ITP38 Overview

Deployment Location: 4/19/2010, 11:00 UTC at 88° 39.4'N, 145° 35.7'E

Last Location: 3/17/2011, 1:00 UTC at 66° 12.0' N, 17° 6.2' W

Duration: 332 days

Distance Traveled: 6703 km

Number of profiles: 1011 in 253 days

Other instruments: IMB 2010-A, AOFB 20, PAWS, webcam

ITP 38 was deployed on a 1.7 m thick icefloe in the Transpolar Drift from the Russian ice camp Barneo in collaboration with the North Pole Environmental Observatory (NPEO) . On the same icefloe, a Naval Postgraduate School Arctic Ocean Flux Buoy (AOFB 20), an US Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Mass Balance Buoy (IMB 2010-A), an US-IABP Polar Area Weather Station (PAWS) and NOAA/PMEL webcam were deployed. The ITP operated on a fast-sampling schedule of 4 one-way profiles between 7 and 760 m depth each day. Eleven months after deployment, the un-tethered buoy washed ashore on the northern coast of Iceland, was found by a farmer, and later returned to Woods Hole.

ITP38 Deployment Operations

Skirting the volcanic ash cloud between Iceland and Svalbard delayed the arrival of the 3 man deployment team at the Russian ice camp Barneo. Three hours after arriving at the camp on April 18, 2010, they departed on an MI-8 helicopter with ITP 38 and AOFB and a temporary camp. The Russian pilot was instructed to head as far upstream of the ice drift as possible to lengthen the drift of the Ice-Based Observatory (IBO) of 4 buoys that were to be deployed, and seek a relatively flat multiyear floe 2.5 to 3.5 m thick, at least 100 m in diameter, with ridges no greater than 2-3 m in height. However all of the ice in the region was similar first year ice (~1.8 m thick) formed the previous autumn, so we had to settle for thinner ice. After about 2 hours, the helicopter landed on a large flat floe about 500 m in diameter with modest ridges all around at 88.5 °N, 148 °E - about 80 miles upstream of Barneo. The weather was clear with light winds and air temperatures around -15 °C.

Immediately upon landing, a 5 cm hole was augered through a selected floe to determine the floe thickness, then the helicopter was shut down and the gear unloaded. While the helicopter waited, 3 NPEO personnel constructed the 8'x20' winter tent and heater on the floe which took about an hour, while the deployment team staged the instrumentation and camp provisions. After a short briefing on the flare gun and rifle, all but 3 boarded the MI-8 and departed for Barneo. Our small party was left to live on this floe for the next few days, install the ITP and AOFB buoys on this floe, and when completed would call for the delivery of the IMB and PAWS systems, which would be installed while the tent was being removed. The AOFB was specified to be at least 25

m from all the other buoys and the same distance away from any ridges. After the placement of the buoys was determined, and a working tent some of the deployment apparatus were assembled, our efforts turned toward outfitting our living quarters with cots, melting ice for drinking and cooking water, and bringing food inside for defrosting.

The following day started off with similar weather conditions as the previous day. Deployment of ITP 38 began around 0900 UTC by augering the 11-inch diameter hole through the icefloe. An hour and a half later the ITP profiler was in the water and passed its first communications test. Another hour later (by 1140 UTC) the surface package was in place over the system, and the profiler again tested positively. Deployment of the AOFB began after lunch 90 paces away from the ITP surface float. The ice thickness at the AOFB site was 1.85 m thick, with 15 cm of freeboard and 33 cm of snow (however the ice thickness only a few paces away for the thermistor string was only 1.4 m). The wind picked up some during this time which slowed the deployment somewhat, but still took less than 2 hours. Over the next 2 hours, the ice thermistor string was installed, and all testing completed positively.

On April 20, the Russian MI-8 helicopter arrived in the afternoon with the other 2 buoys. The tent was removed while the IMB and PAWS buoys were deployed in 1.5-1.6 m thick areas of the ice. The consistent 30 cm of snow across the floe may have hid variations in floe thickness that would have been apparent if the surface topography was visible. A NOAA/PMEL webcam was also installed at this time. After a 45-minute flight back, the deployment team and all gear were returned to Barneo and were transported back to Svalbard on the following day.

ITP38 Data Processing

The 1011 profiles that were recovered from the ITP were processed according to the procedures described in the ITP Updated Data Processing Procedures. However, vertical coverage became intermitted when first up profiles (beginning with number 905) and then also down profiles (beginning with number 958) failed to cover the full depth range. Downs recovered for a few profiles just before the record ended.

Following a very clean first half of the record, a significant difference between up and down profiles suddenly appeared by profile 487, and, together with increased profile noise, remained for the rest of the dataset. Various attempts to remove the hysteresis via sensor lags were unsuccessful. However, these profiles seemed "not bad enough" to be completely removed, and instead were marked as "questionable" (quality flag = 1).

The dataset was processed according to the procedures described in the ITP Updated Data Processing Procedures. The processing parameters for this ITP are shown in the figures to the right. Thermohaline staircases were initially present but not well developed (and not recognizable after profile 486). After comparing different options, we relied primarily on standard lag settings that had worked well in the past for well operating ITPs, with small adjustments to correct small up/down hysteresis between profiles 404 to 486, or to correct spikes, etc. when possible.

