

ITP47 Overview

Deployment Location: 4/11/2011, 18:00 UTC at 87° 59.3'N, 178° 30.5'W

Last Location: 10/4/2012, 23:00 UTC at 67° 37.9' N, 29° 3.6' W

Duration: 542 days

Distance Traveled: 5573 km

Number of profiles: 1289 in 322 days

Other instruments: IMBB 2011-C, AOFB 23, PAWS, webcam

ITP 47 was deployed on a 3.5 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 23), an US Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Mass Balance Buoy (IMB 2011-C), 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.

In September 2013, the surface package of the ITP was discovered washed ashore in Blacksod Bay in western Ireland by filmmaker Fergus Sweeney who retrieved the buoy and showcased it on an educational exhibit called "Drifted, ITP 47" at Aras Inis Gluaire in Belmullet, Ireland in February 2014.

ITP47 Deployment Operations

In collaboration with the North Pole Environmental Observatory, an Ice-Based Observatory consisting of ITP 47, and AOFB, an IMB, a PAWS, and webcam were to be deployed remotely in 2011 from the Russian ice camp Barneo using a Russian MI-8 helicopter. In order to avoid the added work, time, and logistics required to operate out of a remote camp as conducted in 2010 during ITP 38 deployment, this year the deployment operations were to be conducted while the helicopter waited at the site.

The deployment team and IBO instrument and equipment arrived from Longyearbyen, Svalbard to the Barneo ice camp on April 10 (located at 89° 12' N, 138° 38' E) where the conditions were clear and cold (-23°C). The evening consisted of coordinating with the camp managers and helicopter crew and organizing and preparing the gear for the operations. The following day (still clear and cold), everything and everyone were loaded on the MI-8 helicopter and flown in little over an hour 175 km upstream to a large floe which was subsequently measured to be between 1.9 and 3.7 m thick.

ITP47 Data Processing

The 1289 profiles that were recovered from the ITP were processed according to the procedures described in the ITP Updated Data Processing Procedures. The processing parameters for ITP 23 are shown in the figures to the right. Buoy drift speeds were almost always less than 30 cm/s while traversing the Arctic Basin, so the profiler covered the full extent of nearly every profile that it communicated to the surface package.

Some thermohaline staircases were present during the time series, enabling CTD lag correction estimates. However, the lags were only in typical ranges for the first 330 profiles, then fouling or icing of the CTD sensors resulted in longer response times. The lags could be largely corrected up to profile 540, but afterwards nearly all of the data were subject to some degree of dampening. This is most evident from the hysteresis in T-S plots between up and down profiles throughout the halocline, and appears as large differences between up and down profile potential conductivity (rat) corrections. The more robust temperature data are not affected as much as the conductivity data, so most of the temperature data are retained. However, nearly 30% of the salinity profiles had to be eliminated, and all of the remaining ones after profile 542 should be considered questionable, particularly those up to profile 800. The quality of the salinity profiles retained after profile 800 are somewhat better, but still show some hysteresis in T-S space and should be considered of lesser quality.

On December 24, 2011 transmissions from the surface package ceased, presumably due to the buoy being submerged below the ice, however did later resume on May 19, 2012, but no GPS locations were acquired during the gap. Meanwhile, the profiler had continued to profile and relay data to the surface package until February 28, 2012. Consequently, locations for all profiles beginning with 1026 have been reconstructed using Fowler (2003) daily ice motion vectors.

Fowler, C. 2003, updated. Polar Pathfinder Daily 25 km EASE-Grid Sea Ice Motion Vectors. Boulder, Colorado USA: National Snow and Ice Data Center. Digital media. <https://nsidc.org/data/nsidc-0116.html>.

While several holes were drilled to survey the ice and position the buoy array, all of the IBO equipment and apparatus were removed from the helicopter, except for those items which needed to stay warm (the air temperature remained around -23°C throughout the day). While one group installed the PAWS, another group began installation of the AOFB. When the PAWS was positioned, the first group subsequently worked on the webcam and IMB installations. When the AOFB was installed, the second group began the ITP deployment. Only a short break was taken for lunch and to warm up. Eight hours after landing, the IBO was completely deployed, all of the deployment gear was back onboard, and the helicopter departed from the floe.

ITP47 Data Description

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

The buoy drifted with the Transpolar Drift over the Lomonsov Ridge towards Fram Strait transmitting data until it was apparently submerged below the ice north of Greenland on December 24, 2011. On May 19, 2012, the buoy reappeared 2000 km south in the Denmark Strait between Greenland and Iceland and resumed transmitting backlogged profiles (without locations during the time it was under the ice) and present GPS locations. The profiler was no longer communicating with the surface package, and the unit finally ceased transmitting altogether nearly 5 months later on October 4, 2012. Almost one year later, in September 2013, the buoy was discovered washed ashore on western Ireland.

