ITP43 Overview

Deployment Location: 10/8/2010, 01:00 UTC at 76° 42.9'N, 135° 11.7'W

Last Location: 2/10/2011, 23:00 UTC at 74° 26.5' N, 143° 12.9' W

Duration: 126 days

Distance Traveled: 1287 km

Number of profiles: 253 in 126 days

Other instruments: AOFB 21, IMB 2010-F, O-buoy

ITP 43 was deployed on a 2.45 m thick ice floe in the Beaufort Sea as part of the Beaufort Gyre Observing System (BGOS) during the JOIS 2010 cruise on the *CCGS Louis S. St. Laurent*. On the same icefloe, a Naval Postgraduate School Arctic Ocean Flux Buoy (AOFB 21), a US Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Mass Balance Buoy (IMB 2010-F), and an autonomous atmospheric chemistry buoy (O-Buoy 2) were also installed. The ITP included a dissolved oxygen sensor and operated on a standard sampling schedule of 2 one-way profiles between 7 and 760 m depth each day.

ITP43 Deployment Operations

On October 6, 2010, the second and final Ice-Based Observatory was to be deployed during the JOIS 2010 expedition. While the weather and visibility were good for surveying ice floes by helicopter reconnaissance, the ice conditions in the region were not so good. During the first reconnaissance in the morning, one landing was made on a floe which was less than 1 m thick, and no other reasonable floes were spotted. In the afternoon reconnaissance no reasonable floes were spotted, so the deployment was postponed.

The following day, a reasonable floe greater than 2 m thick was found on the second landing during the morning helicopter reconnaissance, and the deployments began in the afternoon. In a little less than 6 hours, the four buoy systems were deployed while other researchers performed detailed ice measurements. The air temperature dropped throughout the day, and by the end of operations was less than -16° C.

ITP43 Data Processing

Following its deployment, ITP43 transmitted 253 profiles until February 11, 2011. These were 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. While the profiler was able to reliably profiler vertically throughout the short time series, sensor problems developed after about a month, likely due to a CTD pump failure. Down profiles were severely corrupted and were edited out. With the CTD mounted on the top endcap of the ITP, up profiles

were less severely affected, corrected, as much as possible, and were retained here, albeit marked as "questionable" (qflag = 1).

Thermohaline staircases were present during the initial 60 profiles of the time series, enabling CTD lag corrections there. Stair cases were mostly smoothed out following the pump failure. Larger lag values helped reduce spiking here. Conductivity calibration adjustments (variable "rat") were mostly flat and close to unity, aside from a large adjustment some profiles prior to the pump failure. Some calibration adjustment spikes late in the record appeared triggered by anomalous values in the deepest of three levels of the fit to mapped history CTD conductivities. Their removal (*i.e.*, basing the calibration adjustment on only two of the three levels) reduced the spread in deep ITP densities and TS patterns.

Oxygen processing was mostly straightforward. Again, anomalous patterns in the O2 calibration adjustment towards the end of the record were removed when basing the calibration on the top two of three levels of mapped CTD oxygen.

ITP43 Data Description

The ITP profiler was configured to operate with 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, and buoy temperature and battery voltage status were recorded.

ITP 43 drifted generally southwest through the Beaufort Gyre region over the short 4 month lifetime of the system. At least one warm core and several cold core halocline eddies were encountered. Suddenly, with no indication of any technical problems, the surface package ceased transmitting via Iridium. Meanwhile, the O-buoy continued to operate until July 2011, the IMB until August 2011 and the AOFB until August 2012. It is unclear whether the ITP suffered a catastrophic hardware failure, or was crushed by the ice.

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: itp43rawlocs.dat

Level III 1-Hz processed profile data in MATLAB format: itp43cormat.tar.Z or itp43cormat.zip

