

ITP42 Overview

Deployment Location: 10/4/2010, 00:00 UTC at 77° 39.8'N, 146° 15.5'W

Recovery Location: 7/31/2011, 23:02 UTC at 76° 20.6' N, 148° 2.7' W

Duration: 300 days

Distance Traveled: 2418 km

Number of profiles: 386 in 192 days

Other instruments: AOFB 22, IMB 2010-E

ITP 42 was deployed on a 2.35 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 22) and a US Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Mass Balance Buoy (IMBB 2010-E) were installed. The ITP operated on a standard sampling schedule of 2 one-way profiles between 7 and 760 m depth each day until the profiler battery failed prematurely after only 6 months. Fortunately, the system drifted near the cruise track of the *CCGS Louis S. St. Laurent* during the JOIS 2011 expedition, and the opportunity was taken to recover the ITP intact.

ITP42 Deployment Operations

It took 2 landings to find a suitable icefloe for deploying the first Ice-based Observatory (IBO) during the JOIS 2010 cruise. While the floe appears to be relatively large (300 m diameter) and flat, the 3 survey holes drilled are 1.5, 2.5 and 1.8 m thick beneath the snow. The AOFB is deployed first and while it is being interrogated to make sure that it operates properly, the ITP is deployed. Meanwhile another group is deploying the IMB and other scientists are conducting a thorough survey of the icefloe. The deployment operations end with the installation of a wind generator for the AOFB. As dusk begins to set in, all gear and passengers are returned to the ship, just before the weather turns and visibility declines.

ITP42 Recovery Operations

After 6 months of excellent profiling data acquisition and telemetry, the battery pack in ITP 42 profiler inexplicably exhausted. Fortunately, the surface package continued to acquire GPS locations and send status back daily via the Iridium transmissions so that when the JOIS 2011 expedition approached the vicinity of the buoy in July 2011, recovery of the system could be attempted. Besides retrieving the hardware for refurbishment and reuse, the instrument is needed to determine the cause of the battery failure.

On the morning of July 31st, a helicopter reconnaissance was conducted, and ITP 42 was located over 20 miles away from the ship sitting in melt pond. The IMB that was deployed near the ITP was still on the same icefloe, but the AOFB buoy was nowhere to be found. The IMB was still sending data, so was to be left undisturbed during the ITP recovery operation.

The ship arrived onsite in the afternoon and the Captain proceeded to expertly guide the vessel over the floe, so that it separated the ITP and left the IMB. The surface package was tagged by a crewmember using the man basket, and the system methodically hauled onboard using the mooring winch. Within an hour, the profiler appeared perfectly undamaged resting on the bumper and was brought onboard. Later testing determined that the profiler functioned perfectly, and that the failure could only be explained by a rare bad lithium battery pack.

ITP42 Data Processing

The 386 profiles that were transmitted and recovered from the ITP were processed according to the procedures described in the ITP Updated Data Processing Procedures. The processing parameters for ITP 42 are shown in the figures to the right. Buoy drift speeds infrequently exceeded 30 cm/s so the profiler covered the full extent of over 98% of the profiles. The CTD sensors were largely free of fouling, providing over 90% good data return.

Thermohaline staircases were present at the beginning and end of the time series, enabling CTD lag corrections. All the lags were in the typical range as previous systems and did not vary significantly. Potential conductivity exhibited some small spikes on 2 down profiles and larger shift over 6 other consecutive profiles. In general, the data quality is excellent over the short record.

ITP42 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.

The buoy drifted slowly south, meandered west and back east before the battery unexpectedly expired in the profiler in April 2011 after only a little over 6 months. The system continued to drift within a 200 km diameter area over the following 4 months for a total of 2583 km, until it was recovered 155 km from the deployment site.