The noise and up/down hysteresis during the second half of the record showed some variability. In particular, a set of profiles from 698 to 721 was significantly worse, and also included the only large "spike" in the conductivity adjustment ("rat"). Presumably it was affected by an additional contamination, and together with a small number of individual outlier profiles, was removed from the dataset, as were some of the very short profiles towards the end of the record.

ITP38 Data Description

The ITP profiler was configured to operate with on a fast sampling schedule of 4 one-way profiles between 7 and 750 m depth each day. In the surface package, the GPS receiver was powered hourly to obtain locations, and buoy temperature and battery voltage status were recorded.

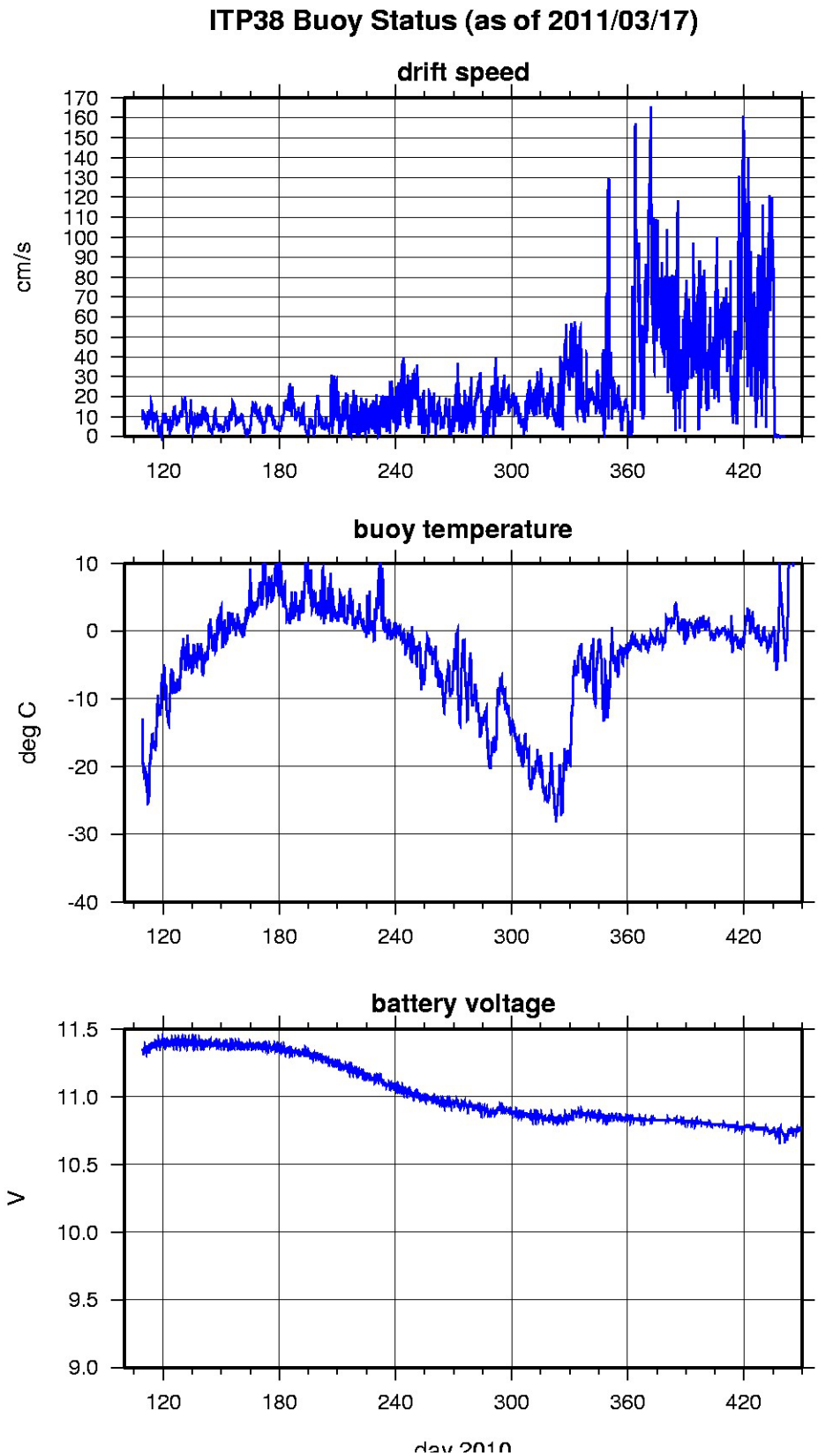
The buoy drifted rather slowly towards Fram Strait along the Eurasian side of the Lomonosov Ridge approaching within 30 km of the North Pole on May 23, 2010. The system then drifted south through the Fram Strait, picked up speed, had difficulty profiling, and significant fouling in the East Greenland current until the profiler stopped communicating on December 24. The surface package continued to provide GPS locations until mid-March when it washed ashore on the north coast of Iceland.