Level III 1-db bin-averaged processed profile data in MATLAB format: itp43final.mat
Level III 1-db bin-averaged processed profile data in ASCII
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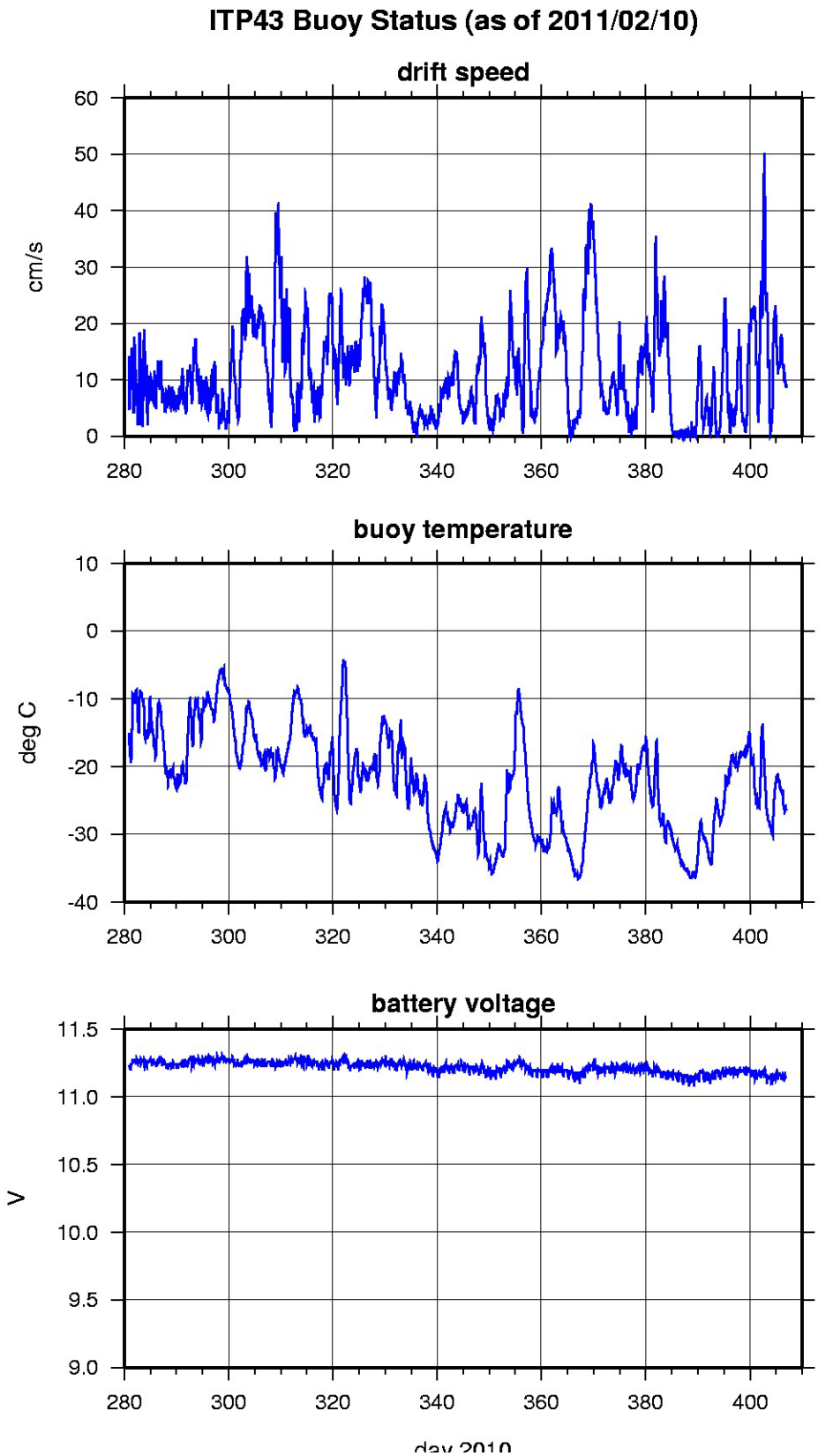
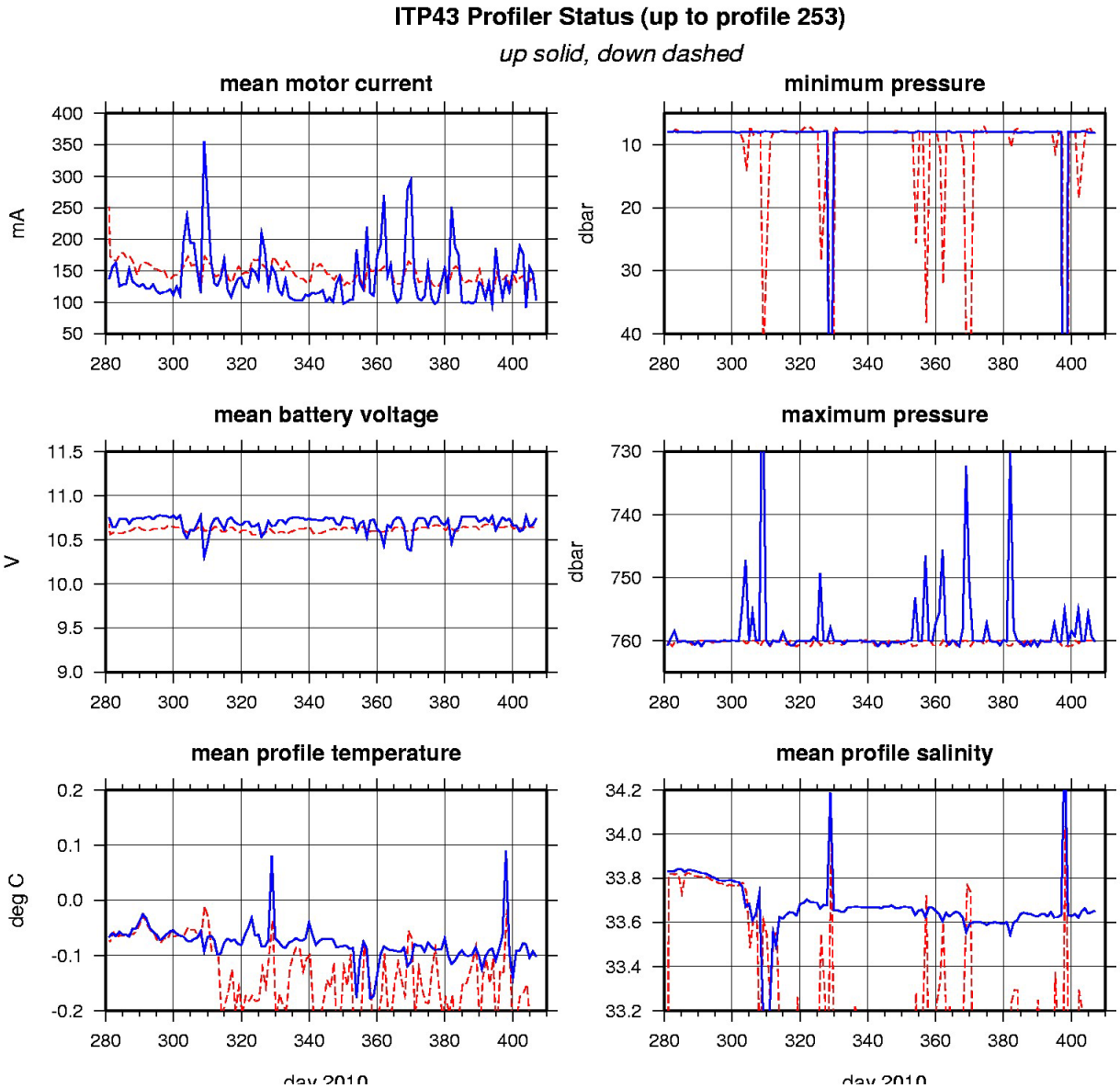
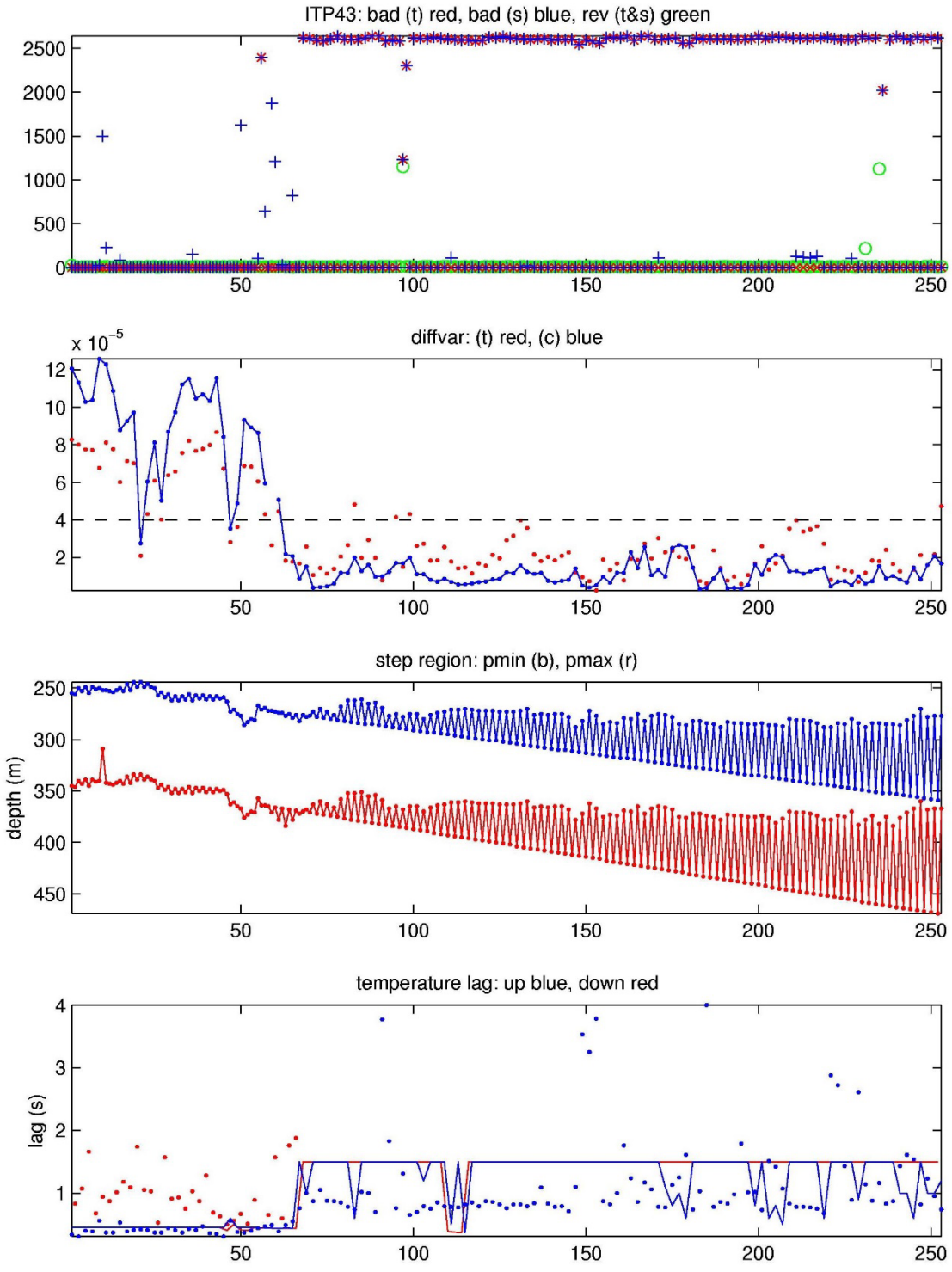


