FIELD REPORT -ALL WATER LOGGERS

DPLUS206 CLIMATE IMPACTS ON FI PAST, PRESENT AND FUTURE FRESHWATER DYNAMICS

PREPARED BY NYEIN THANDAR KO

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[Publish Date] - **NYEIN KO**

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2. INTRODUCTION

As part of our ongoing efforts to enhance hydrological monitoring across the Falkland Islands, this project focuses on expanding in-situ measurements to support satellite-based research and hydrological modelling. To achieve this, we are installing new water level loggers (Baro Stout and Level Stout) in key rivers, including the Murrel River, to collect continuous water level data. These ground-based observations will serve as essential reference points for calibrating and validating hydrological models in future studies, thereby improving the accuracy of freshwater dynamics assessments.

3. FIELD OBSERVATION

Currently, six monitoring stations have been established across the six distinct water bodies under the Darwin Plus 116, Wetlands Project, (Figure 1). During a previous site inspection, we confirmed the loss of loggers at the Mile Pond monitoring station, most likely due to unanticipated high flow events. Consequently, five operational monitoring stations remain active across the Falkland Islands.

Between May and July 2025, we visited all remaining sites to replace the existing LevelSCOUT and BaroSCOUT loggers with new units. The newly deployed level and barometric loggers were configured to record data at 15-minute intervals, commencing at 15:00 /16:00 on the respective visit dates. Both loggers were synchronized to ensure simultaneous data acquisition, enabling accurate water level estimation. Table 1 provides details of the field visit schedule and summarizes data retrieval information for each monitoring site, including the information on the previous downloaded data on each site.

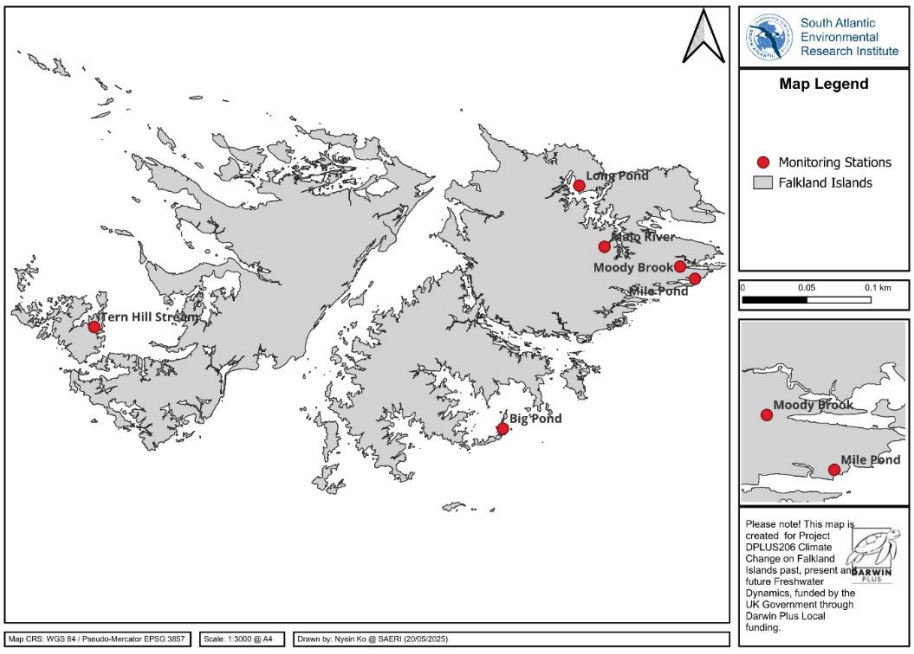

Figure 1 Map of Monitoring Stations in Falkland Islands by the Darwin Plus 116, Wetlands Project

Table 1 Current and previous downloaded data, and new recording dates and times at each location

Locations	Loggers	P-Drive (Previous Downloaded)		Time Interval	Download by Freshwater Project		Time Interval	Continue	
		From	To		From	To		Yes/No	If Yes, Date
Moody Brook	Baro	06/05/2021 13:25	28/04/2022 15:55	15 min	29/04/2022 09:11	23/01/2025 09:11	15 min	Yes	16/05/2025 15:00
	Level	06/04/2021 10:13	06/04/2022 10:13	15 min	29/04/2022 09:27	23/01/2025 09:27	15 min	Yes	16/05/2025 15:00
Malo River	Baro	26/05/2021 11:20	26/05/2022 11:20	15 min	08/06/2022 14:55	04/03/2025 14:55	15 min	Yes	16/07/2025 15:00
	Level	26/05/2021 11:26	26/05/2022 11:26	15 min	Lost level logger			Yes	16/07/2025 15:00
Long Pond-Salvador	Baro	29/06/2021 11:47	08/06/2022 11:32	15 min	08/06/2022 12:00	04/03/2025 12:00	15 min	Yes	23/05/2025 15:00
	Level	29/06/2021 11:51	08/06/2022 11:21	15 min	08/06/2022 11:48	04/03/2025 11:48	15 min	Yes	23/05/2025 15:00
Tern Hill Stream-Weddell	Baro	25/03/2021 11:41	25/03/2022 11:41	15 min	12/03/2025 17:26	17/06/2025 09:56	30 min	Yes	11/06/2025 15:00
		10/05/2022 12:08	11/07/2024 15:08	30 min					
	Level	25/03/2021 11:37	25/03/2022 11:37	15 min	12/03/2025 17:23	17/06/2025 10:23	30 min	Yes	11/06/2025 15:00
		10/05/2022 12:10	11/07/2024 15:40	30 min					
Big Pond-Bleaker	Baro	12/05/2021 08:39	23/11/2021 16:54	15 min	06/06/2022 08:32	02/03/2025 08:32		Yes	14/07/2025 16:00
	Level	25/03/2021 11:44	23/11/2021 15:44	15 min	Missing			Yes	14/07/2025 16:00
Mile Pond	Baro	26/05/2021 10:52	07/07/2021 09:22	15 min				No	
	Level	26/05/2021 10:46	07/07/2021 09:31	15 min	Lost level logger			No	

4. ANALYSIS

Both water level and barometric pressure data were recorded at identical intervals on the same dates; however, their start times varied slightly between loggers at each site. For instance, at Moody Brook, the LevelSCOUT logger began recording at 09:27, while the BaroSCOUT logger started at 09:11. To ensure accurate gauge pressure estimation, it is crucial to synchronize these datasets.