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

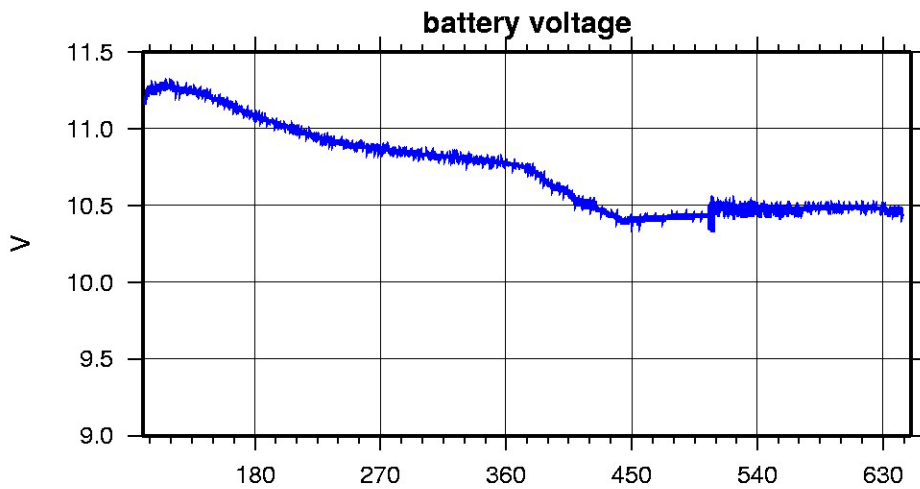
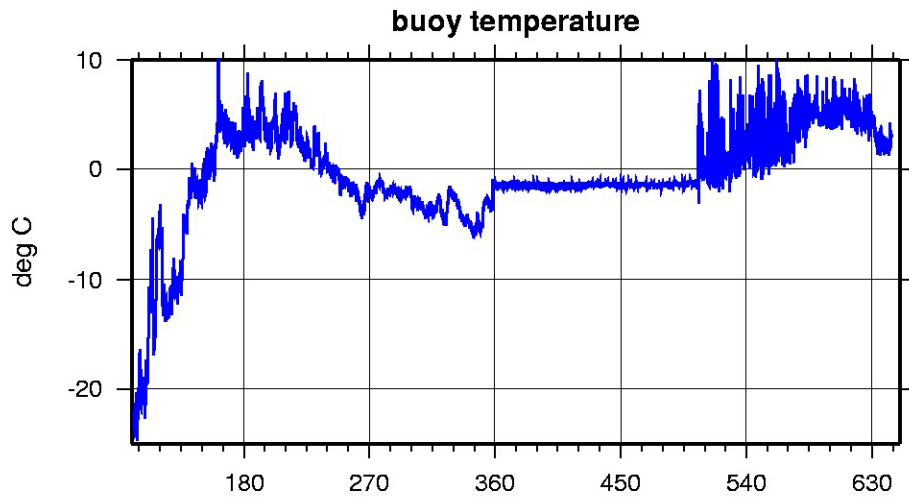
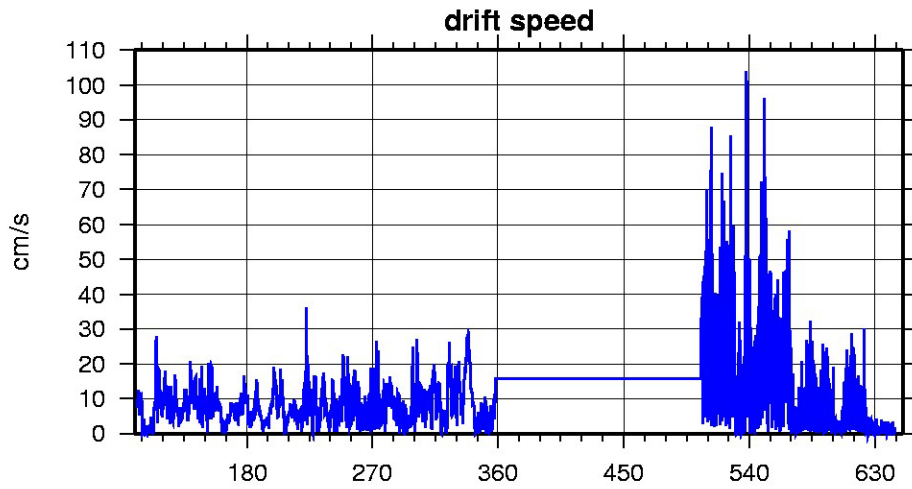
Level II hourly buoy location data in ASCII format: `itp47rawlocs.dat`

Level III 1-Hz processed profile data in MATLAB format: `itp47cormat.tar.Z` and `itp47cormat.zip`

Level III 1-db bin-averaged processed profile data in MATLAB format: `itp47final.mat`

