Physical oceanography data from the UFO Seaglider mission in the southern Norwegian Basin, August 2024 – May 2025

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Introduction

The glider data described herein was collected as a part of the Upstream pathways of the Faroe Overflow (UFO). Which is a multi-institutional, interdisciplinary effort to study the origin and pathways of the dense water that feeds the Faroe Bank Channel overflow. The UFO program, led by Woods Hole Oceanographic Institution (WHOI, R. Pickart) includes a mooring array, gliders, hydrographic surveys, and modeling. The overall objective is to determine where the densest water is formed in the Nordic Seas, how this water progresses to the Greenland-Scotland Ridge, and how it is modified along the way including the role of atmospheric forcing.

An array of 10 moorings was deployed across the Iceland-Faroe Ridge out to the Norwegian Sea (Figure 1). The array was deployed in autumn 2024. The first 8 tightly spaced profiling moorings (WHOI) aim to resolve and bracket the two previously documented Iceland Faroe Slope Jet branches. The Norwegian Sea Gyre (NSG) rim was measured simultaneously by UFO-09 (University of Bergen, Norway), and UFO-10 (Faroe Marine Research Institute, Faroe Islands). To complement the outermost moorings, the SG563 glider was used to cover a transect between UFO-08 and the outermost station of Section N, a section regularly serviced by the Faroe Marine Research Institute (FAMRI). The glider measured profiles of temperature, salinity and dissolved oxygen, as well as depth-averaged current (DAC) for each dive. The goal with the glider deployment is to capture the upper part of the NSG Rim current and get a better picture of the mesoscale structures in the area.

The dataset is provided as a merged depth-gridded netCDF file (SG563_UFO_Norwegian_Sea_2024_2025.nc), merged time series netCDF file (SG563_UFO_Norwegian_Sea_2024_2025_timeseries.nc) and individual netCDF files for each pair of dive/climb profiles (SG563_UFO_Norwegian_Sea_2024_2025_profiles.zip). The individual files include all recorded data, glider settings for the specific dive, calibration coefficients, quality-controlled data and any derived parameters, with associated quality flags. The merged depth-gridded file includes a selection of variables that have gone through additional quality control.

The data are openly available from the Norwegian Marine Data Centre, from [https://doi.org/ 10.21335/NMDC-622419694](https://doi.org/10.21335/NMDC-622419694) under a CC BY 4.0 license.

This report is an attachment for the data set:
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Mission overview

The glider was deployed at 8.4623°W and 63.7168°N the 23 August 2024 from R/V Neil Armstrong (cruise AR84-03). The first days were spent getting to the transect line. On 29 August 2024 the glider started regular profiling of a 70 km long transect from 7.5646°W and 63.9996°N to 6°W and 64.1833°N. Starting 2 February 2025 the glider sampled the entire mooring array line once. Due to strong currents, this was not repeated. By the end of the mission, battery life was an issue. Therefore, we decided to reduce the frequency of transects and let it loiter in between. Loitering means that the glider stays neutral at an approximate depth level for an extended amount of time, which greatly reduces the energy consumed by the buoyancy pump. The sparse measurements collected during loitering phases were excluded from the dataset during post-processing. The last transect was taken on 16 March 2025. In total the glider completed 33 transects. The glider was then moved closer to the Faroe Islands along section N for recovery, where it was picked up at 6.0519°W and 63.0223°N on 15 May 2025 by Jákup Sverri (cruise number 2521).

