ITP 13 Overview

Deployment Location: 8/13/2007, 02:00 UTC at 78° 01'N, 149° 12'W

Last Location: 9/7/2008, 23:00 UTC at 72° 54.7' N, 135° 47.9' W

Duration: 391 days

Distance Travelled: 2636 km

Number of profiles: 876 in 391 days

Other instruments: IMB 2007-F, AOFB 12, 3 UAF

ITP13 was deployed as part of an Ice-Based Observatory (IBO) in the Beaufort Sea as part of the Beaufort Gyre Observing System (BGOS) during the summer JOIS 2007 cruise on the *CCGS Louis S. St. Laurent*. On the same icefloe, a US Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Mass Balance Buoy (IMB 2007-F) and a Naval Postgraduate School Arctic Ocean Flux Buoy (AOFB 12) 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.

ITP 13 Deployment Operations

On a clear summer morning, while setting out several drifters for scientists at UAF to monitor ice deformation, a suitable large 3 m thick multiyear floe for deploying our first Ice-Based Observatory in 2007 was spotted. Approximately 90-100 m long and 60-70 m wide, light blue melt ponds attested to the overall thickness. Freeboard measurements of the ice surface above the seawater surface measured 40-45 cm, confirming the sturdiness of this floe. This was an excellent site for an IBO especially considering everywhere around, thin melt-ridden ice occupied the region.

The conditions were excellent for the deployment on the ice: air temperatures were mild, and there was virtually no wind. Sunshine in the early afternoon, gave way to cloud cover later in the day. Beginning around 2 PM local time (UTC-6 hours), personnel and equipment were transported by helicopter to the floe. First a few quick 2" holes were drilled to survey the floe (between 2.85 and 3.2 m thick), then work began installing the Ice Mass Balance Buoy (IMB) by one team, while another team began augering an 11" diameter hole for deploying the Arctic Ocean Flux Buoy (AOFB). Meanwhile more personnel and equipment continued to be ferried onto the ice by the helicopter; the heaviest items (like ITP winch/wire and anchor) were conveyed using long slings.

In 2 hours, the AOFB was installed. The IMB was completed nearly 1 hour later, and the ITP package was deployed 20 minutes after that. Then the wind generator was attached to the AOFB to provide extra power for bursts of high frequency measurements, the floe was cleaned of

deployment debris, and other ice coring and measurements were completed. By 20:30 local time the ice camp (nicknamed Zebra) was abandoned except for the installed IBO instrumentation (and a stray seal who poked his head out of the water near the floe), and everyone was back on the ship.

ITP 13 Data Processing

The 876 profiles that were recovered from the ITP were processed according to the procedures described in the ITP Data Processing Procedures. The processing parameters (described in ITP Data Processing Procedures) for ITP 13 are shown in the figures below. Thermohaline staircases were present throughout most of the time series, allowing lags to computed throughout. The temperature and conductivity physical separation lags differ significantly from typical values from previous units, but not the conductivity thermal mass lags. This ITP also suffered from the software overflow bug inherent in the 2007 systems, and experienced 52 resets with complete loss of data for these profiles, and typically incomplete vertical coverage for the next subsequent profiles.

Profiles between 760 and 780 were acquired while the ITP was rapidly drifting over the western Canada Basin slope and have odd T-S shapes above and through the Atlantic Water layer. **It is not clear that these particular profiles suffered from typical sensor fouling and could contain unique information, so while not consistently stable in density and of questionable quality, they are retained in the final data product**.

After profile 814, the system reached the Marginal Ice Zone, and indications are that it was released from the icefloe as the temperature of the surface package became that of the seawater and profiling motor currents became highly variable (presumably due to vertical motion of the mooring system due to wave action). From this time unreasonable lags are needed to correct the T & S data, as apparently the vertical motion and/or pumping problem smeared or seemingly delayed the rate of the seawater passing the sensors by 10s of seconds up to more than 2 minutes (compared to 0.5 second typical lag). The error remaining in these profiles appeared to be so large even after applying the mega-lag corrections, that they were removed from the final dataset.

ITP 13 Data Description

In addition to the standard SBE41-CP CTD, this unit was the first to include an Integrated Dissolved Oxygen (IDO) sensor which proved to provide much less noisy profile measurements than the SBE 43-F sensor on ITP 6 (which was the only previous ITP to incorporate a DO sensor).