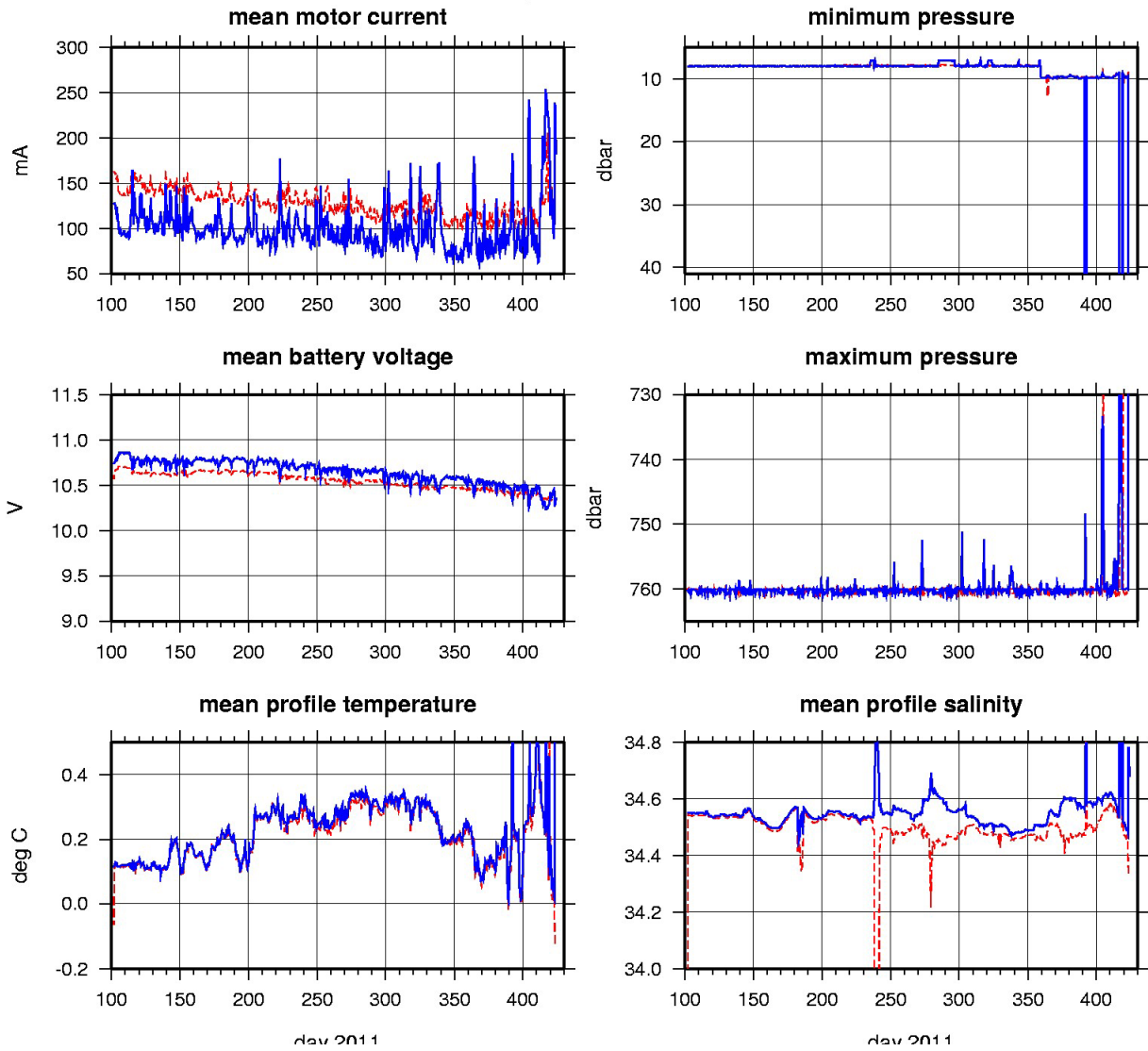
Level III 1-db bin-averaged processed profile data in ASCII format: `itp47final.tar.Z` and `itp47final.zip`

ITP47 Buoy Status (as of 2012/10/04)