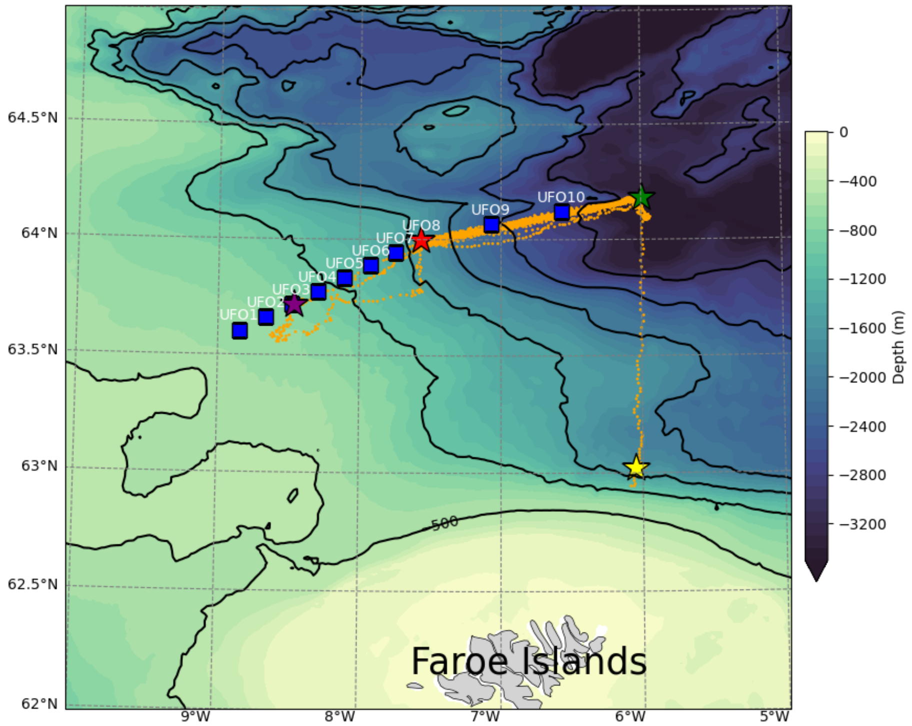

Figure 1. Map showing the location of the UFO mooring array (blue squares) and the glider profiles (orange dots). The location of the glider deployment (purple star) and recovery (yellow star), as well as the start (red star) and end (green star) of the transect line are marked.

Data collection and data processing

The Seaglider SG563 (WMO ID 6801613) was equipped with a Kistler pressure sensor, an unpumped SBE CT sail (SN 0263) and an Aanderaa dissolved oxygen sensor (SN 799). The CT sail was last calibrated on 21 Jan 2018. The optode was last calibrated on 10 September 2018.

The mission contains 980 dives. Science sampling was turned off during dives 731-768, 946-952 and 957-970. The salinity was all bad for dive 547. These dives were not included in the gridded data file, which includes in total 1840 profiles. During dives 773-825, 856-945, 953-956 and 971-980 the glider sampled during descents only. Compass calibration dives were done twice, using data from dives 19-20 and dives 39-40. The final compass coefficients were updated on dive 49. The glider sampled salinity and temperature every 10 seconds in the upper 300 m, and every 15 seconds between 300 and 500 m. Below 500 m the sampling interval was initially set to 60 seconds until dive 18, 30 seconds until dive 71, and to 15 seconds thereafter. After dive 596 on 15 Jan 2025, the sampling was reduced to 20 seconds intervals below 500 m in an effort to save battery.

The data was reprocessed using the python based Seaglider Basestation3 software (version 3.0.8, https://github.com/iop-apl-uw/basestation3/) developed and maintained by the Integrative Observational Platforms (IOP) group at the University of Washington's Applied Physics Laboratory (APL-UW). The flight model regression continuously evaluates the volume and hydrodynamic model parameters of the glider as described in Bennet et al. (2019): https://github.com/iop-apl-uw/basestation3/blob/master/docs/FlightModel.pdf. Details on the thermal lag correction of the conductivity cell and the quality control included in the Basestation3 software are provided here: https://github.com/iop-apl-uw/basestation3/blob/master/docs/Seaglider_Quality_Control_Manual.html.

The reprocessing routine first removes data outside of globally set bounds (-2°C<TEMP<30°C, 27<PSAL<36). Large outliers and bad data were flagged manually. Additionally, the processing software suggests bad data points. Both the manual and suggested bad data were excluded to get a clean dataset, which was run through processing again. After processing, we applied a salinity offset of 0.020 based on shipboard CTD profiles taken during recovery (see section Comparison with shipboard CTD). The salinity with applied offset is stored in the variable "salinity_adjusted".

