Ocean Cryosphere Exchanges in Antarctica:

Impacts on Climate and the Earth system

Recovery of moorings in South Sandwich Trench

Milestone MS10

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Milestone report

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1. Means of verification of the achievement of the milestone

Two oceanographic moorings were recovered from Royal Research Ship *Sir David Attenborough* on 24-25 February 2025. Data have been downloaded from instruments and will be backed up on internal BAS systems before analysis takes place. Partner in charge of delivery of the milestone: UKRI-BAS.

2. Work performed and main achievements

On 16 February 2024, two oceanographic moorings were deployed in South Sandwich Trench from FV *Argos Georgia*, as a component of monitoring northward exports of Antarctic Bottom Water in WP5 of OCEAN ICE. The deployments are described more fully in the cruise report (Abrahamsen 2024a), and the report for milestone MS9 (Abrahamsen 2024b). These moorings were recovered from RRS *Sir David Attenborough* on 24-25 Feb 2025. Milestone MS10 covers the recovery of these moorings, which are described in more detail below.

2.1 Mooring recovery

The recovery of the South Sandwich Trench moorings took place from the RRS Sir David Attenborough on research cruise SD046 between 24th-25th February 2025. Since the moorings were not trilaterated after deployment, both were trilaterated on arrival at the South Sandwich Trench to establish the precise position of the mooring releases at the seafloor. The position of the releases of the central mooring was found to be 60°12.8505' S, 25°07.3560' W where the seabed depth is 5963 m. The position of the releases of the western mooring was found to be 60°06.490' S, 25°18.542' W where the seabed depth is 3957 m. Due to low visibility in the area, the ship's EK80 echo sounder system was then used to attempt to identify the position of the top buoy for each mooring so the ship could be as close as possible for when the mooring was released. While this was possible for the central mooring, the buoy could not be seen in the acoustic data for the western mooring, raising questions about whether the top buoy was still attached.

On 24th February, once the visibility was considered good enough, the central, deepest mooring was released, and the buoys were soon visible at the surface. The mooring was recovered, beginning with the surface buoy, at a position of 60.22°S, 25.12°W. The recovery went smoothly, and all nine instruments were successfully recovered, along with the acoustic releases and all floats. Information about the instruments is listed in Table 1.

The shallower, western mooring was then released on 25th February 2025, and only the three deeper floats were visible on the surface. A portion of the mooring was then recovered, starting with the lower buoys and releases at a position of 60.13°S, 25.30°W. Unfortunately, only two instruments were recovered – a temperature sensor and a current meter listed in Table 2 – as the rope had snapped just above.

Instrument	Depth (m)	Parameters measured	Sampling frequency (seconds)	Time started and stopped logging (UTC)
SBE-37 Microcat	5945	Temperature, Salinity, Pressure	600	15-02-24 00:00 25-02-25 22:03
Aquadopp	5944	Current Velocity, Pressure	600	15-02-24 00:00 26-02-25 05:32
RBRSoloT 10k	5200	Temperature	60	15-02-24 00:00 26-02-25 20:15
Aquadopp	4452	Current Velocity, Pressure	600	15-02-24 00:00 26-02-25 06:10
RBRSoloT 10k	3700	Temperature	600	15-02-24 00:00 26-02-25 19:53
Aquadopp	2950	Current Velocity, Pressure	600	15-02-24 00:00 26-02-25 05:47
RBRSoloT 10k	2200	Temperature	60	15-02-24 00:00 26-02-25 17:55
SBE-37 Microcat	1456	Temperature, Salinity, Pressure	600	15-02-24 00:00 25-02-25 22:57
Aquadopp	1455	Current Velocity, Pressure	600	15-02-24 00:00 26-02-25 05:47

Table 1: Instruments recovered from the deeper central South Sandwich Trench mooring.

Instrument	Depth (m)	Parameters measured	Sampling frequency	Time started and stopped logging (UTC)
Aquadopp	3939	Current Velocity, Pressure	600	15/02/2024 00:00 25/02/2025 18:47
SBE-39	3444	Temperature	600	15/02/2024 00:00 25/02/2025 18:24

Table 2: Instruments recovered from the shallower west South Sandwich Trench mooring.