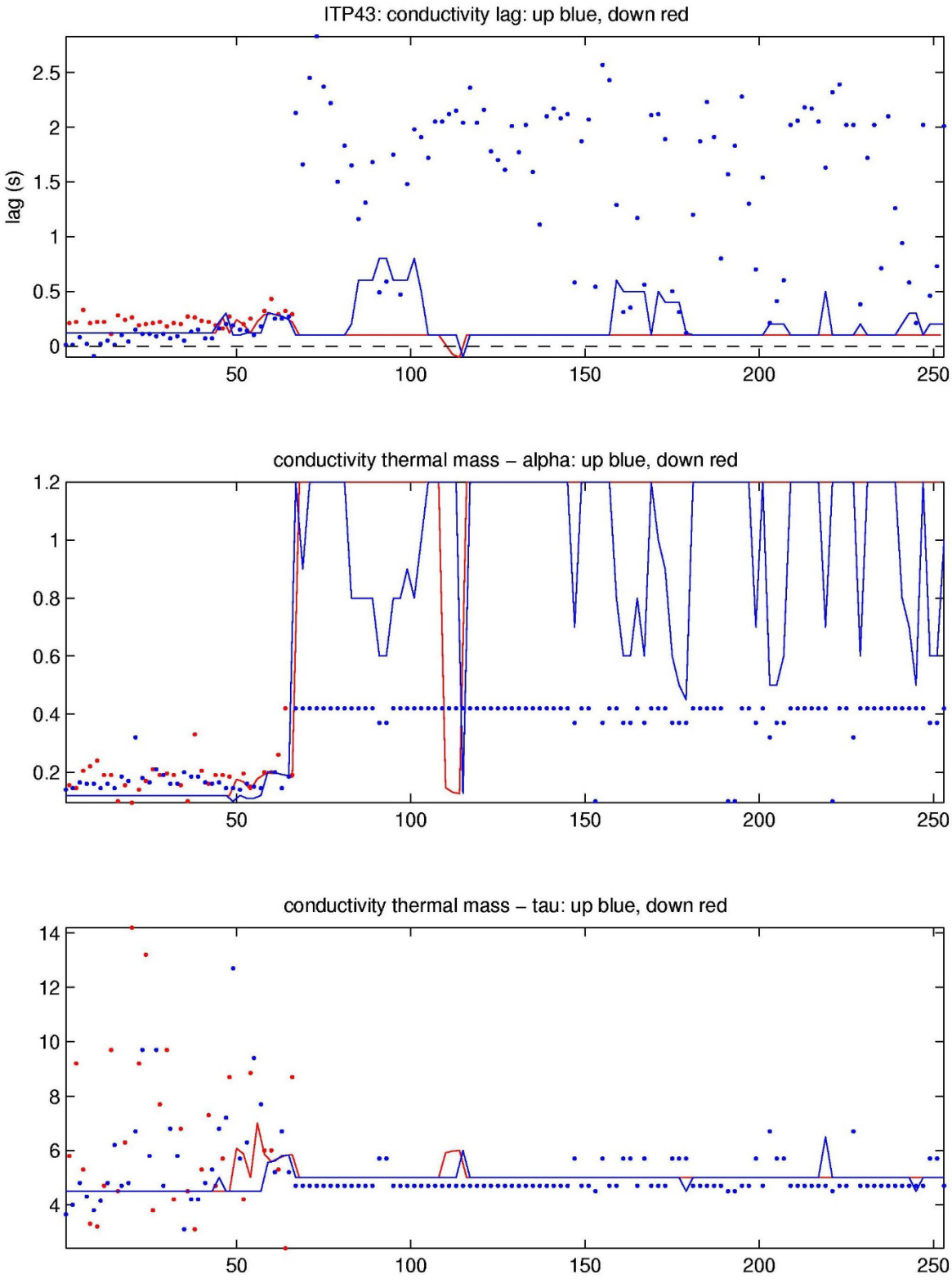
ITP surface buoy status.