Individual nc-files were created for all dives. Additionally, we created two mission-wide nc-files. One as a time series and one as a series of 1m depth-binned profiles. The individual files and time series are direct outputs from the Basestation3 software, including raw and quality-controlled data, with associated quality control flags. These files also include oxygen data, which was sampled until dive 596. Oxygen measurements were not calibrated against water samples and have not gone through any quality control.

The depth-binned product only includes a selection of variables and has gone through additional quality control. Each profile was despiked using three passes of Hampel filters. First with a window size of 15 points and a sigma threshold of 5, then a window size 5 and sigma 3, and finally a window size 3 sigma 2. A spike was retained when its amplitude was over a noise level of 0.004 for salinity and 0.005 for temperature. Below 500 m, where the variability is small, the threshold was reduced by a factor of two. A data point identified as a spike was replaced by NaN and not interpolated. After despiking, measurements showing density inversions with density anomalies exceeding a threshold of 0.008 were replaced by NaN to remove overturns. Finally, all profiles were inspected manually to identify remaining segments of suspect temperature or salinity data.

Profiles were also inspected for differences between descent and ascent profiles (see Figure 2). The comparison shows good agreement between descent and ascent profiles, and no further correction was necessary. The standard deviation of the descent profiles is slightly larger due to some dives sampling during descent only and not during ascent.

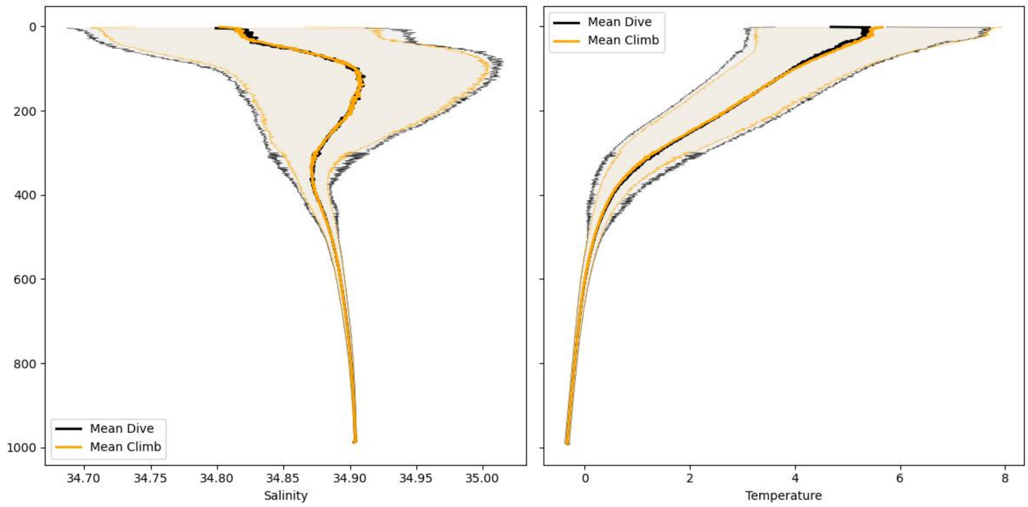

Figure 2: Mean dive (descent) and climb (ascent) profiles with shaded standard deviation.

Comparison with shipboard CTD

The glider was calibrated against shipboard CTD profiles collected during the recovery cruise by Jákup Sverri (cruise number 2521). We compare shipboard CTD and glider profiles that are within 10 km and 12 hours of each other (see Figure 3). Two shipboard CTD profiles were identified within this range. Station 25210012 was matched with six glider profiles and station 2521001 with two. Based on these comparisons we applied a 0.020 offset on the glider salinity measurements. No offset was applied to the temperature measurements. A comparison between the shipboard and glider profiles is shown in Figure 4.