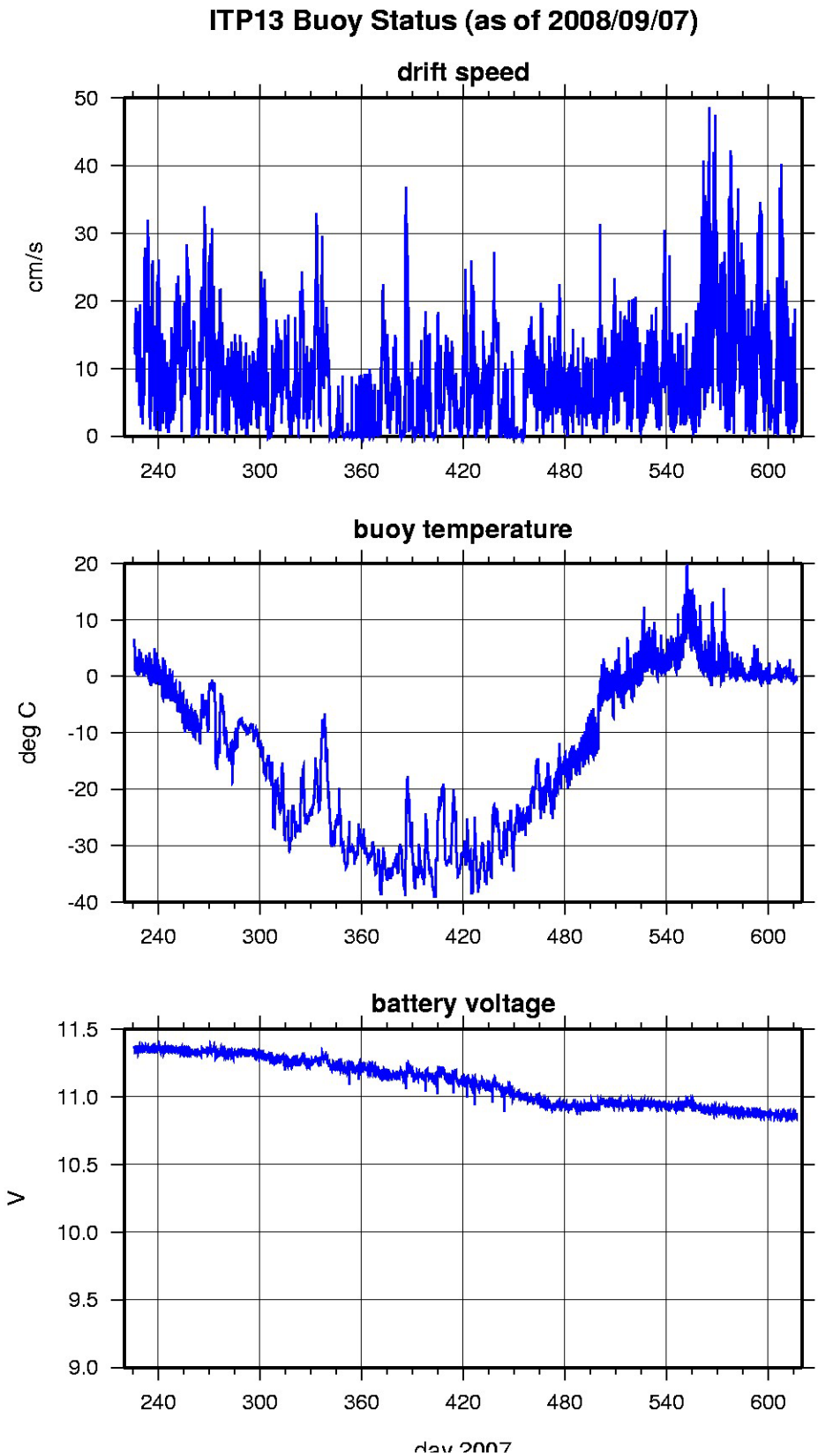
In the surface package, the GPS receiver was powered every hour to obtain locations, and buoy temperature and battery voltage status were recorded. After 391 days of reliable operation and data telemetry the system stopped transmitting in late summer after apparently being released from the ice in the southwest Beaufort Gyre and drifting in the open ocean for approximately a few weeks.

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

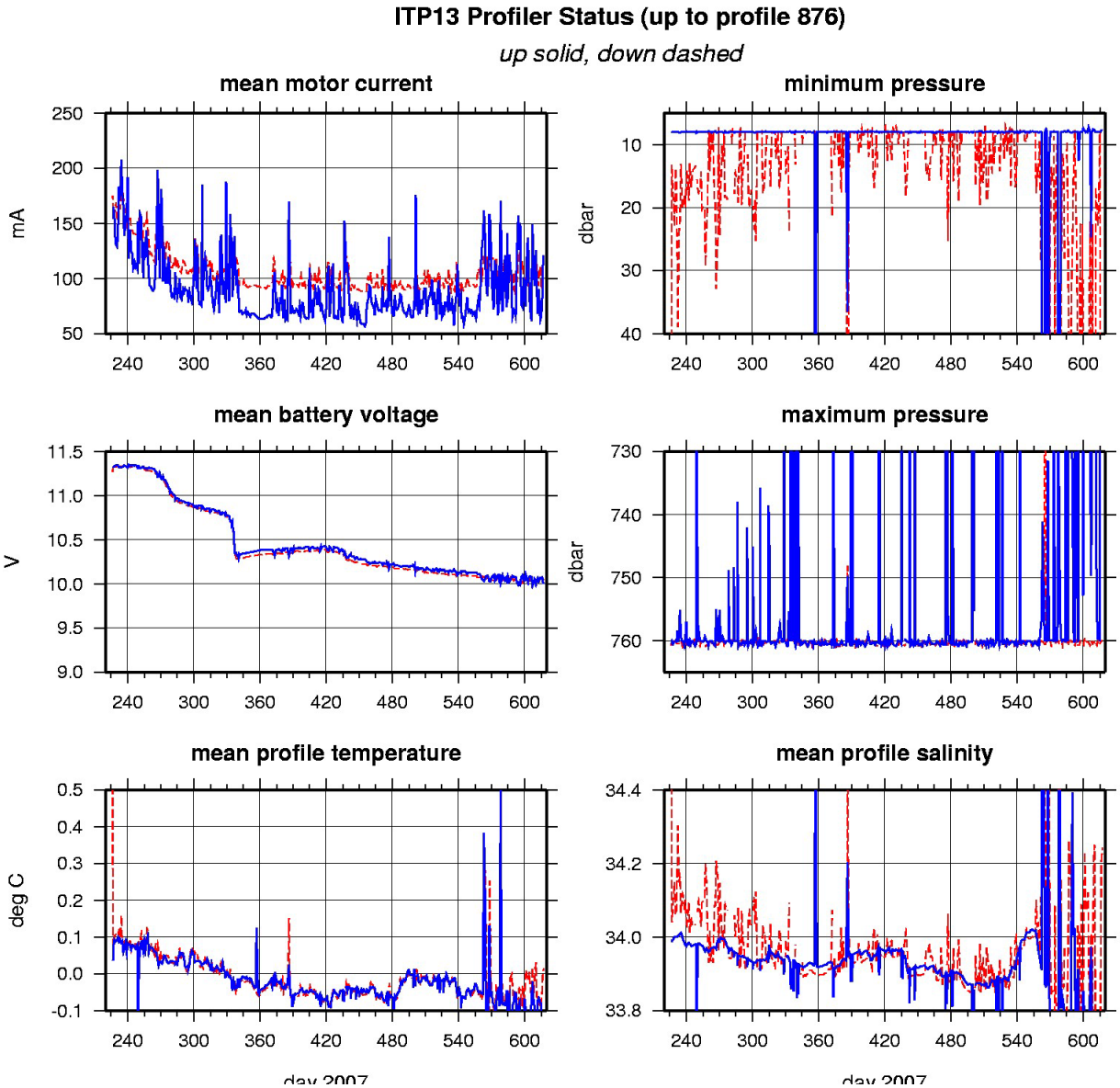
Level II hourly buoy location data in ASCII format: itp13rawlocs.dat