The plots below are of the final, calibrated, edited data (as opposed to the raw data presented on the active instrument pages).

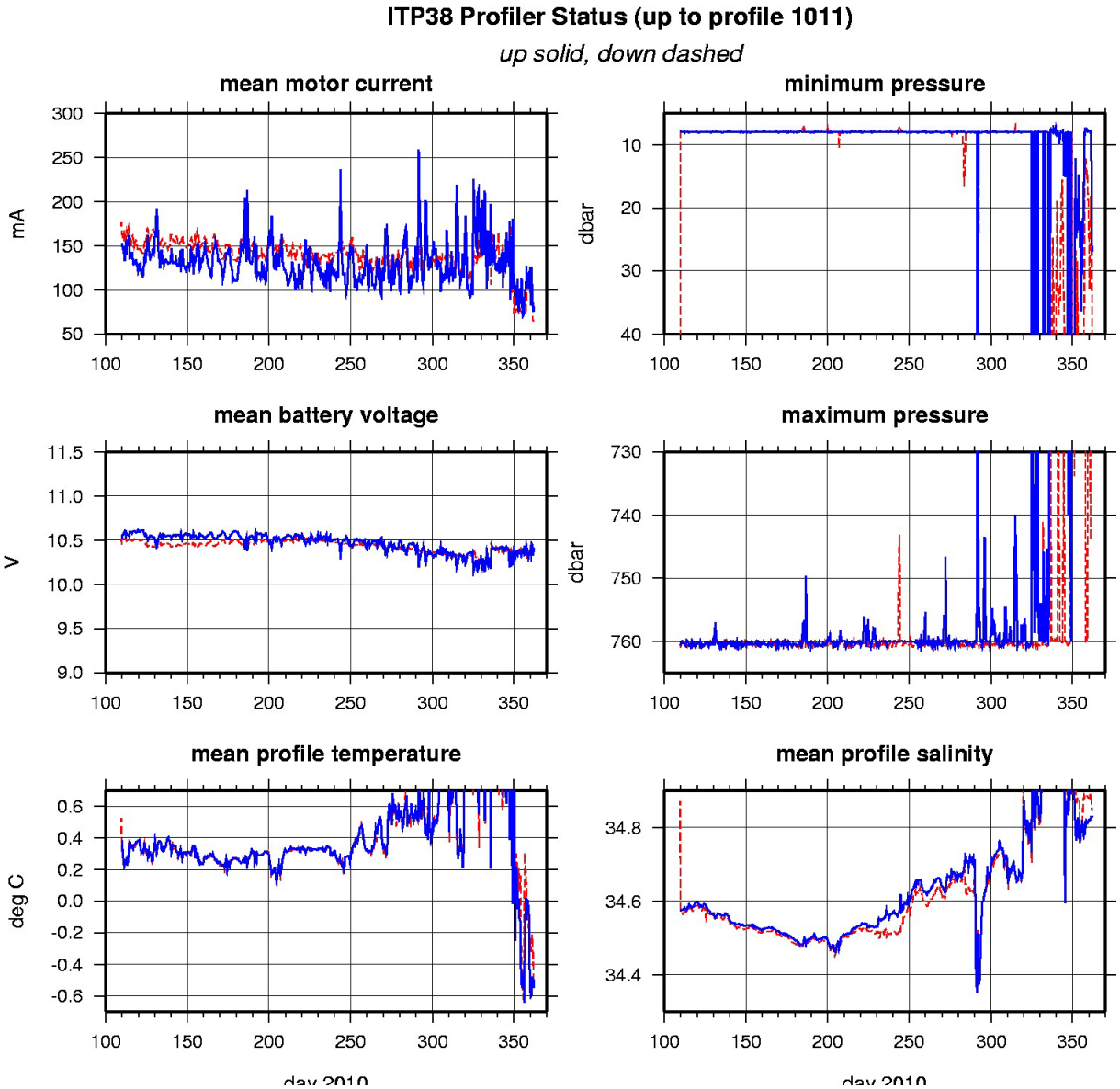
Level II hourly buoy location data in ASCII format: itp38rawlocs.dat

Level III 1-Hz processed profile data in MATLAB format: itp38cormat.tar.Z or itp38cormat.zip

