ITP 8 Overview

Deployment Location: 8/11/2007, 23:00 UTC at 78° 21'N, 154° 1' W

Recovery Location: 10/3/2009, 23:00 UTC at 80° 19'N, 151° 54'W

Duration: 767 days

Distance Travelled: 7272 km

Number of profiles: 1570 in 784 days

Other instruments: none

ITP8 was deployed on a 3.49 m ice floe in the Beaufort Gyre as part of the Beaufort Gyre Observing System (BGOS) during the JOIS 2007 cruise on the CCGS Louis S. St. Laurent. The ITP operated on a standard sampling schedule of 2 one-way profiles between 7 and 760 m depth each day, nearly completely encircling the perimeter of the Beaufort Gyre anticyclonic circulation cell in two years. Until July 30, 2008, the ITP profiler transmitted the information via the inductive modem (IM) and Iridium but ceased for no apparent reason. Location data was still being obtained and transmitted by the surface package so that when the system was recovered in October 2009 (during JOIS 2009), an additional 800 profiles were recovered from the underwater unit. Only about half of these include complete profiles because in early 2009 the instrument dragged on the Chukchi/Northwind topography and became inverted and tangled on the tether (as recovered). Several hours after recovery, ITP32 was deployed in the same hole from which ITP8 was recovered, only a short distance from the edge of the 2.5 m thick icefloe.

ITP 8 Deployment Operations

A survey by helicopter was conducted on August 11, 2007 to choose an icefloe between 3 and 5 m thick for deploying ITP 8. Extremely thin and loose ice conditions substantially limited the possibilities, but on the second landing, a suitable 3.49 m icefloe was found. After 5 flights to deliver the deployment team, apparatus and buoy, the ITP was installed after a routine 2.5-hour deployment. At the same, the icefloe was cored and surveyed by a team of scientists from UAF.

ITP 8 Recovery Operations

During its second year after deployment, the inductive modem on ITP 8 apparently failed, although the profiler continued to ring the surface package after every scheduled profile. Consequently, there was great interest in recovering the unit to retrieve the information stored in the underwater unit. Early on October 3, 2009, a helicopter reconnaissance successfully found the surface package only minutes away from ceasing the search.

An hour later, a team and apparatus arrived on the ice floe to begin the recovery operation. A hot water drill ring apparatus was used to cut a 36" ice core around the buoy, which was

removed from the buoy tether with a chainsaw. The tether wire was hauled using a portable hydraulic block until the profiler arrived at the surface tangled in the wire, and upside down. Mud and scratches on the profiler indicated that it had dragged on shallow topography (presumably in the Chukchi region according to the drift track).

After the 4.5-hour recovery operation, ITP 8 was transported back to the ship and ITP 32 was deployed in the same hole. Later on the ship, the much anticipated missing data were retrieved from the profiler on ITP 8.

ITP 8 Data Processing

The 1569 attempted profiles that were retrieved from the ITP profiler were processed according to the procedures described in the ITP Updated Data Processing Procedures. The processing parameters are shown in the figures to the right.

Thermohaline staircases were found in the data up to about profile 900 enabling determination of sensor lag corrections (which did not vary greatly). Afterwards, the lags are predominantly extrapolated from the earlier data. Data that were not transmitted indicate that the profiler was often unable to profile the full extent vertically between profiles 707 and 1180, which is attributed to increased drift speeds. Between profiles 1181 to 1258 and 1274 to 1295, the profiler was dragged over shallow topography and unable to profile at all, although it was able to recover and obtain 34 additional profiles between these intervals. After profile 1318, the instrument dragged again, and became tangled in the tether for the remainder of the drift. No CTD information was transferred from the underwater unit to the surface unit for profile 352 for unknown reasons. Large conductivity adjustments were applied during the first week of acquired profiles, likely due to icing on the sensor. Other biofouling instances are less than previous ITPs.

ITP 8 Data Description

The ITP profiler was configured to operate with a standard sampling schedule of 2 one-way profiles between 7 and 760 m depth each day and the GPS receiver was powered every hour to obtain locations, and buoy temperature and battery voltage status were recorded. Full vertical profiler data was reliably acquired and transmitted for the first 707 profiles (354 days) until an apparent problem with the inductive modem communications prevented data exchange between the underwater and surface packages. However, the surface package continued to transmit GPS locations and status, and the profiler continued to ring the surface unit after every attempted profile up until July 30, 2009. Upon retrieval of the instrument, data from an additional 862 attempted profiles was recovered.

Over the two-year period, the ITP encircled the perimeter of the anticyclonic Beaufort Gyre. Eddies are not prevalent in the time series, although there are some different characteristics in the water column when the system drifted from east to west along the southern slope in the Beaufort Sea. The system avoided the shelf region near Barrow, Alaska, but encountered shallow

bathymetry between March 24 and May 1, 2009, and between May 9 and May 20, 2009 along the Chukchi shelf region, and dragged over the Chukchi Plateau on May 31, 2009.