Level III 1-Hz processed profile data in MATLAB format: itp13cormat.tar.Z or itp13cormat.zip

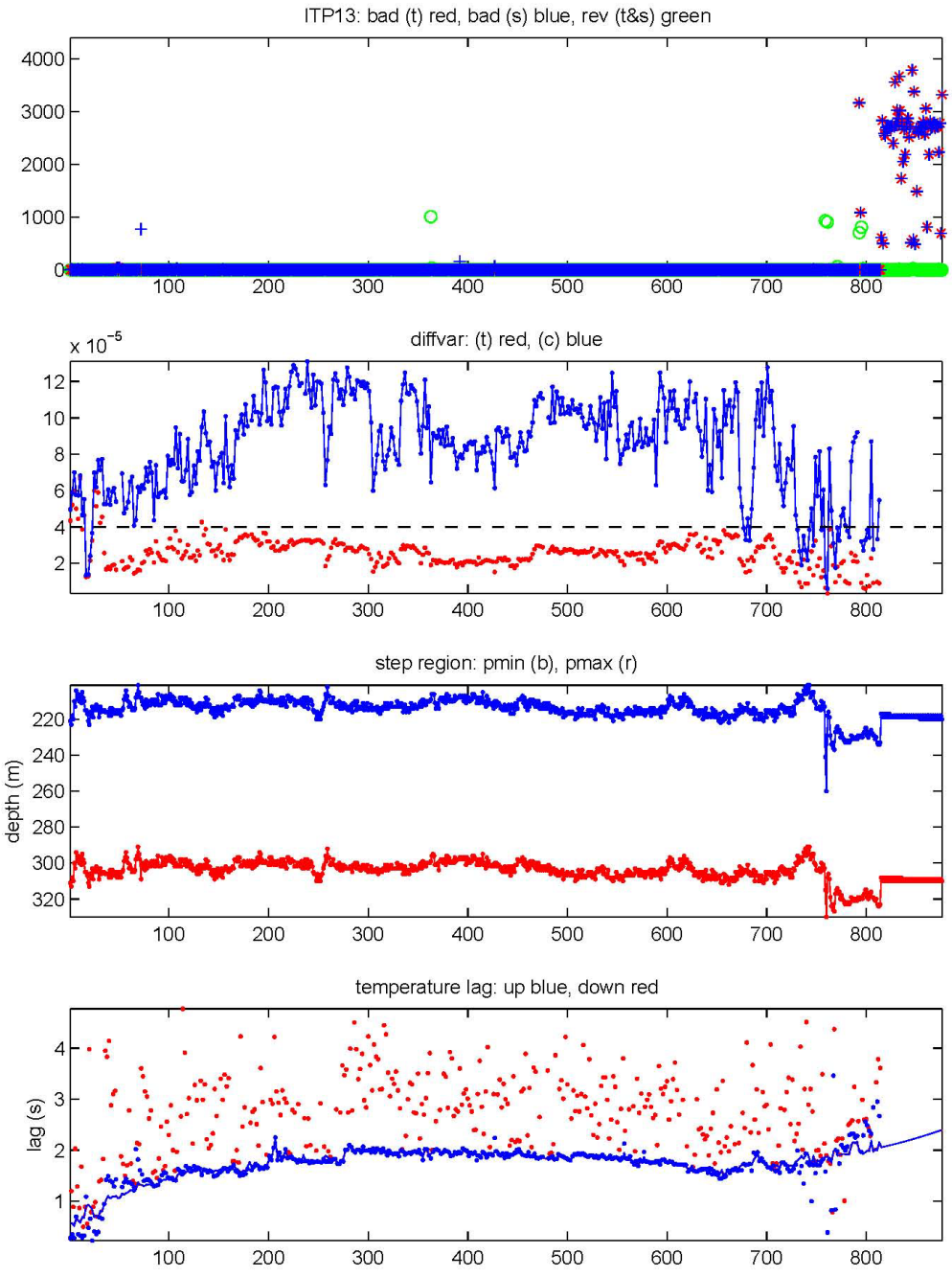
Level III 1-db bin-averaged processed profile data in MATLAB format: itp13final.mat
Level III 1-db bin-averaged processed profile data in ASCII format: itp13final.tar.Z
or itp13final.zip