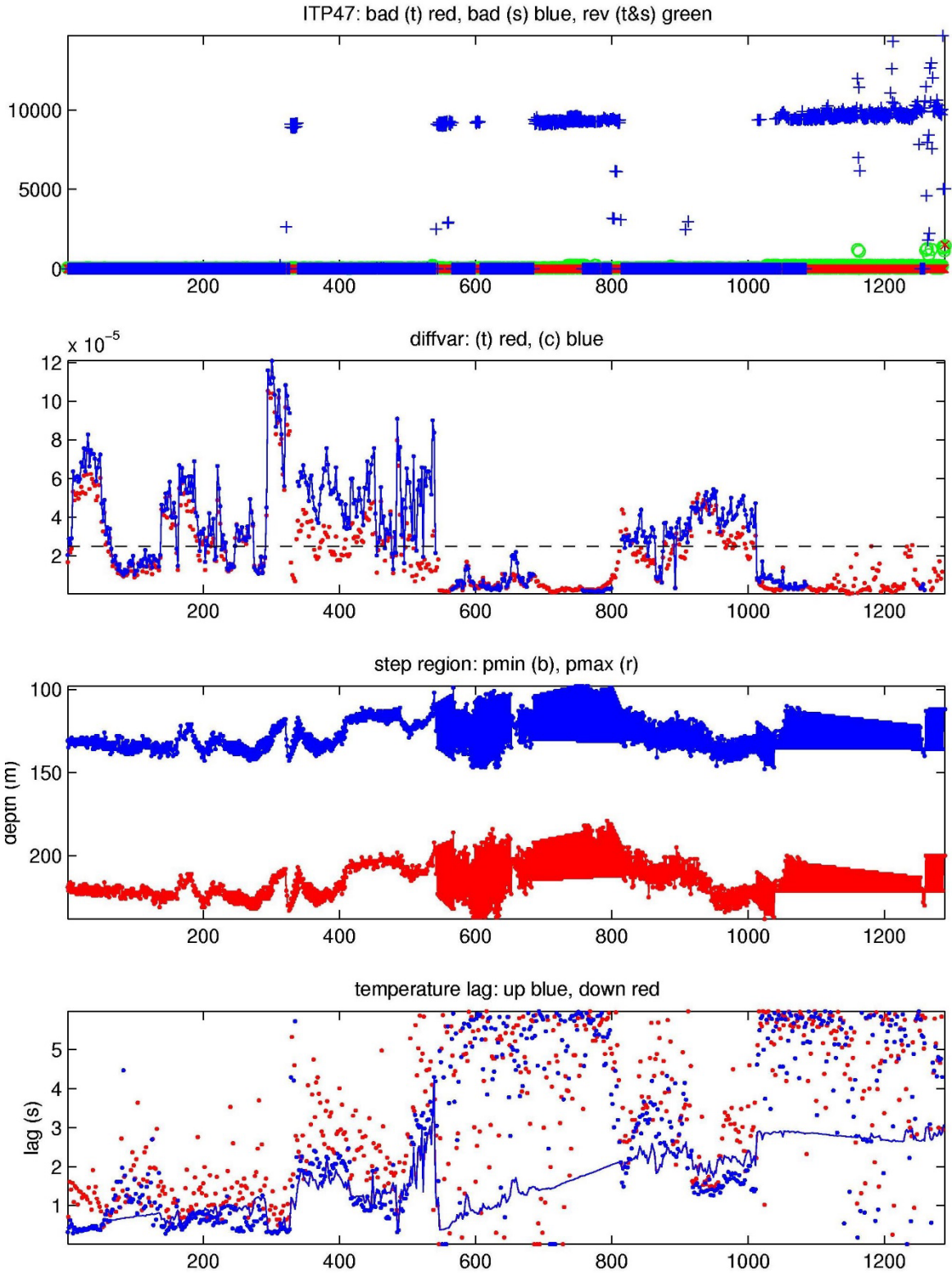


ITP47 Profiler Status (up to profile 1289)

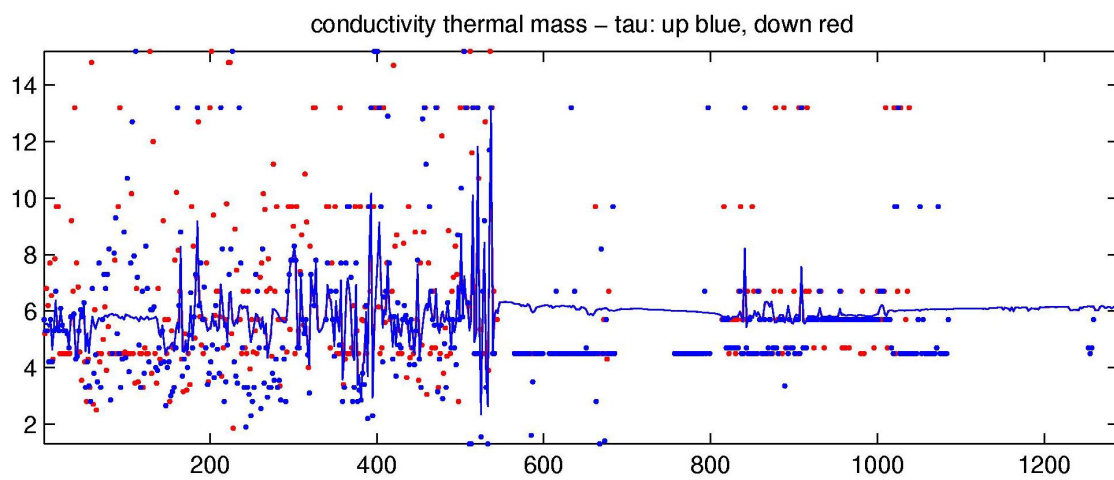
