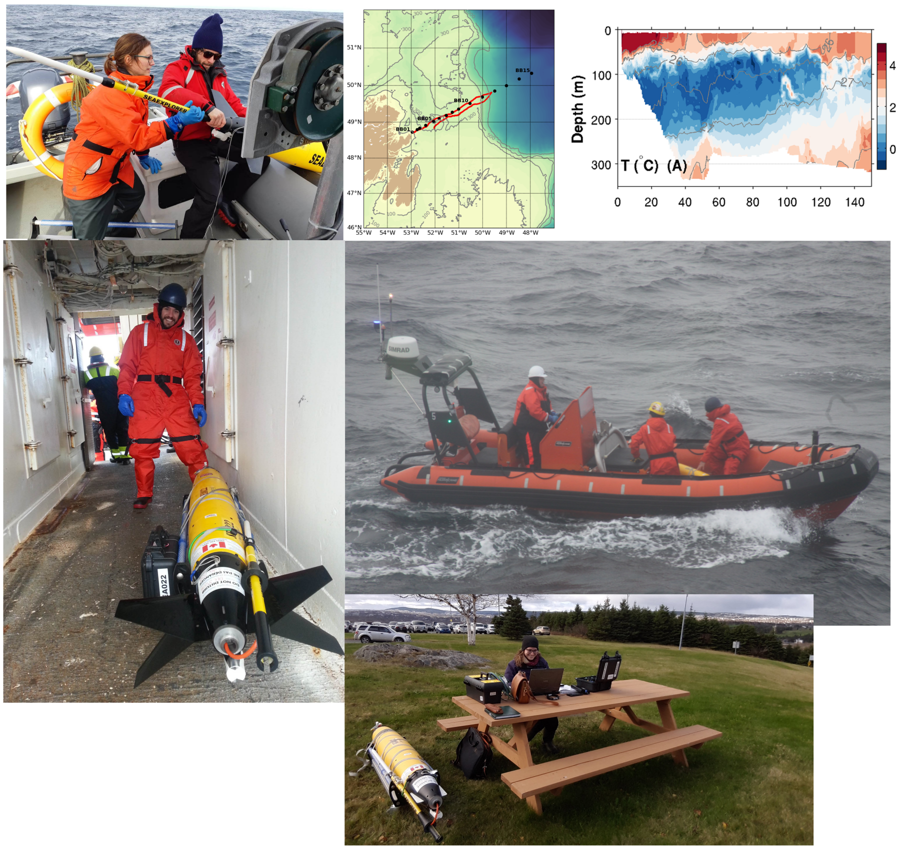
SeaExplorer glider mission in Newfoundland
Section Bonavista

Mission report - BB2018
Fall 2018



Document prepared by Frédéric Cyr*

December 2018

*Frederic.Cyr@dfo-mpo.gc.ca

1 Context

This glider campaign is the first DFO mission in the Atlantic outside the maritime region. It is the result of a successful proposal deposited by Newfoundland region (Oceanography Section), recommended by the Glider Working Group and approved by the OSOM committee. The main goal of this mission was to prove that such deployment in conjunction with an Atlantic Zone Monitoring Program (AZMP) survey is possible in the Newfoundland region. The mission took place along AZMP hydrographic section *Bonavista Bay* between 6-27 November 2018 (3 weeks). This document presents a brief overview of this successful mission.

2 Summary of the campaign

Glider SeaExplorer SEA022, also known as *Mersey*, was deployed at hydrographic station $BB01$ on 6 November 2018 near 15:00 UTC. The deployment was possible thanks to DFO's Conservation and Protection agents in Bonavista (contact person : Robert Stagg). The glider nearly reached station $BB12$ (about 270km offshore from deployment site) on 15 November before starting its return journey. The glider was recovered on 27 November at proximity of station $BB05$ by CCGS Hudson crew using their Fast Rescue Craft Boat (FRC). A total of 427 dives were realized, for a total of 854 casts along the section. The map of the glider track along with the bathymetric features of the region is presented in Figure 1.