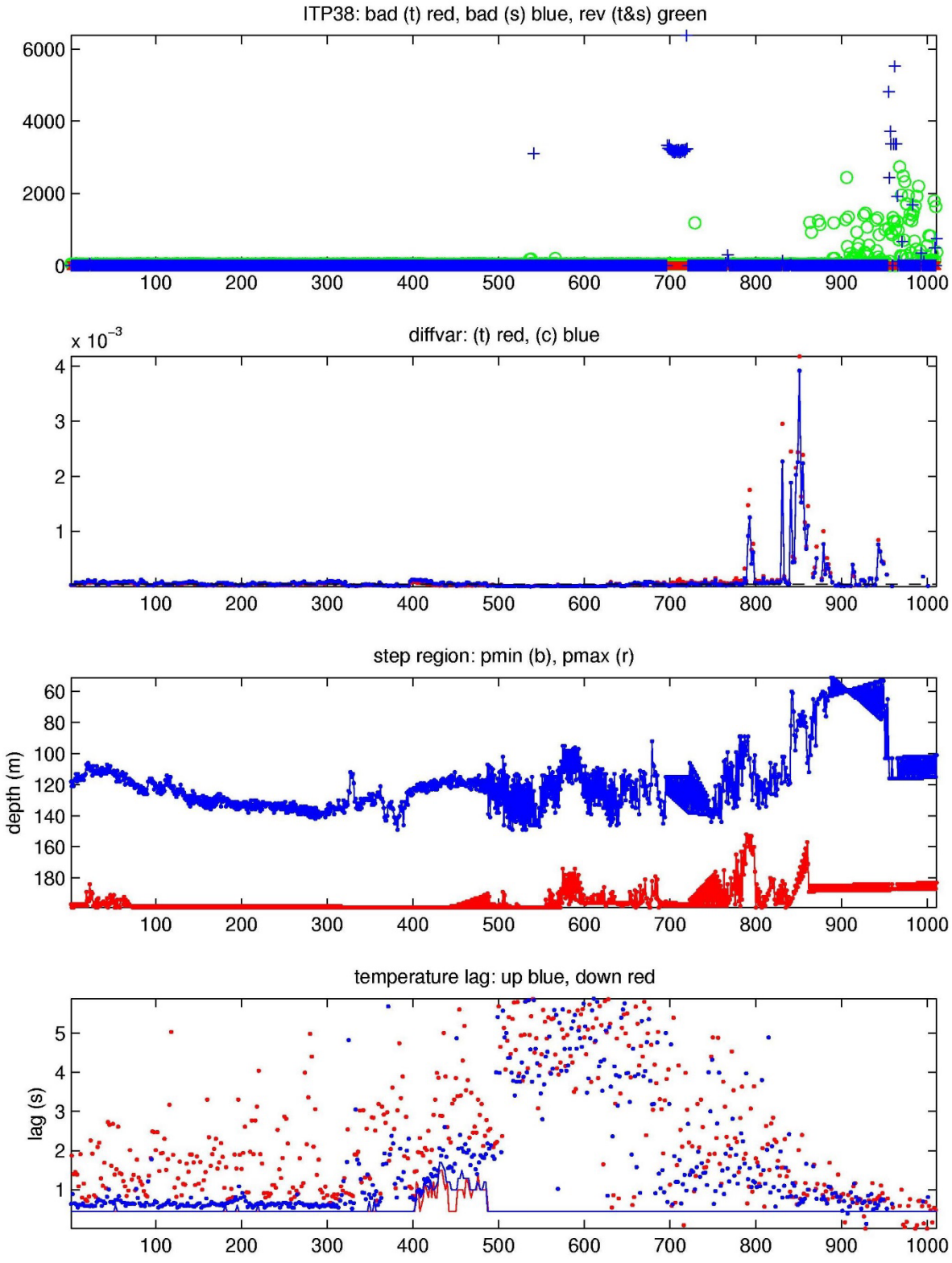
Level III 1-db bin-averaged processed profile data in MATLAB format: itp38final.mat
Level III 1-db bin-averaged processed profile data in ASCII
format: itp38final.tar.Z or itp38final.zip