To address this, the barometric pressure data were interpolated to match the time intervals of the level logger data. After alignment, gauge pressure was computed using the following equation:

$$Gauge\ Pressure = Absolute\ Pressure\ - Interpolated\ Barometric\ Pressure$$

Subsequently, gauge pressure was converted to water depth using the formula:

$$Water\ Depth\ (m) = \frac{P_{Gauge}}{pg}$$

Where, P_{Gauge} is Gauge pressure in Pascals (Pa), p is the density of water (1000 kg/m^3), and g is the acceleration due to gravity (9.81 m/s^2).

5. FIELD RESULTS

The existing LevelSCOUT and BaroSCOUT loggers were retrieved from each site and returned to the SAERI office for data download (Table 1). Below is a summary of findings for each location.

1) MOODY BROOK

We visited Moody Brook on **16 May 2025** to replace the existing LevelSCOUT and BaroSCOUT loggers with new units. The new loggers were configured with a **15-minute recording interval**, beginning at **15:00 on 16 May 2025**.

The retrieved LevelSCOUT logger showed a remaining battery charge of **20.1%**, with **1,984** memory records available, but was in an inactive state. Similarly, the BaroSCOUT logger had **10.1%** battery charge and **1,984** memory records available and was also inactive.

Data records indicate that:

- **LevelSCOUT** collected data from **29 April 2022 (09:27)** to **23 January 2025 (09:27)**.
- **BaroSCOUT** collected data from **29 April 2022 (09:11)** to **23 January 2025 (09:11)**.

(Figure 2 provides a graphical representation of the recorded data.)

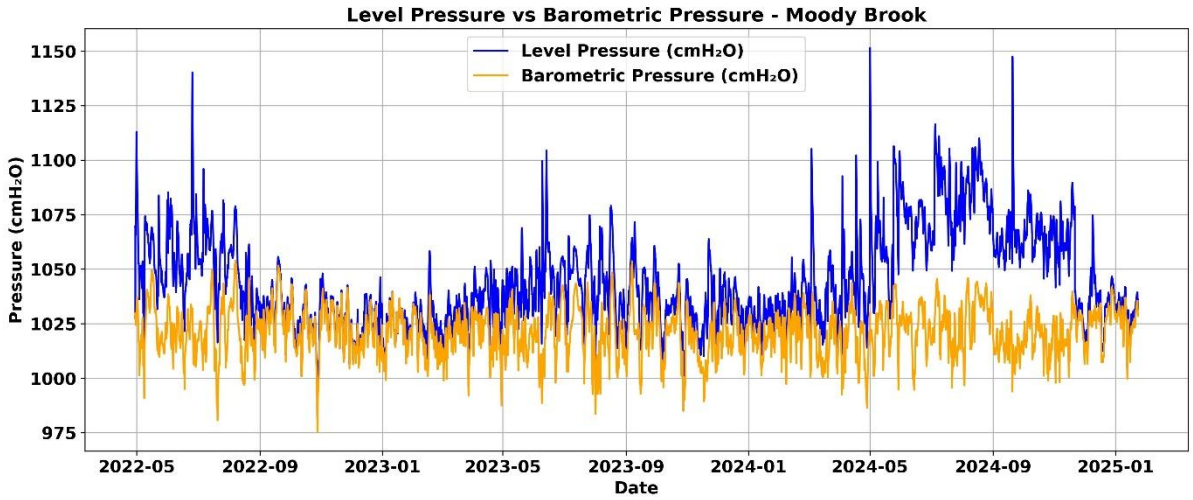

Figure 2 Collected Level Pressure and Barometric Pressure at Moody Brook

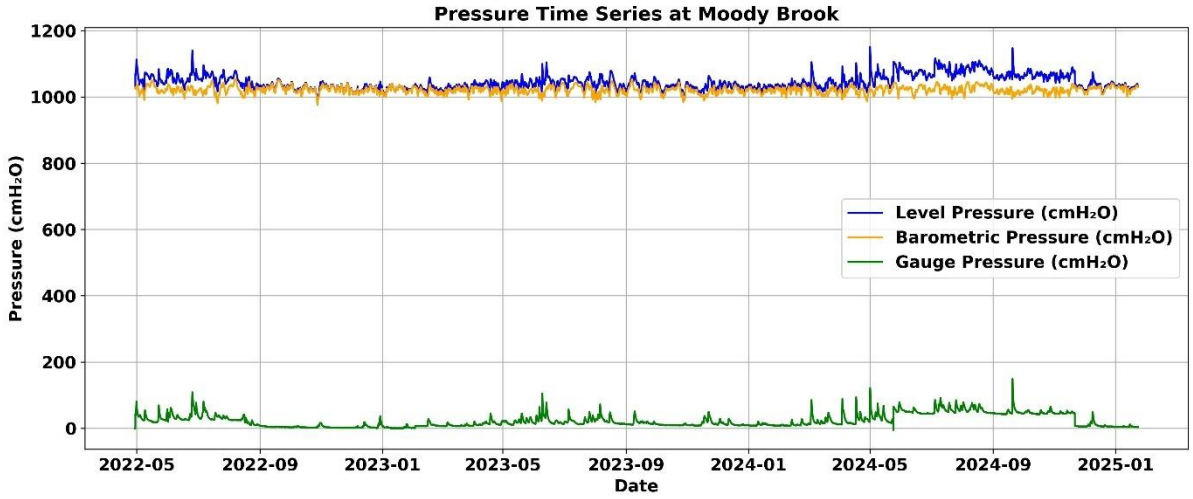

Figure 3 Estimated gauge pressure from collected absolute pressure by LevelSCOUT and barometric pressure by BaroSCOUT at Moody Brook

