ITP 54 Overview

Deployment Location: 8/6/2011, 22:00 UTC at 77° 0.1'N, 140° 5.7'E

Last Location: 8/27/2014, 23:00 UTC at 82° 24.5' N, 173° 40.3' W

Duration: 1117 days

Distance Traveled: 11,071 km

Number of profiles: 1055 in 351 days

Other instruments: IMBB 2011-J, AOFB 25, 3 Ice Beacons, Uptempo

ITP54 was deployed on a 2.23 m thick ice floe in the Beaufort Sea as part of the Beaufort Gyre Observing System (BGOS) during the JOIS 2011 cruise on the CCGS Louis S. St. Laurent. On the same icefloe, a Naval Postgraduate School Arctic Ocean Flux Buoy (AOFB 25), a US Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Mass Balance Buoy (IMB 2011-J), a Yale University array of 3 MetOcean Ice Beacons, and an Uptempo buoy were also installed. The ITP included a dissolved oxygen sensor and a fixed SBE-37 Microcat at 6 m depth and operated on a standard sampling schedule of 2 one-way profiles between 7 and 760 m depth each day.

ITP54 Deployment Operations

The day after the deployment of an Ice-Based Observatory (IBO) including ITP 52 (and only 2 days after the deployment of ITP 53), a second IBO consisting of seven different buoys (including ITP 54) measuring different environmental parameters was to be deployed. In order to accommodate the many systems, a relatively large diameter floe was needed. A helicopter reconnaissance was conducted in the morning, and after about 45 minutes of searching, a floe approximately 200 m in diameter was selected for landing. Drill sites measured between 2.7 and 4.5 m thick, so the site was acceptable, and the ship was brought nearby.

Over the next 6 hours, all seven buoys were deployed by several teams while ice measurements were taken by other scientists. Simultaneously 4 drifters were deployed by helicopter in a 10 km array around the floe. Towards the end of the deployment, fog arrived again, as it had during the previous day's deployment operations.

ITP54 Data Processing

Out of the 1055 profiles that were apparently performed by the ITP profiler, software problems with the inductive modem circuit prevented all except for 106 of the CTD profiles from being received by the surface package which were subsequently telemetered. These were processed according to the procedures described in the ITP Updated Data Processing Procedures. The processing parameters for are shown in the figures to the right. Of the profiles communicated to

the surface package, buoy drift speeds were almost always less than 30 cm/s so the profiler covered close to the full vertical extent except for a few profiles.

This particular ITP was the first outfit with the newer IMM hardware rather than the SIM/UIM configuration of earlier units in order to allow a microcat to be added to the tether at a fixed depth and that higher temporal resolution (15 minute) T&S data to also be communicated to the surface package on the same circuit. However, in this prototype the shorter engineering files were able to be conveyed to the surface unit, but the longer CTD files often timed out before being successfully sent. Consequently, the 106 CTD profiles received were within the first 230 profiles that the profiler conducted but were not all consecutive and included gaps. Thermohaline staircases were present during the time series, enabling CTD lag correction estimates. The lags started in typical ranges but drifted, particularly after profile 163.

Communications between the surface unit and microcat were better, and all samples were received for the first 170 days (until January 23, 2012). Then there was a gap of over 225 days (until June 5, 2012) until the next samples from the microcat were received by the surface package. Subsequent gaps occurred between July 12, 2013 and September 8, 2013 (58 days), September 16, 2013 and June 15, 2014 (272 days), and June 23, 2014 and June 25, 2014 (1 day). The last microcat data were acquired on July 5, 2014. No corrections have been applied to the microcat T&S data.

ITP54 Data Description

The ITP profiler was configured to operate on a standard sampling schedule of 2 one-way profiles between 7 and 750 m depth each day. In the surface package, the GPS receiver was powered hourly to obtain locations hourly, and buoy temperature and battery voltage status were recorded.

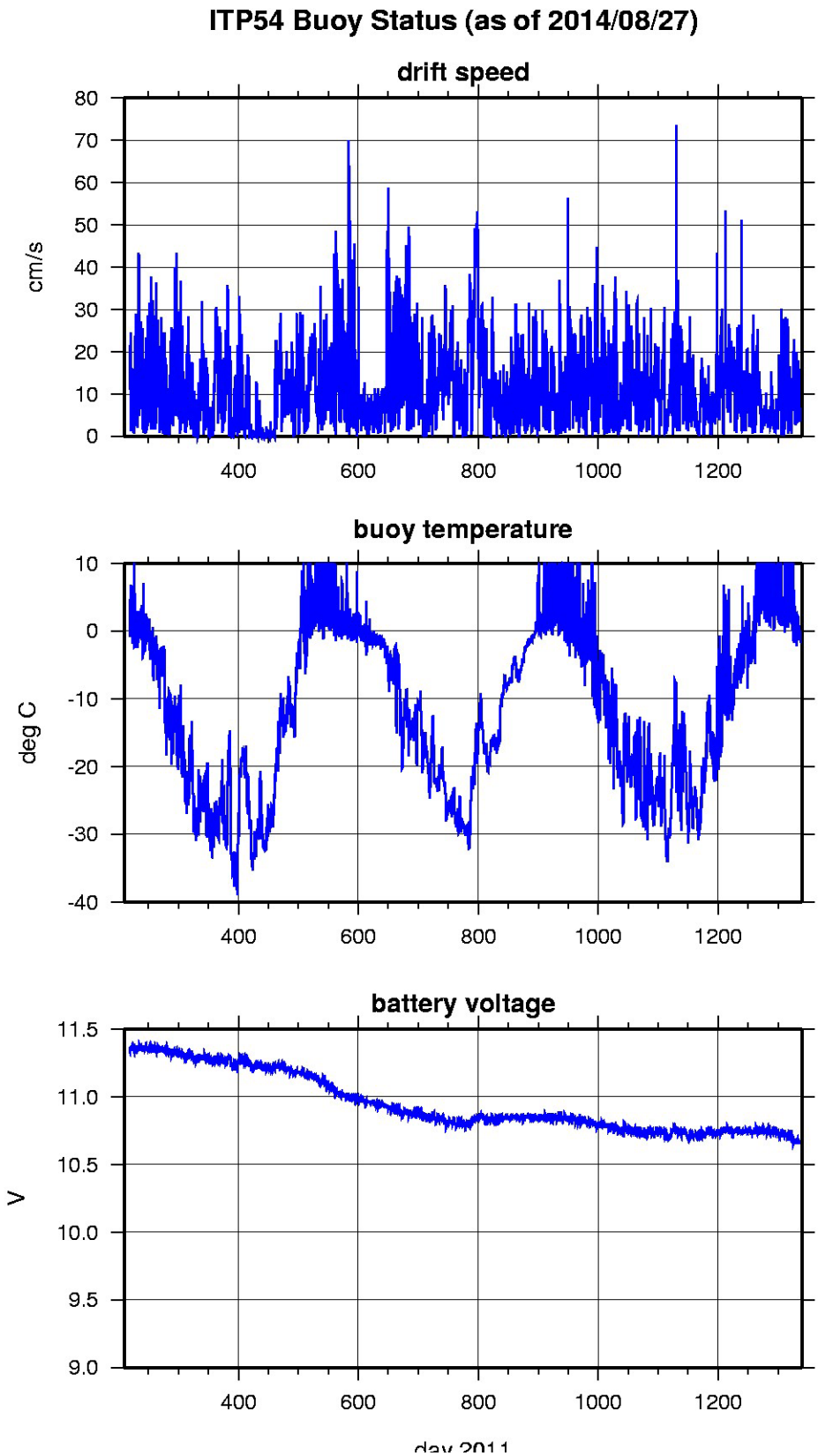
The buoy circulated with the anticyclonic Beaufort Gyre circulation, first heading southward, then westward and northward over the Chukchi Plateau bathymetry, back eastward into the basin, and then southward and westward over the Chukchi shelf. After crossing the dateline (180° longitude) the buoy eventually meandered westward of the Mendelyev Ridge and northward to over 82°N before finally ceasing to transmit after travelling over 11,000 km in over 3 years. While the microcat provided data (with some large gaps) until July 2014, the last communications from the ITP profiler occurred on August 9, 2012 and the received CTD profiles terminate on October 22, 2011 while the system was still in the Beaufort Sea eastward of 143°W longitude.

