Underwater Gliders at Memorial University
Summary of Deployments and Collected Data 2006 - 2020

Nicolai von Oppeln-Bronikowski, Brad de Young, Ralf Bachmayer, Brian Claus, Mingxi Zhou, Robin Matthews, Charlie Bishop, Tara Howatt, Jaime Palter, Mark Downey, Neil Riggs, Jack Foley

Memorial University
Department of Physics and Physical Oceanography
St. John’s, NL, A1X 3P7
Canada

2021
1. Introduction

This summary report is dedicated to 15 years of glider deployments at Memorial University. A small group of people invested considerable time and energy into developing this technology and furthering its applications. Gliders are relatively small (<2m long) torpedo-shaped and winged autonomous underwater vehicles. They change their buoyancy to sink and use variable pitch angles to generate forward speed from wings similar to winged aircraft. Indeed, these vehicles are called gliders for that reason. They “glide” through the ocean at depths of up to 1000m and can do so repeatedly for months at a time. Owing to their simple design, they are energy efficient but move slowly with forward speeds of 15-35 cm/s depending on the water currents.

Figure 1.1 Example of early MUN Slocum Glider (Unit 049) with unpumped CTD (SBE41) and a later version G2 1000m Slocum Glider (Unit 473) showing an Oxygen Optode (ADI 4831) and pumped CTD (GPCTD).

Giders are impressive in their ability to stay at sea for long periods, repeatedly sampling an area with a resolution better than that gained from sparse ship cruises or moorings (Testor et al. 2009, Testor et al. 2019). Gliders can fill in gaps from other sampling strategies and, together with the Argo program, form the backbone of modern global ocean observing system strategies. From the beginning of their development, Memorial has been involved in various projects involving gliders and has contributed to the
development and improvement of the technology. This report details the gliders, missions, and deployments to overview the 15 years of glider deployments at MUN. Some smaller missions (e.g. less than a day) are omitted. Not all glider deployments were found due to archiving issues. However, approximately 90% of the missions are included here. This report is intended as a reference guide for the published glider data sets so that anyone who wants to work with these data can assess the value and utility of the data.

2. Background: Gliders at Memorial University

Memorial has owned and operated gliders since 2004. Drs. Brad deYoung (Physics) and Ralf Bachmayer (National Research Council and later Engineering) began to deploy gliders on and around the Newfoundland shelf to test these vehicles in shorter missions. These early deployments utilizing a small fleet of 4 underwater Slocum gliders (Generation 1) leading to many advancements in glider operation, data collections, glider sensors, navigation and missions. These early gliders used alkaline batteries enabling continuous glider deployments of up to a month or up to 1000 km’s with dive depths of up to 200m. These early deployments included deployments around Greenland ice shelves to advance under ice glider missions. Work by Charlie Bishop and Dr. deYoung led to new algorithms to correct science data from gliders paving the way towards studying ocean shelf dynamics with gliders to capture heat, salt and oxygen exchange. Indeed the 2006 CBS glider missions with an oxygen optode were among the first worldwide.

A more formal glider group emerged at MUN in 2012 with the creation of the Autonomous Ocean Systems Laboratory (AOSL) led by Drs. Bachmayer and de Young that continued using glider technology and other platforms to explore various applications of autonomous ocean systems. Projects of AOSL over the years focussed on iceberg profiling, underwater terrain-aided navigation, development of a glider with a magnetically geared thruster and underwater navigation with sonar and acoustic modems. Several larger pan-Canadian science projects came into existence after 2012, explicitly integrating glider observations into the core science themes, including the NSERC-CCAR-funded VITALS project studying heat, oxygen and salt transports across the Labrador Sea. This significant project involved several postdocs, PI’s and many HQP that resulted in 10 glider deployments on the Labrador Shelf, Newfoundland and the central Labrador Sea. More gliders were added to the fleet during that period. The next generation gliders (G2) have made it possible to dive deeper, carry more instruments and stay deployed for more prolonged periods using new lithium batteries and extended energy bays. New science sensors were also integrated, such as the prototype Aanderaa pCO2 optode. One deployment carried a glider across the Labrador shelf into the central Labrador Sea to sample oxygen and CO2 for four months in synchronization with other ocean observations from moorings and floats.