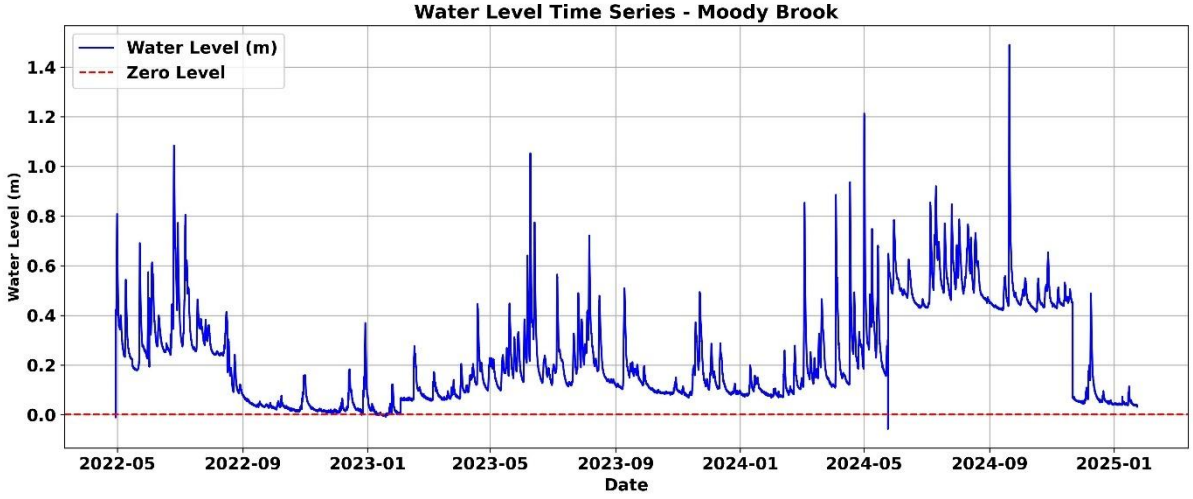

Figure 4 Estimated water level (m) from gauge pressure at Moody Brook

2) Malo River

We visited the Malo River site, located on River View Farm, on **23 May 2025**. During this visit, we retrieved the existing BaroSCOUT logger; however, the LevelSCOUT logger could not be located. The recovered BaroSCOUT had a remaining battery charge of **12.9%**, with **1,984** memory records available, and was in an inactive state. Data retrieved from this logger covered the period 8 June 2022 (14:55) to **4 March 2025** (14:55).

On **16 July 2025**, we returned to the site to install new LevelSCOUT and BaroSCOUT loggers to restore continuous monitoring at Malo River. Both loggers were configured to record at 15-minute intervals, starting at 15:00 on 16 July 2025. A follow-up visit is planned for the summer low-water period to search for the missing LevelSCOUT along the river channel. Water levels for Malo River were estimated using previously downloaded data collected between 26 May 2021 and 26 May 2022 (Figure 5).