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

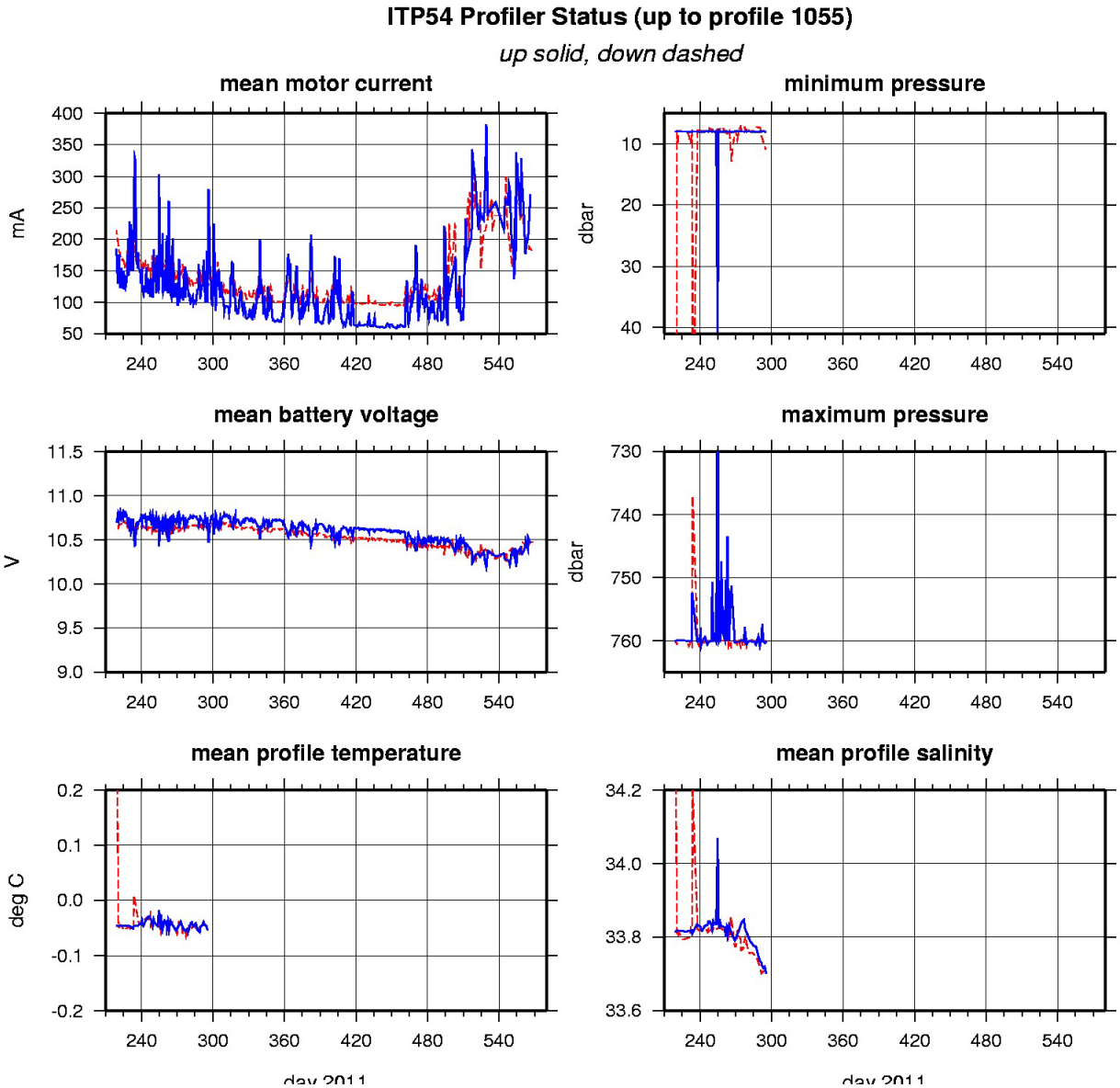
Level II hourly buoy location data in ASCII format: itp54rawlocs.dat

Level III 1-Hz processed profile and microcat data in MATLAB
format: itp54cormat.tar.Z or itp54cormat.zip