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: itp8rawlocs.dat

Level III 1-Hz processed profile data in MATLAB format: itp8cormat.tar.Z or itp8cormat.zip

Level III 1-db bin-averaged processed profile data in MATLAB format: itp8final.mat
Level III 1-db bin-averaged processed profile data in ASCII
format: itp8final.tar.Z or itp8final.zip

ITP8 Buoy Status (as of 2009/09/16)

drift speed

buoy temperature

battery voltage
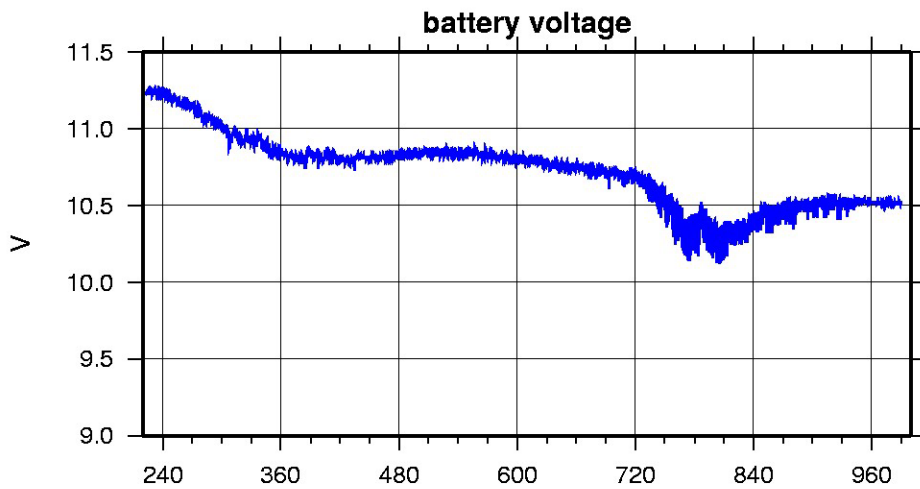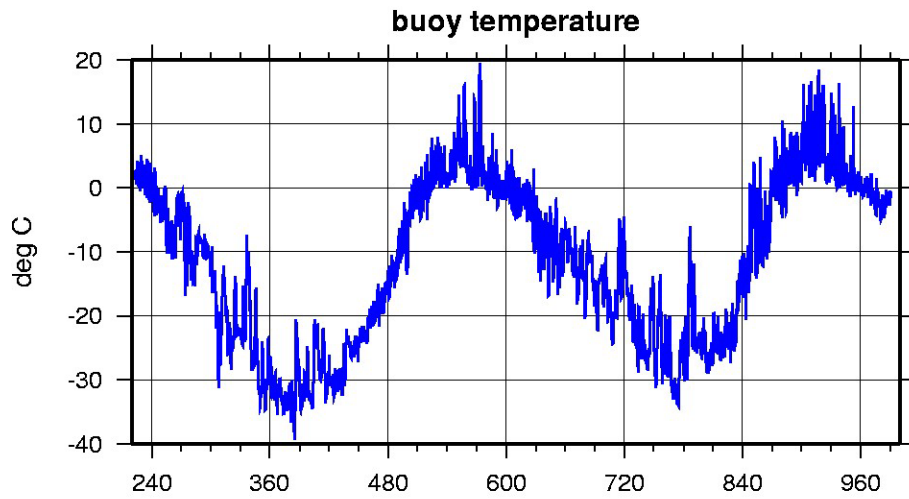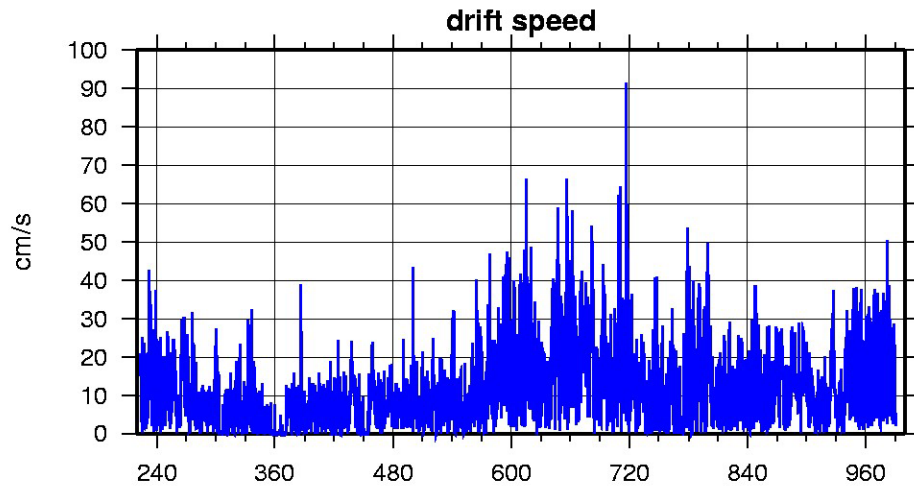
day 2007