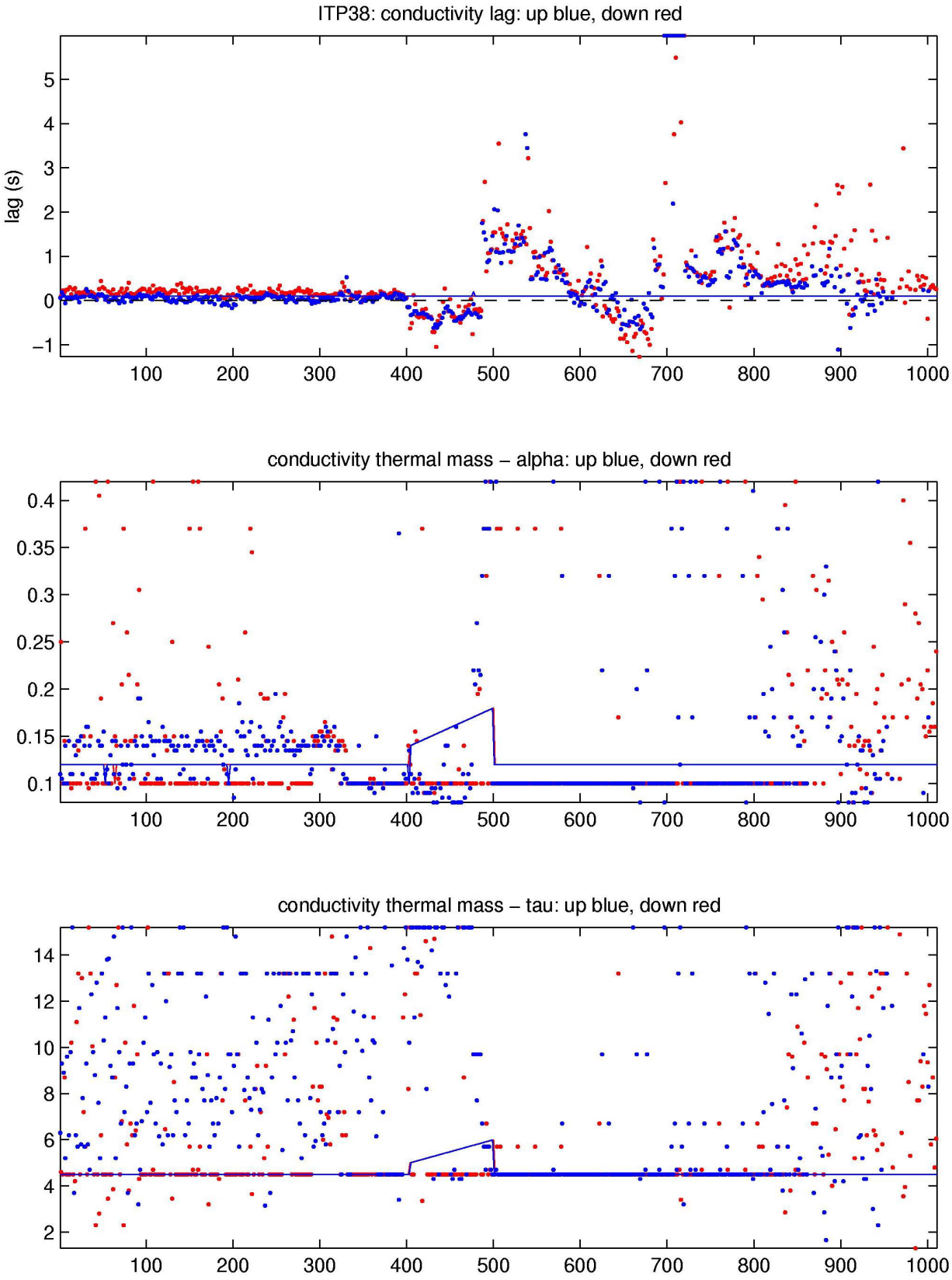
ITP surface buoy status



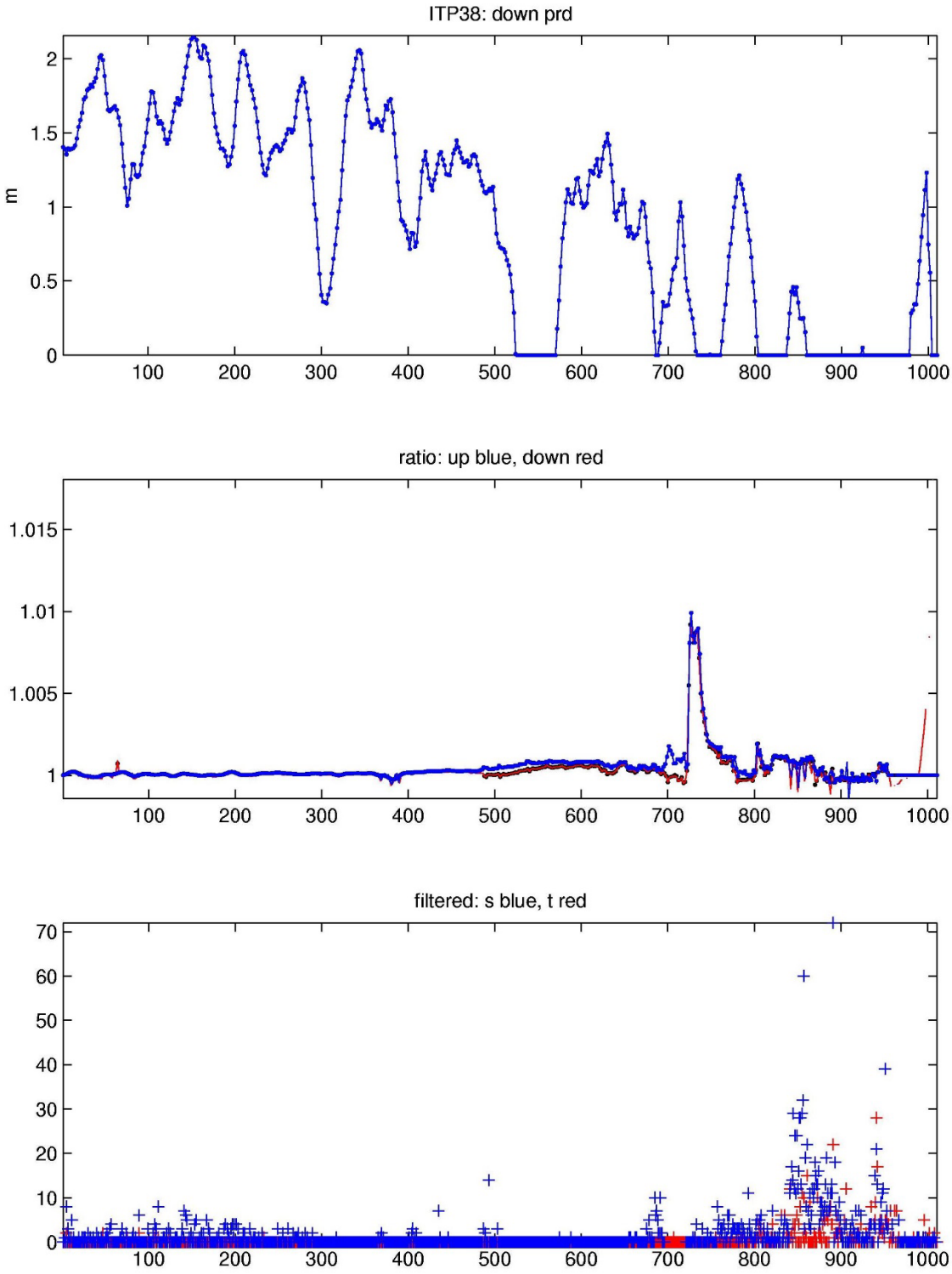
ITP profiler engineering data.