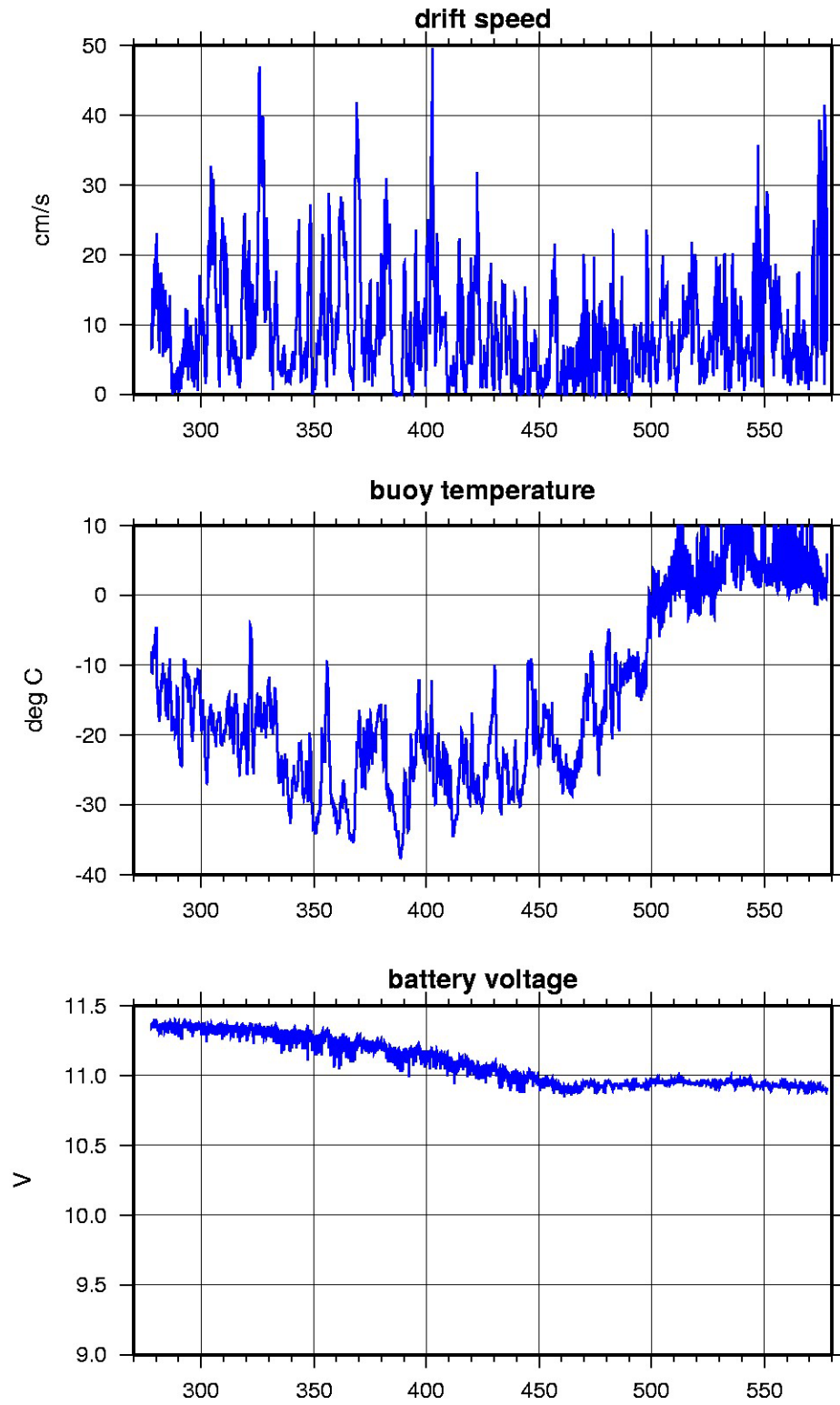
The plots below are of the final, calibrated, edited data (as opposed to the raw data presented on the active instrument pages).

Level II hourly buoy location data in ASCII format: `itp42rawlocs.dat`

Level III 1-Hz processed profile data in MATLAB format: `itp42cormat.tar.Z` or `itp42cormat.zip`

