy moored in the core of the Norwegian Atlantic Current off Svinøy, transmitting real time environmental data.

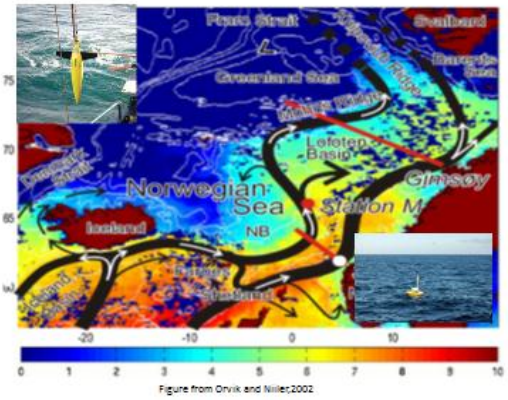

Figure 1. Norwegian Atlantic Current Observatory (NACO) with Seagliders and the NACO-buoy

Instrumentation

Seagliders are autonomous underwater vehicles that use change in buoyancy to displace, by inflating and deflating a bladder. Wings and body change the pressure field and create horizontal motion. Diving up and down and along the horizontal in saw-tooth shaped trajectories with a speed of about 25 cm/s. They are capable to collect data in the open seas under very rough weather, and can substitute classical and expensive CTD - transects from ships. The Seaglider can be equipped with a range of different sensors (Seabird CTD and oxygen sensor, WetLabs optical backscatter and chlorophyll fluorometer, etc.). A typical dive goes to 1000 m depth covering a horizontal distance of, three to seven kilometers, and surfaces after seven to eight hours. Then it receives its GPS position and contacts the base station through the Iridium satellite phone system for data communication. One of the key features of an underwater glider like the Seaglider is its ability to estimate the average current during a dive, from its hydrodynamic model. Then the absolute current can be derived using the geostrophic method. The NACO-buoy is a moored Wavescan buy transmitting real time wave and methodological data as well as current data from a bottom mounted ADCP using telemetry.

Results

With reference to our 18- year current time series in the core of the Norwegian Atlantic Current, we concentrate on Seaglider observations. In the Svinøy section SG560 reveals the slab like extension of warm and saline Atlantic water down to about 500m depth with its major baroclinic subsurface front and associated frontal jet around the 2000 m isobaths. Additionally, there is a 100m thick surface layer of Atlantic water extending farther northwestward into the Norwegian Sea. However, the observations show large variability of the baroclinic field demonstrating the unstable frontal structure. The SG559 accomplishing 800 km crossings of the Lofoten Basin between Lofoten and Jan Mayen Island shows Atlantic water down to about 800 m depth with a major baroclinic front toward the Jan Mayen. A striking feature is the vigorous eddy field along the entire sections being most energetic in the central Lofoten Basin. There the glider reveals a deepening dome of Atlantic water down to about 1000 m depth with an anticyclonic velocity field. These findings substantiate a quasi-permanent anticyclonic eddy of Atlantic water in the central Lofoten Basin in accordance with Søiland and Rossby, 2013. We also demonstrate real time wind, wave and current data from the NACO buoy.

References

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