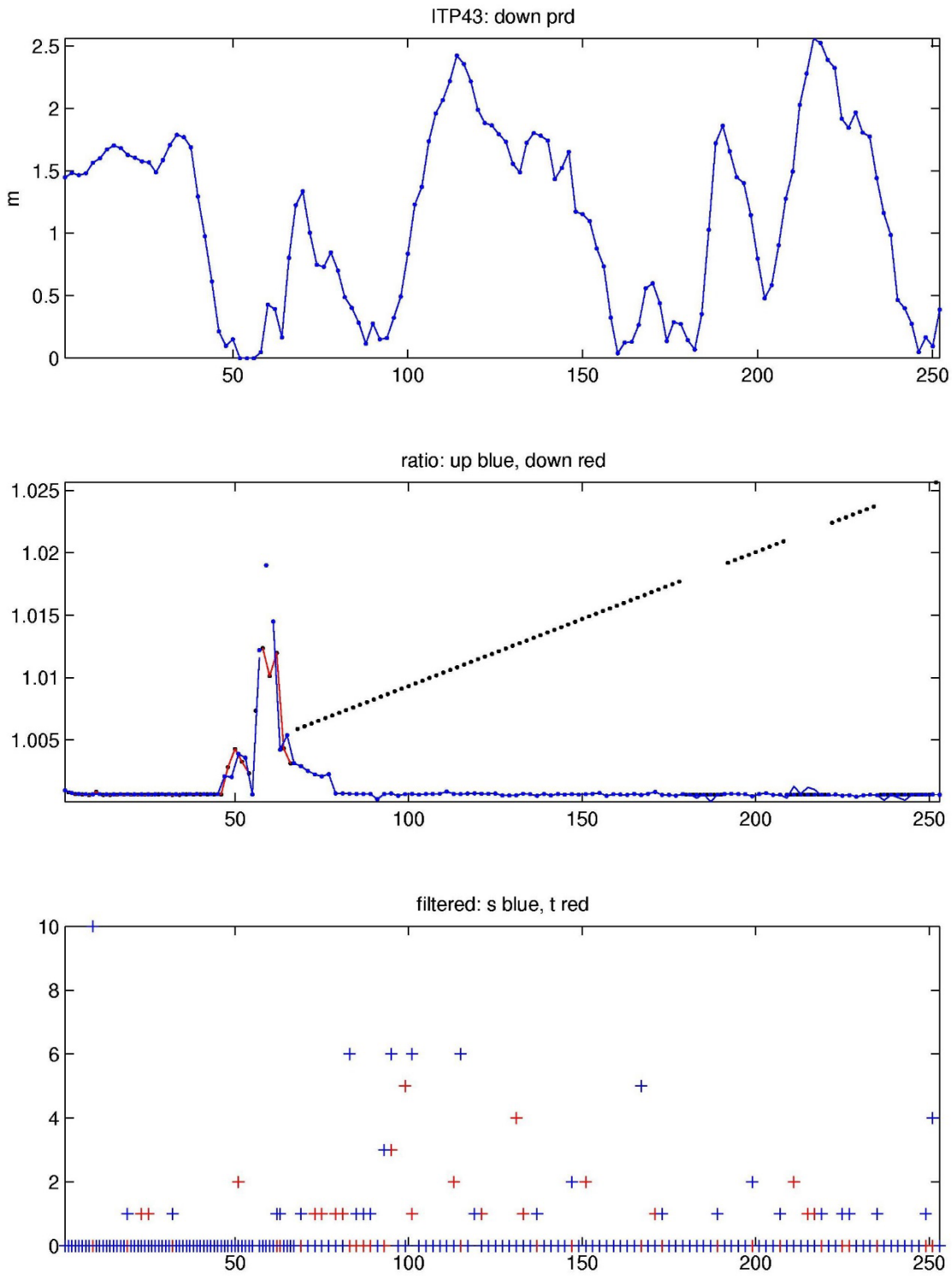
ITP profiler engineering data.



