2 Campaign log

2.1 Preparation

The Ice-T buoy deployment was scheduled to take place from I/B *Le Commandant Charcot* during her transarctic journey departing Longyearbyen (Svalbard) on September 5, 2025, and arriving in Nome (Alaska) on September 24, 2025. This cruise has sea-ice stops both at the geographic and magnetic North Poles. The interest of the Magnetic North Pole (MNP) is that it is located farther upstream on the transpolar drift, permitting the hope for a longer entrapment of the buoy within the Arctic sea-ice. Buoy deployment operations were arranged with Eric Brossier, skipper of the *Vagabond* expedition yacht, and one of the scientific coordinators of *Le Commandant Charcot* during the transarctic cruise. Eric Brossier has an outstanding experience with scientific operations in sea ice and was already acquainted with the Ice-T buoy, previously deployed from the *Vagabond*.

The buoy was shipped from LOCEAN (Paris) on August 6, 2025, and arrived in Longyearbyen on August 26, 2025.

Frédéric Vivier and Antonio Lourenco flew to Longyearbyen on September 3, 2025. The shipment was recovered and transferred aboard *Le Commandant Charcot*. The buoy was then assembled, tested, and installed on the top deck of the ship with Eric Brossier. It was turned on before the ship's departure on September 4, 2025, ready to be deployed.

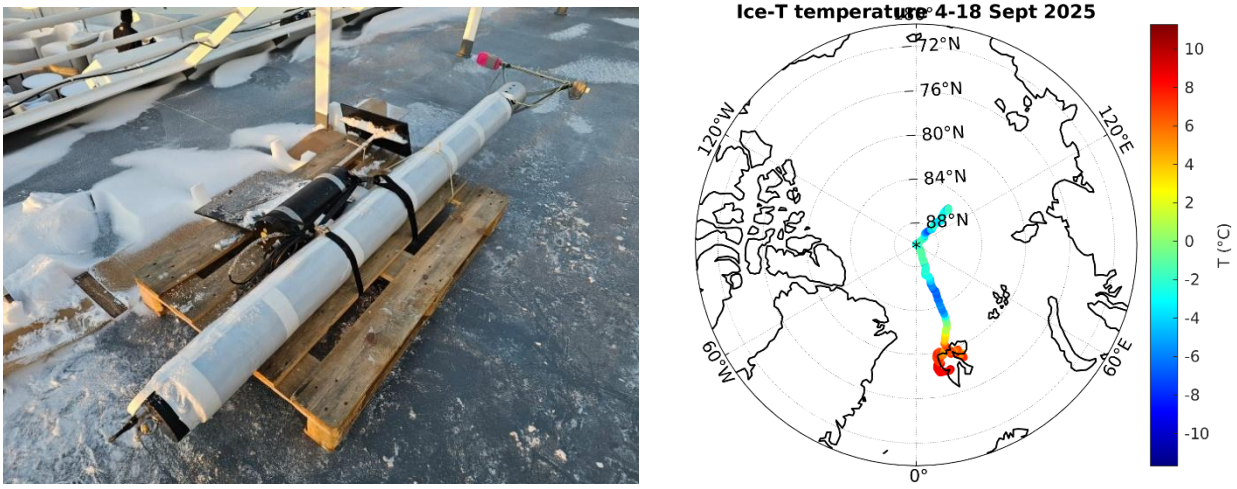

Figure 1: ***Left panel: Ice-T buoy on the top deck of Le Commandant Charcot. Right panel: Air temperature transmitted by the buoy during the transect between Longyearbyen and the Magnetic North Pole, reached on September 16, 2025.***

2.2 Deployment

The buoy was deployed at the MNP (85.5410°N – 138.6023°E) by Eric Brossier on September 16, 2025, at 13:35 UTC in a 105 cm thick sea ice with a thin (5 cm) snow layer (Figure 2). The sea-ice freeboard was slightly positive (1-2 cm). The buoy was deployed close to an AWI buoy. A mapping of the sea-ice field around the buoy was performed by eight boreholes, as shown in Figure 3. This enabled us to verify that the sea-ice draft derived from the buoy's data is consistent with the local spatial variability around the buoy (the orientation of the sonic beam of the fish changes with sea-ice motions).

Figure 2*: Ice-T buoy deployed at the Magnetic North Pole on September 16, 2025 (picture from Eric Brossier).*