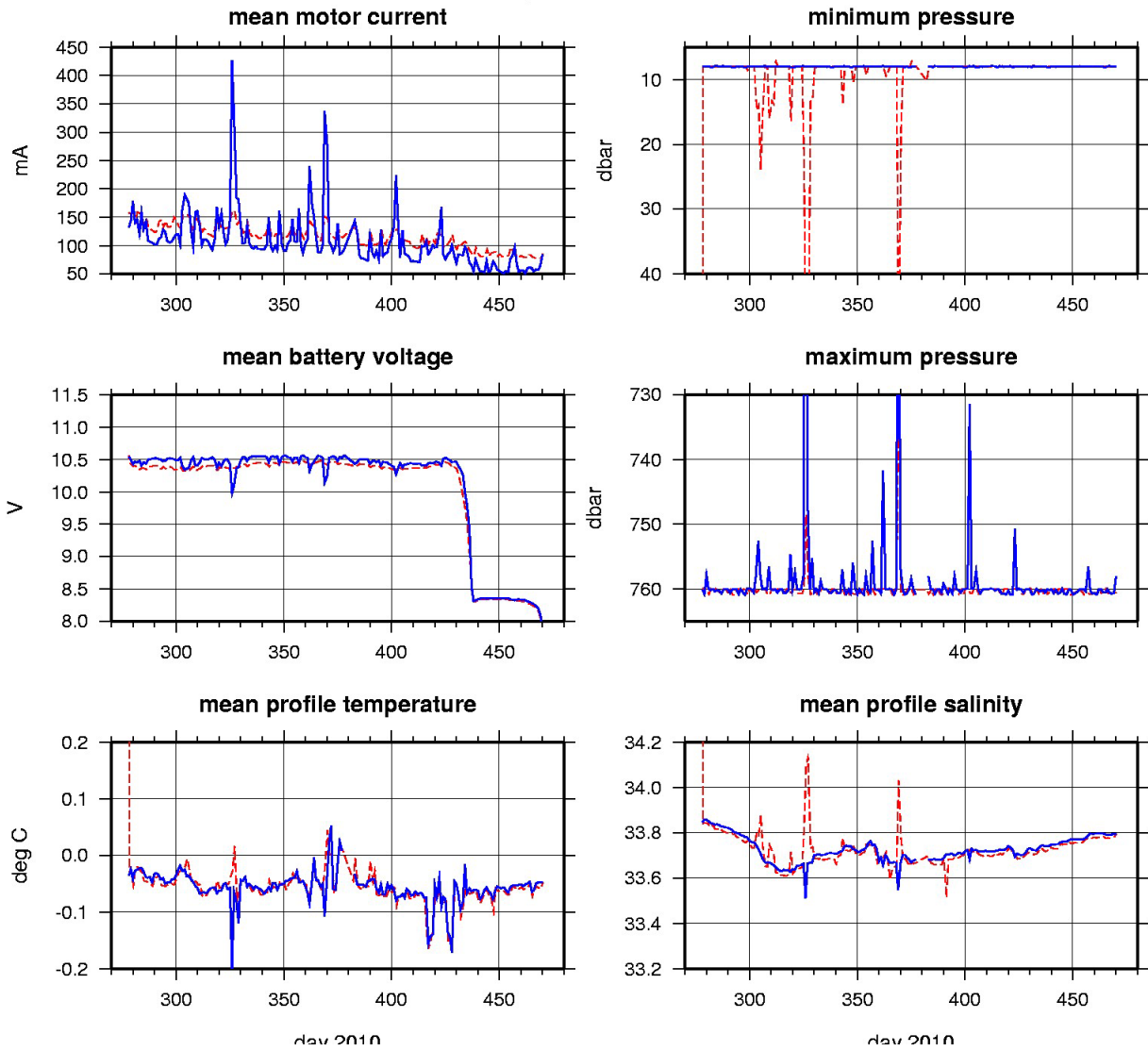
Level III 1-db bin-averaged processed profile data in MATLAB format: itp42final.mat
Level III 1-db bin-averaged processed profile data in ASCII
format: itp42final.tar.Z or itp42final.zip

ITP42 Buoy Status (as of 2011/07/31)