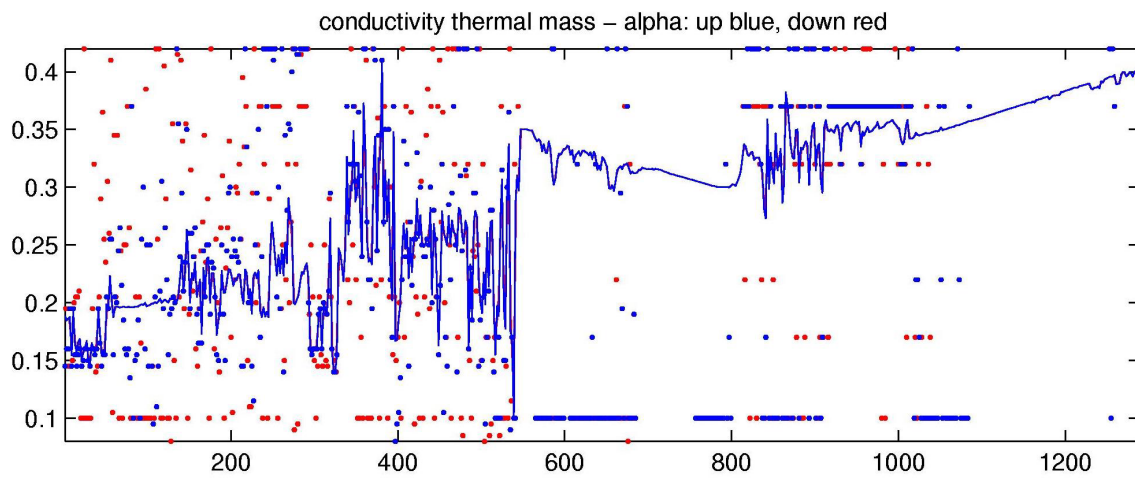
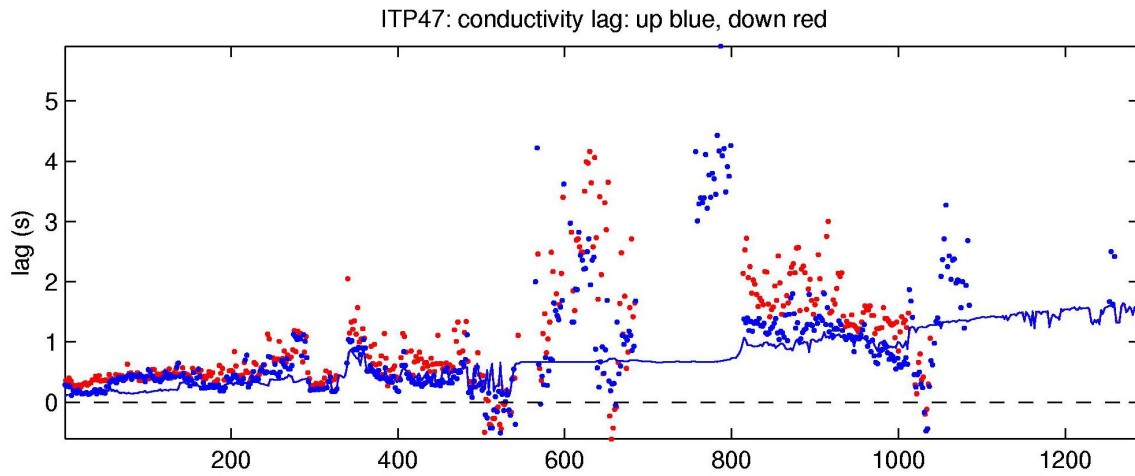
up solid, down dashed