ITP surface buoy status

ITP8 Profiler Status (up to profile 1570)

up solid, down dashed

mean motor current

mA

240 360 480 600 720 840 960

minimum pressure

dbar

240 360 480 600 720 840 960

mean battery voltage

V

240 360 480 600 720 840 960

maximum pressure

dbar

240 360 480 600 720 840 960

mean profile temperature

deg C

240 360 480 600 720 840 960

day 2007

mean profile salinity


240 360 480 600 720 840 960

day 2007
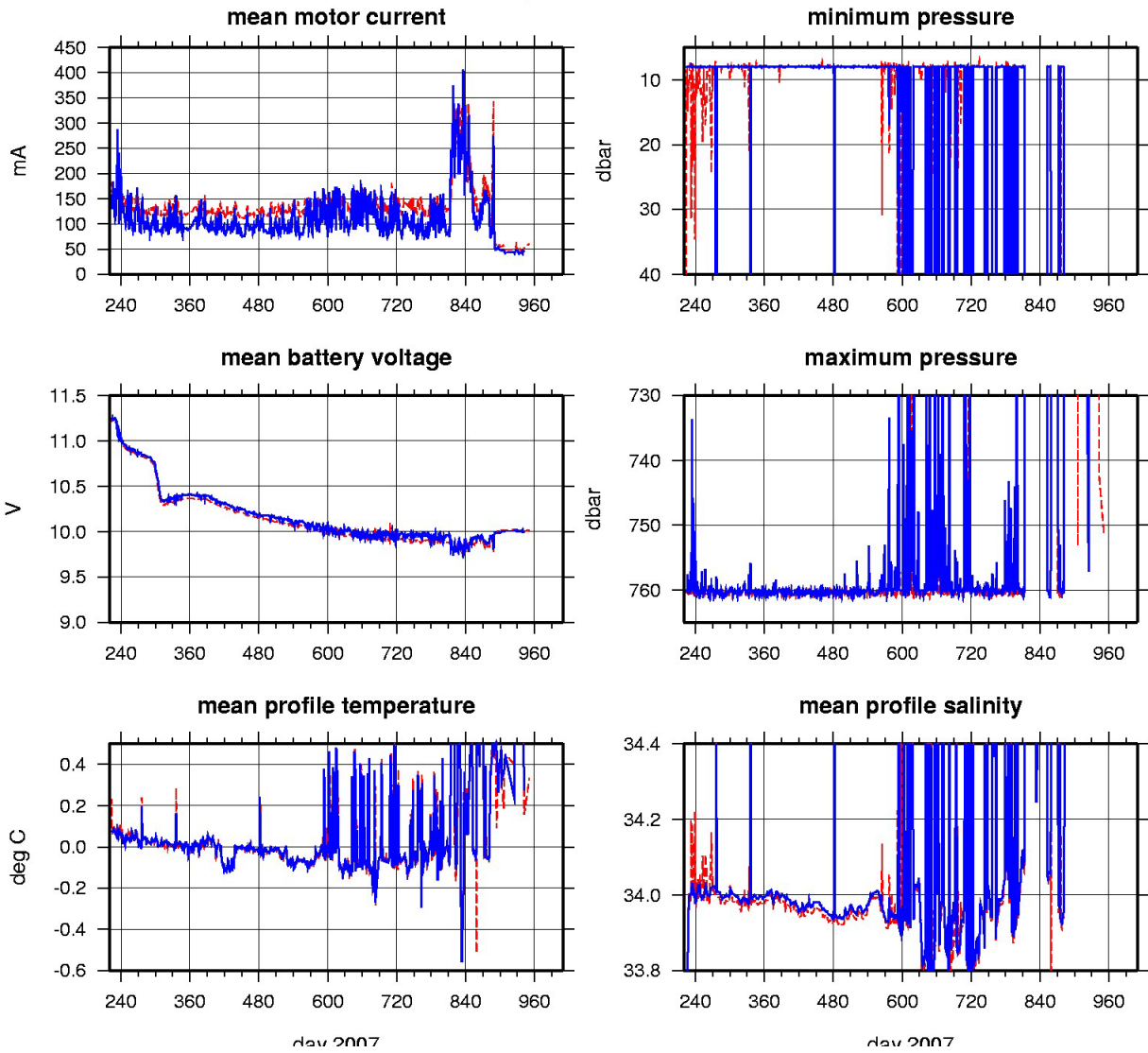
ITP profiler engineering data
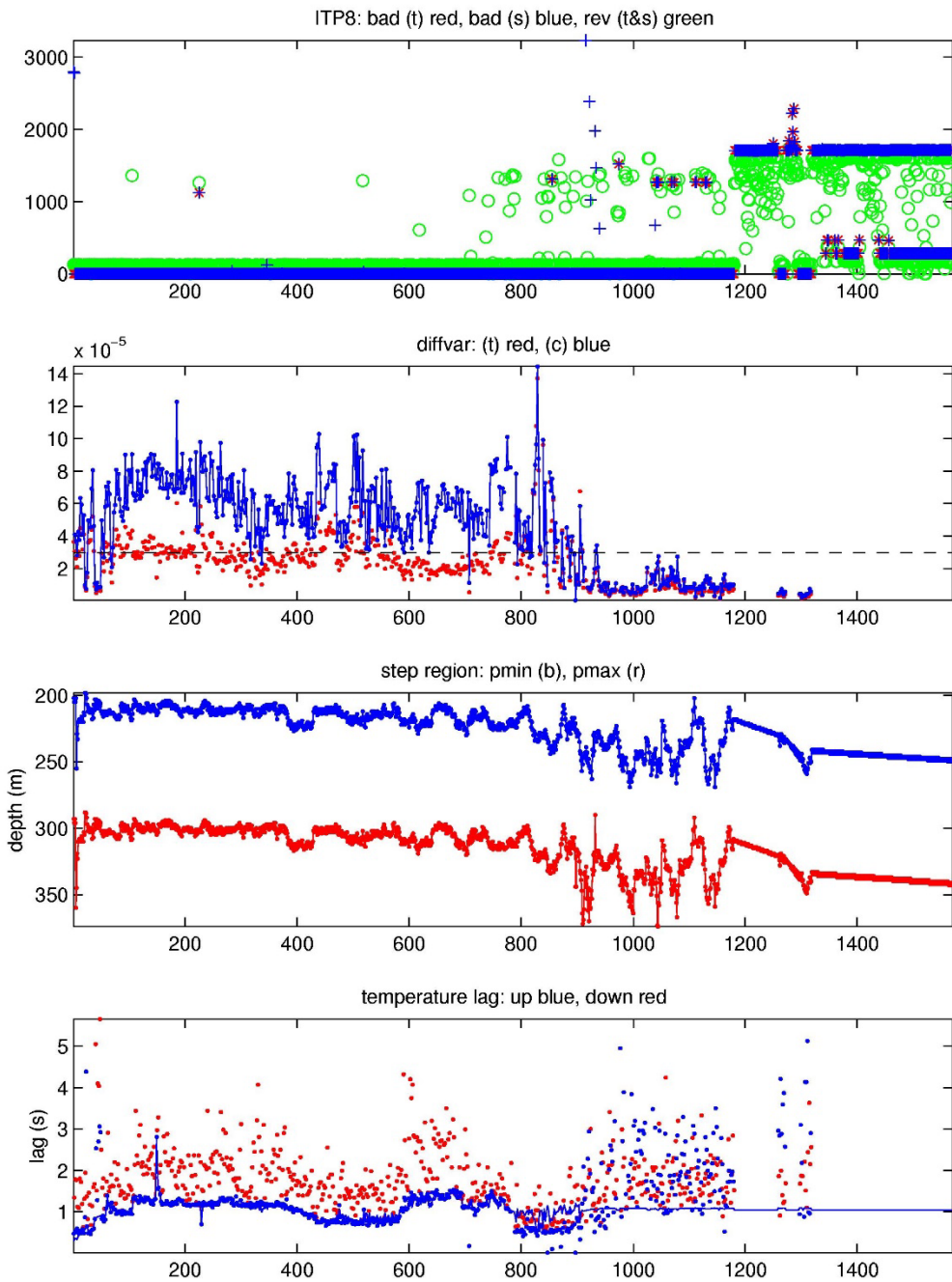
Number of bad points removed (top); variance of vertical difference of temperature and salinity in step region for up-going profiles; depth of staircase layer; temperature lag (bottom).