3 Preliminary results

The glider was equipped with a pumped conductivity-temperature-depth sensor (Seabird's GPCTD) from which the conservative temperature (T), the absolute salinity (S_A) and the density anomaly referenced to the surface (σ_0) are derived using TEOS-10 toolbox (*McDougall and Barker*, 2011). This GPCTD is also equipped with a dissolved oxygen (O_2) sensor (Seabird's SBE-43F) from which concentrations are derived. A WetLabs ECO FLBBCD was also mounted on the glider for measurements of Chlorophyll-a (Chl-a) fluorescence ($\lambda_{\mathrm{Ex}}/\lambda_{\mathrm{Em}}$: 470/695 nm), backscattering at 700 nm (BB700) and humic-like fluorophore fluorescence ($\lambda_{\mathrm{Ex}}/\lambda_{\mathrm{Em}}$: 370/460 nm) expressed in $\mu\mathrm{g\,L^{-1}}$ equivalent quinine sulfate units ($\mu\mathrm{g\,L^{-1}}$ QSU). Glider observations were processed with the Socib glider toolbox (*Troupin et al.*, 2015) for cast identification and georeferencing.

Unfortunately, the conductivity cell stopped working about 10 days after the deployment. The origin of this malfunctioning is unknown at the moment, but occurred during a storm that hit the region near 15 November. Preliminary results presented here (Figure 2) are thus limited to the period before this problem occurred (note that there is also some problems with the oxygen concentration values, panel E). The results presented here however show an unprecedented high-resolution picture of the hydrographic properties on Bonavista Section with significant details on small-scale properties changes. Among interesting features on this transect, we note what seems the destruction of the CIL starting near $x = 120$ km and which correspond to the beginning of the storm. This storm, also coincides with an increase of the turbidity near the bottom (panel F), which may indicates on near-bottom resuspension.

We also note the presence of what resembles a baroclinic anticyclonic eddy between $x = 30$ km and $x = 60$ km, as suggested by outcropping of the isopycnals near the surface and the downwelling at depth. This structure exhibit lower oxygen values than the surrounding waters, and present a slight increase in CDOM at depth and certainly deserves more in-depth investigation. For reference, the full outbound and inbound transects are also provided in Figures 3 and 4 but are not discussed here.

4 Recommendations for future deployments

While this mission can be called a success, there are several aspects that are worth noting in preparation of future missions :

— The day of the recovery, the wave heights were about 2 to 4 m, which seems an upper limit for a recovery using the ship's FRC.
— Given the above restriction on weather conditions, a recovery point close to the coast is preferable (a large difference in wave conditions was noted between $BB01$ and $BB05$ the day of the recovery). An alternate recovery plan should also be considered as part of the glider mission design.
— Since the glider's battery life-time is not sufficient to complete the full return transect on the Bonavista Section (i.e., from $BB01$ to $BB15$ and back), the only way to fully sample the section would be to deploy the glider from the offshore part.
— Flexibility in the hydrographic (e.g. AZMP) mission plan is also necessary. Overall, the recovery procedure (including the transit time to the glider) took at least 6 hours. Given that the recovery must be realized during day time, a conservative calculation would allow at least 12 to 18 hours for the recovery.