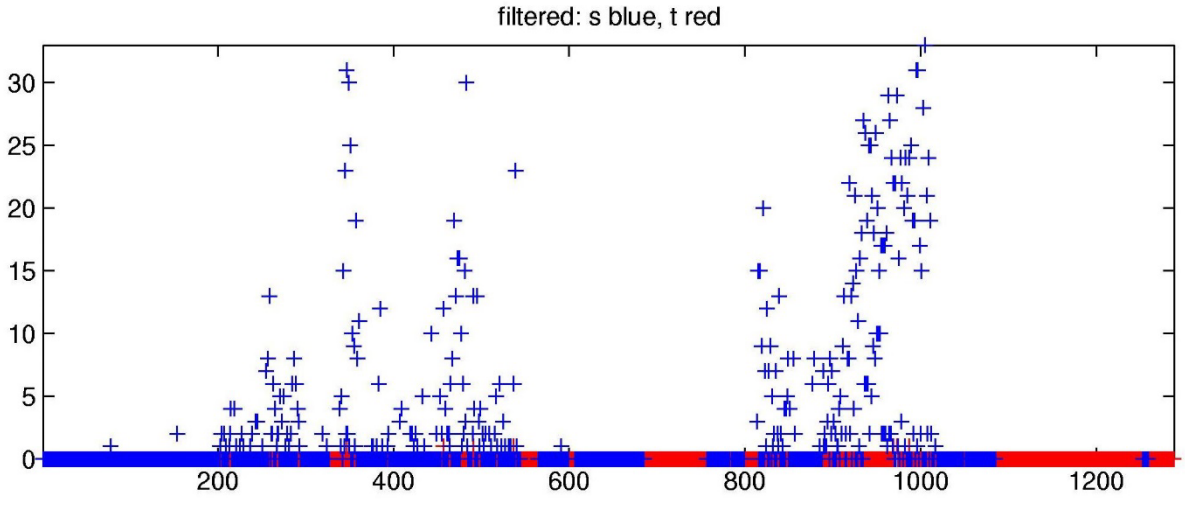
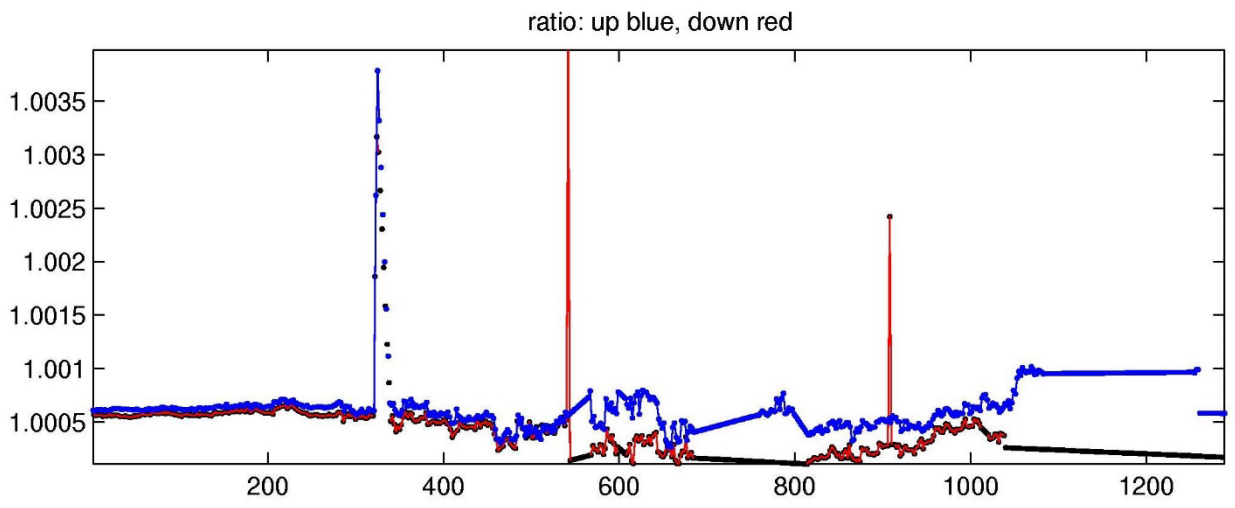
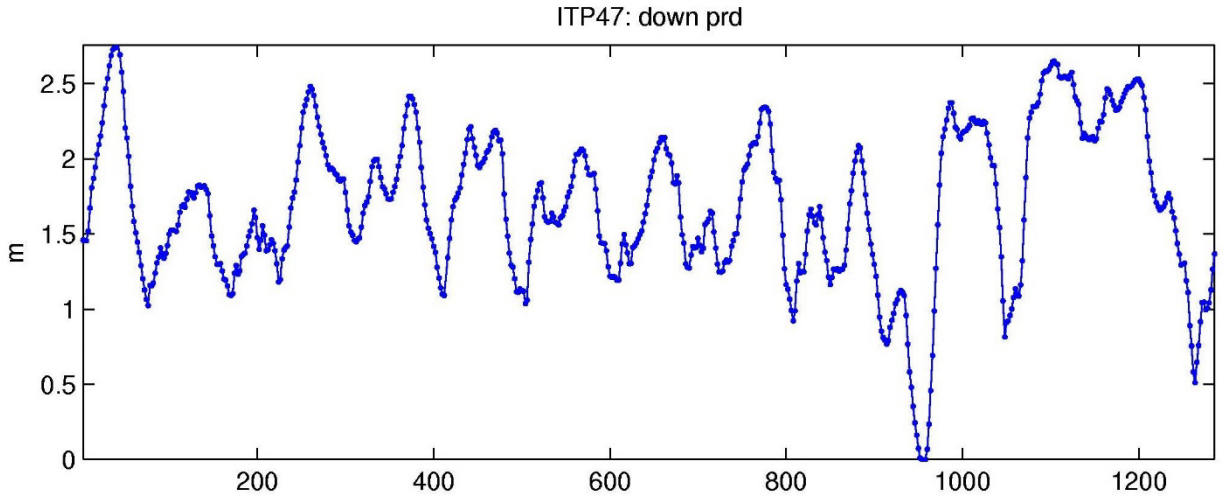
ITP profiler engineering data.