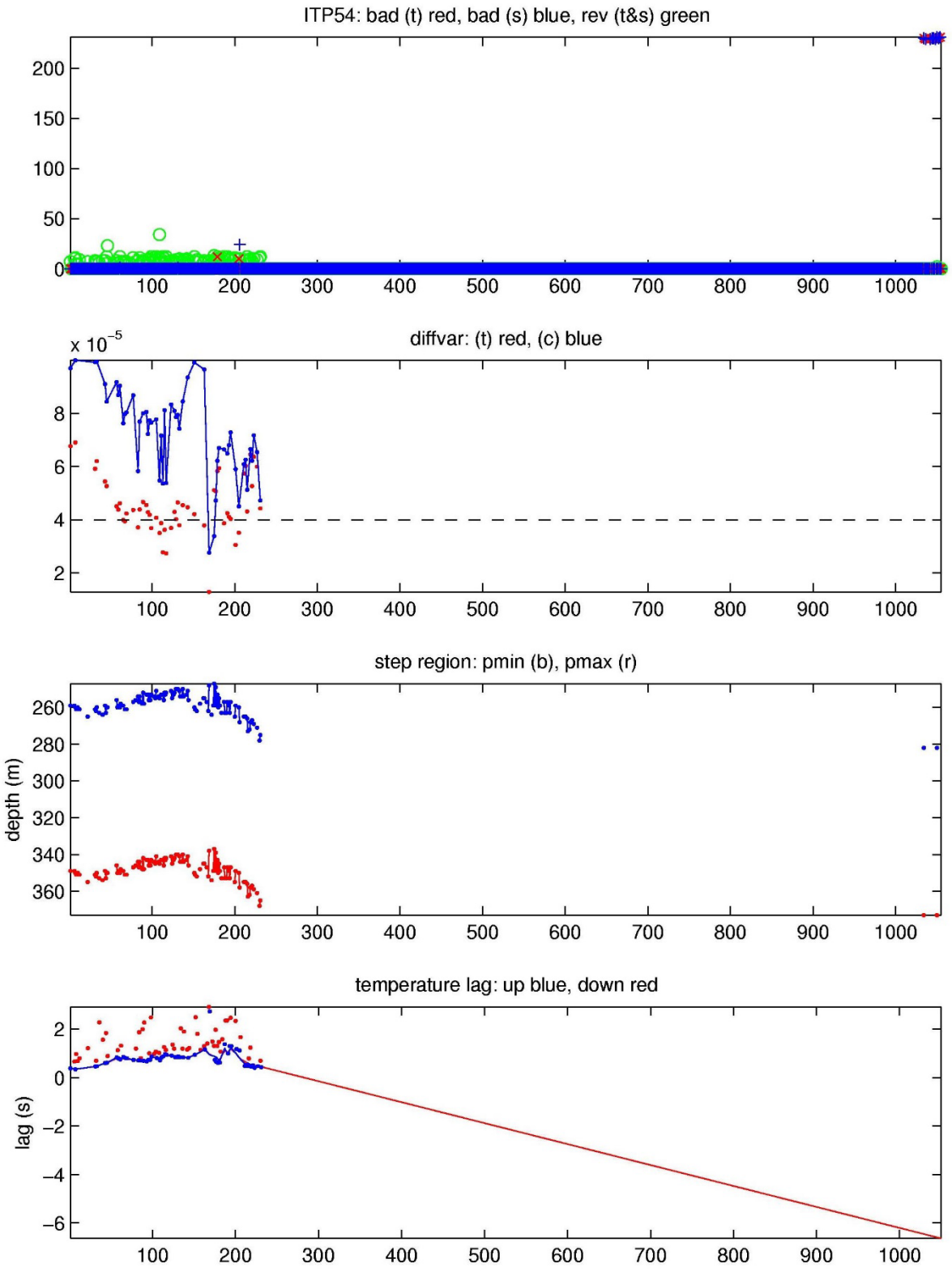
Level III 1-db bin-averaged processed profile and microcat data in MATLAB format: itp54final.mat
Level III 1-db bin-averaged processed profile and microcat data in ASCII format: itp54final.tar.Z or itp54final.zip



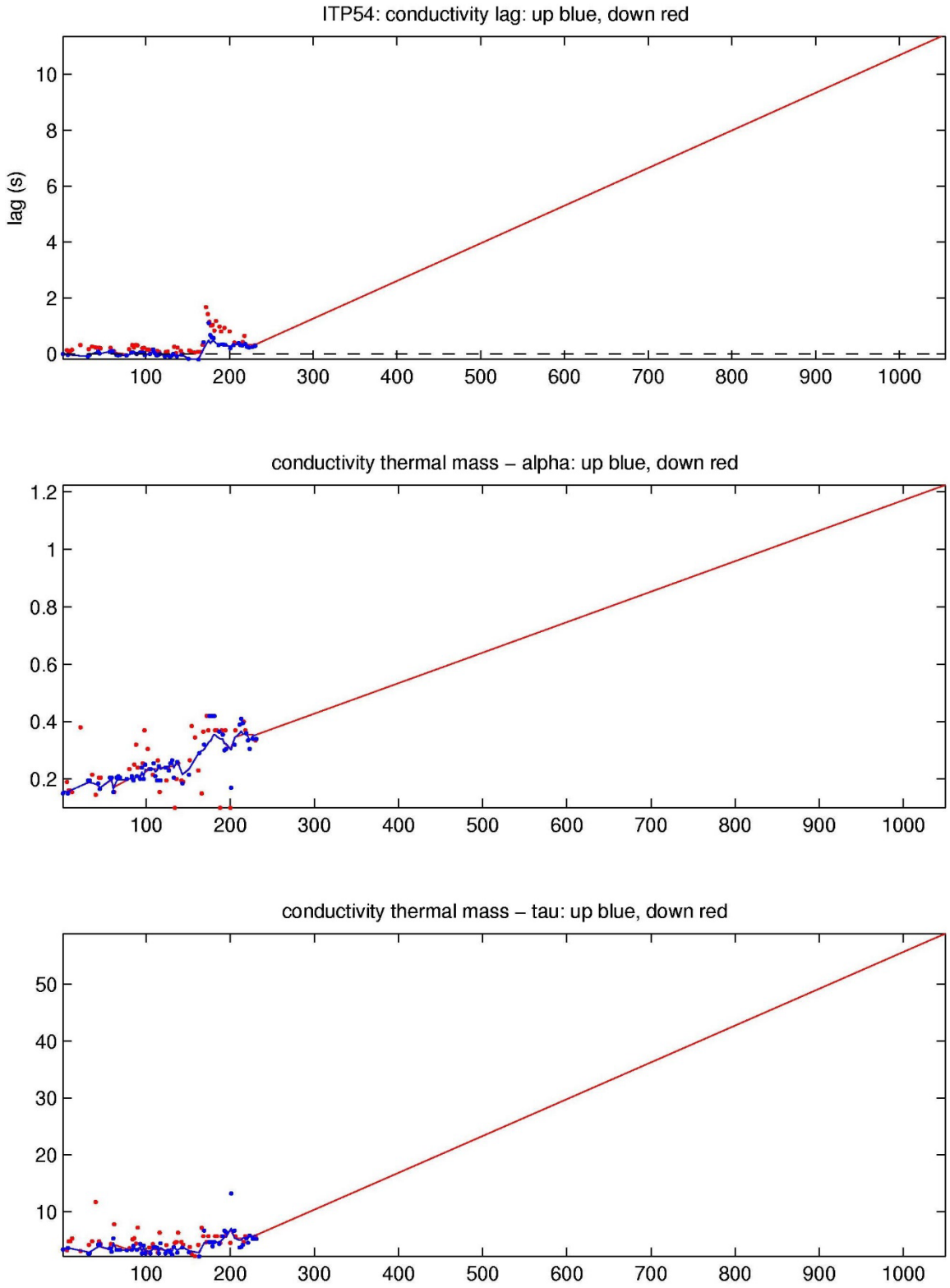
ITP Surface Buoy Status.