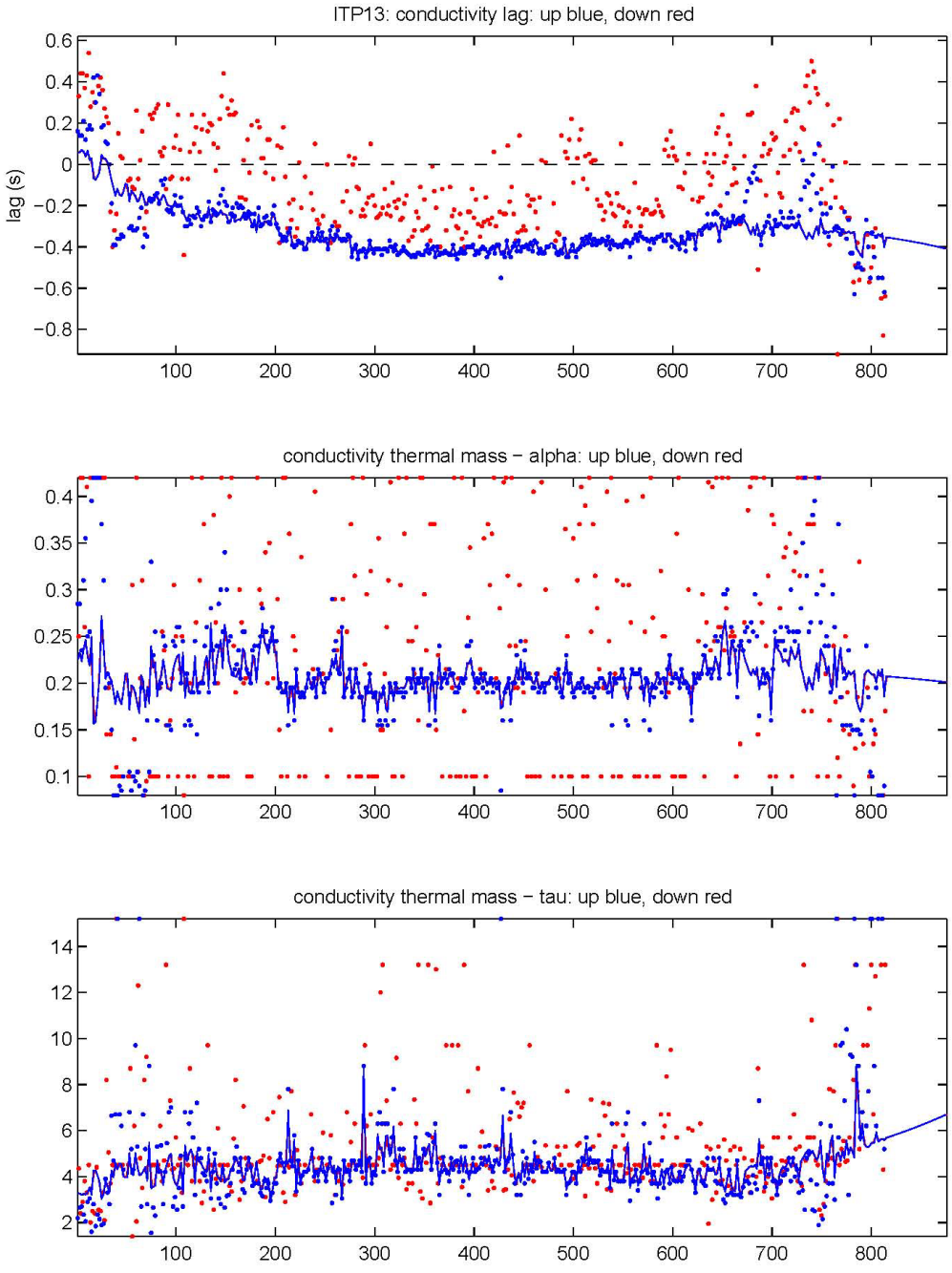
ITP surface buoy data



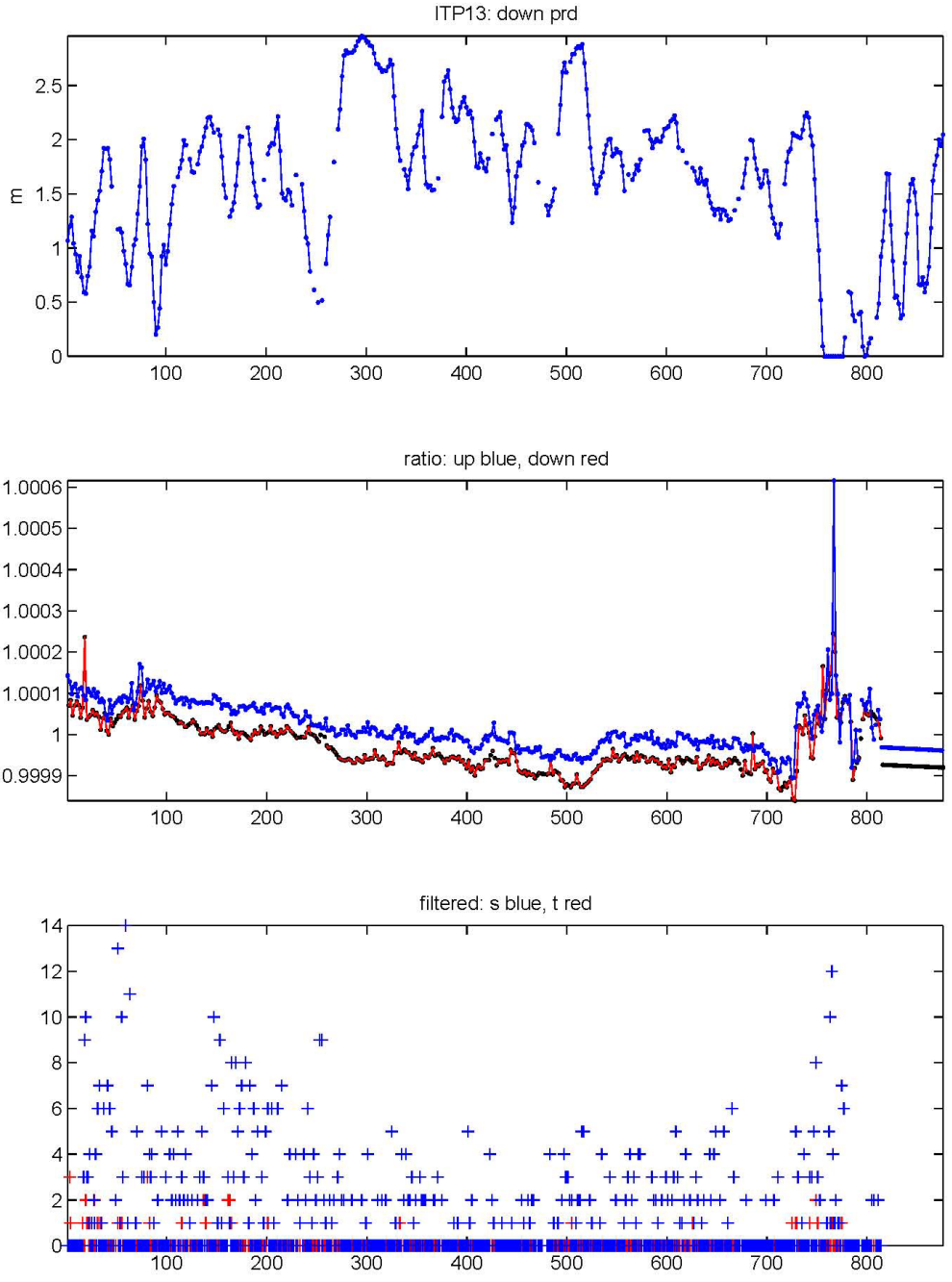
ITP profiler engineering data



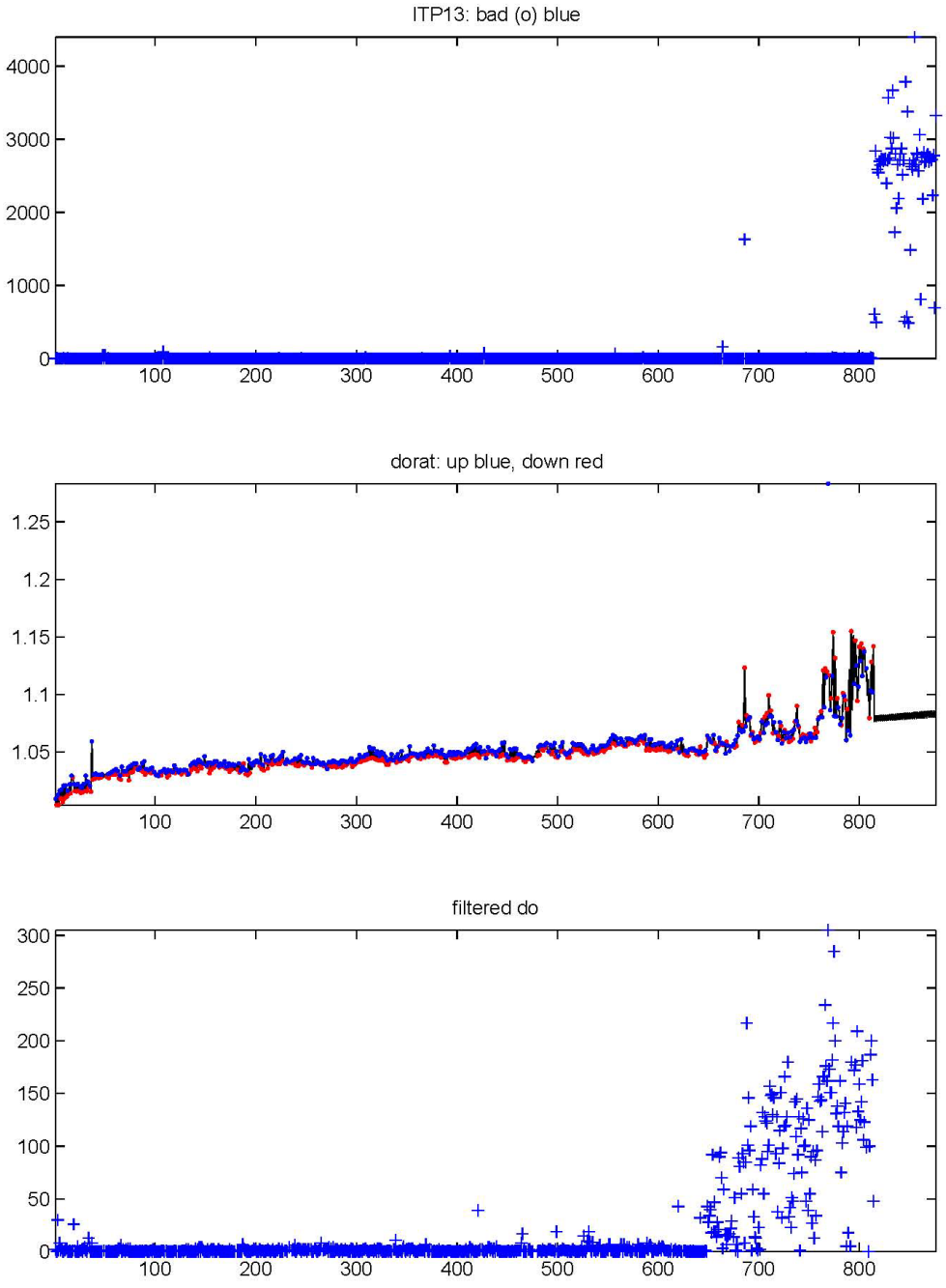
Number of bad points removed (top); variance of vertical difference of temperature and salinity in step region for up-going profiles; depth of staircase layer; temperature lag (bottom).