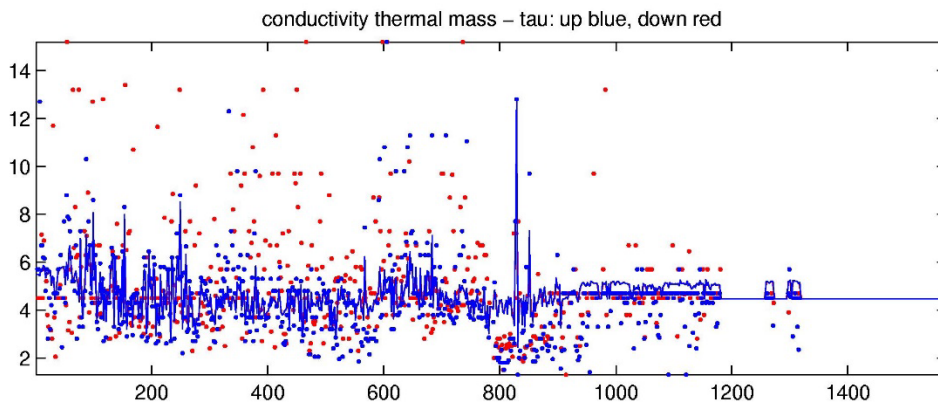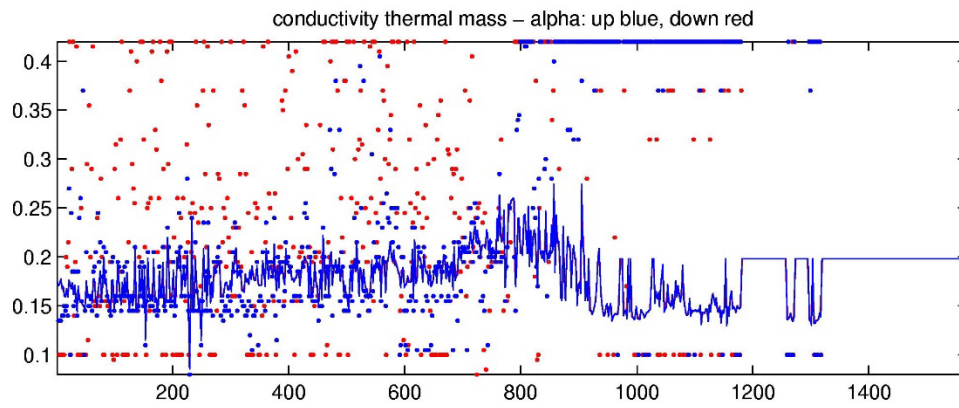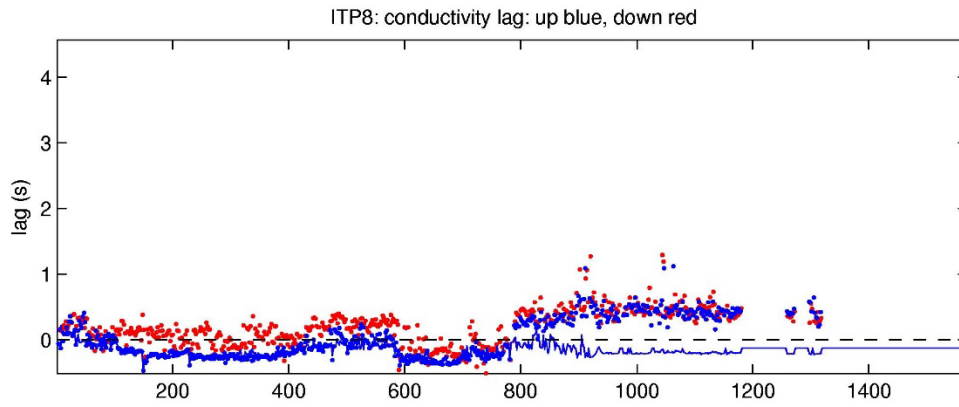
Top: conductivity lag, Middle: conductivity thermal mass amplitude correction, Bottom: conductivity thermal mass lag correction.
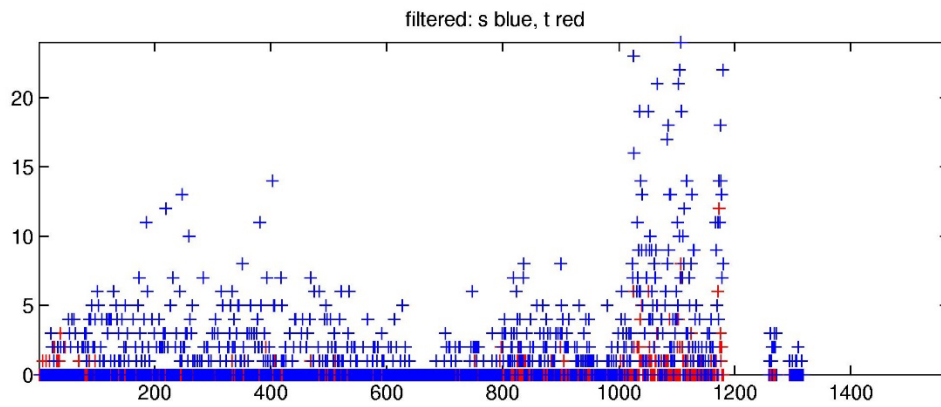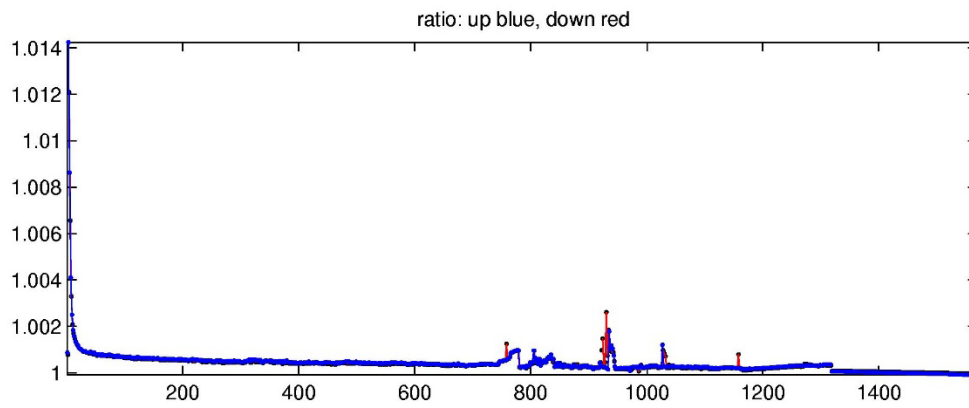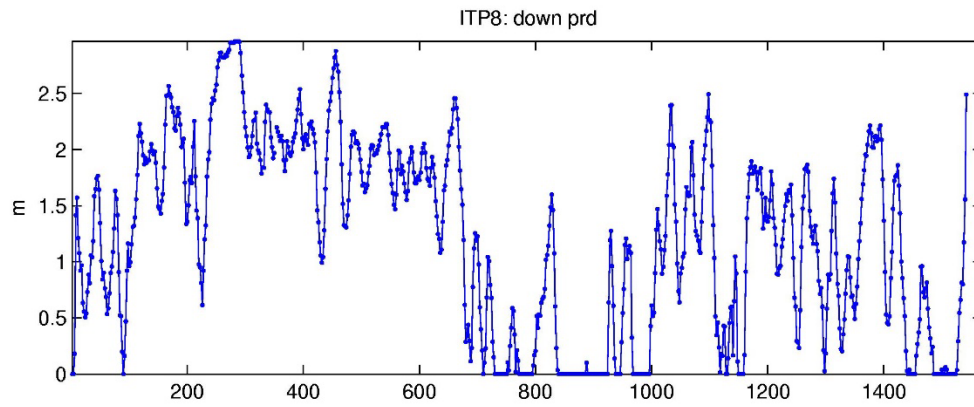