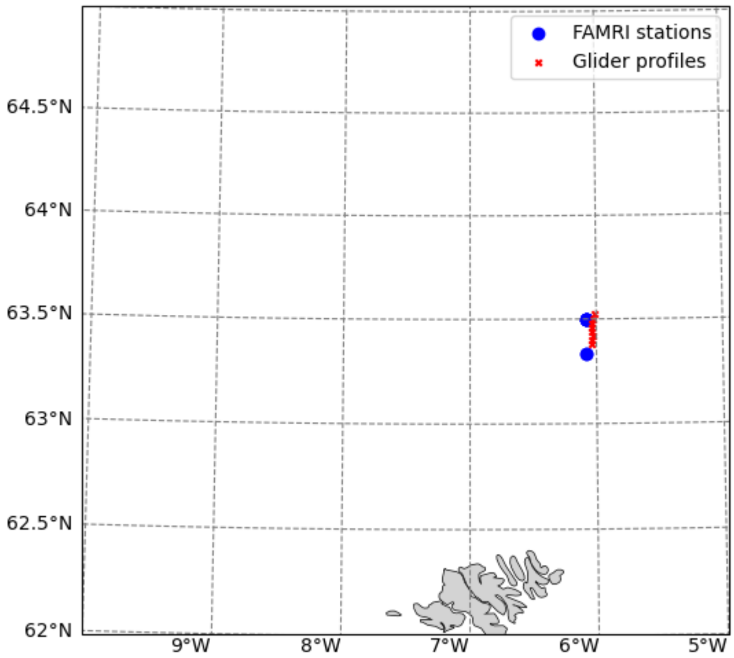

Figure 3: Map of matching shipboard and glider profiles.

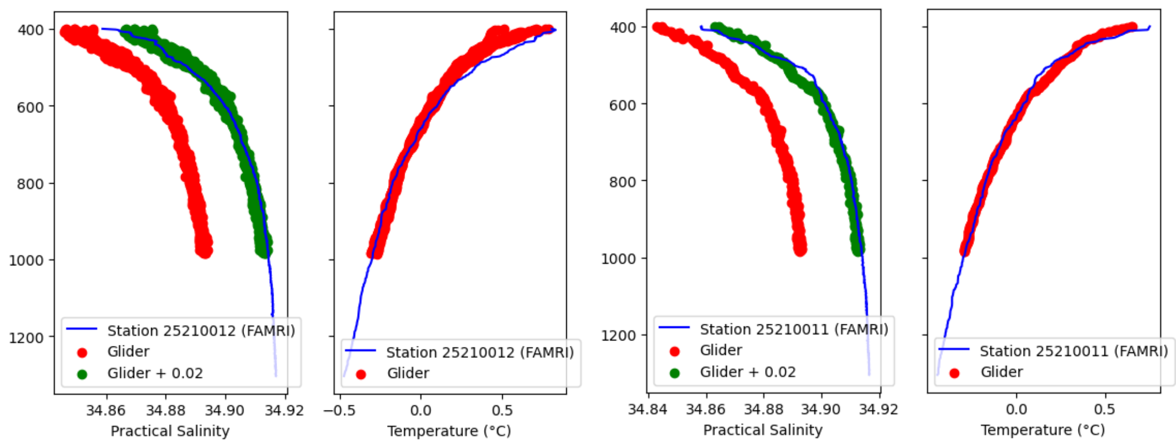

Figure 4: Salinity and temperature profiles from shipboard CTD (blue). Nearby glider measurements are shown in red. Corrected glider measurements with an offset of 0.02 are shown in green.

Acknowledgment

We thank the captain, crew, and UFO participants for their assistance during the deployment and recovery cruises. Karin Margretha Larsen and Hjálmar Hátún kindly provided FAMRI CTD data. The glider was operated by the Norwegian national facility for ocean gliders, (NorGliders) at the Geophysical Institute, University of Bergen.