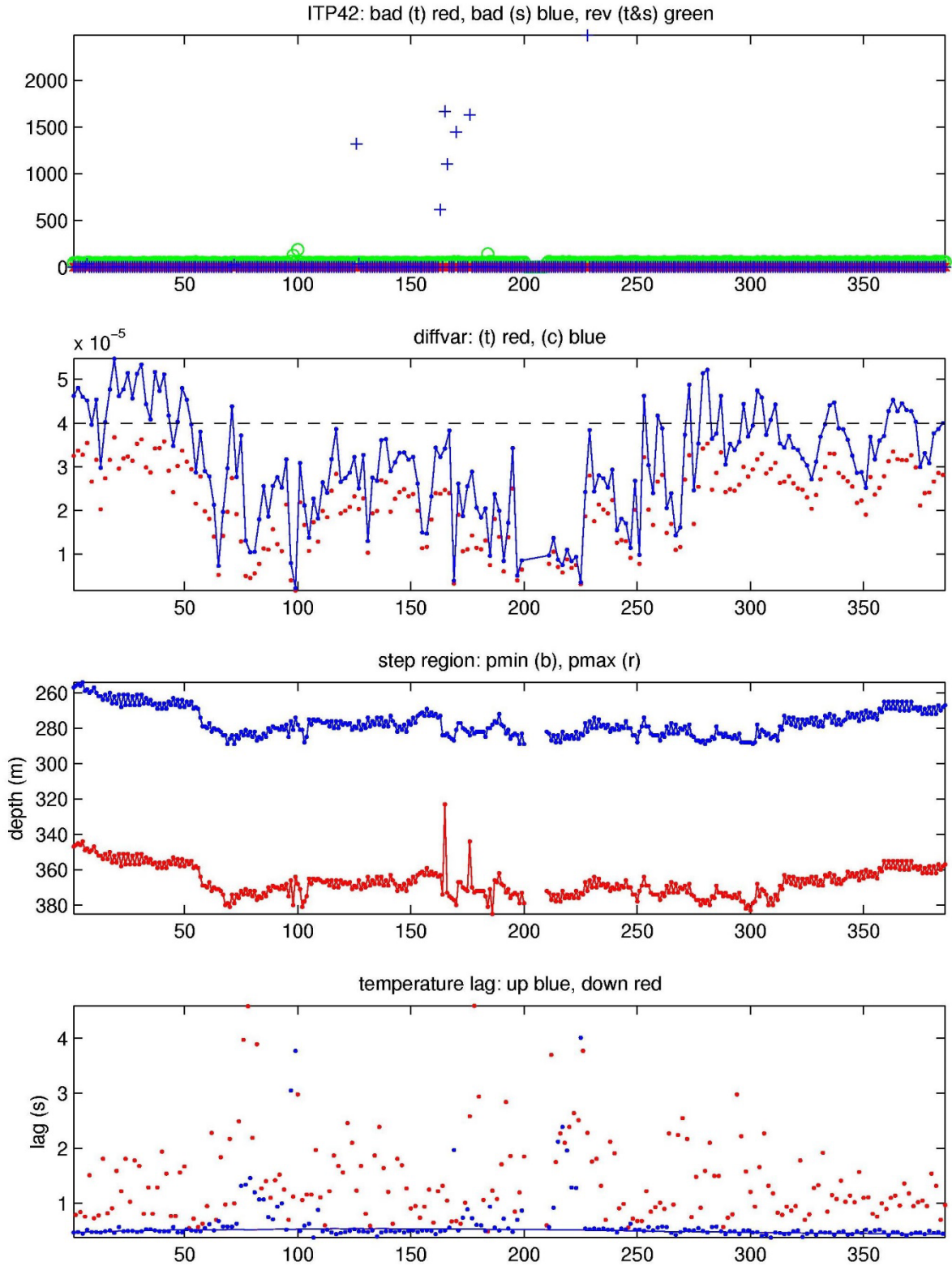


ITP42 Profiler Status (up to profile 386)

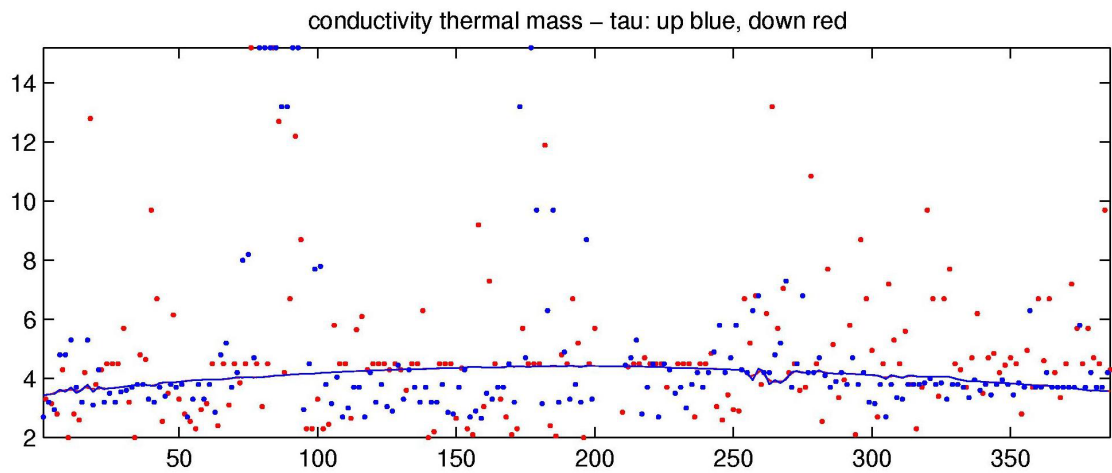
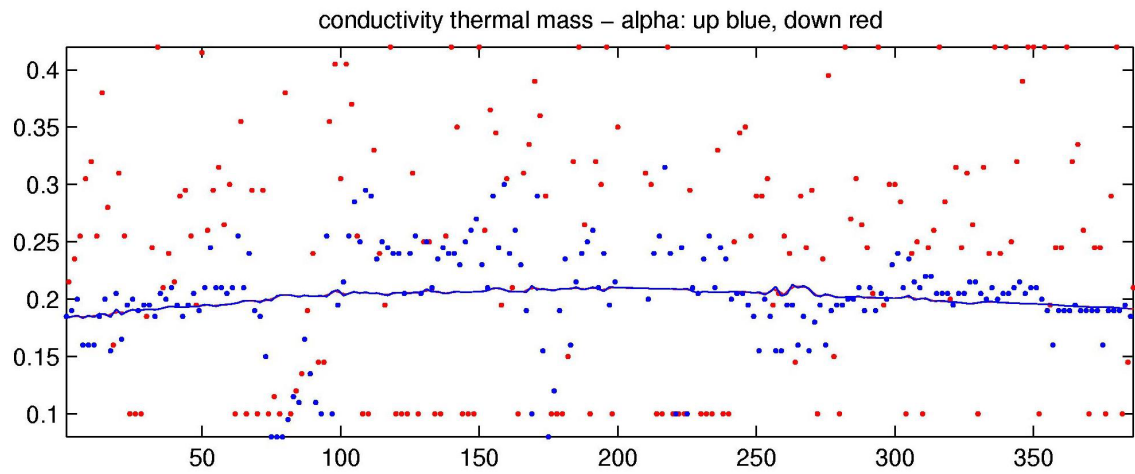
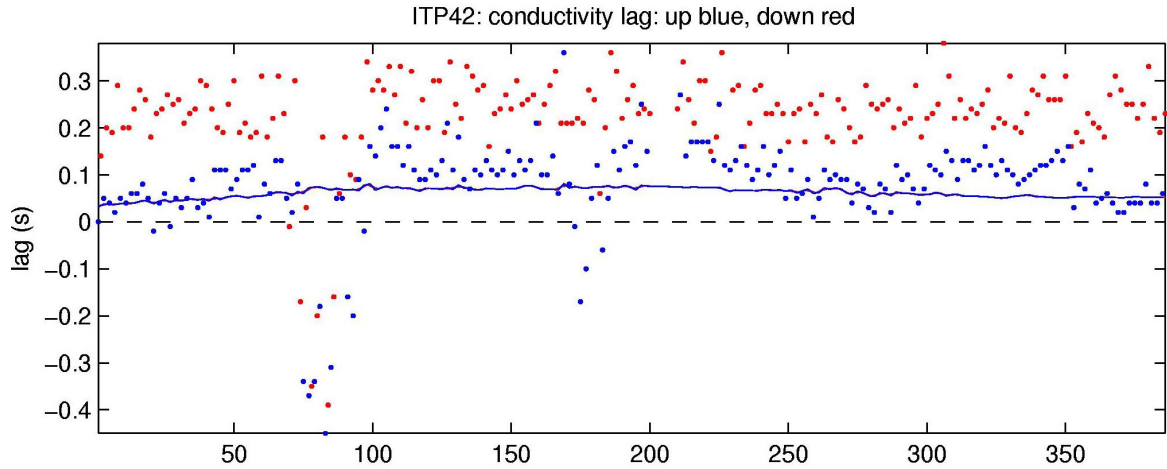
up solid, down dashed