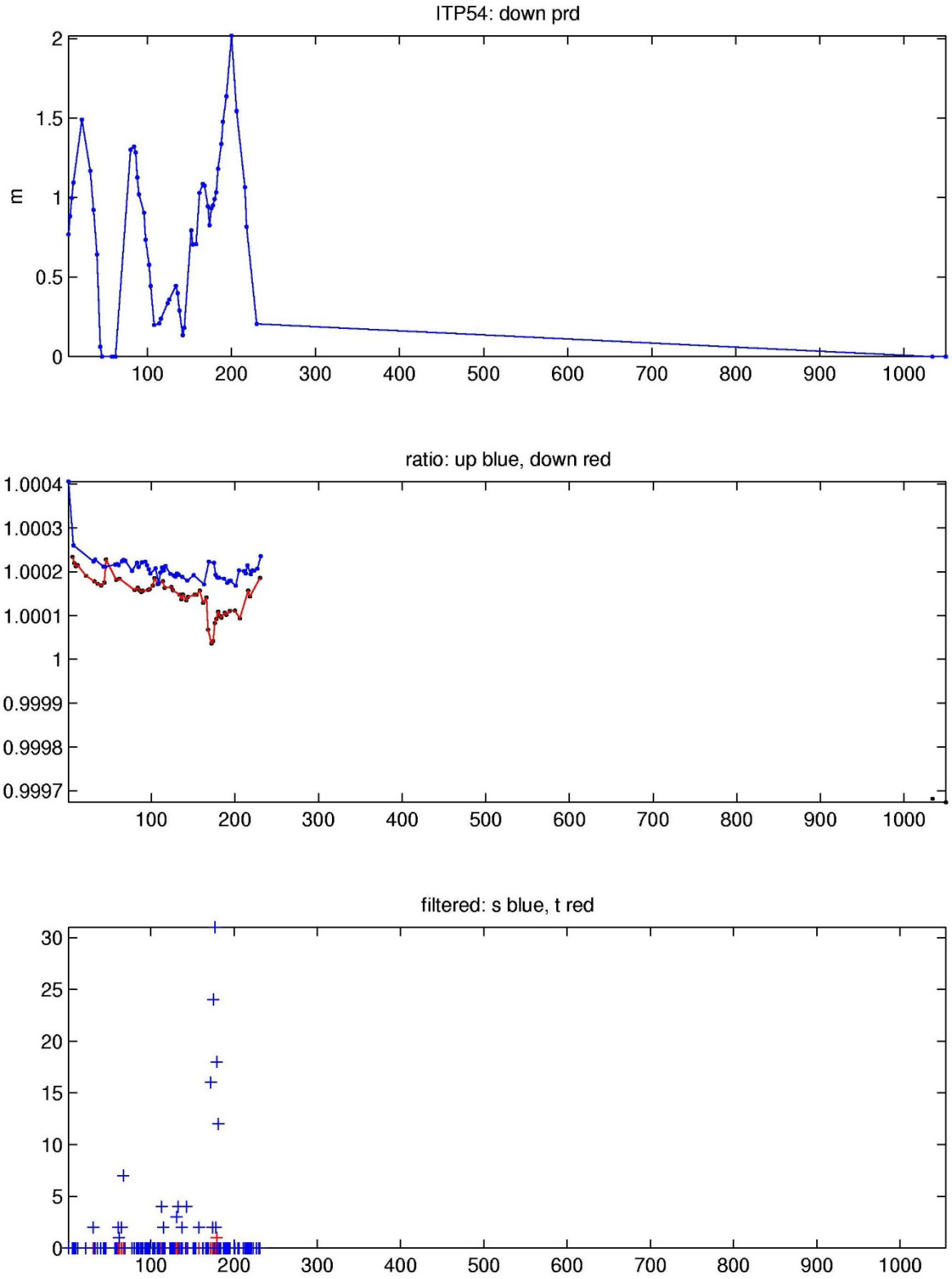
ITP profiler engineering data.