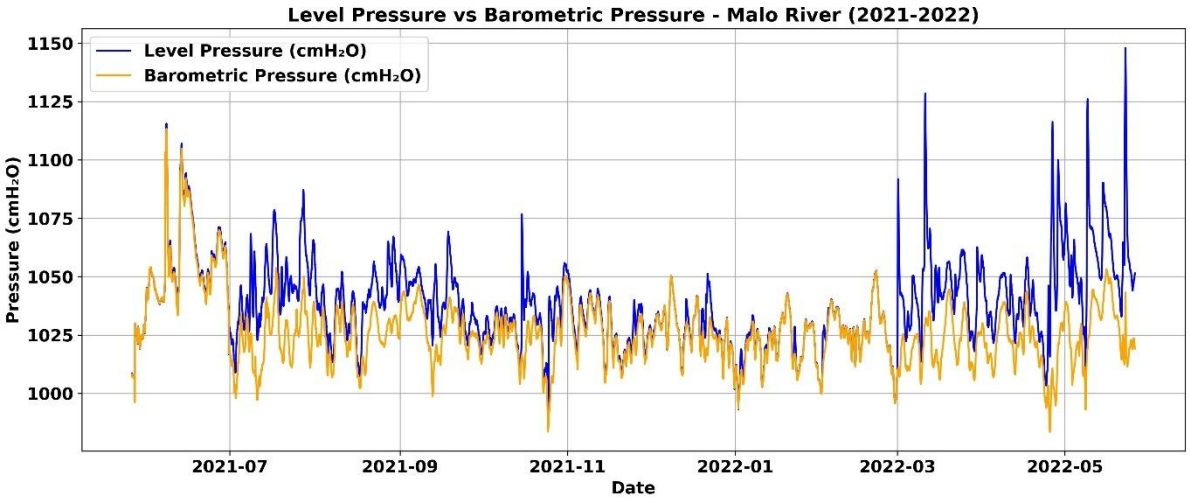

Figure 5 Previous Collected Level Pressure and Barometric Pressure at Malo River

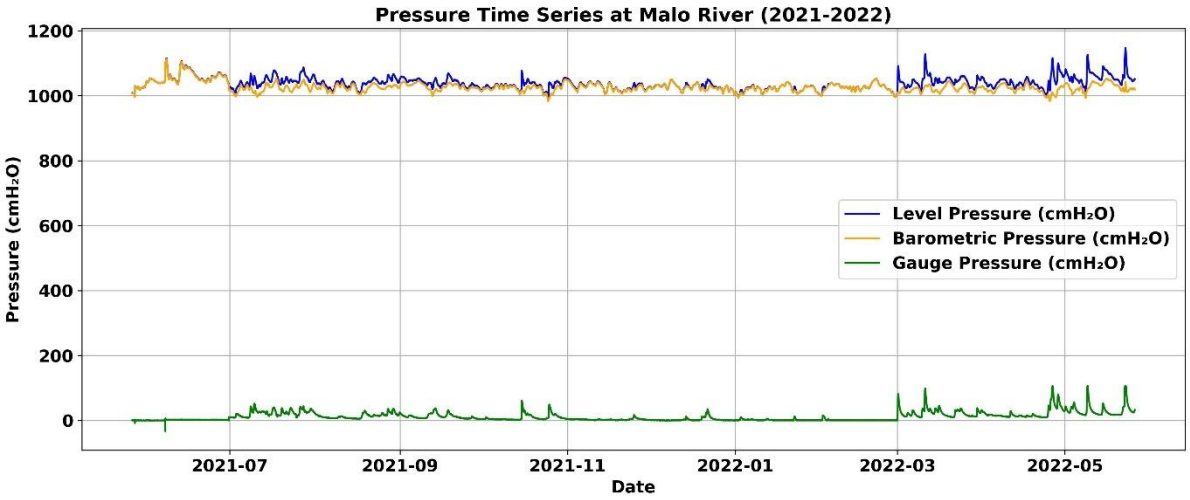

Figure 6 Estimated gauge pressure from previous collected absolute pressure by LevelSCOUT and barometric pressure by BaroSCOUT at Malo River

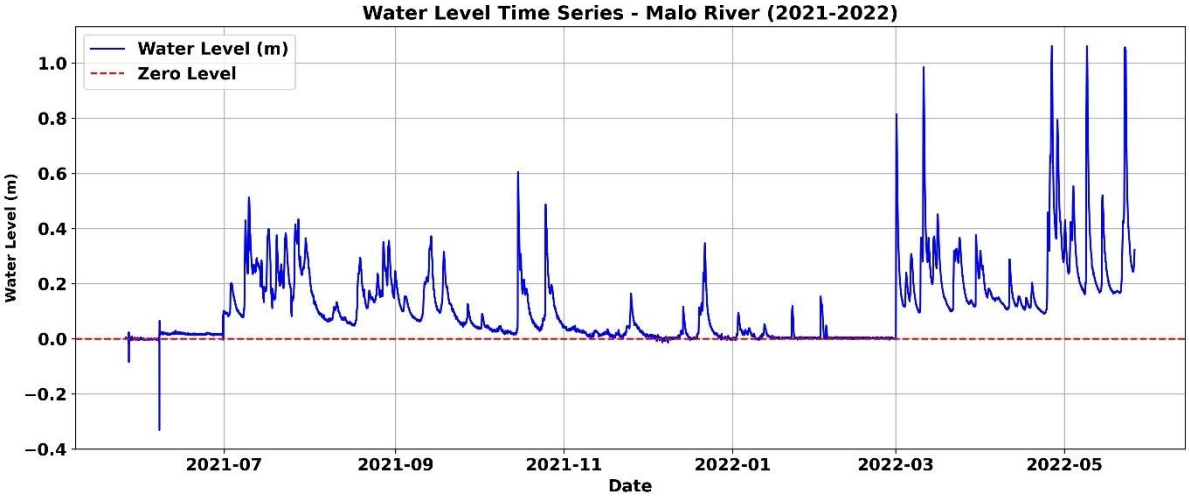

Figure 7 Estimated water level (m) from gauge pressure at Malo River

3) LONG POND -SALVADOR

We visited the Long Pond site at Salvador Farm on **10 June 2025** to retrieve the existing BaroSCOUT and LevelSCOUT loggers and replace them with new units. The new loggers were configured for **15-minute recording intervals**, starting at **15:00 on 10 June 2025**.

The retrieved loggers had the following status:

- **LevelSCOUT**: Battery charge at **19.3%**, **1,984 memory records available**, inactive.
- **BaroSCOUT**: Battery charge at **18.2%**, **1,984 memory records available**, inactive.

Data coverage for the previous deployment:

- **LevelSCOUT**: **8 June 2022 (11:48)** to **4 March 2025 (11:48)**.
- **BaroSCOUT**: **8 June 2022 (12:00)** to **4 March 2025 (12:00)**.

A graphical representation of the recorded data is shown in **Figure 6**.

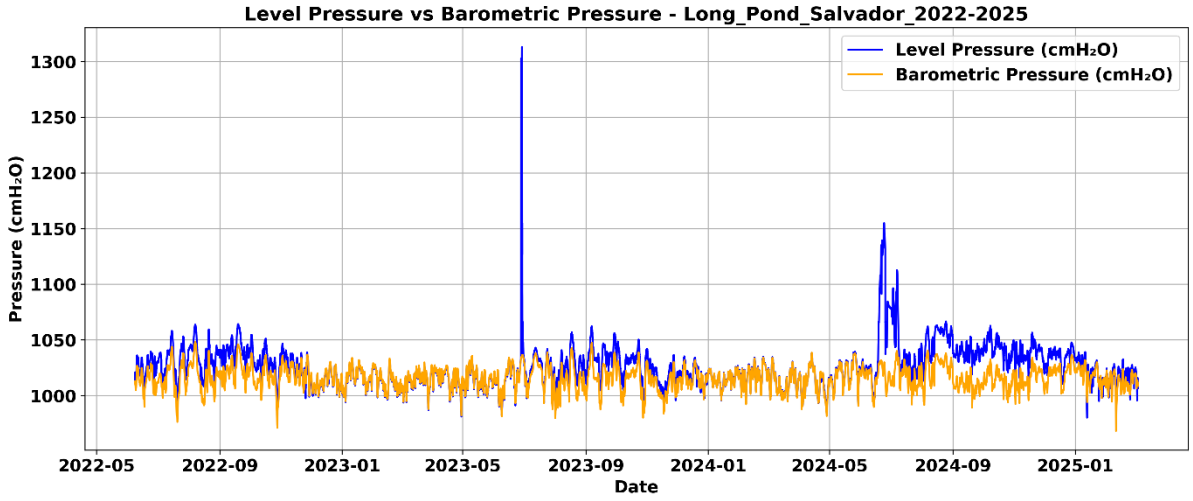

Figure 8 Collected Level Pressure and Barometric Pressure at Long Pond in Salvador