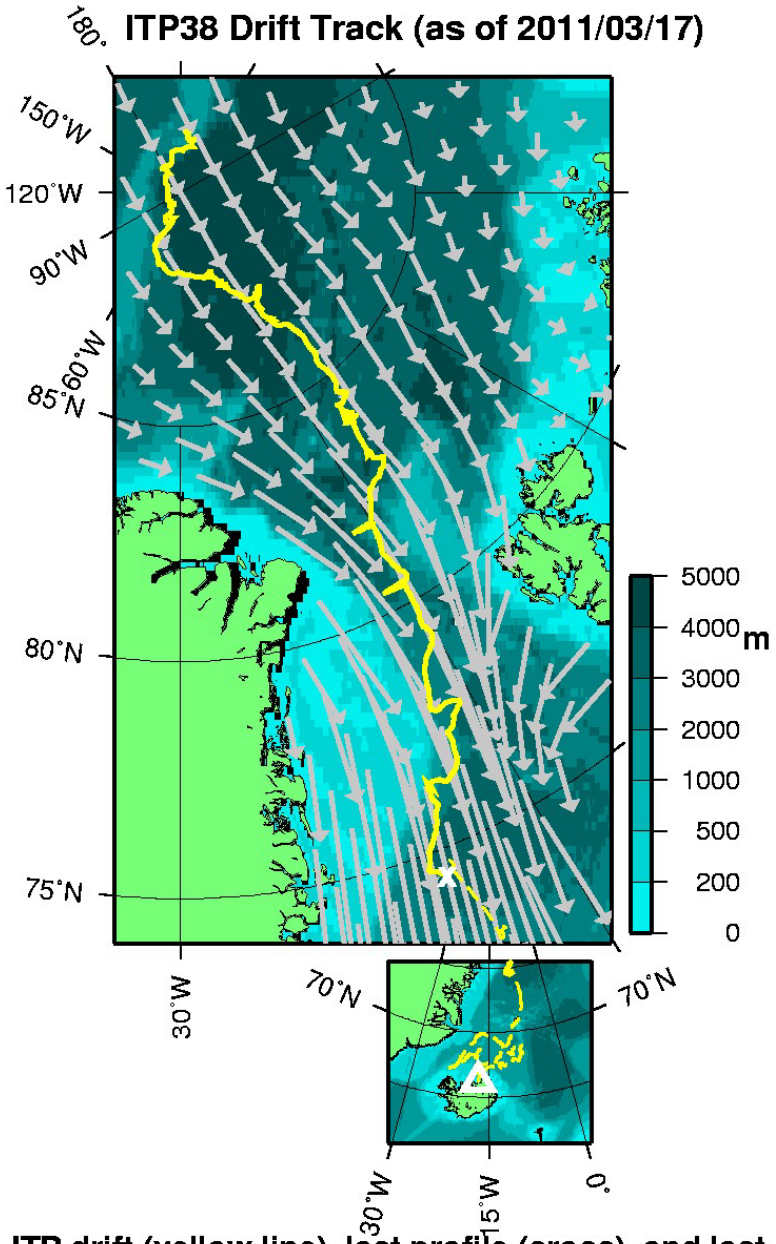
Number of bad points removed (top); variance of vertical difference of temperature and salinity in step region for up-going profiles; depth of staircase layer; temperature lag (bottom).



Top: conductivity lag, Middle: conductivity thermal mass amplitude correction, Bottom: conductivity thermal mass lag correction.