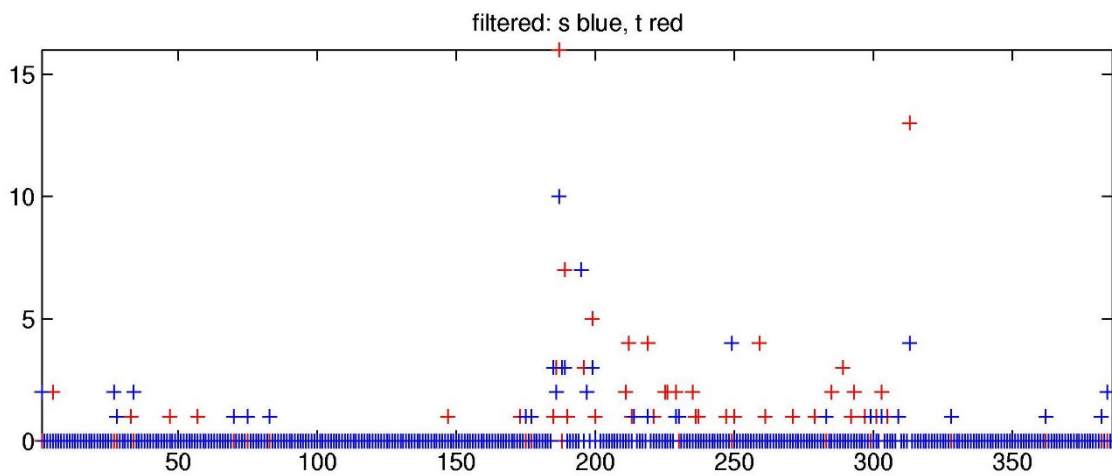
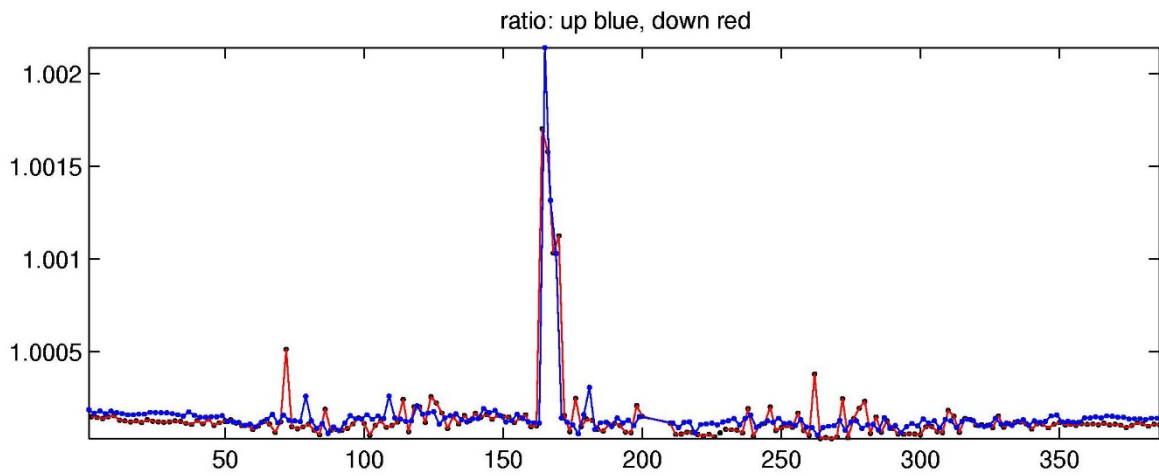
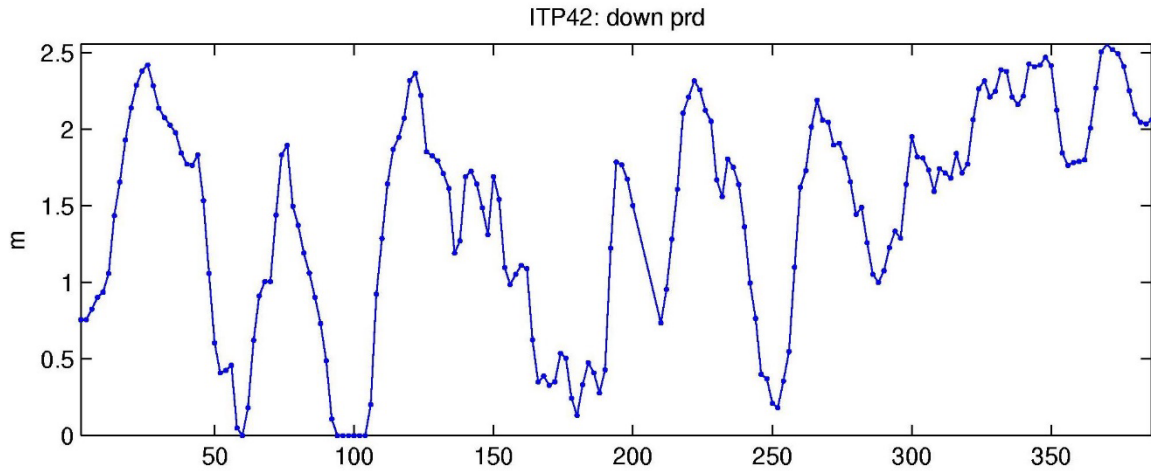
ITP profiler engineering data.



