

MSM123 BELS

Halifax – St. John’s

23 November – 27 December 2023

5th Weekly Report (18.12.2023 - 24.12.2023)

We began this week planning the recovery of our equipment that has been deployed for the last several weeks. This includes two SWIFT buoys from University of Washington, a BELS homemade drifter, the bubble buoy tethered to the waverider buoy, and a Slocum glider. Some of these, such as the Slocum, have been in the water for almost the entire cruise. The Slocum Glider ‘Polly’ (*Figure 1*) is operated by Dalhousie University’s CEOTR and OTN technical support team. The objective of this glider mission was to quantify turbulence in the ocean surface boundary layer, as relevant for the development of air-sea flux parameterizations. Near-surface turbulence plays an important role in the rate at which gas is exchanged at the ocean-atmosphere interface and, as such, the vertical structure of turbulent dissipation rates are useful in air-sea flux parameterizations. Micro-structure measurements of temperature and shear velocity were made with a Rockland Scientific Microrider 1000, from which turbulent kinetic energy dissipation rates are calculated. Dissipation rates near the surface under high winds and wave-breaking conditions, where bubble plumes may be present, are rare and will lead to a better understanding of near-surface turbulence in these conditions. Further, these measurements will allow a comparison of air-sea gas exchange parameterizations under these extreme conditions.

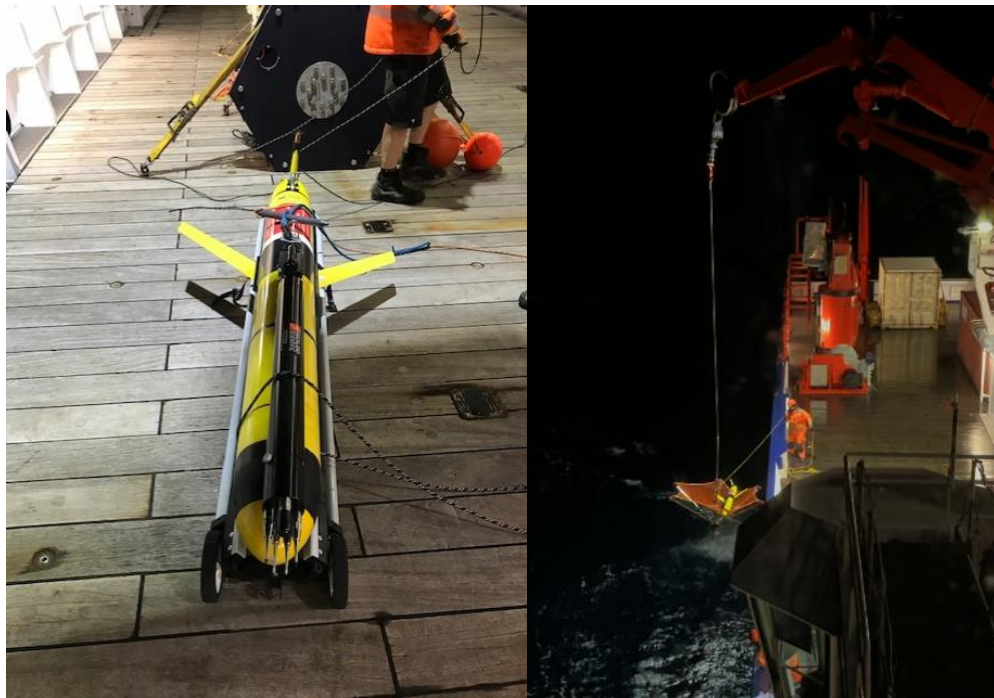


Figure 1: Slocum Glider ‘Polly’ and Microrider 1000 during deployment (left) and recovery (right) from the RV Maria S. Merian.

The glider system is an ideal platform for turbulence measurements due to its ability to propel itself through the water column with a low vibration profile. The Slocum Glider utilizes a buoyancy pump to alter its volume in the water column, allowing it to dive and climb to depths up to 1000 meters. To aid the vehicle in maintaining a constant pitch it can also utilize a servo-controlled battery pack that allows for ± 30 deg of pitch control. In the mission profile for this deployment, the glider was setup to utilize its buoyancy motor only once per dive and climb and maintained a fix position of its battery, a setup deemed most suitable for taking fine scale shear turbulence measurements. Typically, a glider mission is designed to be deployed for up to 6 months at a time, covering roughly 20km a day. The Slocum was set to dive below the mixed layer to 250 meters and breach the surface on every climb to maximize near-surface measurements. One example profile of the data collected with the Microrider is shown in *Figure 2*. A shear, temperature and dissipation rate profile is presented for one glider dive on December 17th.