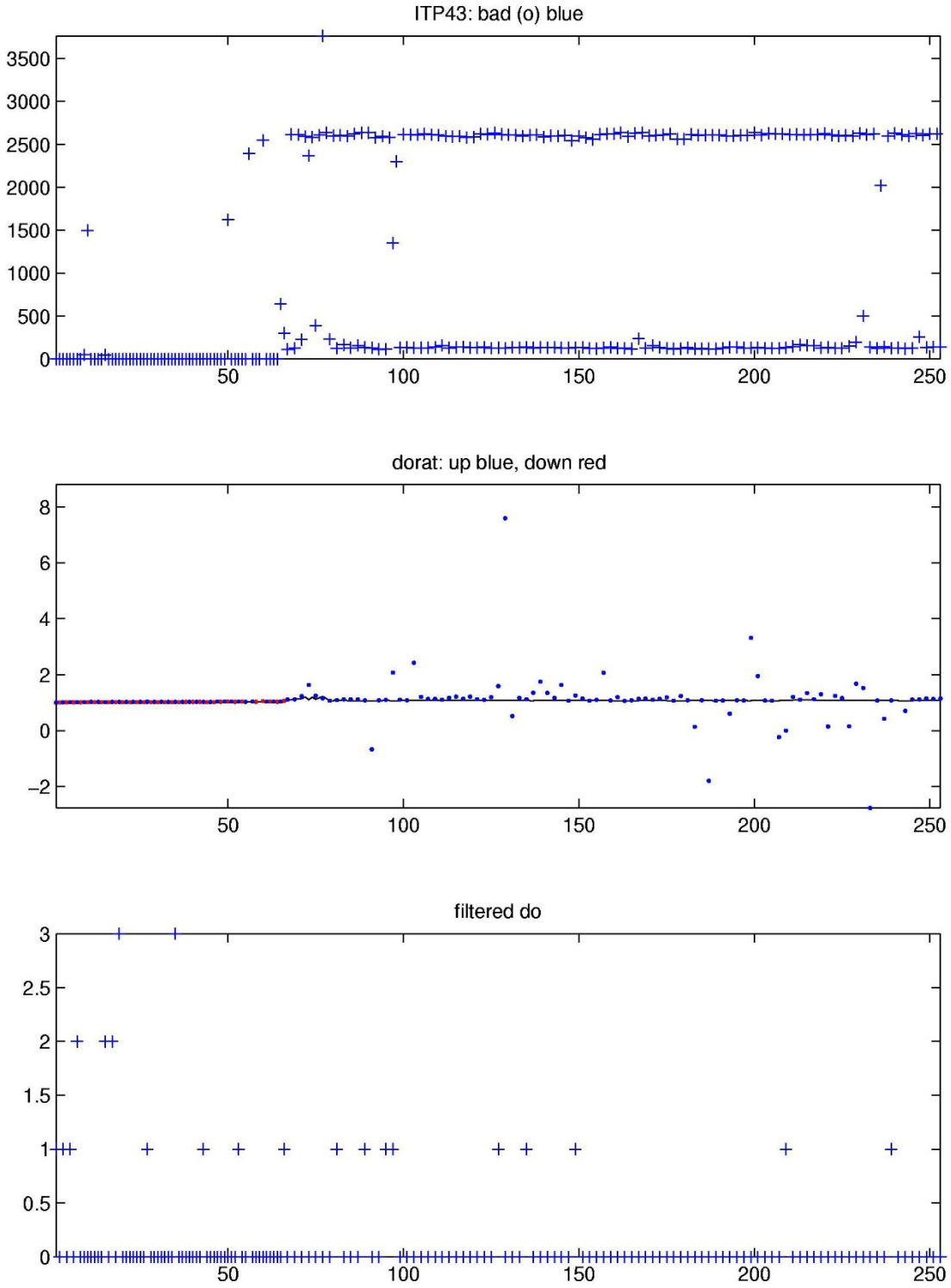
Number of bad points removed (top); variance of vertical difference of temperature and salinity in step region for up-going profiles; depth of staircase layer; temperature lag (bottom).



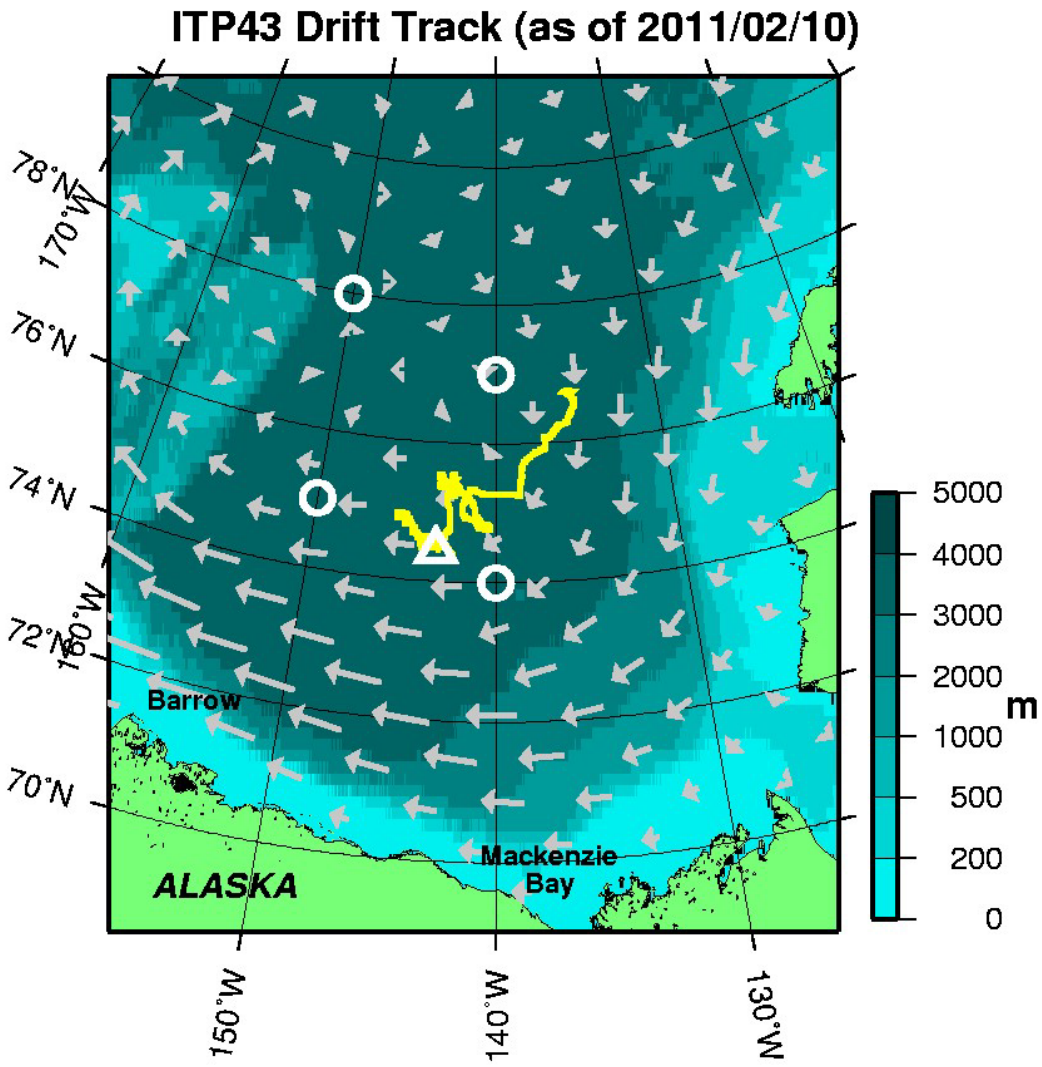
Top: conductivity lag, Middle: conductivity thermal mass amplitude correction, Bottom: conductivity thermal mass lag correction.