Overview of data

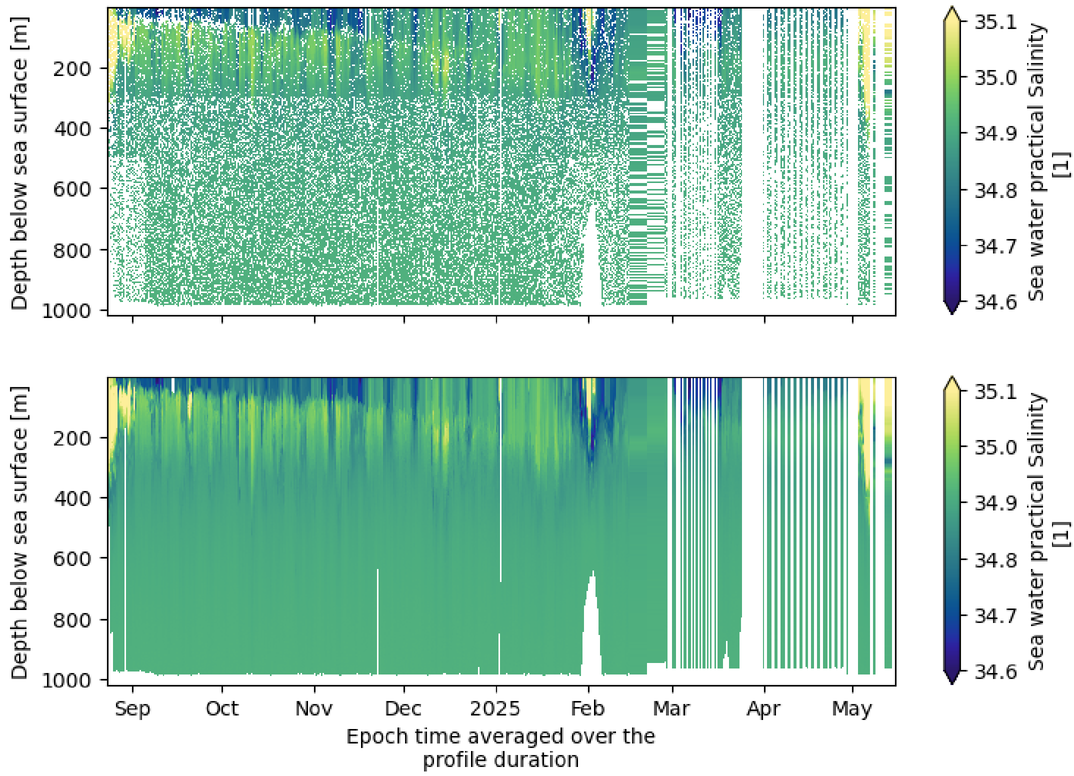

Figure 5: Provided (upper) and vertically interpolated (lower) practical salinity.