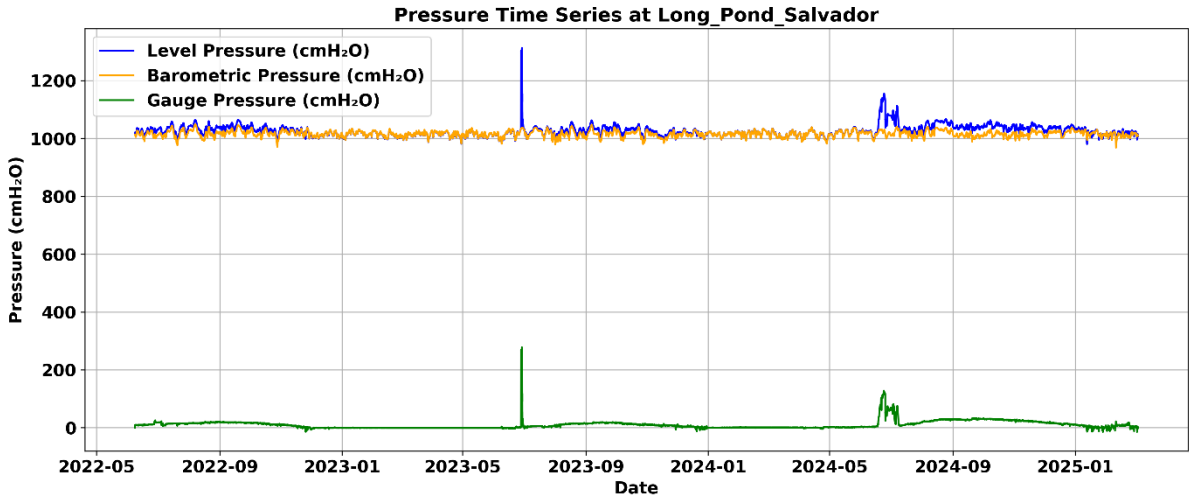

Figure 9 Estimated gauge pressure from collected absolute pressure by LevelSCOUT and barometric pressure by BaroSCOUT at Long Pond in Salvador

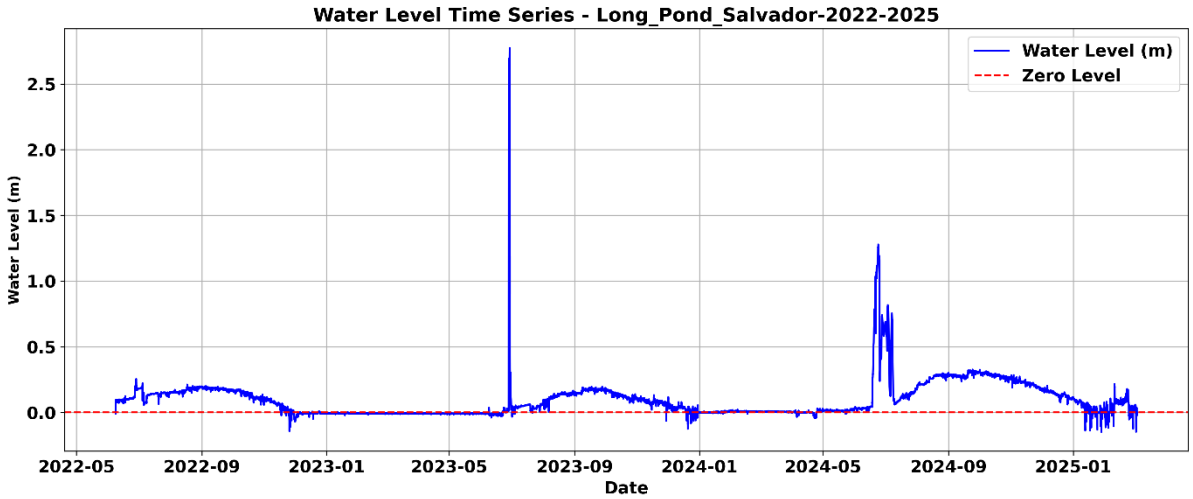

Figure 10 Estimated water level (m) from gauge pressure at Long Pond in Salvador

4) Tern Hill Stream – Weddell Island

With assistance from Dr. Rosanne BROYD (Peatland Project) during a field visit to Weddell Island, we retrieved the existing LevelSCOUT and BaroSCOUT loggers and deployed new units. The new loggers were configured for 15-minute recording intervals, starting at 15:00 on 11 June 2025.

The retrieved loggers had the following status:

- **LevelSCOUT**: Battery charge at **18.3%**, **45,343 memory records available**, active.
- **BaroSCOUT**: Battery charge at **8.1%**, **45,343 memory records available**, active.

Data coverage for the previous deployment:

- **LevelSCOUT**: **12 March 2025 (17:23)** to **17 June 2025 (10:23)**.
- **BaroSCOUT**: **12 March 2025 (17:26)** to **17 June 2025 (19:56)**.

A graphical representation of this dataset is provided in **Figure 8**.