Top: down pressure deviation correction, Middle: salinity ratio adjustment, Bottom: Number of filtered spikes.
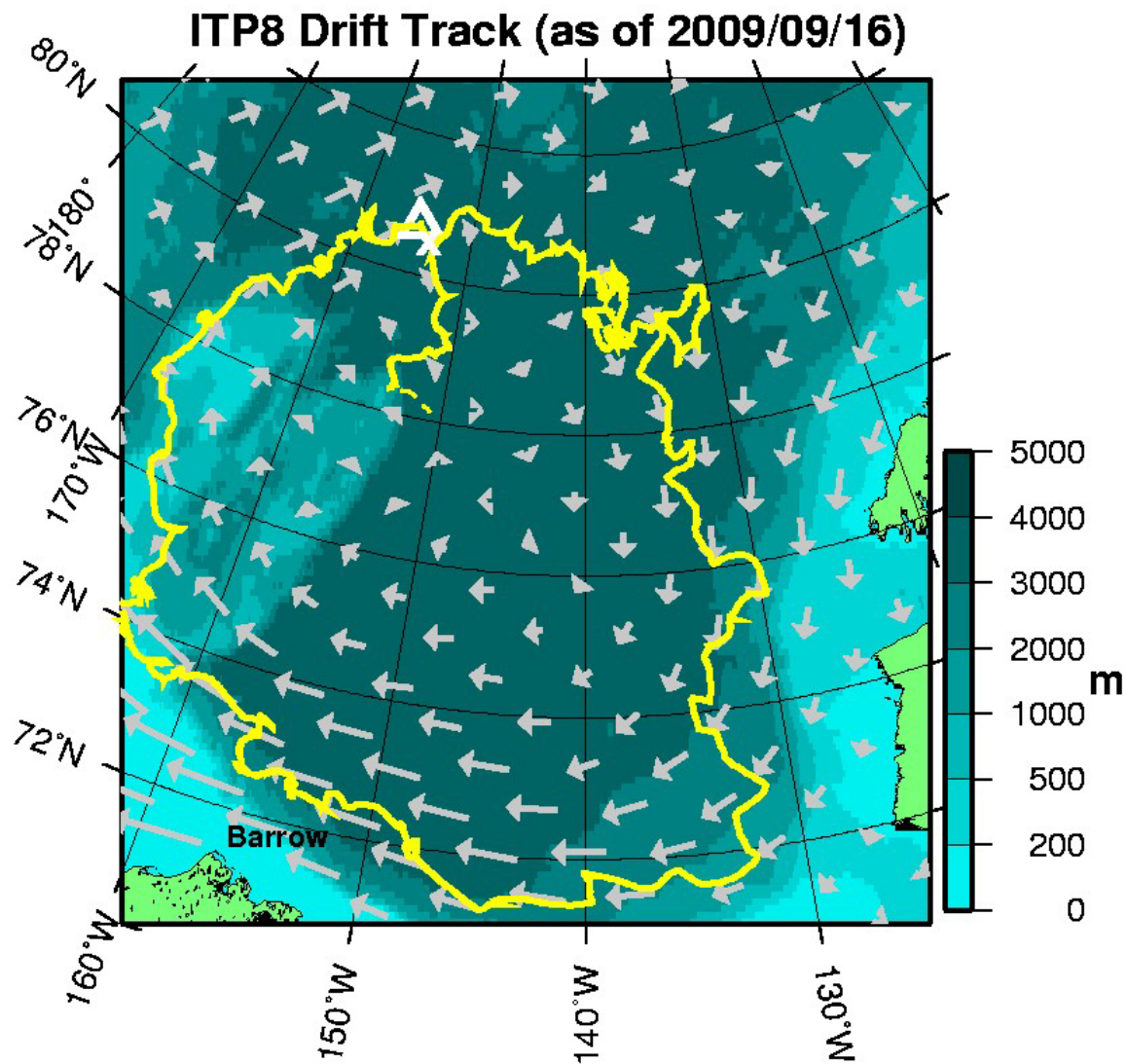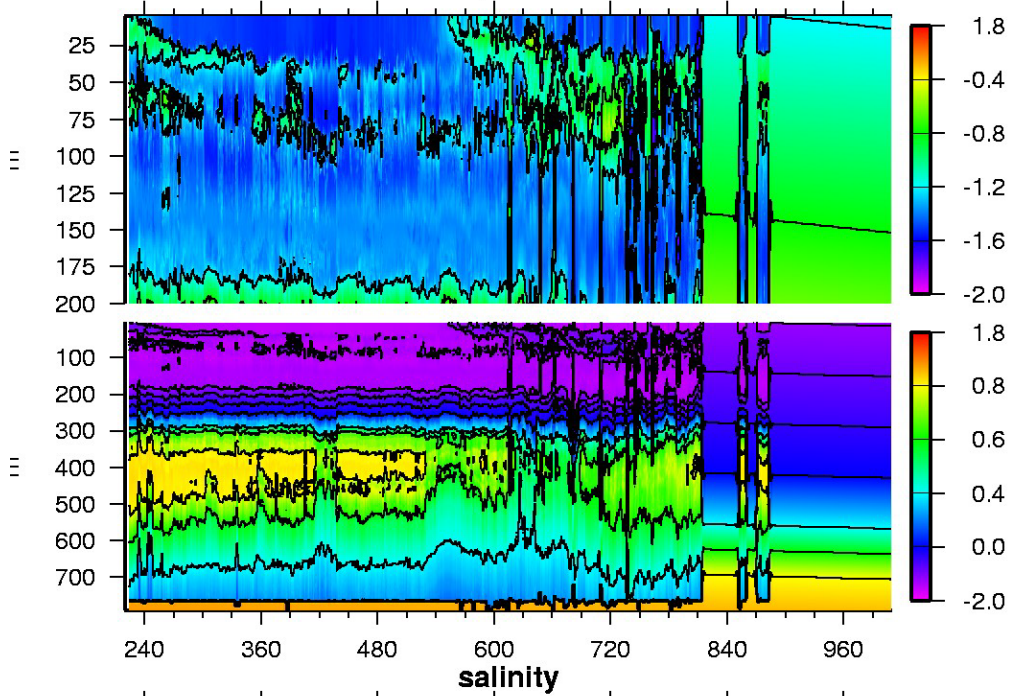
ITP drift (yellow line) and latest location (triangle), BGOS moorings (white circles) and annual ice drift from IABP (grey vectors) on IBCAO bathymetry (shading).
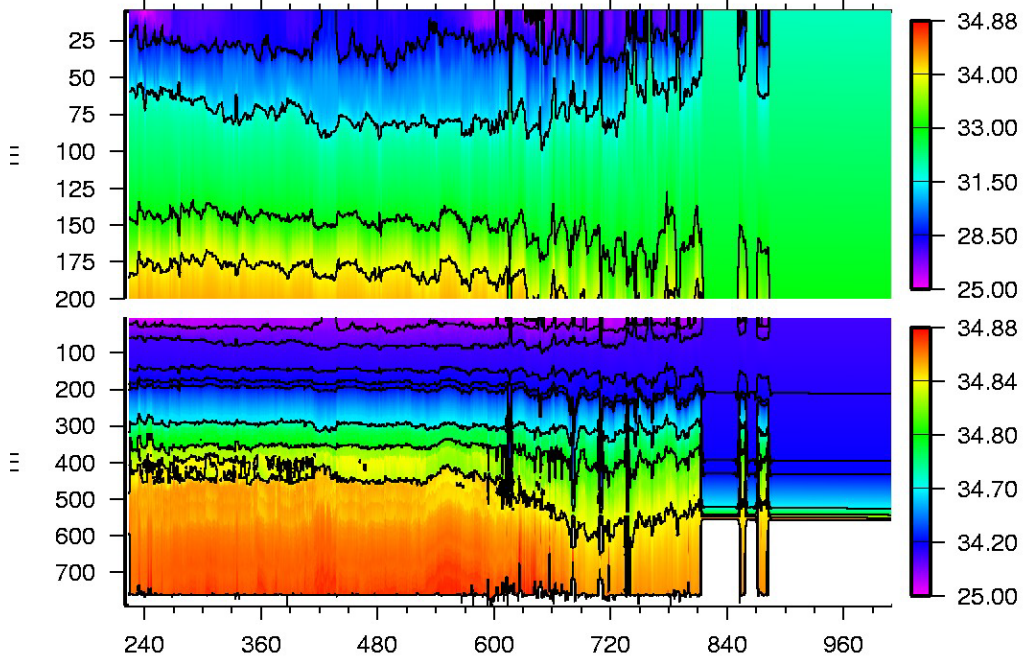
Plot of buoy locations.