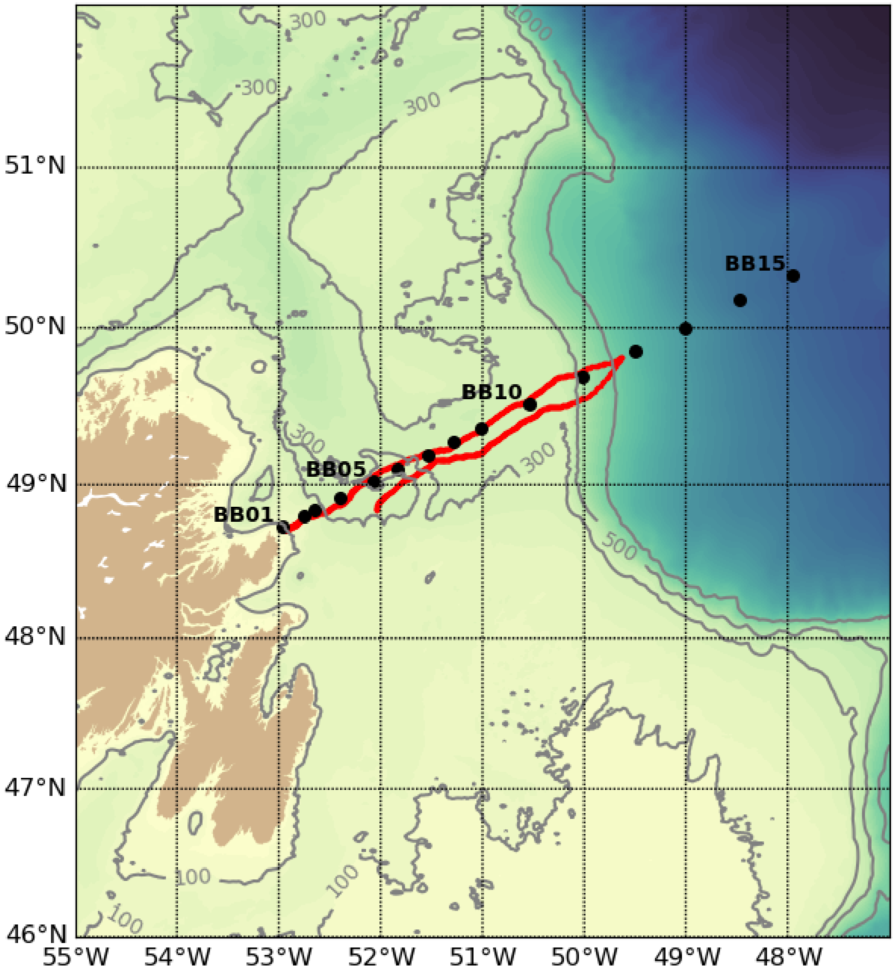


FIGURE 1 – Bathymetric map of the region, including the hydrographic stations on the Bonavista Section (black circles) and the glider track (854 casts in red).