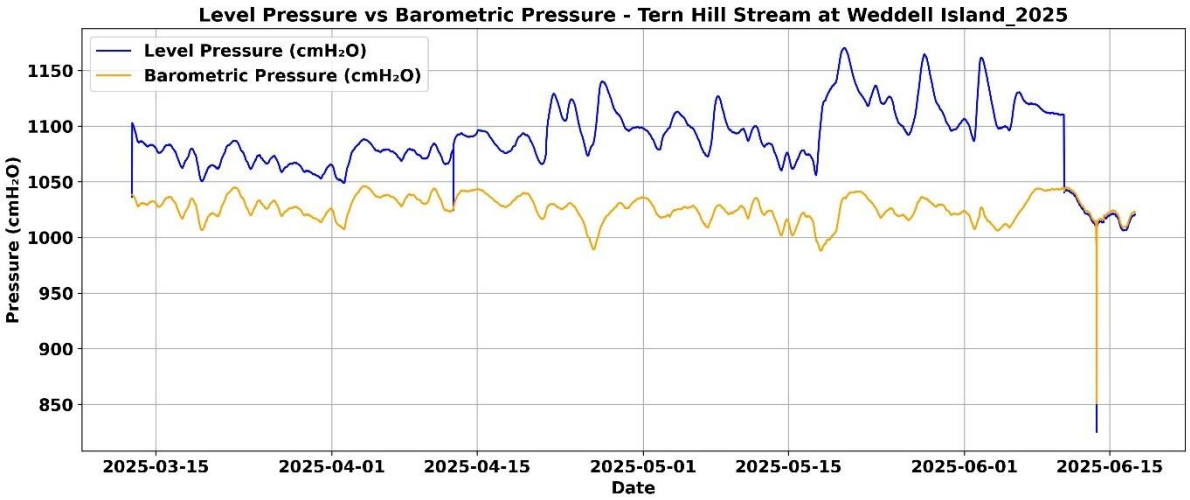

Figure 11 Collected Level Pressure and Barometric Pressure at Tern Hill Stream in Weddell Island

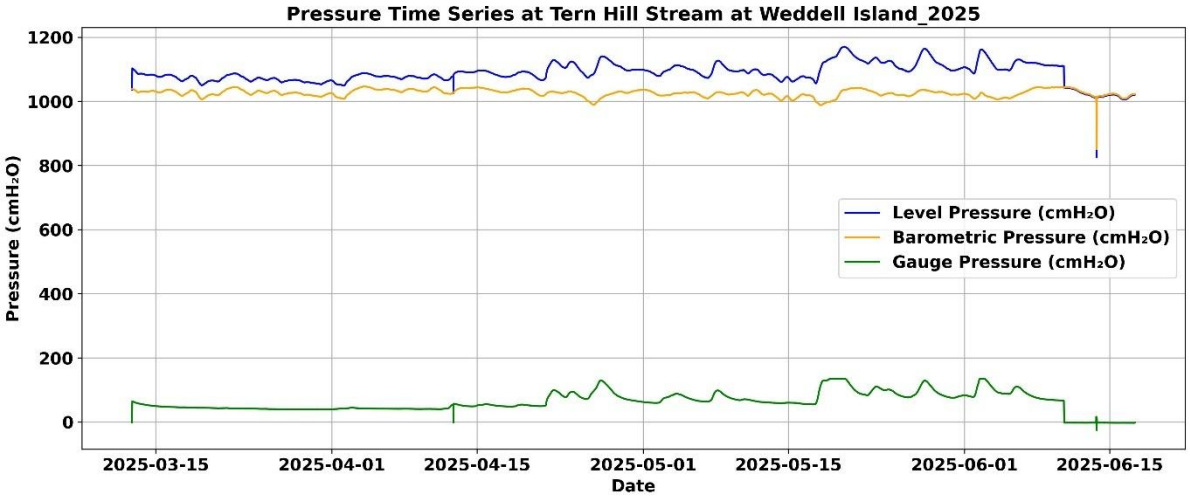

Figure 12 Estimated gauge pressure from collected absolute pressure by LevelSCOUT and barometric pressure by BaroSCOUT at Tern Hill Stream at Weddell Island

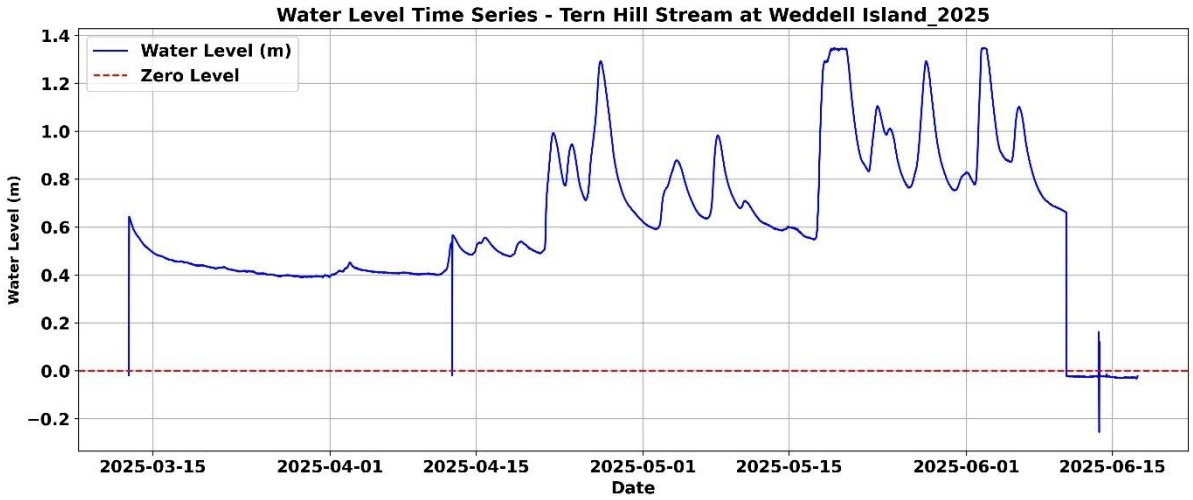

Figure 13 Estimated water level (m) from gauge pressure at Tern Hill Stream at Weddell Island

5) Big Pond – Bleaker Island

We visited Big Pond on Bleaker Island on 14 July 2025 to service the monitoring station. During this visit, we retrieved the LevelSCOUT logger; however, the BaroSCOUT could not be located. Based on feedback from the landowner, water levels in Big Pond have been unusually high this year, suggesting the BaroSCOUT may be submerged. The landowner has agreed to monitor the site and report any findings. A follow-up visit is planned during the summer low-water period to continue the search for the missing BaroSCOUT.