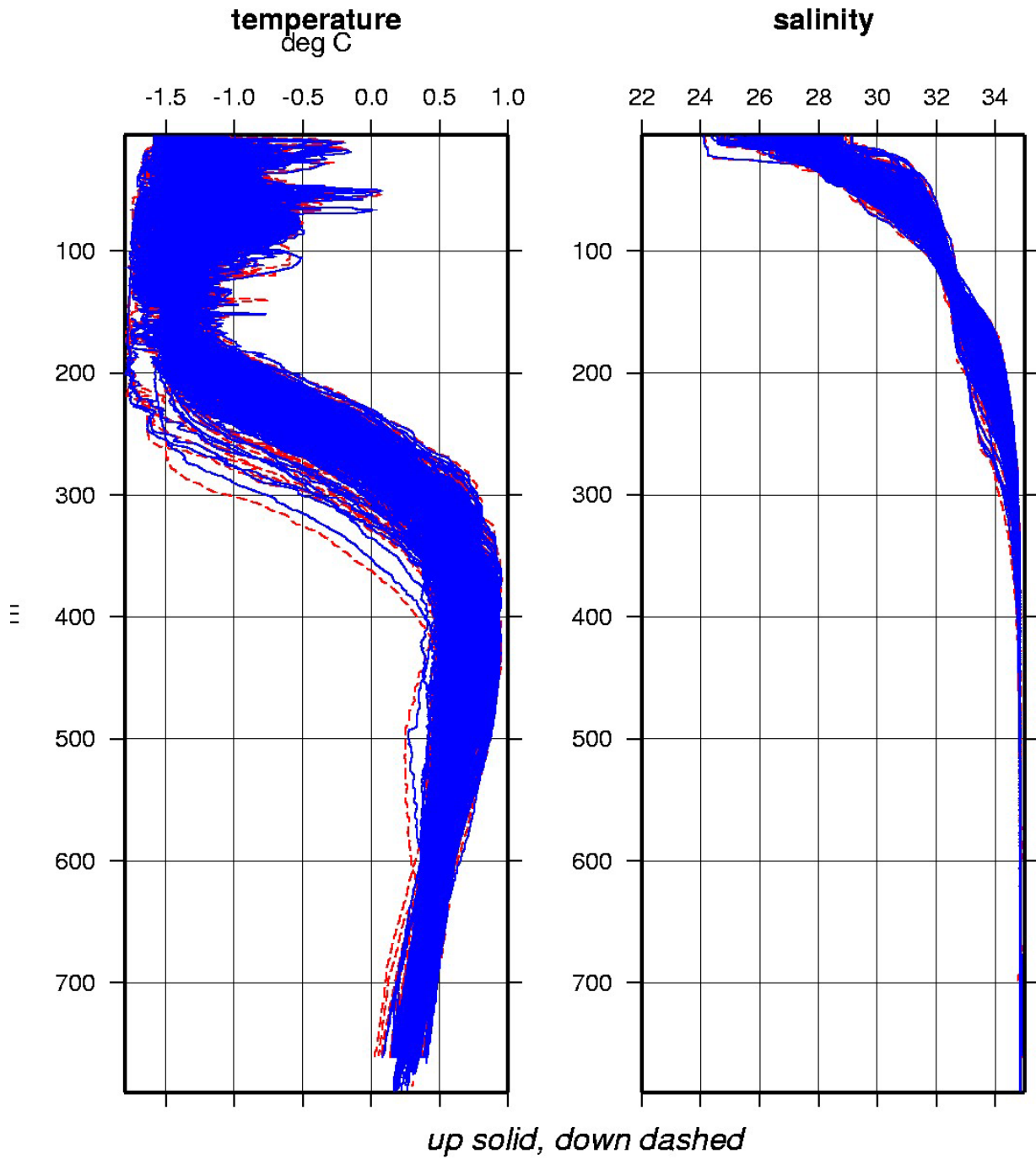# ITP8 Up Profile Contours (to profile 1569)