2.2 Mooring Data

All recovered instruments were in good condition, and the data was downloaded from each. A conductivity-temperature-depth profiler (CTD) with a lowered acoustic Doppler current profiler (LADCP) was deployed close to each mooring site, with temperature, salinity and current velocity recorded, along with other parameters, in order to calibrate the mooring instruments. The two recovered SBE-37 Microcats were also attached to the CTD itself on a later cast, to calibrate the sensors against those on the CTD, which in turn are calibrated against IAPSO standard seawater and an SBE-35 Deep Ocean Standard Thermometer.

The data from the western mooring (Figure 1) shows no indication that the mooring failed part way through the time series, suggesting the rope broke either on deployment or release. The SBE-39 was higher up in the water column, but unfortunately did not have a pressure sensor so it is unclear what depth it was at throughout the year. However, the temperature data shows no obvious jump as an indication that it changed depth at some point. It is therefore assumed that the mooring rope either snapped on deployment or during release. The pitch, roll, and heading data measured by the Aquadopp shows that, while there was some

movement in the rope, and the roll and heading data looks normal, the pitch only varied between -40 and 40°, suggesting it was somehow caught, potentially on the buoys that would have been below it on the rope.

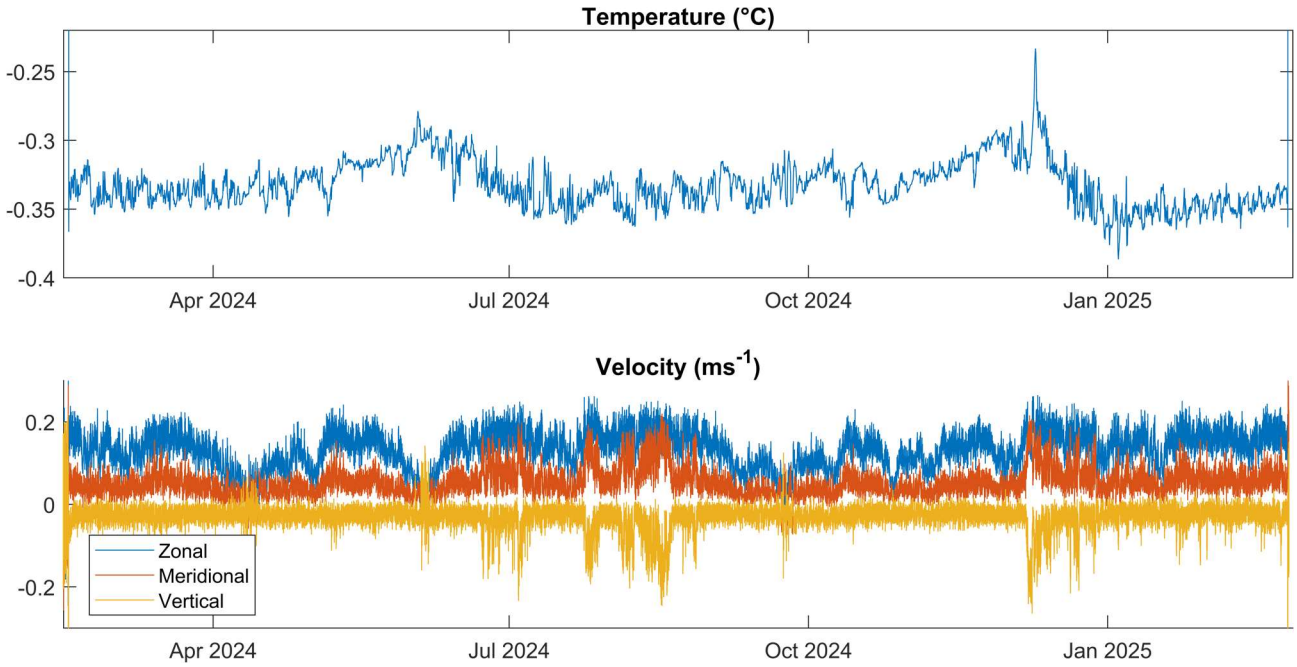

Fig. 1: Raw temperature and current velocity data from the western South Sandwich Trench mooring. The temperature is measured by the SBE-39 and the velocity by the Aquadopp.