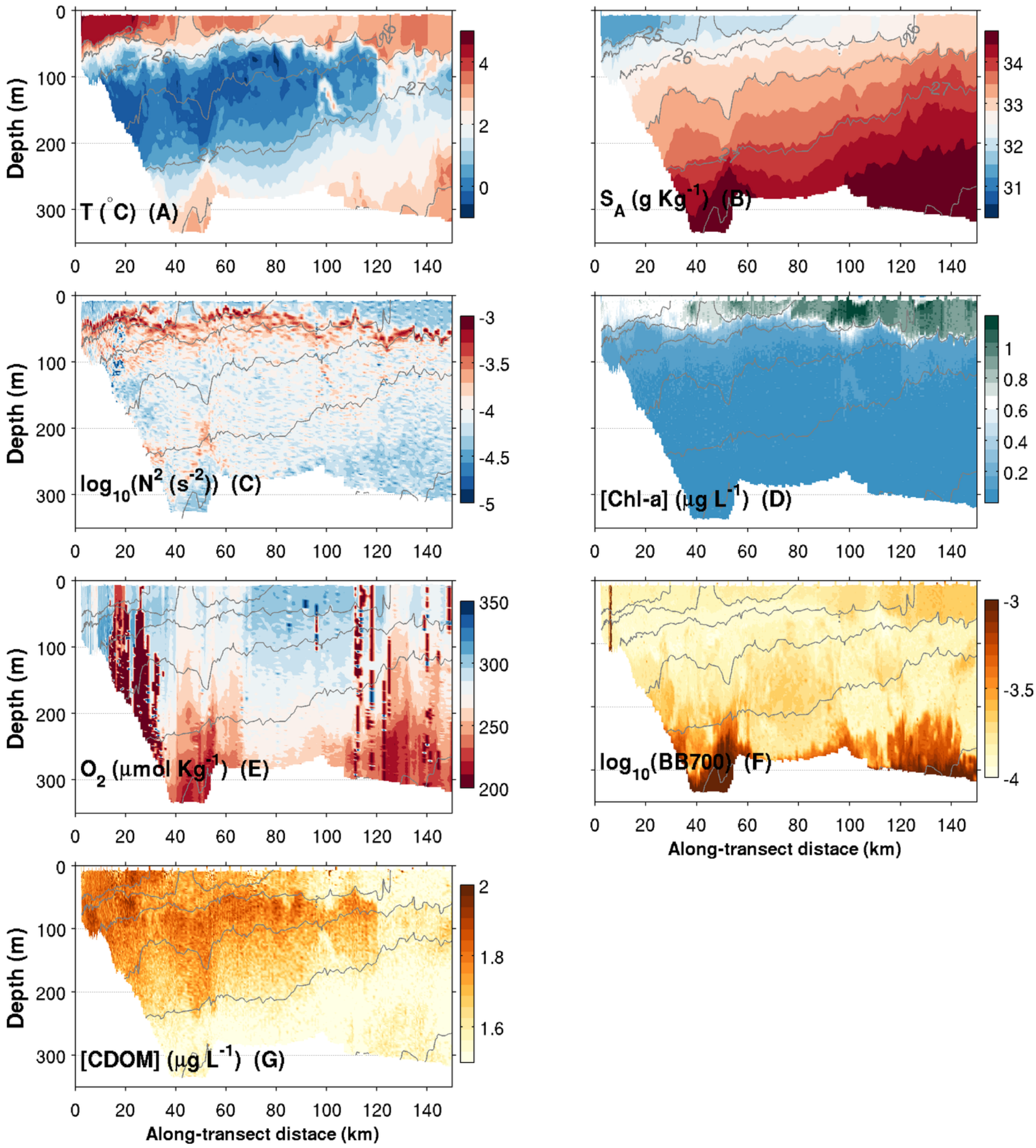


FIGURE 2 – Contours plots of various variables measured by the glider in function of depth and along-transect distance for the first 150 km of the Bonavista Section (see map Figure 1). *A*) Conservative temperature ; *B*) Absolute salinity ; *C*) Buoyancy frequency squared $N^2 = -\frac{g}{\rho_0}\frac{\partial \sigma_0}{\partial z}$, with $\rho_0 = 1030\,\mathrm{kg\,m^{-3}}$ a constant reference density and $g = 9.81\,\mathrm{m^2\,s^{-1}}$ the gravitational acceleration. *D*) Chlorophyll-*a* concentration ; *E*) Dissolved oxygen concentration ; *F*) Turbidity measured as the backscattering signal at 700 nm. *G*) Humic-like concentration ; Isopycnals (σ_0) are plotted in each panel with thin solid light gray lines (values identified in panels *a* and *b*). The full transect is presented in Figure 3.