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.

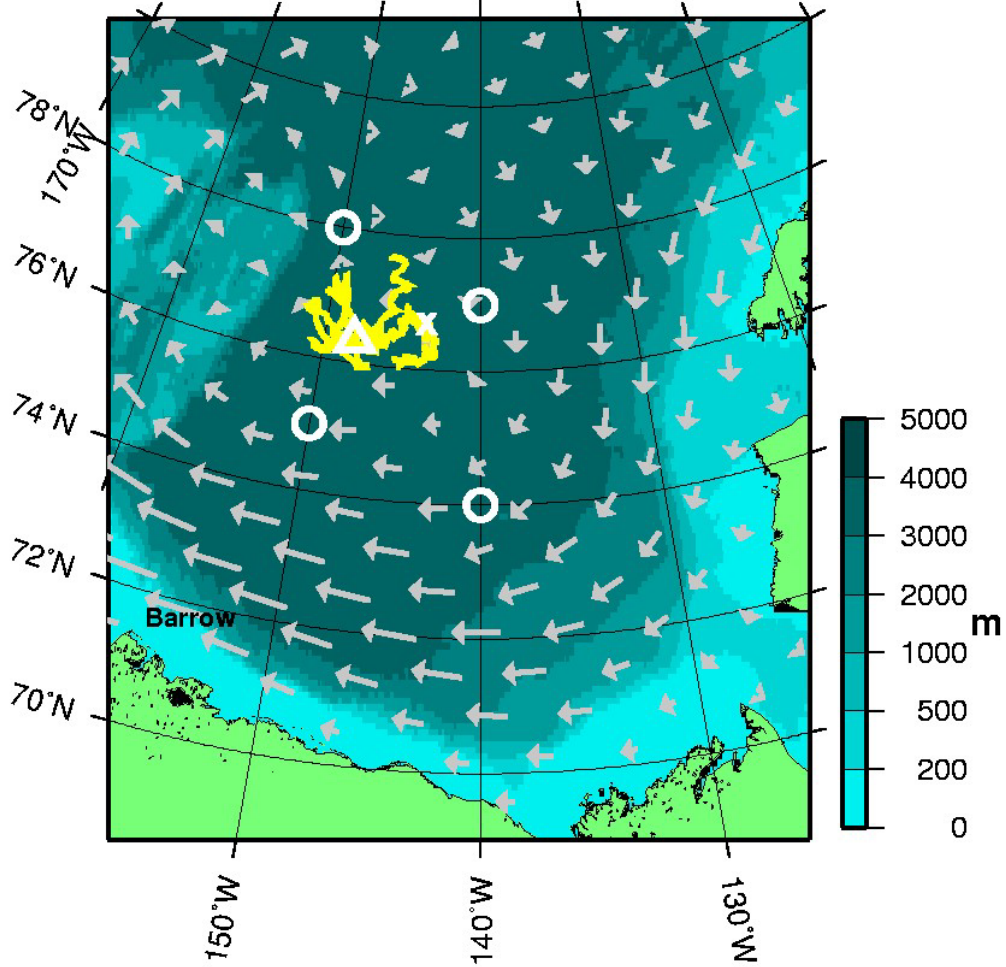


Top: conductivity lag, Middle: conductivity thermal mass amplitude correction, Bottom: conductivity thermal mass lag correction.