The retrieved LevelSCOUT had a remaining battery charge of **19.0%,** with **1,984 memory** records available, and was in an inactive state. Data coverage from the old LevelSCOUT spanned 6 June 2022 (08:32) to **12 March 2025** (08:32).

New LevelSCOUT and BaroSCOUT loggers were deployed and configured to record at 15-minute intervals, starting at 15:00 on 14 July 2025. Water levels for Big Pond were estimated using previously downloaded data collected between 12 May 2021 and 23 November 2021 (Figures 14, 15, and 16).

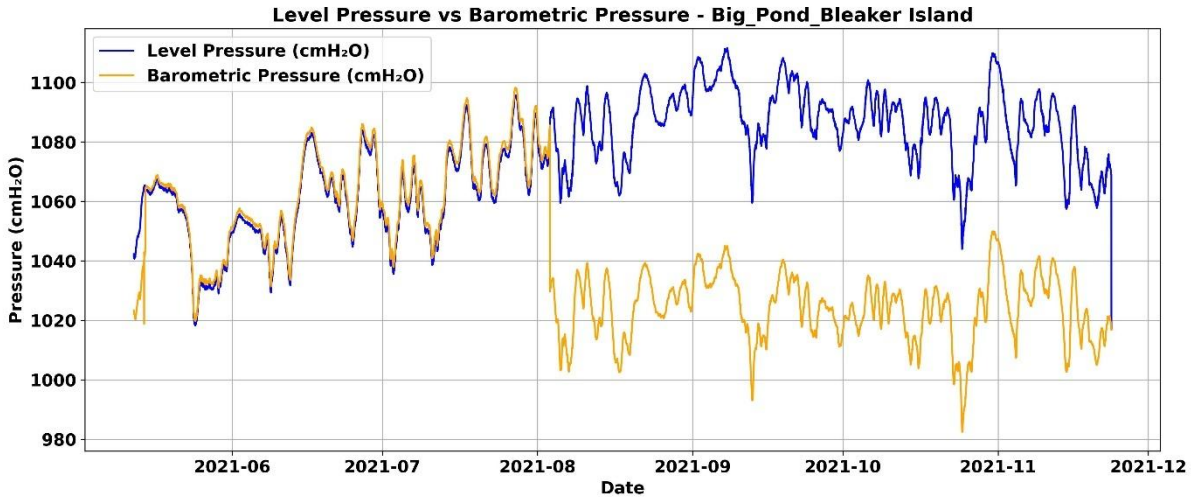

Figure 14 Previous collected Level Pressure and Barometric Pressure at Big Pond on Bleaker Island

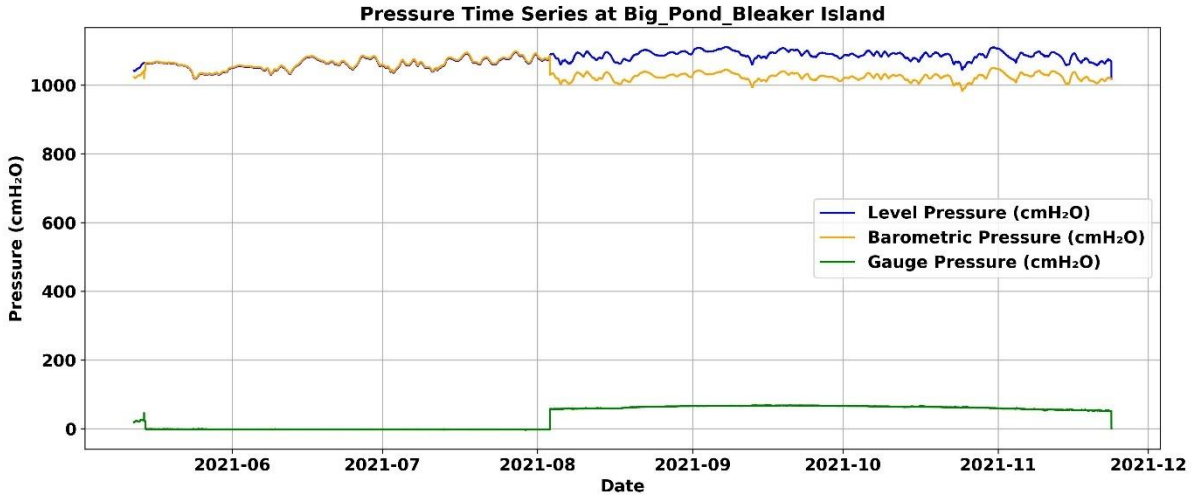

Figure 15 Estimated gauge pressure from collected absolute pressure by LevelSCOUT and barometric pressure by BaroSCOUT at Big Pond on Bleaker Island

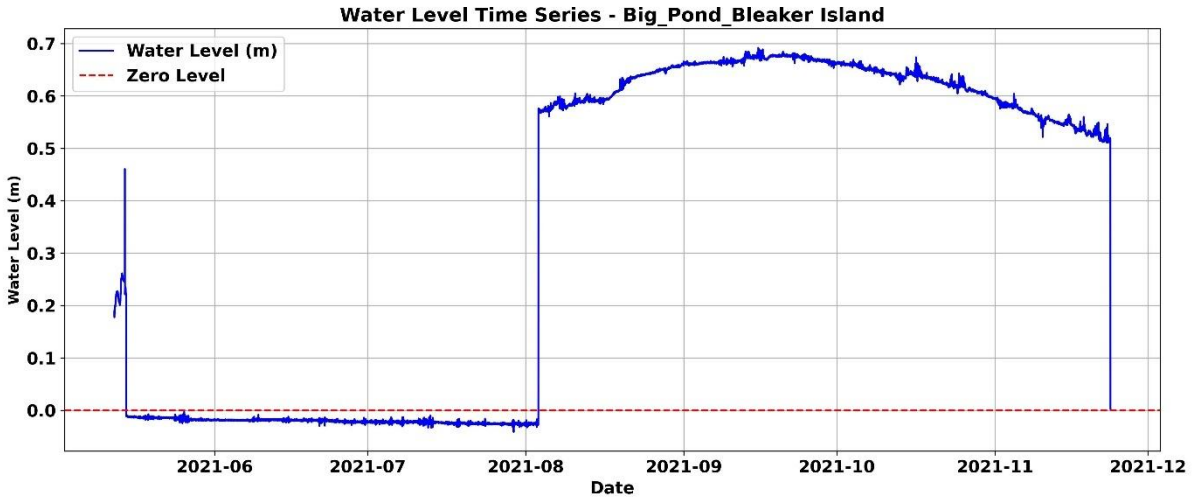

Figure 16 Estimated water level (m) from gauge pressure at Big Pond on Bleaker Island