The next chapter of glider operations at Memorial is underway with the Ocean Frontier Institute (OFI)interdisciplinary projects combining academia, government, and industry to understand the ocean’s value chain, including understanding the Atlantic region’s science gaps. Core projects include the Northwest Atlantic Carbon sink to understand the storage of CO2 in the Labrador Sea and implications for the regional and global climate, economies and ability for people to enjoy the ocean’s tangible benefits. Other projects focus on using ocean observations in other areas outside traditional research projects to broaden scientific research’s benefits. Together with the CFI-funded Development of Autonomous Marine Observing Systems (DAMOS) Infrastructure project, Memorial will be in a position to continue participating in key marine research themes, addressing questions about the ocean. DAMOS brought
additional gliders to MUN and other platforms to enhance the capabilities to conduct autonomous ocean observations.

Table 1. Slocum Glider Inventory, Projects and Status

<table>
<thead>
<tr>
<th>Glider</th>
<th>Type</th>
<th>Sensors</th>
<th>Fate / Status</th>
<th>Projects</th>
<th>Years Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 046 (Nunkaysa)</td>
<td>G1 Shallow</td>
<td>CTD SBE41, O₂ Optode 3835</td>
<td>Lost during deployment</td>
<td>NRC, Ocean Glider Canada DFO Pacific</td>
<td>2004-2013</td>
</tr>
<tr>
<td>Unit 047 (Narwhal)</td>
<td>G1 Shallow</td>
<td>CTD SBE41, Acoustic Modem, Turner Fluorometer</td>
<td>MUN</td>
<td>NRC, Iceberg profiling, Terrain aided navigation</td>
<td>2004-Present</td>
</tr>
<tr>
<td>Unit 048 (Scidaana)</td>
<td>G1 Shallow</td>
<td>CTD SBE41, O₂ Optode 3835</td>
<td>Transferred to DFO Pacific</td>
<td>NRC, Sensor performance, DFO contract Fortune Bay Mission, DFO Pacific, Ocean Gliders Canada</td>
<td>2004-</td>
</tr>
<tr>
<td>Unit 049</td>
<td>G1 Shallow</td>
<td>CTD SBE41, DVL, ADCP, MUN Thruster</td>
<td>Lost during deployment</td>
<td>NRC, Sensor performance, Glider terrain aided navigation, thruster development, iceberg surveys</td>
<td>2004-2012</td>
</tr>
<tr>
<td>Unit 334</td>
<td>G2 200m</td>
<td>CTD GPCTD, Acoustic Modem, Custom BB Proglet, MUN Thruster</td>
<td>On extended project at GSO URI</td>
<td>AOSL, VITALS, Iceberg profiling and underwater navigation using acoustic modems</td>
<td>2012-Present</td>
</tr>
<tr>
<td>Unit 354 (Pearldiver)</td>
<td>G2 1000m</td>
<td>CTD GPCTD, ADI O₂ 4831, ADI CO₂ 4797, orig. Wetlabs ECOPUC Triplet</td>
<td>MUN</td>
<td>VITALS, HOTsEALS, OFI</td>
<td>2012-Present</td>
</tr>
<tr>
<td>Unit 472</td>
<td>G2 1000m</td>
<td>CTD GPCTD, ADI O₂ 4831, ADI CO₂ 4797 Optode, Wetlabs ECOPUC Triplet, TWR Thruster</td>
<td>Lost during deployment</td>
<td>VITALS</td>
<td>2013-2015</td>
</tr>
<tr>
<td>Unit 473 (Gannet)</td>
<td>G2 1000m</td>
<td>CTD GPCTD, ADI O₂ 4831, ADI CO₂ 4797 Optode, MUN Thruster</td>
<td>MUN, Damaged during deployment on repair at TWR</td>
<td>VITALS, OFI, HOTsEALS</td>
<td>2013-2019</td>
</tr>
<tr>
<td>Unit 805 (Sunfish)</td>
<td>G3 1000m</td>
<td>CTD RBR, O₂ Optode, Wetlabs ECOPUC Triplet</td>
<td>MUN, under warranty repair</td>
<td>OFI, DAMOS</td>
<td>2019-Present</td>
</tr>
<tr>
<td>Unit 806 (Migaloo)</td>
<td>G3 1000m</td>
<td>CTD RBR, O₂ Optode, SBE pH Integration</td>
<td>MUN, under warranty repair</td>
<td>OFI, DAMOS</td>
<td>2019-Present</td>
</tr>
</tbody>
</table>