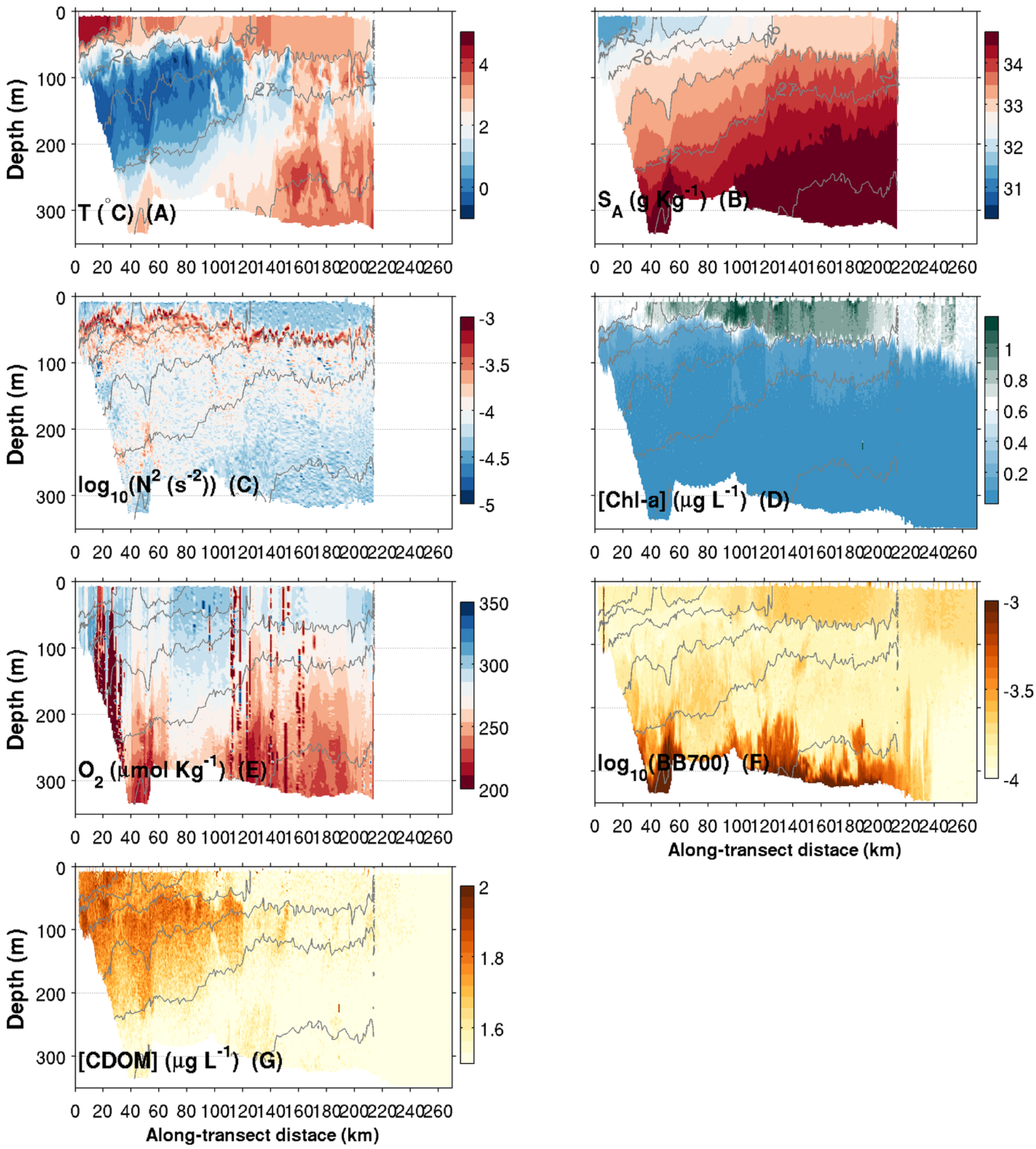


FIGURE 3 – Same as Figure 2, but for the full transect (0-270 km). The blank areas at the end of the transect correspond to missing data due to problems with the conductivity cell.