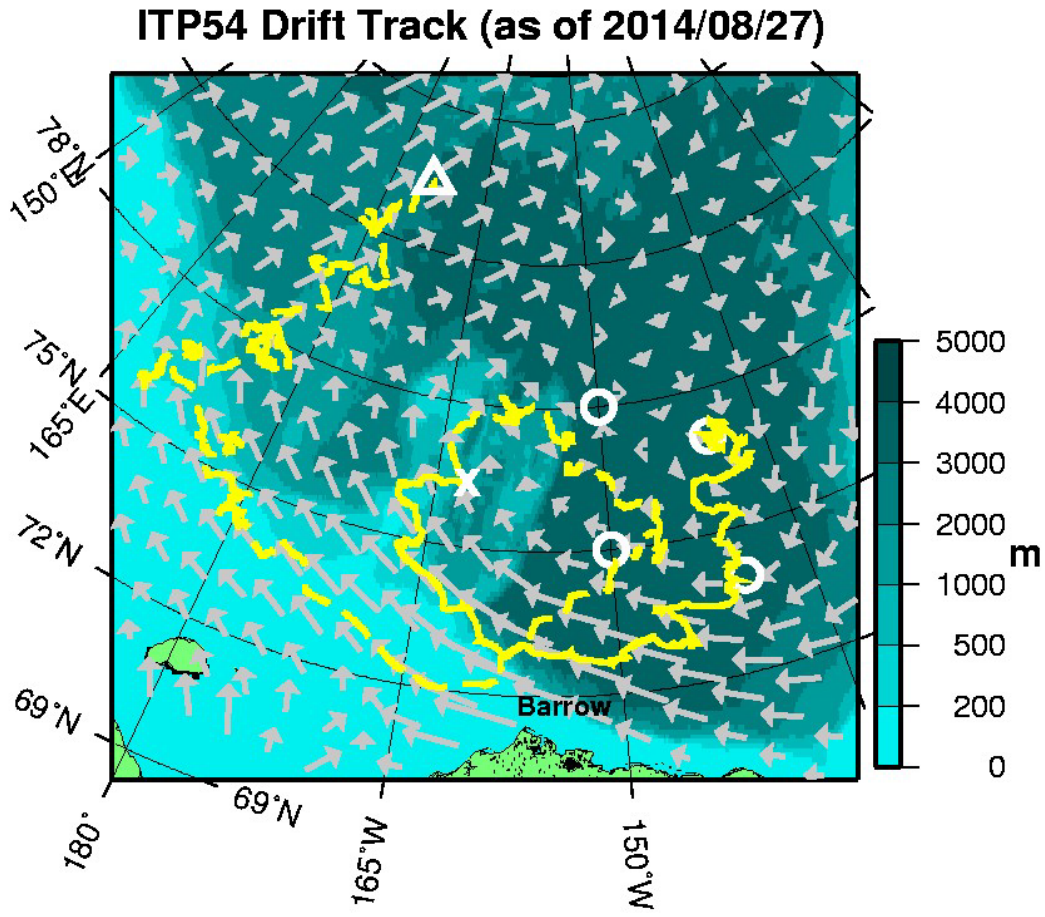
Top: number of bad points removed, Middle: variance of verticle difference of temperature and salinity in step region for up-going profiles, Bottom: temperature lag.



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

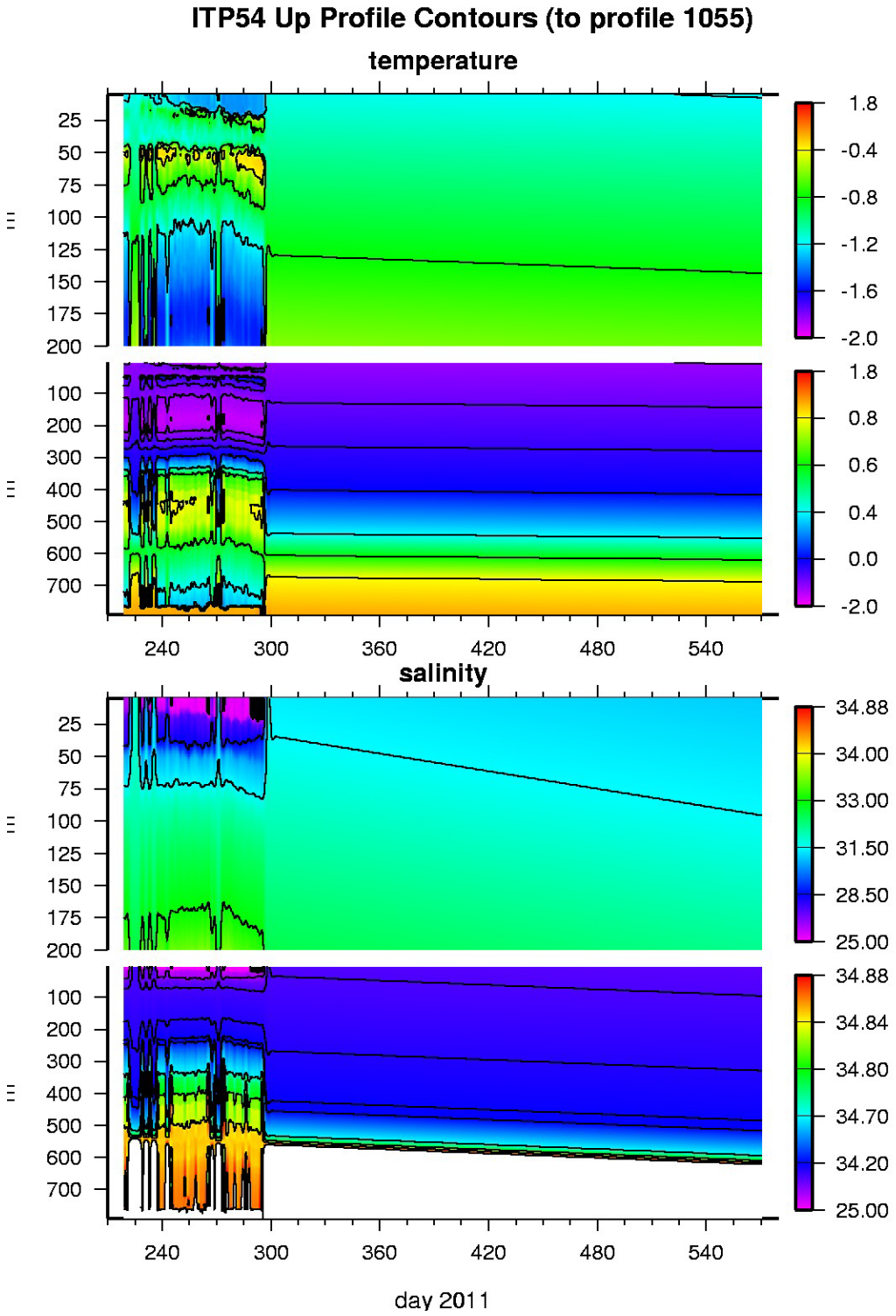


Top: down pressure deviation correction, Middle: salinity ratio adjustment, Bottom: Number of filtered spikes.