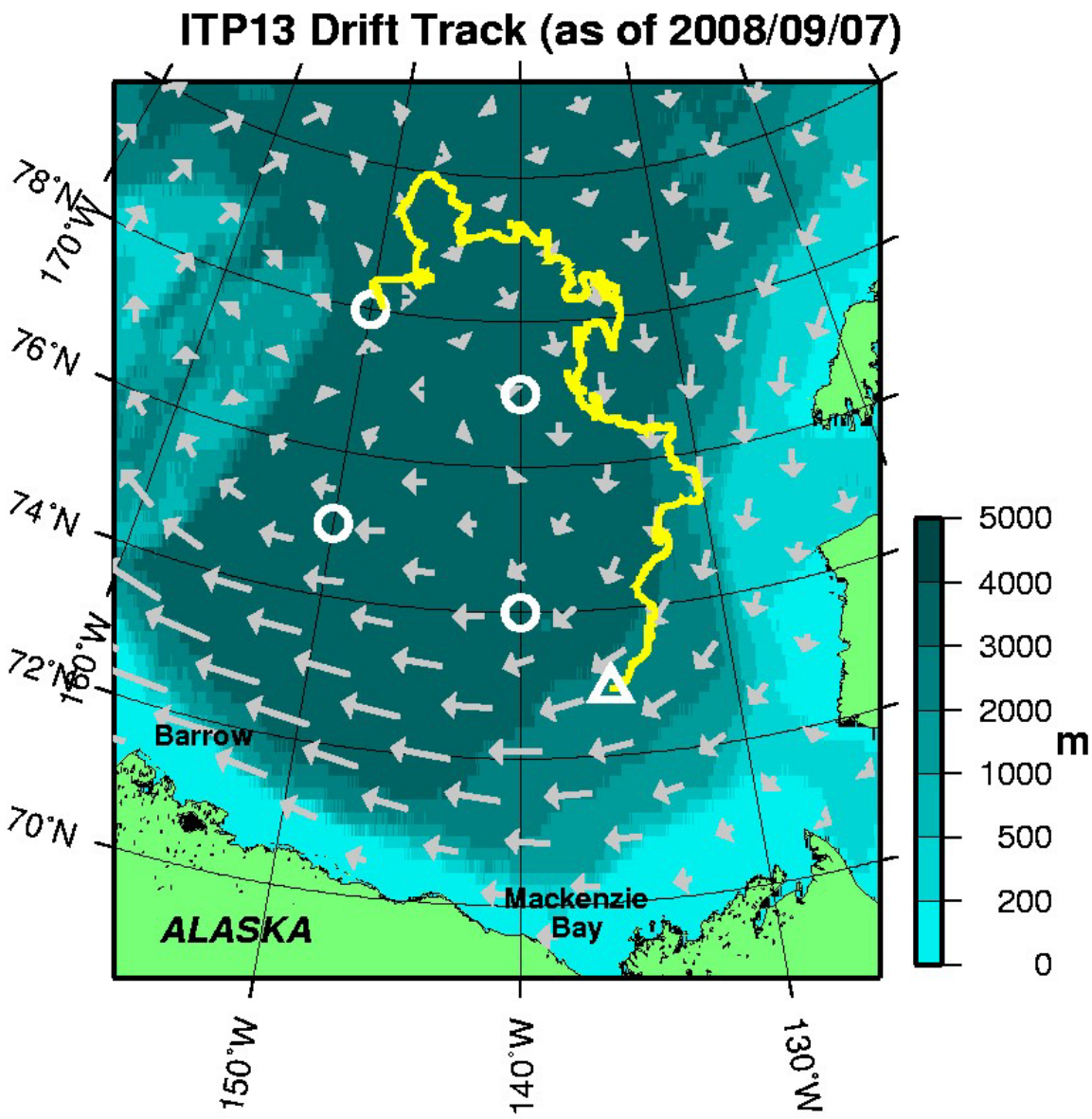
Top: conductivity lag, Middle: conductivity thermal mass amplitude correction, Bottom: conductivity thermal mass lag correction