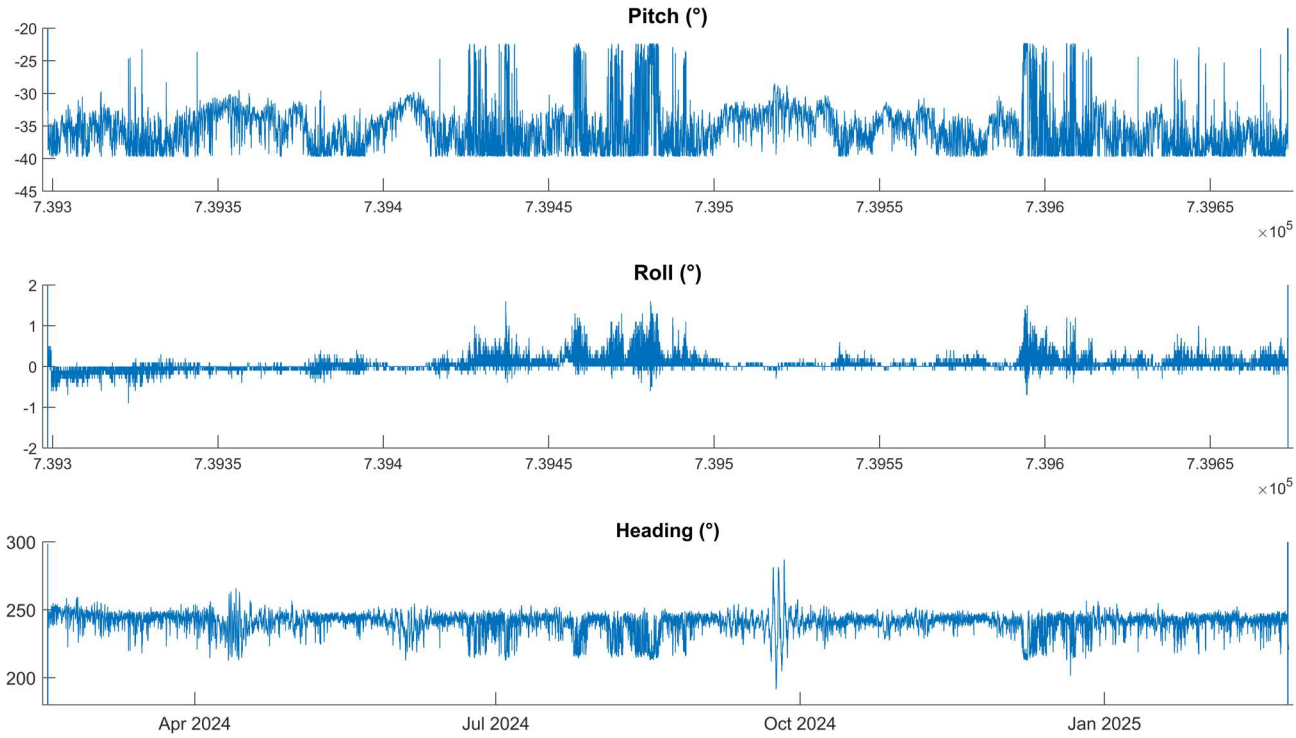

Fig. 2: Pitch, roll and heading data measured by the Aquadopp on the western South Sandwich Trench mooring.

2.3 References

E. P. Abrahamsen, 2024a. Cruise report, RV Argos Georgia Voyage SS24. British Antarctic Survey, https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/argosgeorgia_ss24.pdf

E. P. Abrahamsen, 2024b. Deployment of moorings in South Sandwich Trench (MS9). Zenodo, https://doi.org/10.5281/zenodo.10955998.

2.4 Open Science

Raw data have been backed up on the network drives on RRS *Sir David Attenborough* and will be transferred to the Storage Area Network (SAN) at the British Antarctic Survey, where quality control and analysis will take place. Raw and quality-controlled data will be archived with the British Oceanographic Data Centre and/or Zenodo, to be openly available with a DOI.
The quality-controlled dataset will form deliverable D5.1, Mooring dataset from South Sandwich Trench which is due in October 2025.