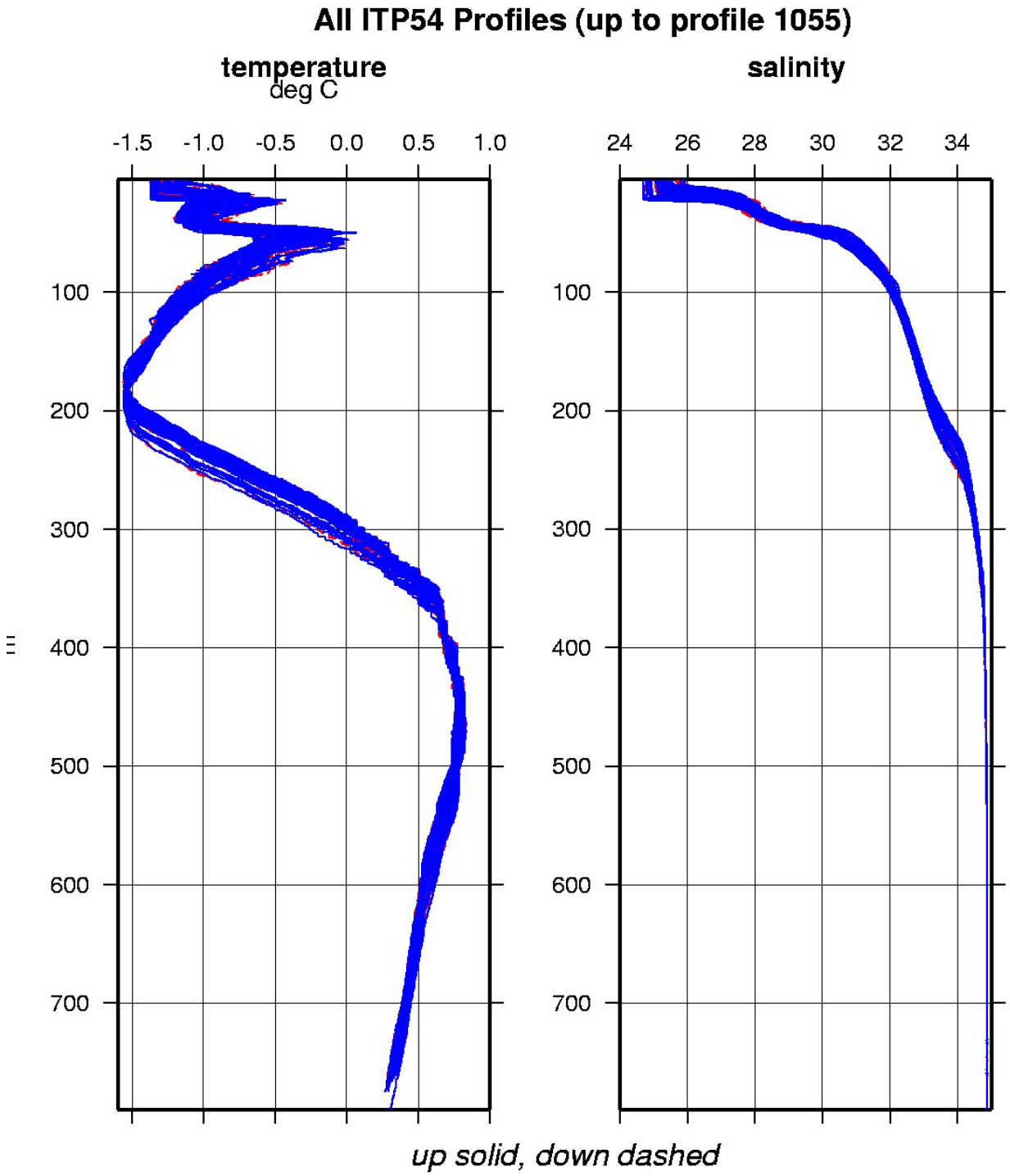


ITP drift (yellow line), last profile (x), last location (triangle), BGOS moorings (white circles) and annual ice drift from IABP (grey vectors) on IBCAO bathymetry (shading).