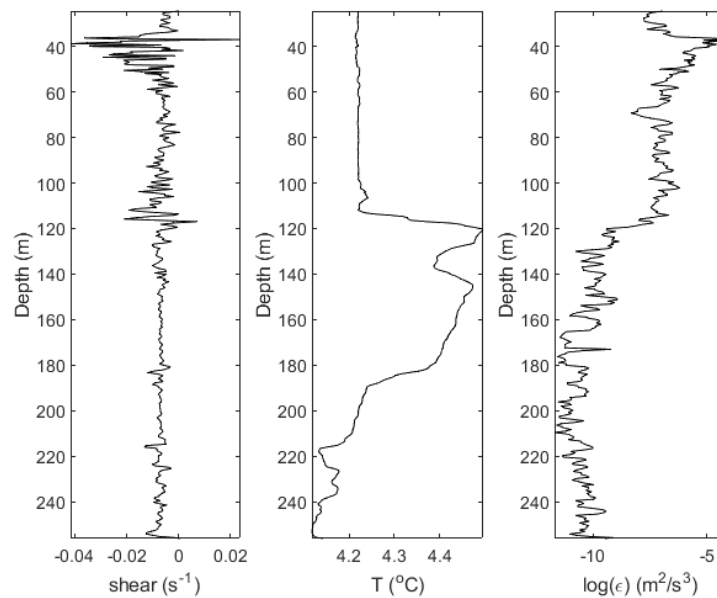


Figure 2: Shear, temperature and dissipation rate with depth.

The glider was able to stay on mission for 19 days (*Figure 3*). For the first segment of the glider's mission (in red), the glider performed a compass calibration and attempted to follow the ship as well as the Dalhousie deployed wave glider. Over the course of nearly two weeks following this period (in green) the glider was set to follow the ocean currents in a quasi-lagrangian pattern. This was accomplished by fixing the glider's rudder to starboard and allowing it to dive and climb in a spiral pattern roughly 10m in diameter. In this setup, the glider moves horizontally with the mean velocity of the water column. As the glider moved closer to the expected recovery position (in blue), it continued to collect data in the vicinity of the vessel, which will be calibrated with the data from the ship's flow through thermosalinograph and the underway pCO₂ system.

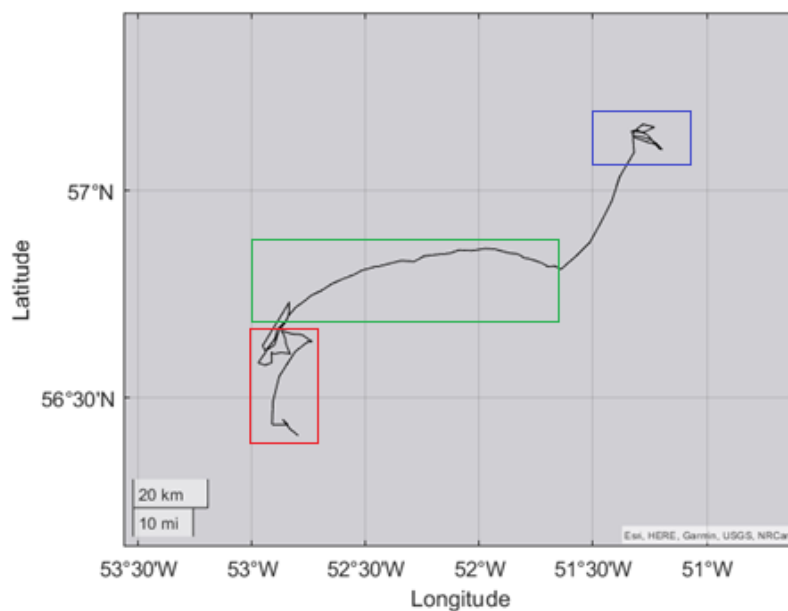


Figure 3: Glider track

We end the week celebrating the holiday season by baking cookies. Thanks so much to the captain, cooks, and stewardess for letting us have some fun in the kitchen!! Seasons greeting to our loved-ones and colleagues on land!



Happy holidays and greetings from the Labrador Sea,

Christa Marandino

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