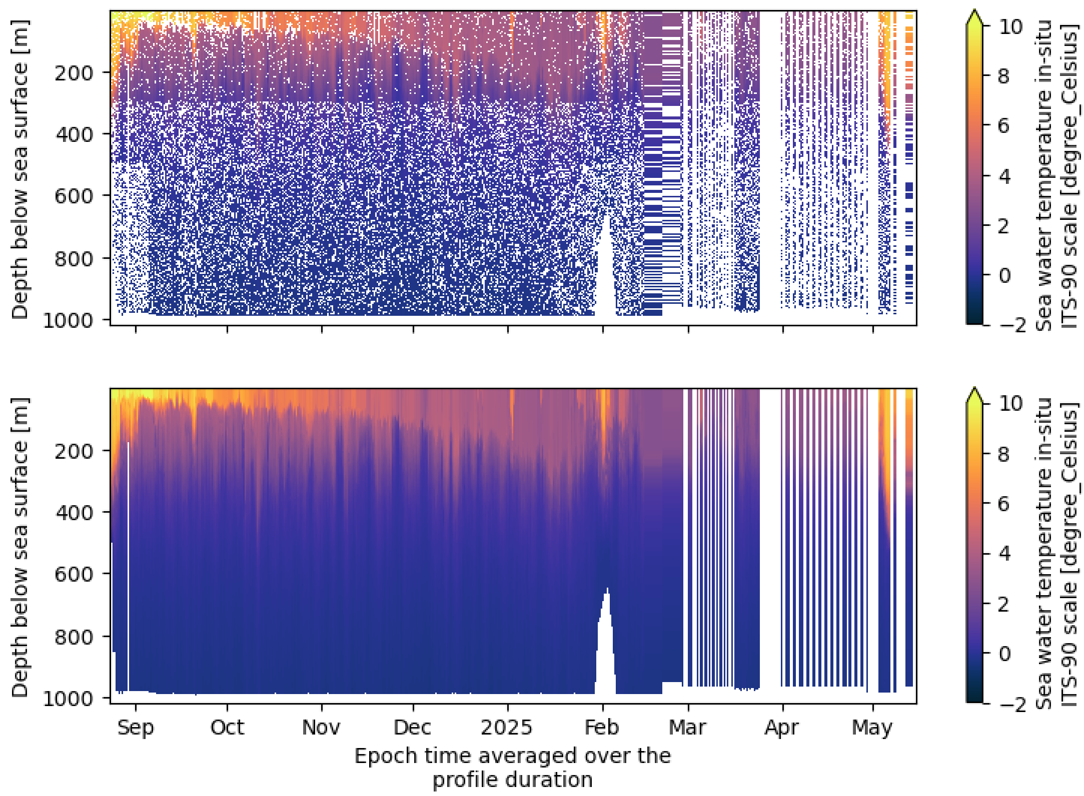

Figure 5: Provided (upper) and vertically interpolated (lower) temperature.

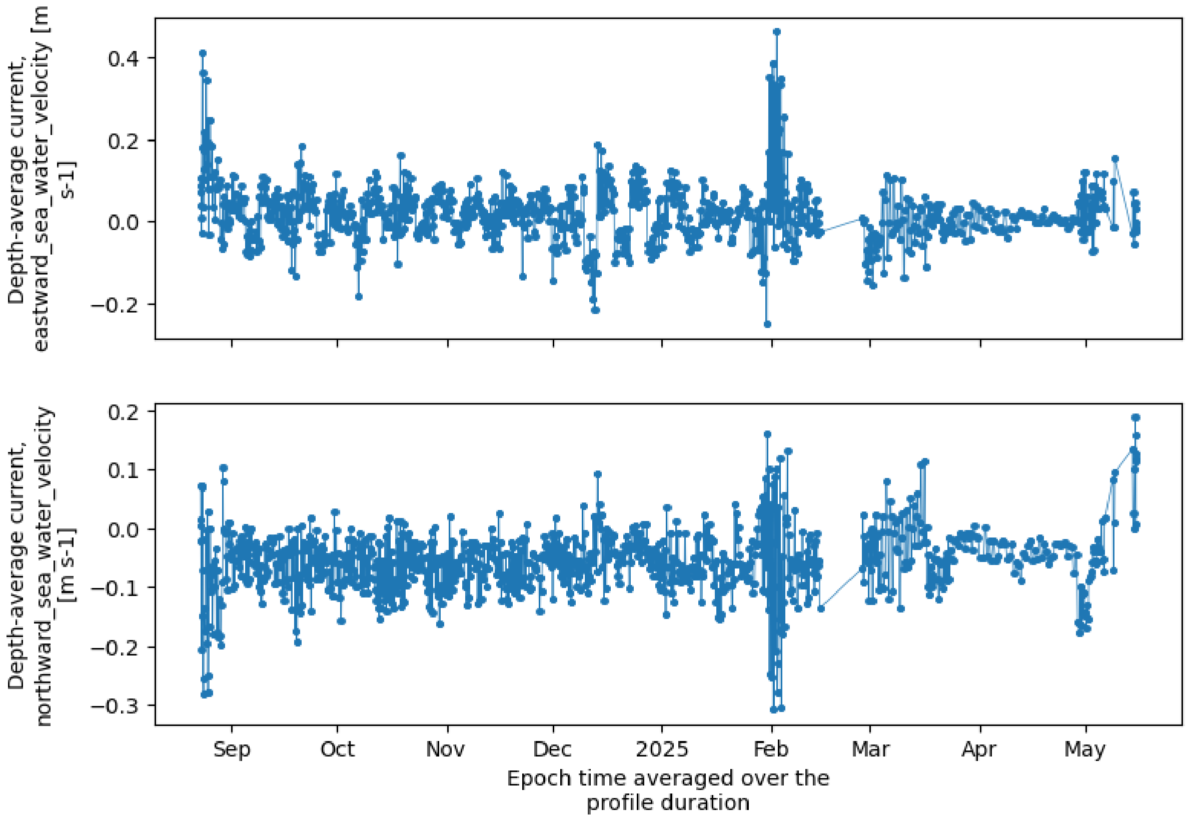

Figure 5: Eastward (upper) and northward (lower) depth averaged current.