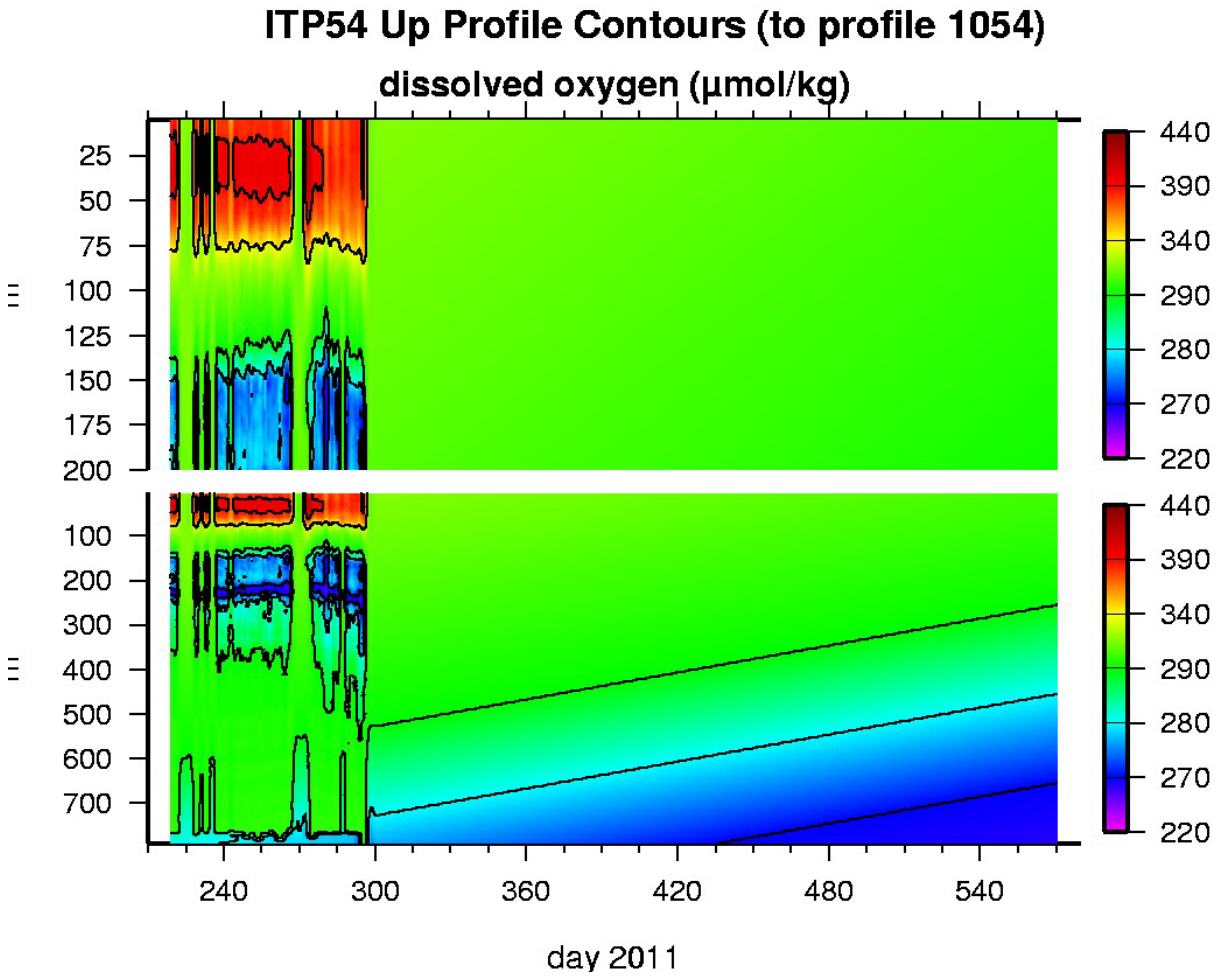
Plot of buoy locations.



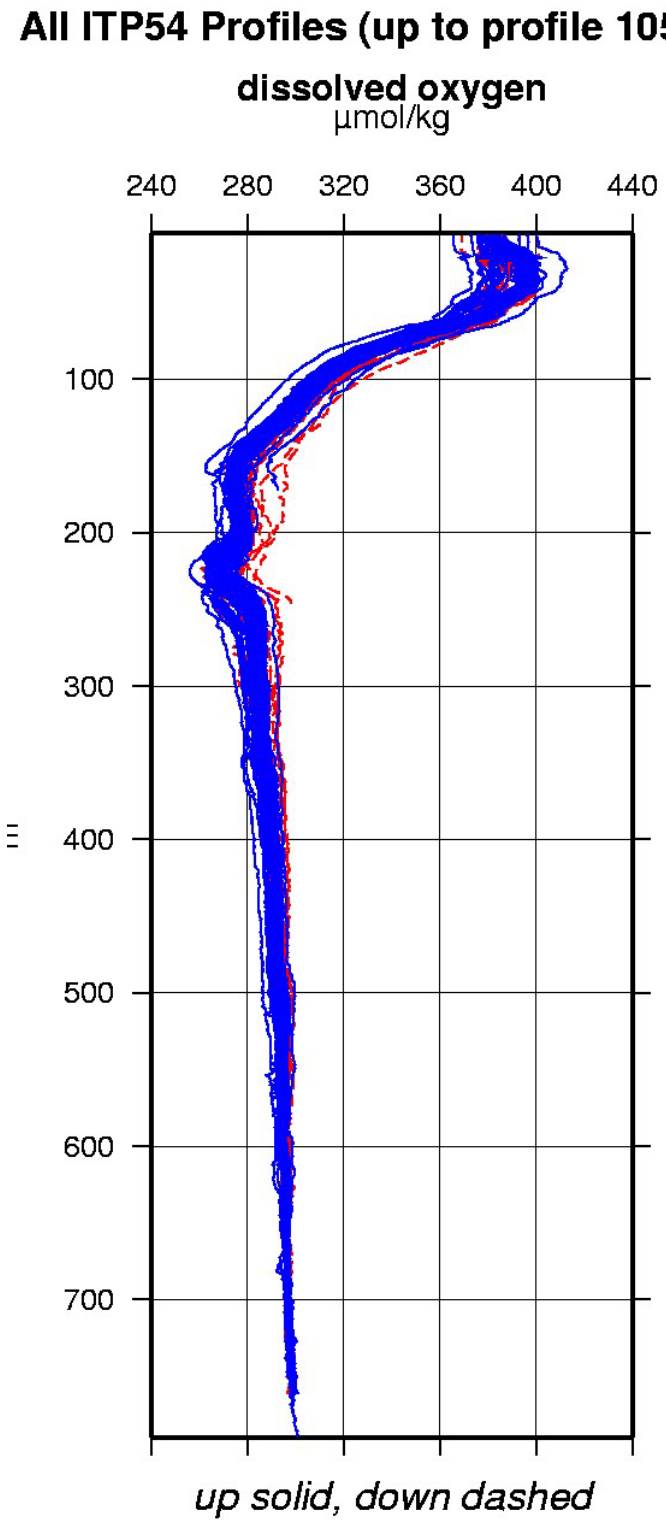
ITP54 temperature and salinity contours.