6. DISCUSSION

We carried out field observations, downloaded data, and preliminary analysis from the 2022–2025 hydrological logger deployments across the Falkland Islands. We integrate the site-specific findings (Moody Brook, Malo River, Long Pond–Salvador, Tern Hill Stream–Weddell Island, and Big Pond–Bleaker Island) with broader operational lessons relevant to the expanded in-situ monitoring network that supports satellite remote sensing and hydrological modelling.

6.1. Network Status at Retrieval (Early–Mid 2025)

Field servicing between May and July 2025 showed that all retrieved LevelSCOUT and BaroSCOUT loggers—except those at Tern Hill Stream (Weddell Island)—had entered an inactive state and stopped recording by early 2025. Remaining battery charge at retrieval ranged from ~6.2% to 20.1% across locations (where recorded), and most units reported ~1,984 memory records free when downloaded. In several cases this indicates that logging had halted prior to memory saturation, most likely due to battery conservation settings, user stop commands, or environmental interruptions (e.g., loss of submergence, mechanical displacement).

In contrast, the Tern Hill Stream loggers remained active at the time of recovery, despite having modest residual battery levels (18.3% LevelSCOUT; 8.1% BaroSCOUT). Notably, both instruments still reported ~45,343 available memory records, suggesting that the sampling program, deployment duration, or internal memory configuration at this site differed from the earlier deployments at other locations. This highlights the value of reviewing and standardizing deployment templates across the network.

6.2. Data Continuity and Operational Gaps

Because multiple stations ceased recording ahead of the 2025 servicing window, there are data gaps between last recorded timestamps (January–March 2025 for most sites) and redeployment dates (May–July 2025). These interruptions limit the continuity needed for multi-year hydrological trend analysis and for validating satellite observations during transitional seasons. Recurrent, scheduled maintenance will be essential to reduce breakpoints in long-term records. The cost of maintaining and downloading stations should be costed into any future long-term freshwater monitoring programs.

6.3. Data Anomalies: Negative Estimated Water Levels

Across several sites, estimated water levels occasionally plotted below zero datum, typically between January and May, with magnitudes ranging from approximately −0.06 m to −0.30 m (Figures 4, 7, 10, 13, 16). Such negative excursions are common in pressure-to-stage conversions and can arise from several, often interacting, causes:

1) **Logger Not Submerged / Exposure During Low Water**
   Periods of low flow, seasonal drawdown, or partial desiccation can leave the LevelSCOUT sensor at or above the water surface, producing apparent negative depths when barometric

compensation is applied. This behavior is frequently observed in small headwater streams, shallow ponds, and intermittently connected wetlands.

2) **Calibration or Offset Drift Between Sensors**
Small calibration differences between the LevelSCOUT and BaroSCOUT can introduce minor pressure offsets, leading to negative water level estimates (e.g., -0.01 m).
3) **Elevation Differences Between Logger Reference Points**
If the BaroSCOUT is positioned at a higher elevation than the LevelSCOUT, it records slightly lower atmospheric pressure. When this value is subtracted from the absolute pressure, the result can be a small negative depth.

Interpretation: Negative excursions within the observed range (up to about −0.30 m) are minor and generally **do not compromise data usability** for relative stage analysis, hydrograph timing, or event detection. However, excursions more negative than ~**−0.50 m** should trigger a quality control review for sensor exposure, fouling, or processing errors.

7. CONCLUSION AND RECOMMENDATIONS

Based on our field observations, analysis, and field data, we propose the following recommendations to ensure continued accuracy and reliability of water level monitoring:

1. **Conduct Regular Field Checks** – To schedule periodic field visits to verify the operational status of all deployed water loggers, especially those installed at the same time as the units at Moody Brook. This requires long-term investment, if the program it to continue beyond the life of the current Darwin Plus project.

2. **Monitor Battery Levels and Memory Capacity** – To establish a routine for checking battery charge and memory status remotely (if possible) or during site visits to prevent data loss due to unexpected shutdowns.

3. **Ensure Accurate Logger Placement** – To confirm that LevelSCOUT loggers are consistently submerged during expected wet periods and positioned in locations less prone to drying out, where feasible.

4. **Standardize Calibration Procedures** – To review and, if necessary, standardize the calibration process for both LevelSCOUT and BaroSCOUT devices to minimize discrepancies in pressure readings.

5. **Account for Elevation Differences** – To document and consider elevation differences between level and barometric loggers during deployment and adjust analysis if needed to correct for pressure biases.

6. **Address Negative Water Level Values** - Small negative values in water level estimates (e.g., -0.01 to -0.3 m) can typically be disregarded; however, larger deviations should be investigated to rule out installation or sensor faults.

7. **Improve Data Synchronization** – To align start times and recording intervals of LevelSCOUT and BaroSCOUT loggers to reduce the need for post-processing interpolation and improve data accuracy.

By implementing these recommendations, we can enhance the reliability of the water level monitoring network and reduce the risk of data gaps or inaccuracies in future recordings.

8. FURTHER FIELD WORK

Field observations across five monitoring locations highlight the urgent need for regular inspections of logger stations to monitor battery life and memory capacity effectively. Plans are underway to install new loggers at additional sites, prioritized based on landowner collaboration and accessibility. These efforts will expand the spatial coverage of freshwater monitoring and strengthen the overall hydrological dataset for the Falkland Islands.

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