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

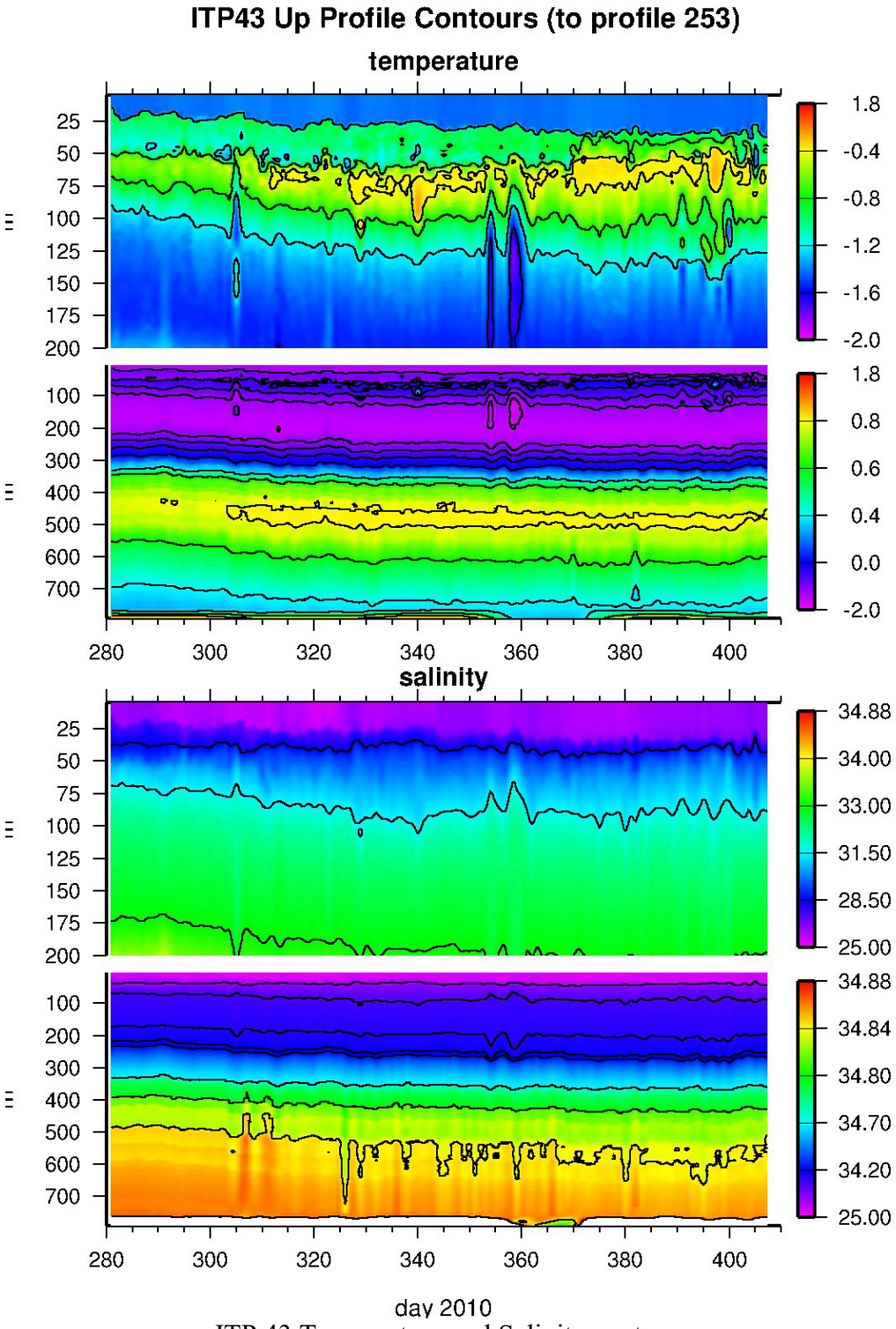


Top: number of bad dissolved oxygen points removed, Middle: dissolved oxygen ratio adjustment, Bottom: Number of filtered spikes.