temperature

salinity

day 2007

ITP 8 temperature and salinity contours.

All ITP8 Profiles (up to profile 1569)

temperature
deg C

up solid, down dashed

Composite plot of ITP temperature and salinity profiles.

ITP9 (foreground) and IMB (background) with installation apparatus (to be removed from the ice) after deployment from a helicopter supported remote ice camp operation from the Russian research vessel "Akademik Federov". Photo by John Kemp.

The only multiyear floe in the neighborhood. The selected icefloe for the ITP deployment stands out from the surrounding meager ice conditions. Photo by Rick Krishfield.

ITP 8 is finally located after a 3 hour helicopter search (and only minutes away from ending the search). Photo by Rick Krishfield.
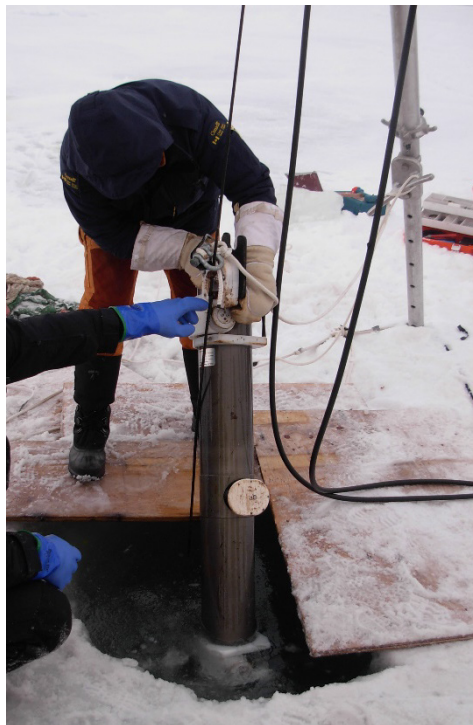
ITP 8 profiler is hauled to the surface through the ice hole. The unit is inverted, dirty, and tangled in the wire, apparently due to contact with shallow ocean topography. Photo by Rick Krishfield.

A close-up of the wire tangle around the inductive modem. Surprisingly, despite the snarl, the instrument continued to ring the surface unit after every attempted profile, although a problem with the surface unit modem electronics prevented the transfer of data. Photo by Rick Krishfield.