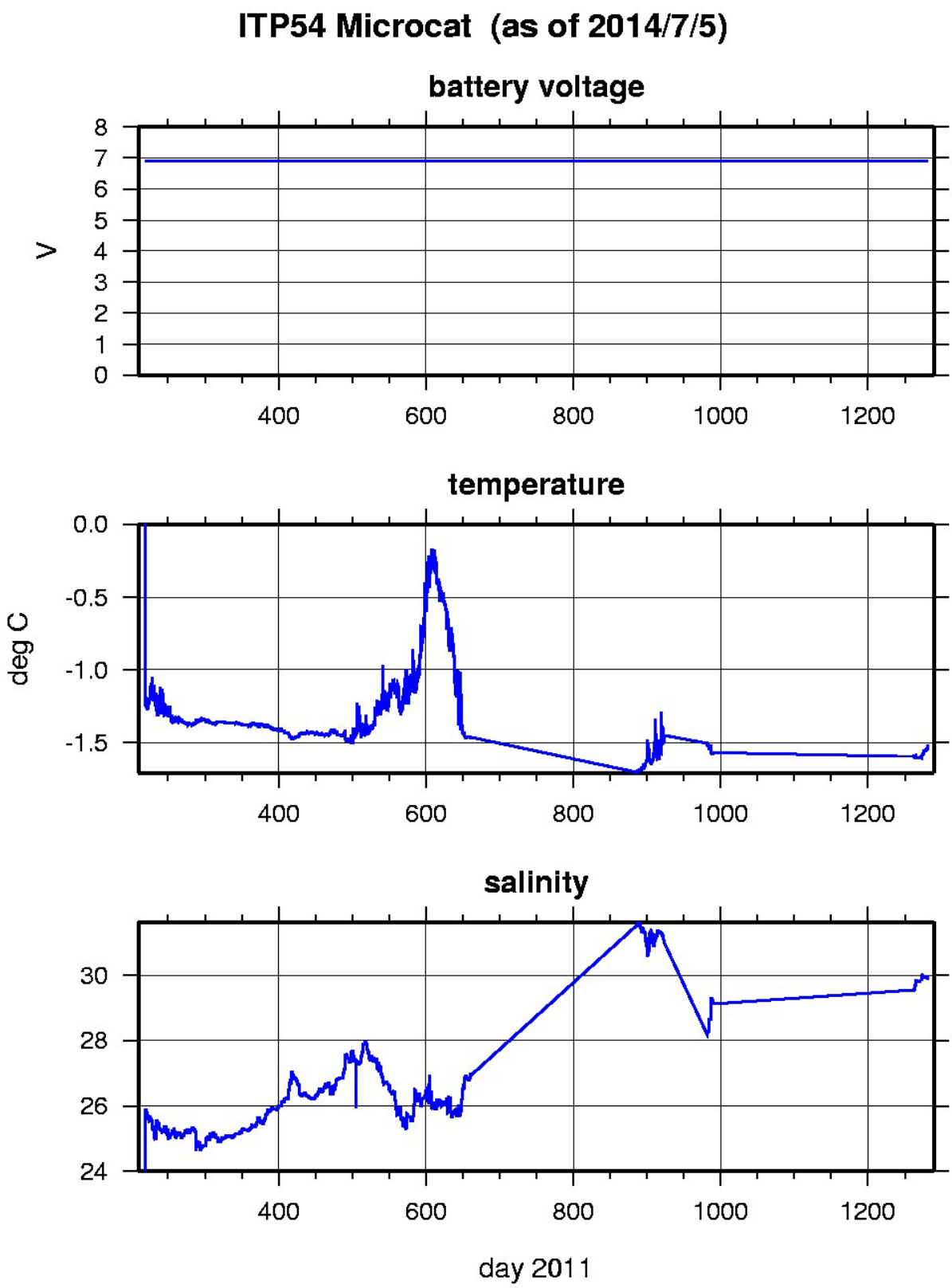
Composite plot of ITP temperature and salinity contours.



ITP 54 dissolved oxygen contours.

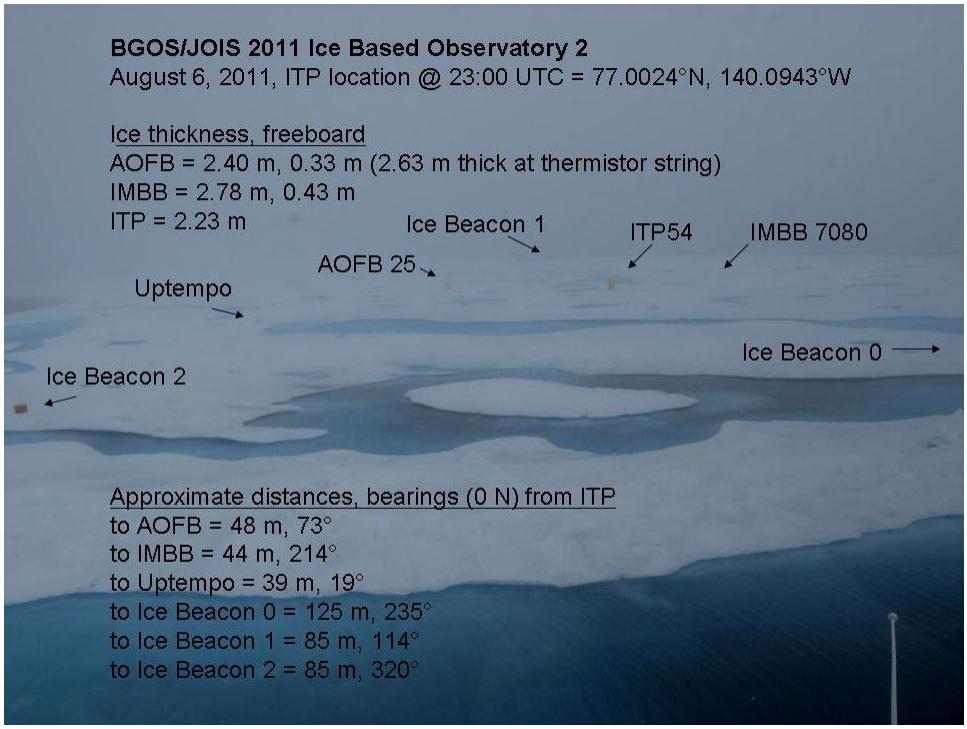


Composite plot of ITP dissolved oxygen profiles.



Plot of Microcat time series.

Through the fog, the IMB and CCGS Louis St. Laurent are barely visible behind ITP 54 shortly after deployment. (Rick Krishfield)



The distribution of the buoys on the floe, ice thickness and freeboard measurements at the buoy sites of the second IBO deployed during JOIS 2011. (Rick Krishfield)