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

ITP42 Drift Track (as of 2011/07/31)

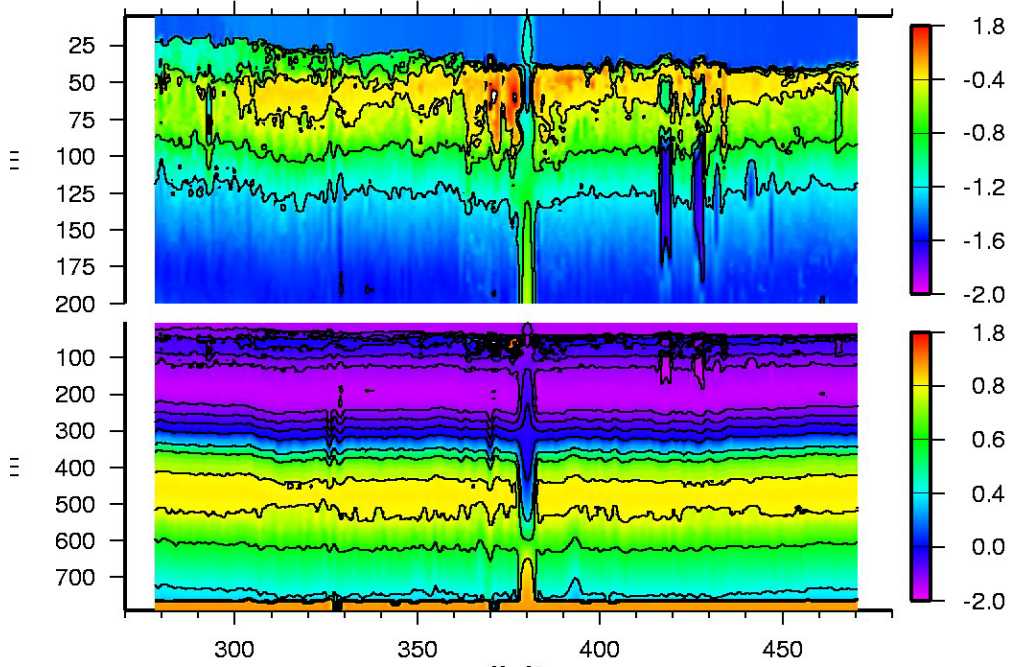


**ITP drift (yellow line), last profile (x), last location (triangle),
BGOS moorings (white circles) and annual ice drift
from IABP (grey vectors) on IBCAO bathymetry (shading).**

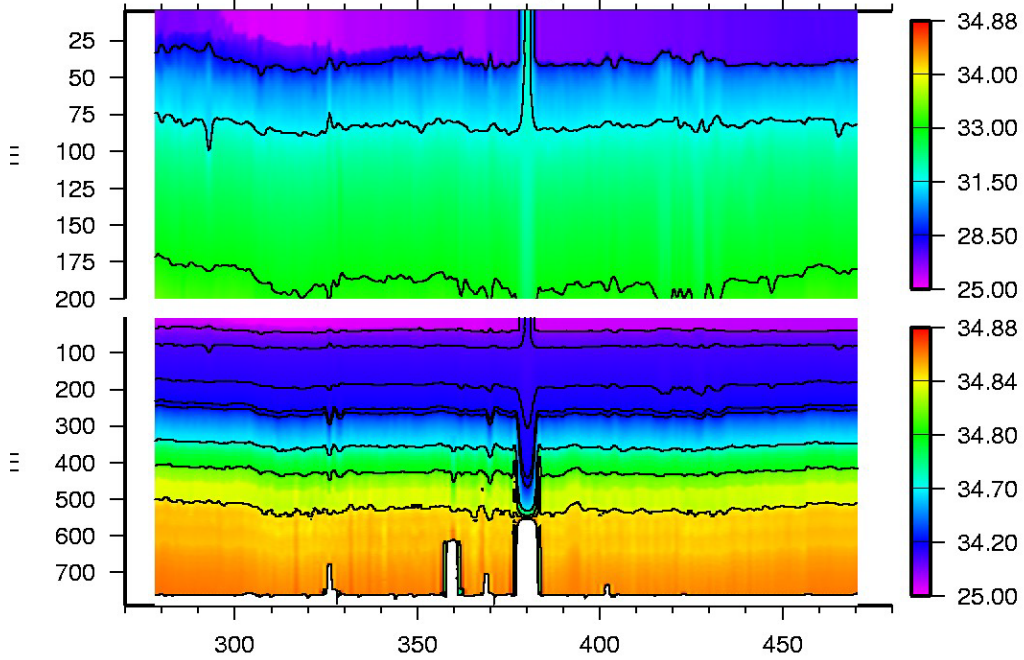
Plot of buoy locations.