- 2021 -
3. Glider Deployments Summary

To date, MUN gliders have travelled a total of 14'663 mission km, 620 deployment days and collected 25'108 total glider profiles. Memorial’s earliest recorded glider deployment is from 2006 for which data is found and the longest deployment was a 7-month mission into the Central Labrador Sea as part of the HOTSeALS project in 2019-2020. Table 3.1 summarizes all the glider deployments recorded, however not all of them are included and processed such as the Twillingate missions to study icebergs.

![Deployment Locations 2006 - 2020](image)

Figure 3.1 Map of Glider Deployment Sites 2006 - 2020 (a) Pacific Region and (b) North-West Atlantic Region.

Table 3.1 List of MUN Glider Deployments (All deployments involved either Ralf Bachmayer or Brad deYoung or both)

<table>
<thead>
<tr>
<th>Year</th>
<th>Where</th>
<th>Objective</th>
<th>Glider</th>
<th>Funding</th>
<th>Key People</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>CBS</td>
<td>Sensor tests</td>
<td>Unit 048</td>
<td>NRC / NSERC</td>
<td>Charlie Bishop,</td>
</tr>
<tr>
<td>2006</td>
<td>Trinity Bay/ CBS</td>
<td></td>
<td>Unit 049</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>Pacific near OWS</td>
<td>Hydrographic Data</td>
<td>Unit 046 (Nunkaysa)</td>
<td>DFO / ONC</td>
<td>Paul LaCroix</td>
</tr>
<tr>
<td></td>
<td>Papa</td>
<td>Collection</td>
<td>Unit 048 (Sidaana)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>Fortune Bay</td>
<td>External Contract</td>
<td>Unit 048</td>
<td>DFO</td>
<td>Andry Ratsimandresy</td>
</tr>
<tr>
<td>2013</td>
<td>Trinity Bay</td>
<td>Sensor tests</td>
<td>Pearldiver</td>
<td>VITALS</td>
<td>Brian Claus</td>
</tr>
<tr>
<td>Year</td>
<td>Location</td>
<td>Project Details</td>
<td>Unit</td>
<td>Organization</td>
<td>Authors</td>
</tr>
<tr>
<td>------</td>
<td>----------------</td>
<td>------------------------------------------------------</td>
<td>------</td>
<td>--------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>2013</td>
<td>Bonne Bay</td>
<td>Fluxgate tests</td>
<td>Unit 334</td>
<td>AOSL IOSS</td>
<td>Brian Claus</td>
</tr>
<tr>
<td>2014</td>
<td>Labrador Shelf</td>
<td>Ekman Transport and Eddy Exchange</td>
<td>Unit 473</td>
<td>VITALS</td>
<td>Brian Claus, Tara Howatt, Jaime Palter, Robin Matthews</td>
</tr>
<tr>
<td>2014</td>
<td>Trinity Bay</td>
<td>Virtual mooring</td>
<td>Unit 472</td>
<td>VITALS</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>Trinity Bay</td>
<td>CO2 Tests</td>
<td>Unit 472</td>
<td>VITALS</td>
<td>Robin Matthews, Mark Downey</td>
</tr>
<tr>
<td>2015</td>
<td>Labrador Sea</td>
<td>CO2 Observ.</td>
<td>Unit 472</td>
<td>VITALS</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>CBS</td>
<td>Terrain Navigation</td>
<td>Unit 049</td>
<td>AOSL IOSS</td>
<td>Brian Claus</td>
</tr>
<tr>
<td>2015</td>
<td>Twillingate</td>
<td>Iceberg Studies</td>
<td>Unit 334</td>
<td>AOSL IOSS</td>
<td>Mingxi Zhou</td>
</tr>
<tr>
<td>2016</td>
<td>Trinity Bay</td>
<td>CO2 Tests</td>
<td>Unit 473</td>
<td>VITALS</td>
<td>Robin Matthews, Mark Downey</td>
</tr>
<tr>
<td>2016</td>
<td>Labrador Sea</td>
<td>CO2 Depl.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>Twillingate</td>
<td>Iceberg Scanning</td>
<td>Unit 334</td>
<td>AOSL IOSS</td>
<td>Mingxi Zhou</td>
</tr>
<tr>
<td>2017</td>
<td>Twillingate</td>
<td>Iceberg Scanning</td>
<td>Unit 334</td>
<td>AOSL IOSS</td>
<td>Mingxi Zhou</td>
</tr>
<tr>
<td>2018</td>
<td>Trinity Bay</td>
<td>CO2 Tests</td>
<td>Unit 473</td>
<td>OFI, VITALS</td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>Bonne Bay</td>
<td>Mooring</td>
<td>Unit 473</td>
<td>OFI</td>
<td>N. Bronikowski, Mark Downey, Mingxi Zhou</td>
</tr>
<tr>
<td>2019</td>
<td>Gulf of St. Lawr.</td>
<td>Hydrography</td>
<td>Pearldiver</td>
<td>OFI</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>Labrador Sea</td>
<td>T,S Exchange</td>
<td>Pearldiver</td>
<td>OFI</td>
<td></td>
</tr>
</tbody>
</table>
4. List of Glider Deployments