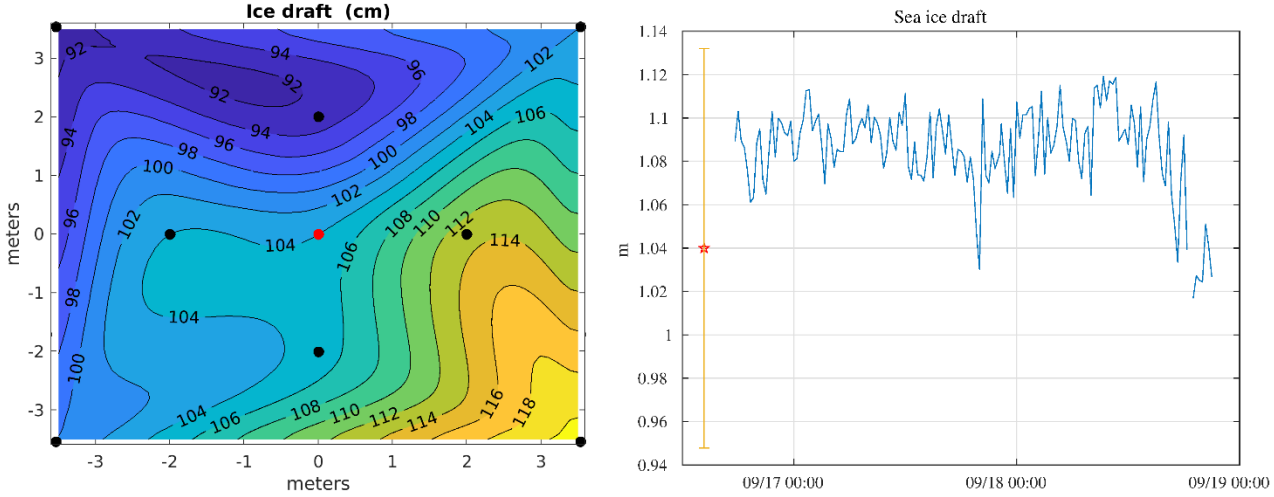

Figure 3*: Left panel: Mapping of the sea-ice draft by boreholes around the buoy. Right panel: Sea-ice draft derived from the buoy's data; the error bar to the left denotes the spatial variability around the buoy obtained from the initial mapping.*

3 Sensor performance analysis

The buoy's deployment was successful with all sensors working nominally. Unfortunately, satellite data transmissions stopped abruptly after the last message received on September 18, 2025, at 21:40 UTC. The latest data were completely normal, and there was no indication of any particular problem with the buoy.

The buoy's trajectory during the 2.5 days in sea ice is shown in Figure 4, displaying a drift of approximately 20 km modulated by inertial oscillations, with a significant acceleration of the buoy before its final transmission.

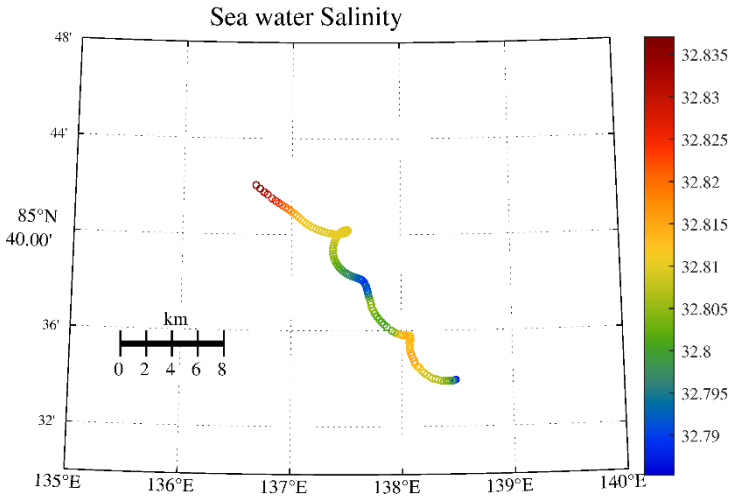

Figure 4: ***Sea-water salinity 6m below the ice along the Ice-T buoy's trajectory (between 16 and 18 September 2025).***

Nothing in the data foreshadowed this very disappointing, premature end to the broadcasts. We sought to understand its origin by examining various factors, both technical and environmental:

- Damage to the antenna by a polar bear: this could be possible, but no sign of polar bear presence was reported during the deployment.
- Sea-ice ridging leading to the destruction of the buoy: this hypothesis was thoroughly examined, especially since the last broadcast positions indicated a substantial acceleration of the buoy's drift. The inclinometer mounted in the buoy showed no sign of tilt, indicating that the ice remained level. If the ice tilted, it must therefore have happened extremely abruptly, over a very short period of time, less than 20 minutes (the duration of the measurement cycle), which is quite unlikely. We further examined the distance separating the Ice-T buoy from the neighbouring AWI buoy. The latter remained constant (within the range of GPS error), indicating no fracturing of the sea ice, at least between the two buoys. The hypothesis of a fatal sea ice ridging episode is therefore unlikely, especially since the neighbouring AWI buoy kept on working after September 18.
- A technical issue, therefore, appears the most likely explanation, even though, as previously mentioned, the latest broadcast technical data were nominal (e.g., stable voltage level). It should be noted that the Ice-T buoy was equipped for the first time with its new electronics, as the microcontroller used until now is no longer manufactured. The electronics of the buoy have been completely revamped by the technical team at LOCEAN around an STM32 microcontroller, and the embedded software was therefore entirely rewritten. This was a substantial development effort, completed in summer 2025. Back at the laboratory, after the campaign, a spare electronic component was tested on the bench. It operated normally for several weeks before abruptly stopping transmissions, closely mirroring what was observed in the field. On the field, the buoy cycled normally between 4 and 18 September, transmitting 1030 data messages, before suddenly becoming silent. The origin of the problem was identified in the software, which remains trapped in an infinite loop on some unexpected (and infrequent) return from the Iridium satellite modem. The software has since been corrected to handle such situations, and additional improvements are currently being implemented to further enhance system robustness. A new deployment of an Ice-T buoy is planned next year.