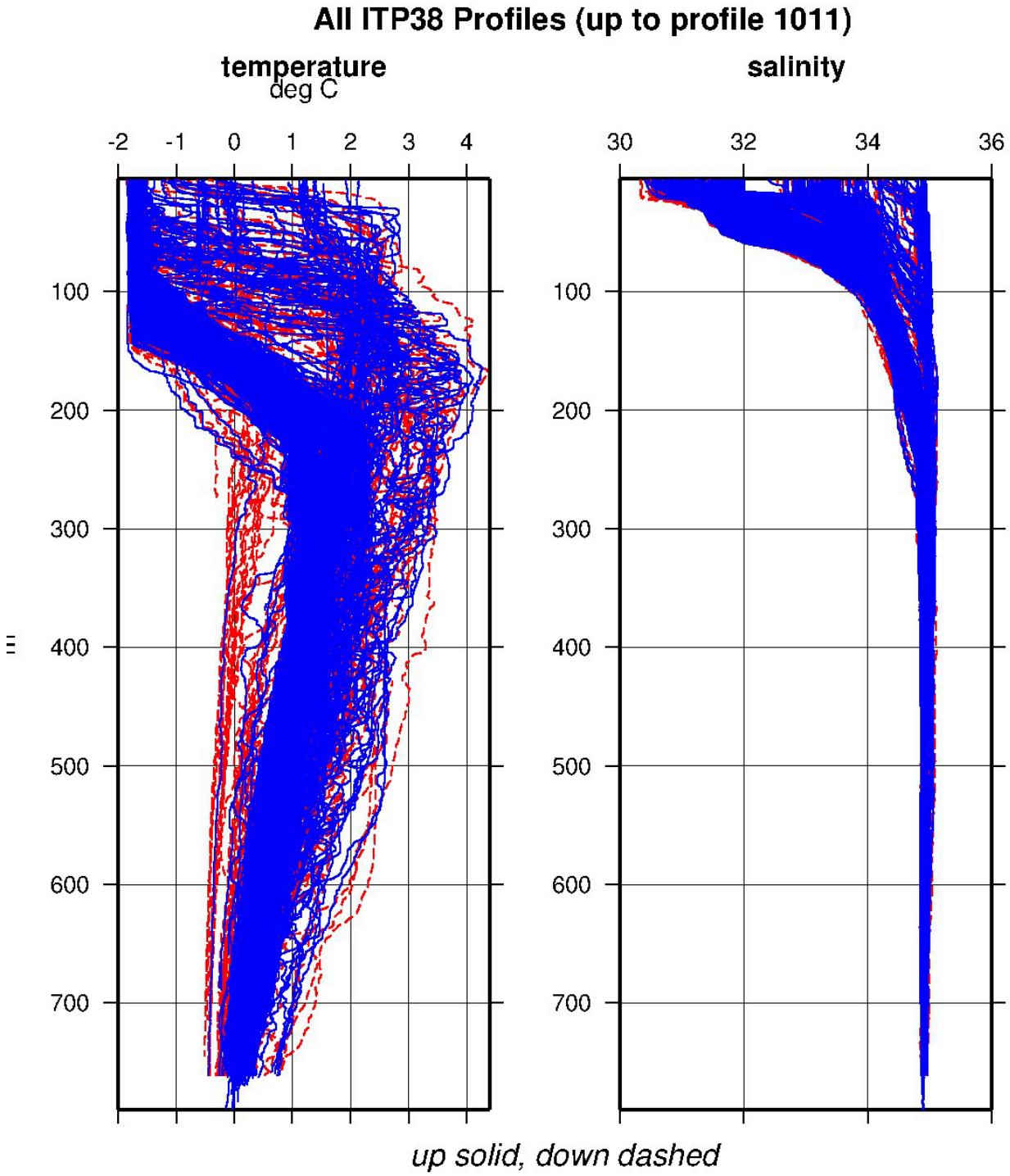


Down pressure deviation correction (top); mega-lag adjustment; salinity ratio adjustment; number of filter spikes (bottom).