4.1 unit_048 Conception Bay Mission 2006

Figure 4.1.1. Mission map of Conception Bay Mission in 2006 for Glider Unit_048 to test new Aanderaa Oxygen Optode 3835 and collect CTD data.
Figure 4.1.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
4.2 unit_049 Newfoundland Shelf Mission 2006

Figure 4.2.1 Mission map of Newfoundland Shelf Mission from Trinity Bay to Conception Bay in 2006 for Glider Unit_049 to collect CTD data for new sensor performance study.
Figure 4.2.2 Collected hydrographic data (a) in-situ temperature, (b) absolute salinity calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
4.3 Fortune Bay Deployment

Figure 4.3.1. Mission map of DFO/Memorial Unit 048 deployment in Fortune Bay, March 2012.
Figure 4.3.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
4.4 Nunkaysa Pacific Deployment 2012

Figure 4.4.1. Mission map of DFO Pacific Region / Ocean Gliders Canada deployment of Nunkaysa (ex. Unit_046) in the Pacific Ocean.
Figure 4.4.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
4.5 Scidaana Pacific Deployment 2012

Figure 4.5.1. Mission map of DFO Pacific Region / Ocean Gliders Canada deployment of Scidaana (ex. Unit_048) in the Pacific Ocean
Figure 4.5.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
Figure 4.6.1. Holyrood Marine Base (HMB) extended deployment of Unit_049 in 2013 as part of Terrain Aided Navigation (TAN) project.
Figure 4.6.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
4.7 Pearldiver Trinity Bay Tests 2013

Figure 4.7.1. Deployment map of Pearldiver Trinity Bay Mission in 2013 to test sensors and glider
Figure 4.7.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed mission days. The time axis shows the length of deployment and is for scale. Data is very spikey for the CTD due to malfunctioning pump.
Figure 4.8.1. Mission map of Bonne Bay deployment for Glider Unit_334 in December, 2013.
Figure 4.8.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity calculated from the GSW toolbox. Axes are plotted over pressure and mission days. The time axis shows the length of deployment and is for scale.
4.9 unit_334 Labrador Shelf Mission 2014

Figure 4.9.1. Deployment map of Labrador Shelf Mission in 2014 for Glider Unit_334, part of Ventilations, Interactions and Transports Across the Labrador Sea (VITALS) Program to capture heat and salt exchange across the Labrador Shelf. The glider suffered from a hair leak and had to be recovered early.
Figure 4.9.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
4.10 Pearldiver Labrador Shelf Mission 2014

Figure 4.10.1. Deployment map of Labrador Shelf Mission in 2014 for Glider Pearldiver (ex. Unit_354), part of Ventilations, Interactions and Transports Across the Labrador Sea (VITALS) Program to capture heat and salt exchange across the Labrador Shelf.
Figure 4.10.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
4.11 unit_473 Labrador Shelf Mission 2014