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.

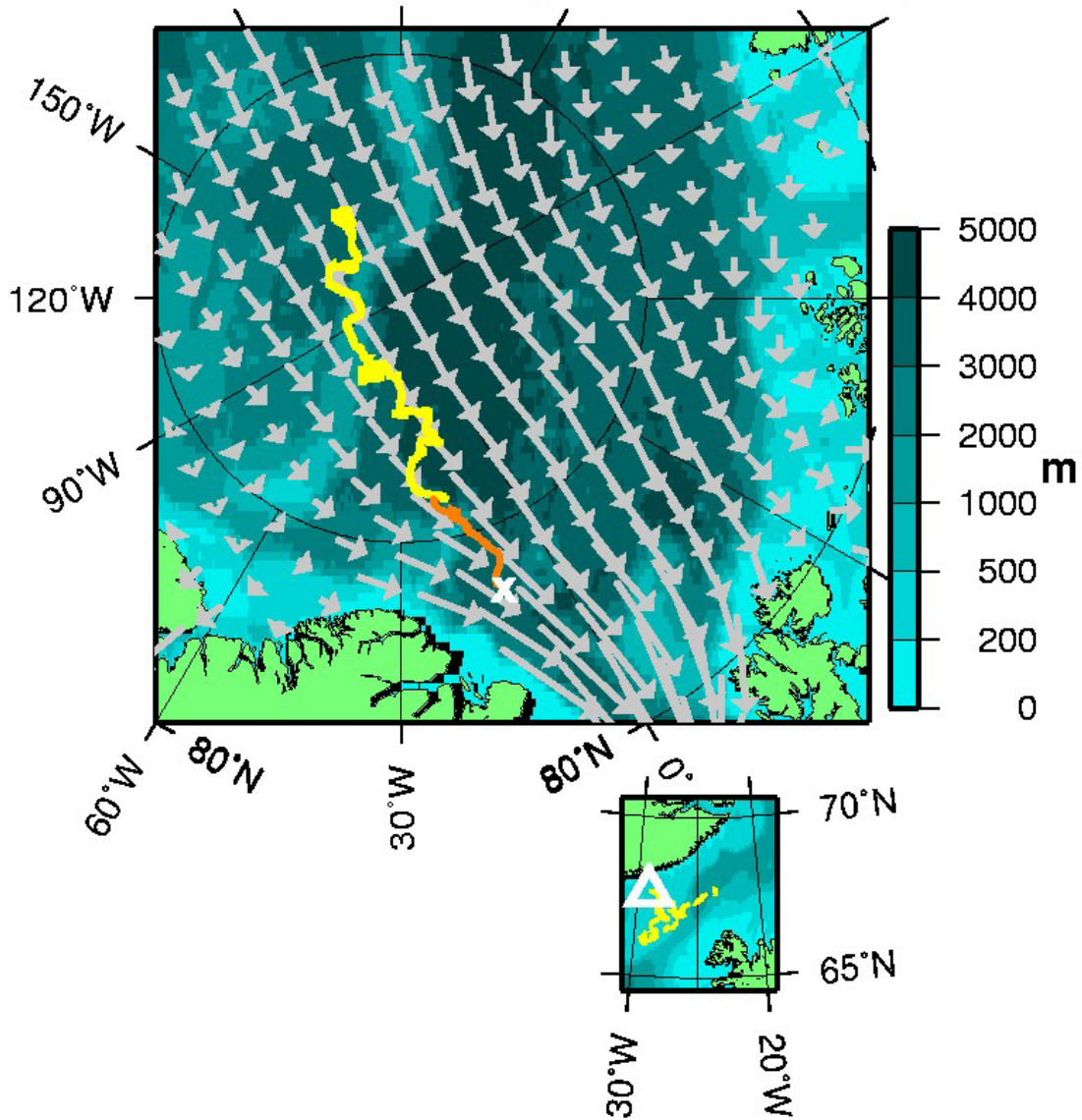


Top: conductivity lag, Middle: conductivity thermal mass amplitude correction, Bottom: conductivity thermal mass lag correction.



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

ITP47 Drift Track (as of 2012/10/04)

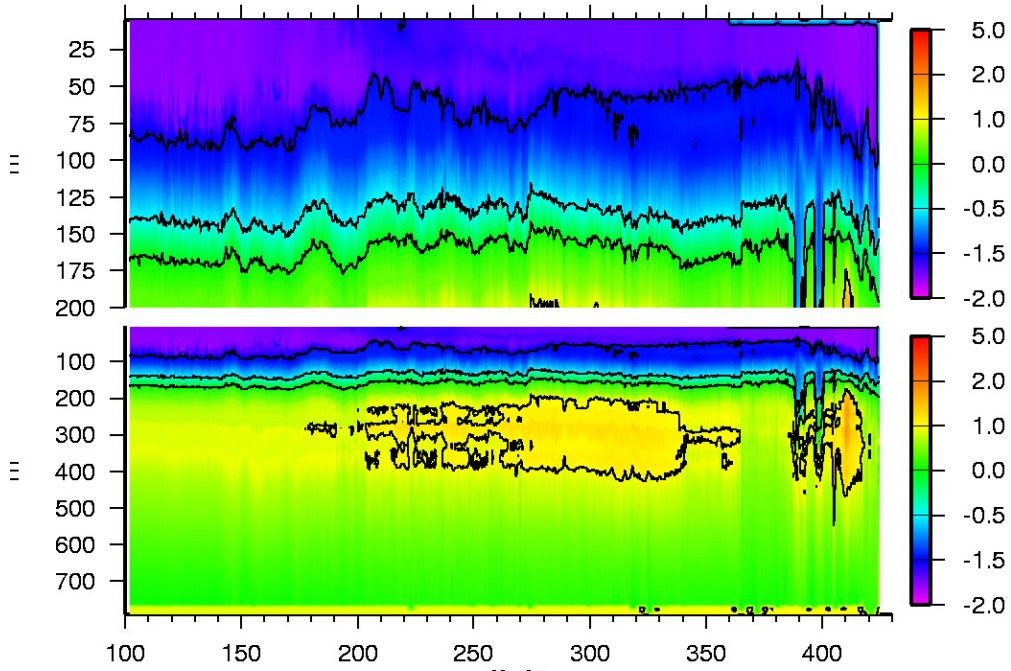


ITP drift (yellow lines), estimated drift (orange), last location (triangle), and annual ice drift from IABP (grey vectors) on IBCAO bathymetry (shading).

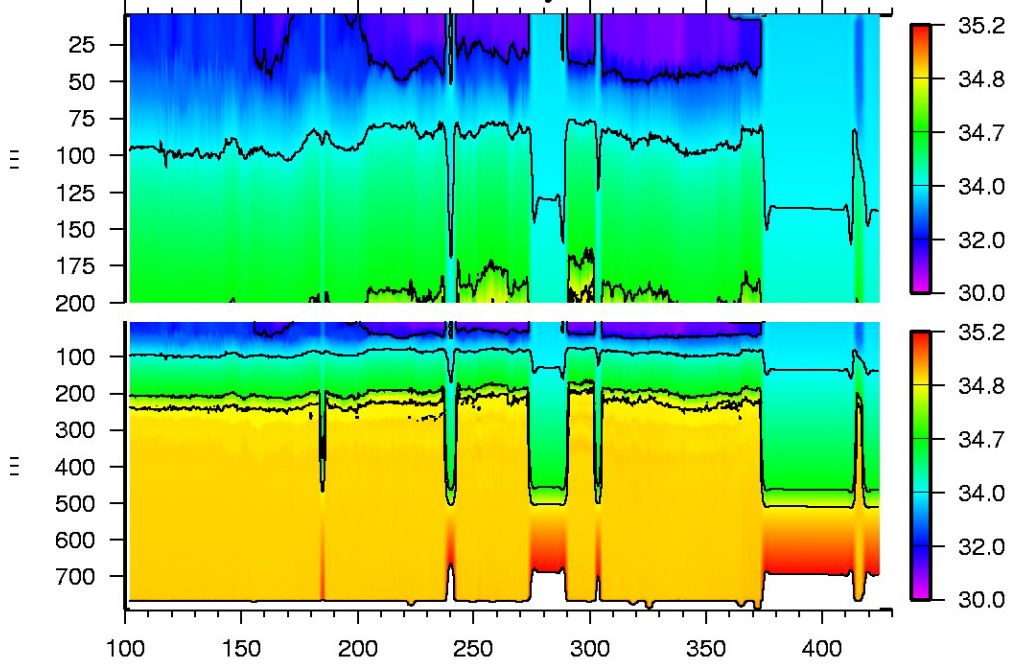
Plot of buoy locations.