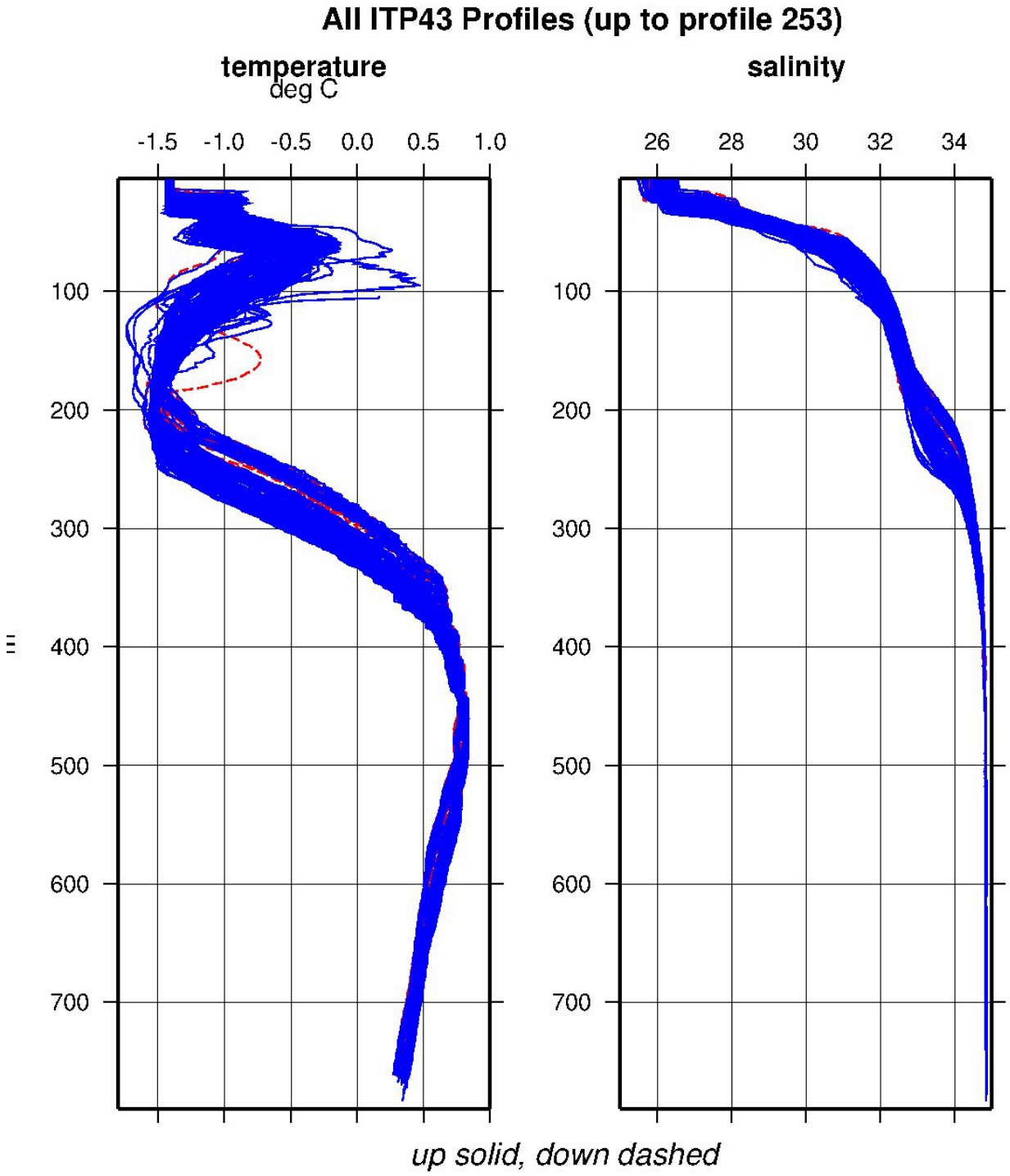


ITP drift (yellow line) and latest location (triangle), BGOS moorings (white circles) and annual ice drift from IABP (grey vectors) on IBCAO bathymetry (shading).

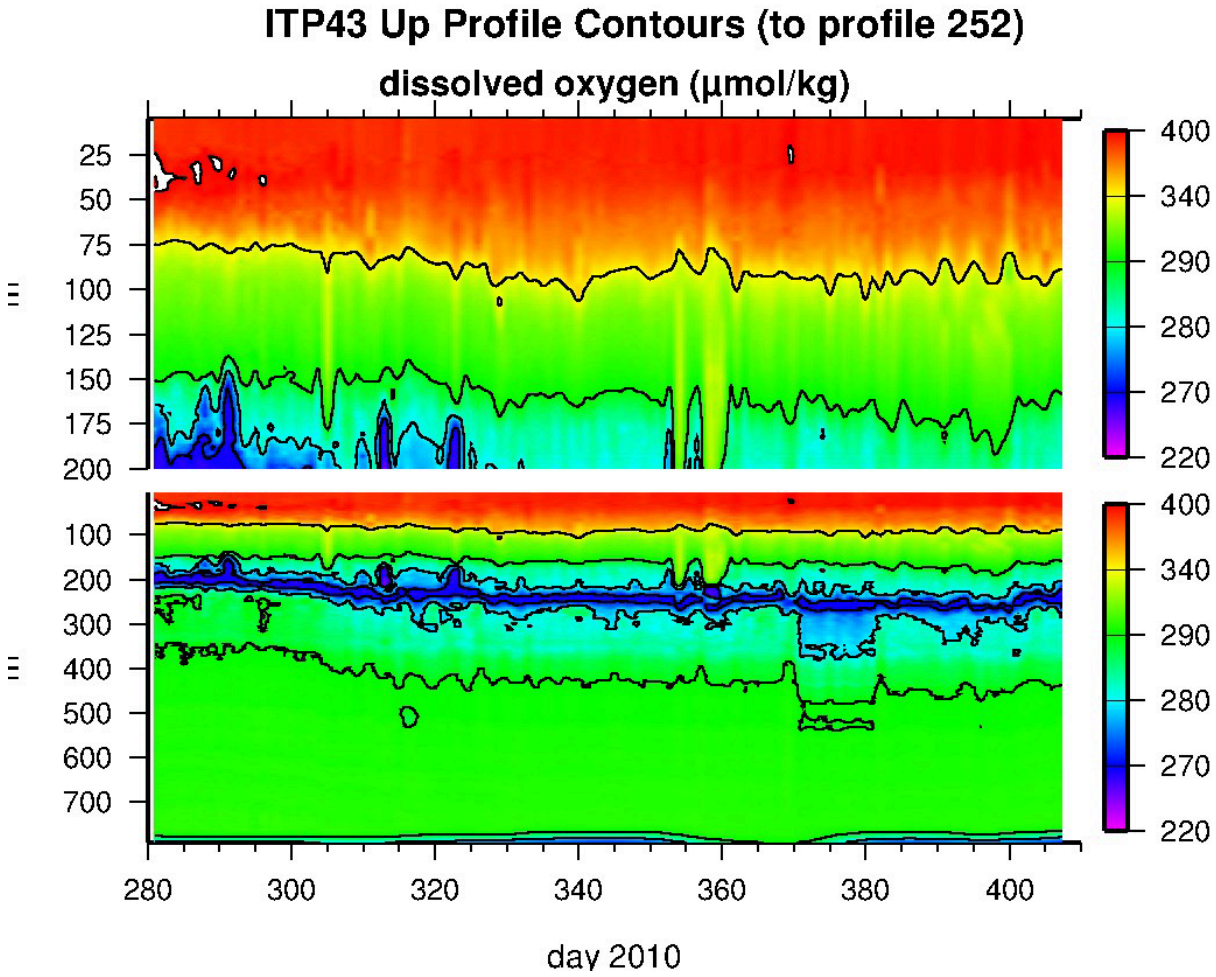
Plot of buoy locations.