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

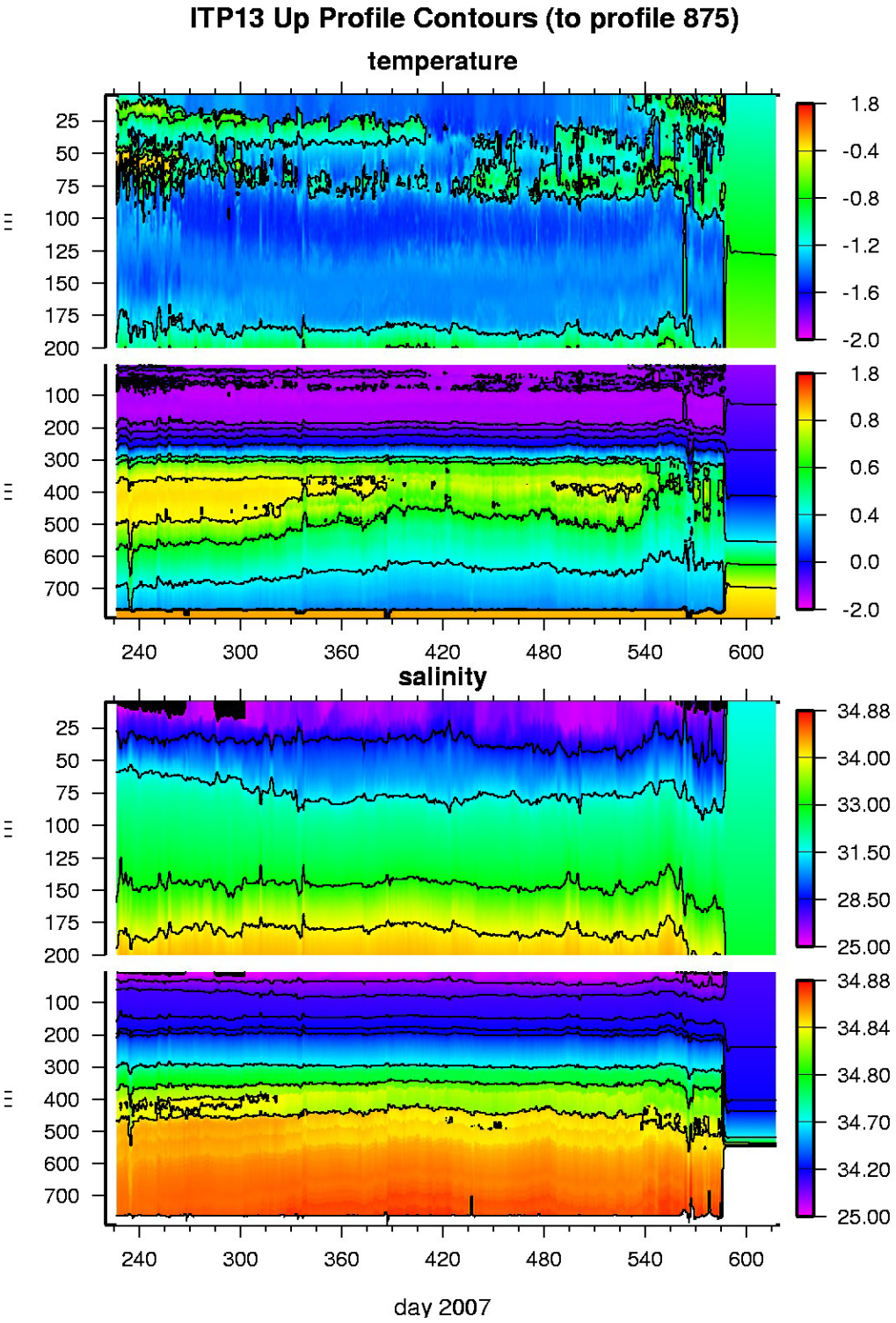


Top: number of bad dissolved oxygen points removed, Middle: dissolved oxygen ratio adjustment, Bottom: number of filtered spikes.