ITP47 Up Profile Contours (to profile 1289)

temperature



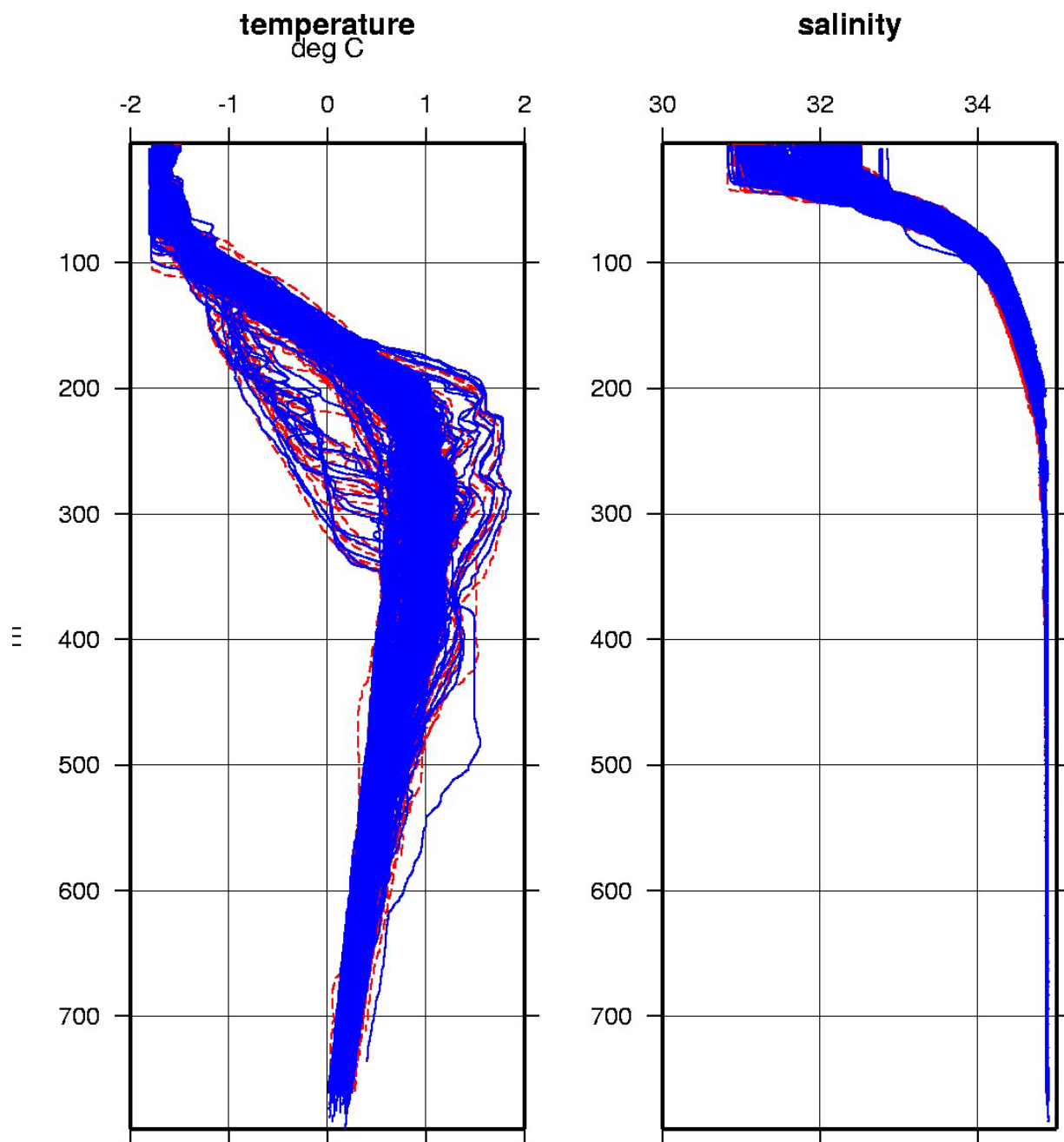
salinity



day 2011

ITP27 temperature and salinity contours.

All ITP47 Profiles (up to profile 1289)



up solid, down dashed

Composite plot of ITP temperature and salinity contours.



Shortly after deployment 175 miles upstream of Russian ice camp Barneo, ITP 47 rests on the 3.5 m thick ice flanked by AOFB on left and barely visible IMB on the right. (Rick Krishfield)



No tether, only surface package remained from ITP 47 when it was found onshore at Blacksod Bay in western Ireland nearly 2.5 years after installation. (Fergus Sweeney)



On display at the “Drifted, ITP 47” exhibit at Aras Inis Gluaire in Belmullet, Ireland in February 2014. (Fergus Sweeney)