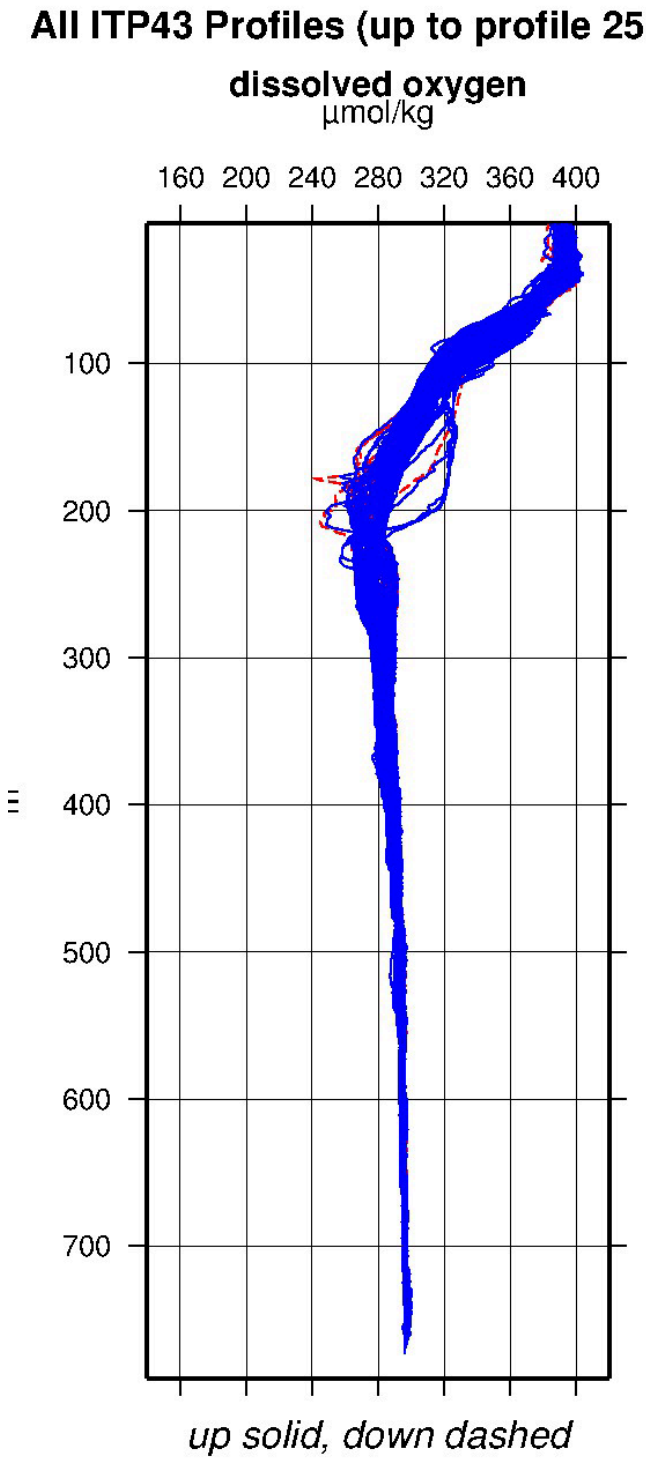
ITP 43 Temperature and Salinity contours.



Composite plot of ITP temperature and salinity profiles.

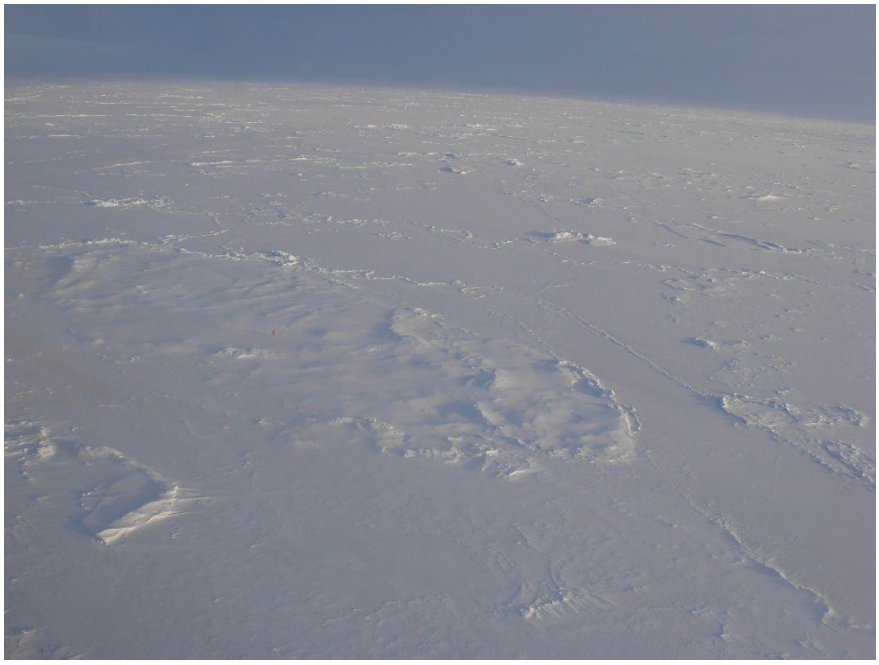


ITP43 dissolved oxygen contours.



Composite plot of dissolved oxygen profiles.

The second and final Ice-Based Observatory deployed during JOIS 2010 shortly after installation consisting of (from left to right): ITP 43, IMB (barely visible), O-buoy, and AOFB. (Rick Kirshfield)



A flag marks the floe selected for the deployment of the IBO containing ITP 43. The greater freeboard makes the 2.5 m thick floe stand out from the surrounding thin ice. (Rick Krishfield)

ITP 43 as deployed. (Rick Krishfield)

The IBO as seen from the last helicopter flight back to the ship as dusk approaches. (Rick Krishfield)