Figure 4.11.1. Deployment map of Labrador Shelf Mission in 2014 for Glider Pearldiver (ex. Unit_354), part of Ventilations, Interactions and Transports Across the Labrador Sea (VITALS) Program to capture heat and salt exchange across the Labrador Shelf.
Figure 4.11.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
Figure 4.12.1. Deployment map of Trinity Bay Mission in 2014 for Glider Unit_473 to test sensors and glider, as well as compare data between platform (Unit_472) for calibration purposes.
Figure 4.12.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
Figure 4.13.1. Deployment map of Trinity Bay Mission in 2014 for Glider Unit_472 to test sensors and glider, as well as compare data between platform (Unit_473) for calibration purposes.
Figure 4.13.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
Figure 4.14.1. Deployment map of Trinity Bay Mission in 2015 for Glider Unit_472. Purpose of the deployment was to test the sensors and collect calibration data for the new pCO2 Optode.
Figure 4.14.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of mission days. The time axis shows the length of deployment and is for scale.
Figure 4.14.3. Collected prototype Aanderaa CO\textsubscript{2} Optode data from the deployment. Some basic corrections have been done to correct the data for conditioning and sensor lag, but the data are not validated. A basic surface correction has been applied to bring the data closer to the mean atmospheric CO\textsubscript{2} values in October 2015. This is the best performance of this sensor in the 3 glider deployments.
Figure 4.15.1. Deployment map of Trinity Bay Mission in 2016 for Glider Unit_473. Purpose of the deployment was to test the sensors and collect calibration data for the new pCO2 Optode.
Figure 4.15.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of mission days. The time axis shows the length of deployment and is for scale.
Figure 4.15.3. Collected prototype Aanderaa CO$_2$ Optode data from the deployment. Some basic corrections have been done to correct the data for conditioning and sensor lag, but the data are not validated. A basic surface correction has been applied to bring the data closer to the mean atmospheric CO$_2$ values in October 2016.
4.16 unit_473 Labrador Sea Mission 2016

Figure 4.16.1. Deployment map of Labrador Shelf Mission in 2016 for Glider Unit_473, part of Ventilations, Interactions and Transports Across the Labrador Sea (VITALS) Program to capture glider-based CO₂ data near K1 Mooring in the central Labrador Sea.
Figure 4.16.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of mission days. The time axis shows the length of deployment and is for scale. Column-like oxygen data from thruster use at depth.
Figure 4.16.3. Collected prototype Aanderaa CO$_2$ Optode data from the deployment. Some basic corrections have been done to correct the data for conditioning and sensor lag, but the data are not validated. A basic surface correction has been applied to bring the data closer to the mean atmospheric CO$_2$ values in October 2016. Constant oxygen and CO$_2$ values with depth are artefacts are from the glider thruster.
4.17 unit_473 Trinity Bay Mission 2018

Figure 4.17.1. Deployment map of Trinity Bay 2018 Deployment for Glider Unit_473, part of Ventilations, Interactions and Transports Across the Labrador Sea (VITALS) Program. This was a verification test for the data collected during the previous 2016 Labrador Sea deployment.
Figure 4.17.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of mission days. The time axis shows the length of deployment and is for scale.
Figure 4.17.3. Collected prototype Aanderaa CO$_2$ Optode data from the deployment. Some basic corrections have been done to correct the data for conditioning and sensor lag, but the data are not validated. A basic surface correction has been applied to bring the data closer to the mean atmospheric CO$_2$ values in September 2018. The sensor likely malfunctioned, rendering this data set not useful for observations. It was used in a test to quantify the sensor performance for the previous 2016 Labrador Sea deployment.
Figure 4.18.1. Deployment map for Bonne Bay 2019 deployment of Glider Unit_473 to study oxygen, heat and salt exchange in a tidal fjord in Newfoundland.
Figure 4.18.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
4.19 Pearldiver Gulf Mission 2019

Figure 4.19.1. Deployment map of Pearldiver (ex. Unit_354) deployed in the Northern Gulf of St. Lawrence to study oxygen levels in Esquiman Channel.
Figure 4.19.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
4.20 Pearldiver Labrador Sea Mission 2020

Figure 4.20.1. Deployment map of Pearldiver (ex. Unit_354) deployed in the Labrador Sea
Figure 4.20.2. Collected hydrographic data (a) in-situ temperature, (b) absolute salinity and (c) oxygen saturation with respect to solubility calculated from the GSW toolbox. Axes are plotted over pressure and the number of completed yo profiles. The time axis shows the length of deployment and is for scale.
5. References