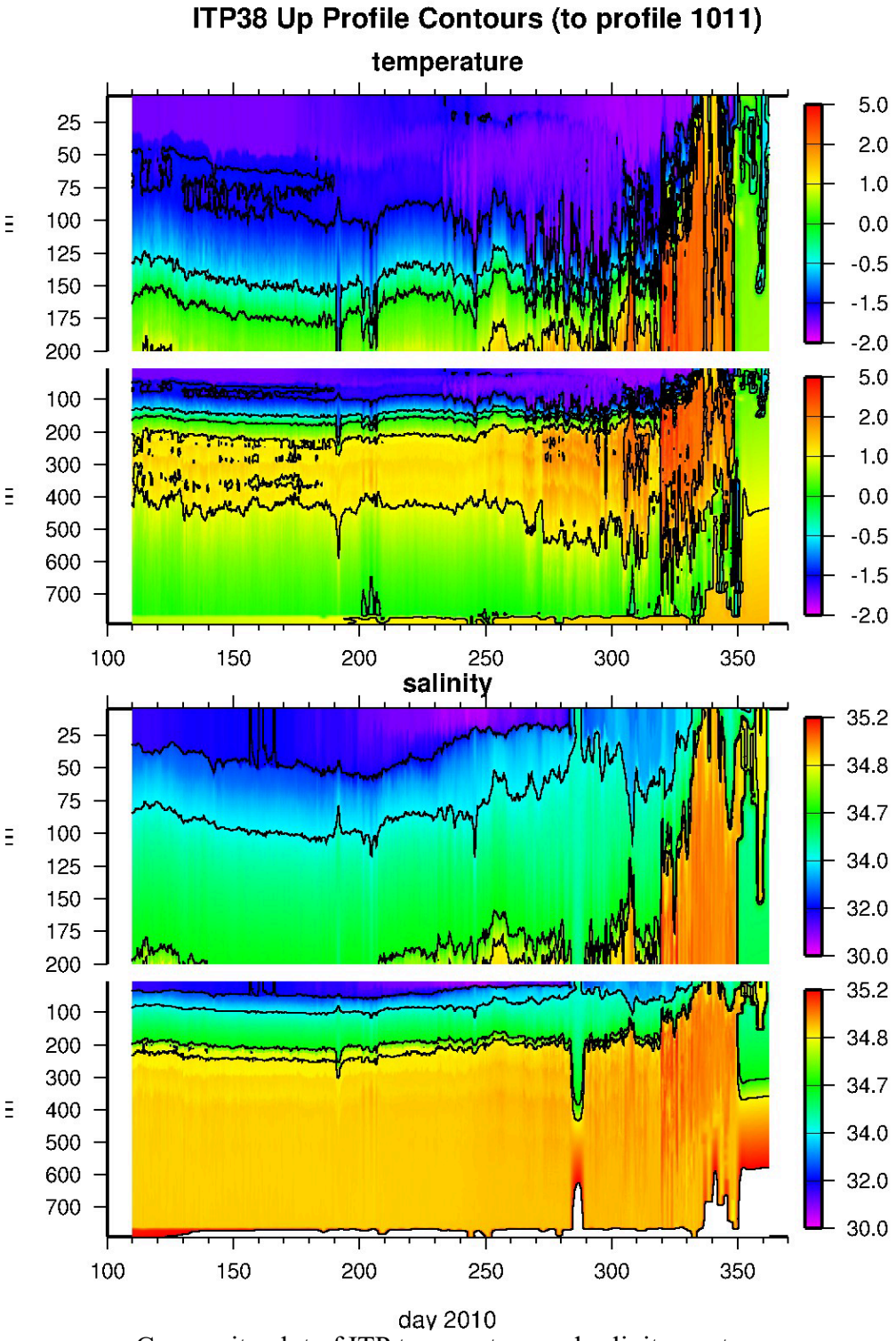


ITP drift (yellow line), last profile (cross), and last location (triangle), and annual ice drift from IABP (grey vectors) on IBCAO bathymetry (shading).

Plot of buoy locations.

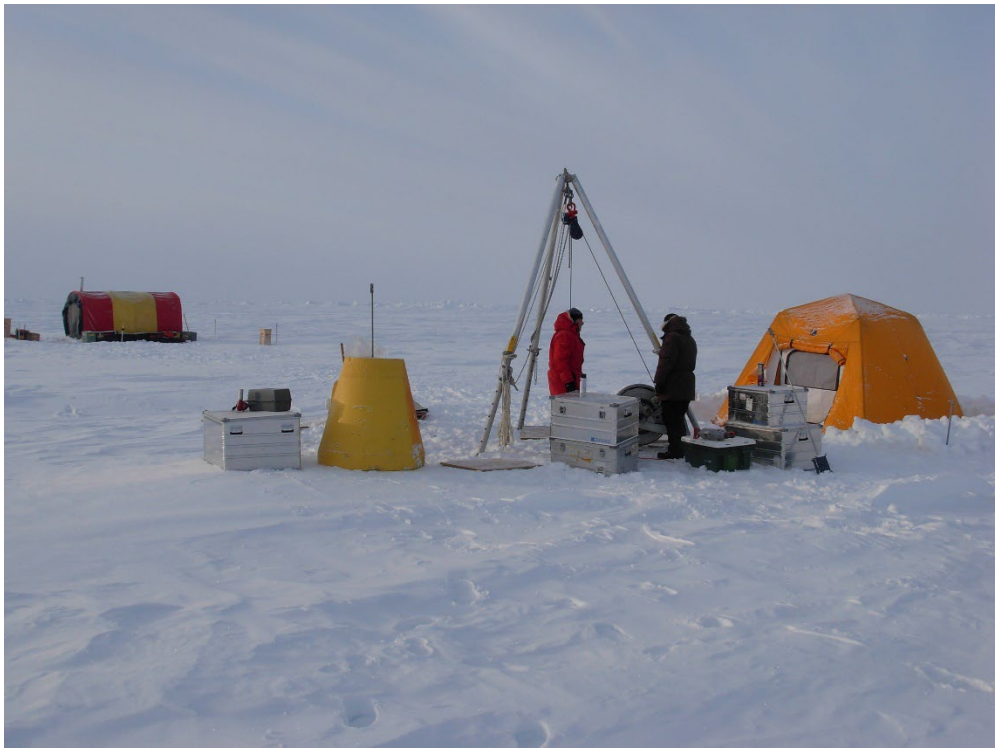


ITP 38 temperature and salinity contours



Composite plot of ITP temperature and salinity contours.

View of the ice-based observatory deployed from a remote ice camp near the North Pole in 2010 consisting of PAWS, AOFB, IMB, and ITP 38 shortly after deployment. (Rick Krishfield)



Having passed the profiler communications test, Newhall and Pietro unspool the ITP tether outside the working tent, living quarters are the tent to the left. (Rick Krishfield)