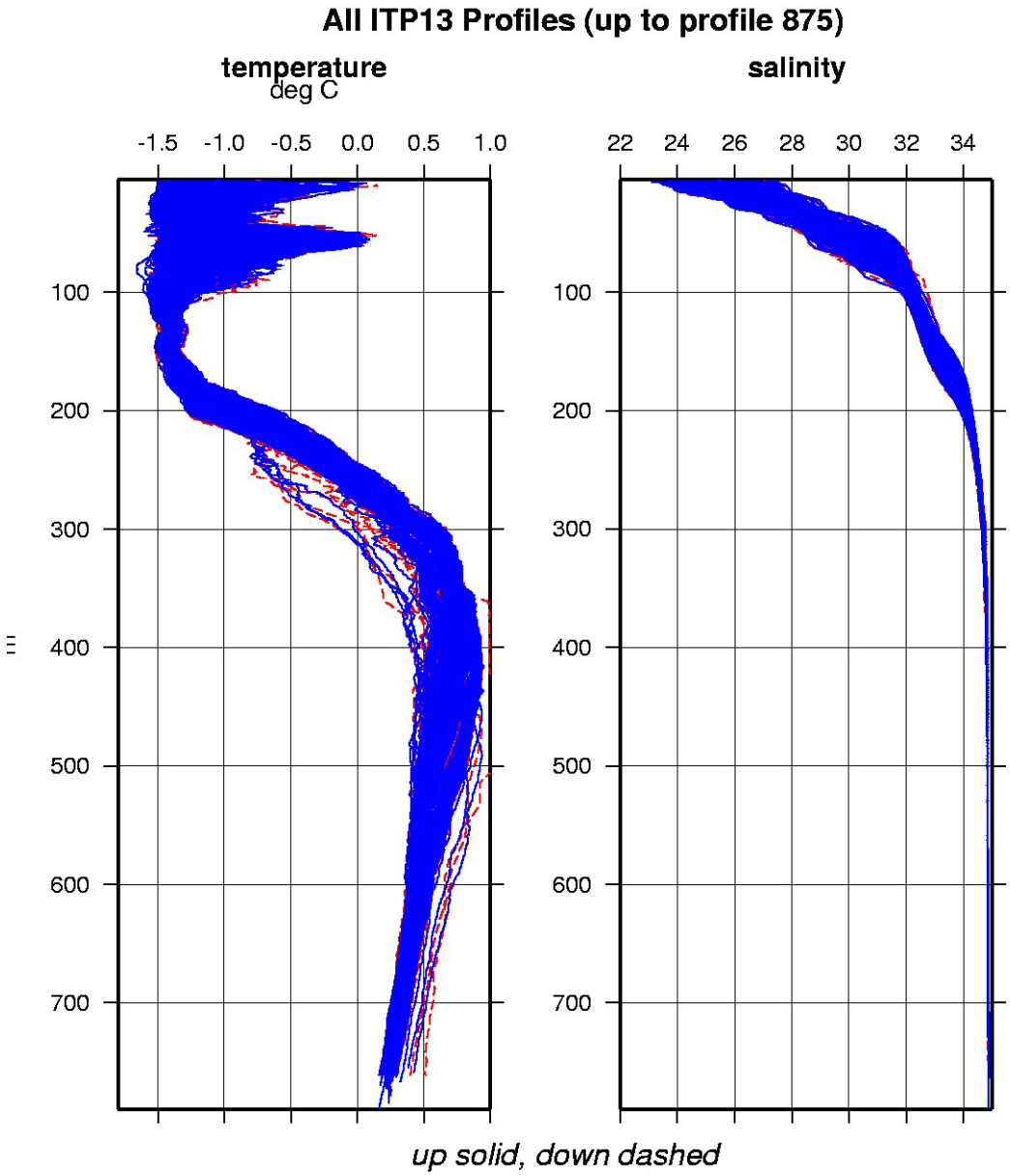


ITP drift (yellow line) and latest location (triangle), BGOS moorings (white circles) and annual ice drift from IABP (grey vectors) on IBCAO bathymetry (shading).

Plot of buoy locations

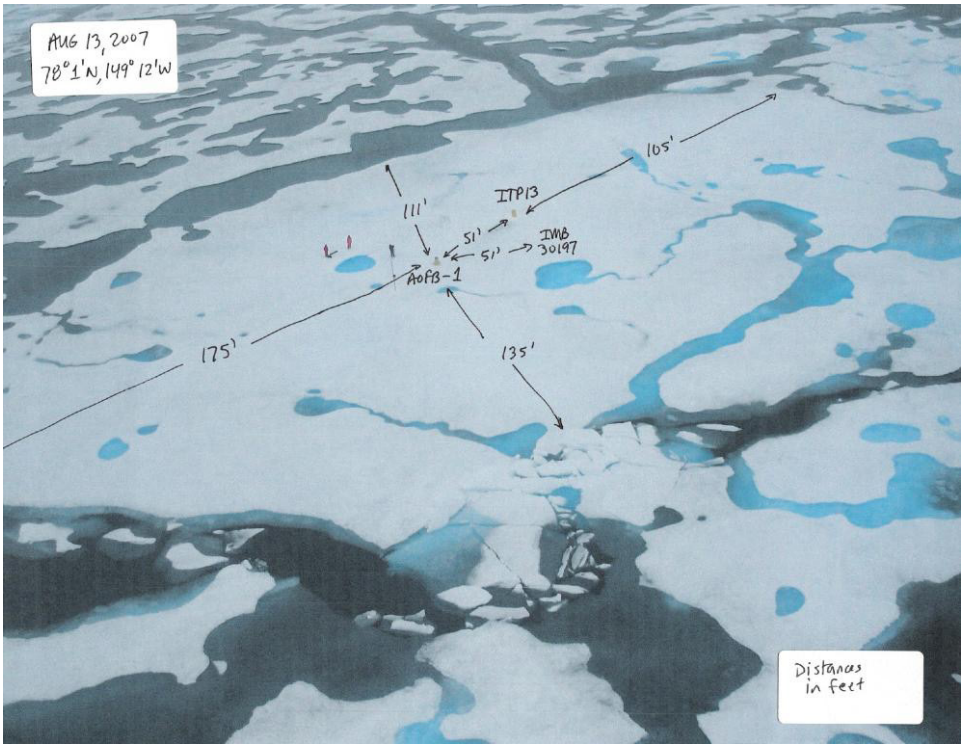


ITP 13 temperature and salinity contours.



Composite plot of ITP temperature and salinity profiles.

A view of the installed IBO consisting of IMB, AOFB, and ITP with the ship's helicopter transporting gear and personnel back to the CCGS Louis S. St. Laurent in the background. (Rick Krishfield)



The icefloe containing the IBO pictured from the air with notations delineating the approximate distances (in feet). (Rick Krishfield)

An Ice-Based Observatory consisting of an Ice-Mass Balance Buoy, Ice-Tethered Profiler, and Arctic Ocean Flux Buoy shortly after deployment in August 2007. (Rick Krishfield)