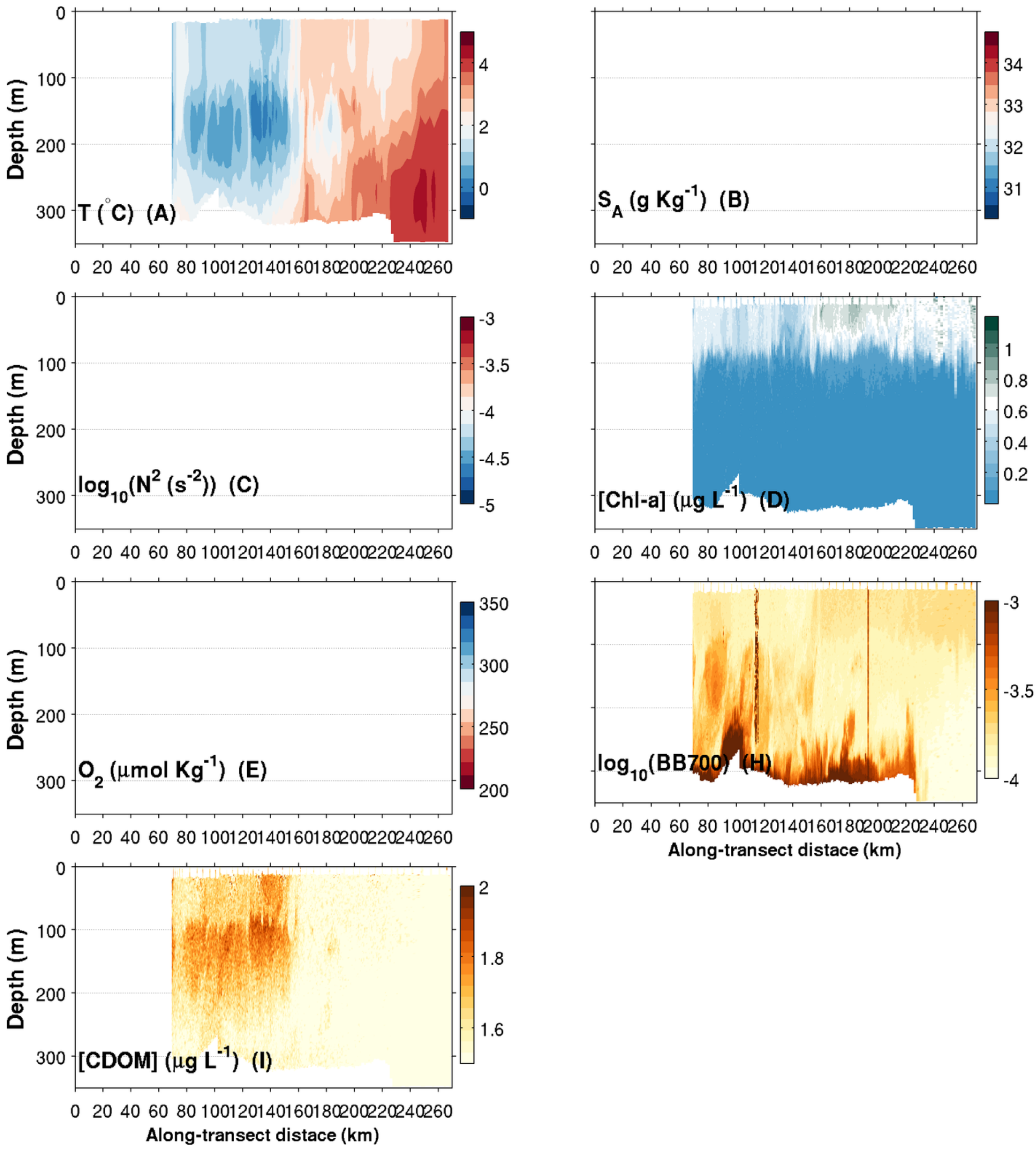


FIGURE 4 – Same as Figure 3, but for the return transect. Again, blank panels correspond to missing data due to problems with the conductivity cell.

Références

McDougall, T. J., and P. M. Barker (2011), *Getting started with TEOS-10 and the Gibbs Seawater (GSW) Oceanographic Toolbox*, May, 28 pp., SCOR/IAPSO WG127.

Troupin, C., J. P. Beltran, E. Heslop, M. Torner, B. Garau, J. Allen, S. Ruiz, and J. Tintoré (2015), A toolbox for glider data processing and management, *Methods in Oceanography*, *13-14* (2015), 13–23, doi :10.1016/j.mio.2016.01.001.