ITP42 Up Profile Contours (to profile 386)

temperature



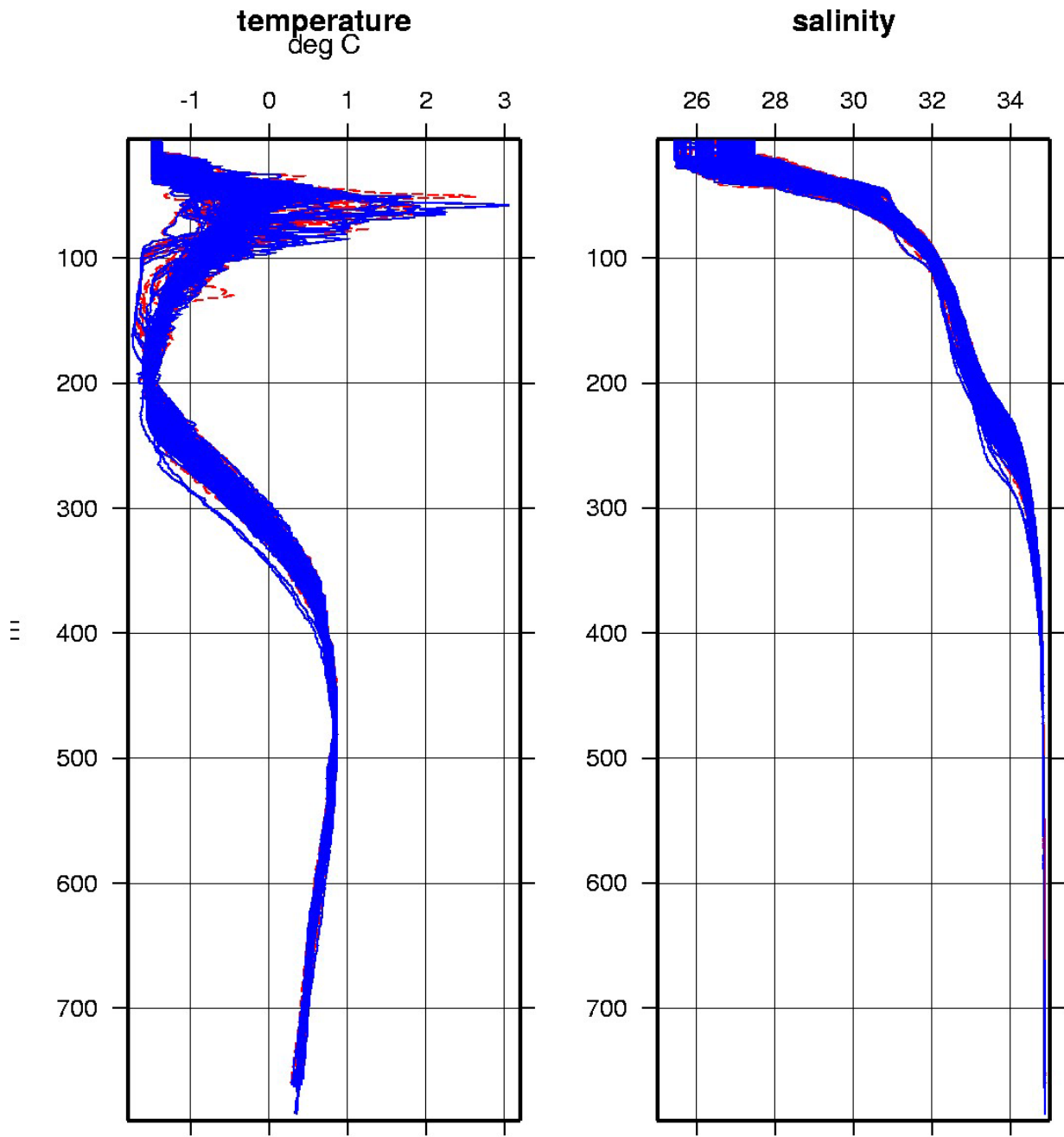
salinity



day 2010

ITP21 temperature and salinity contours.

All ITP42 Profiles (up to profile 386)



up solid, down dashed

Composite plot of ITP temperature and salinity contours.



From left to right, CCGS Louis S. St. Laurent, AOFB, and ITP 42 shortly after deployment during the JOIS 2010 cruise. Also installed as part of this Ice-Based Observatory was an IMBB which is out of the picture to the right. (Rick Krishfield)



The following summer during the JOIS 2011 expedition, ITP 42 and the IMB were found still occupying the same ice floe (reduced in size and thickness), but the AOFB was not found. (Gary Morgan)



The ITP profiler was designed to just fit through the 10.5" diameter hole. (Rick Krishfield)



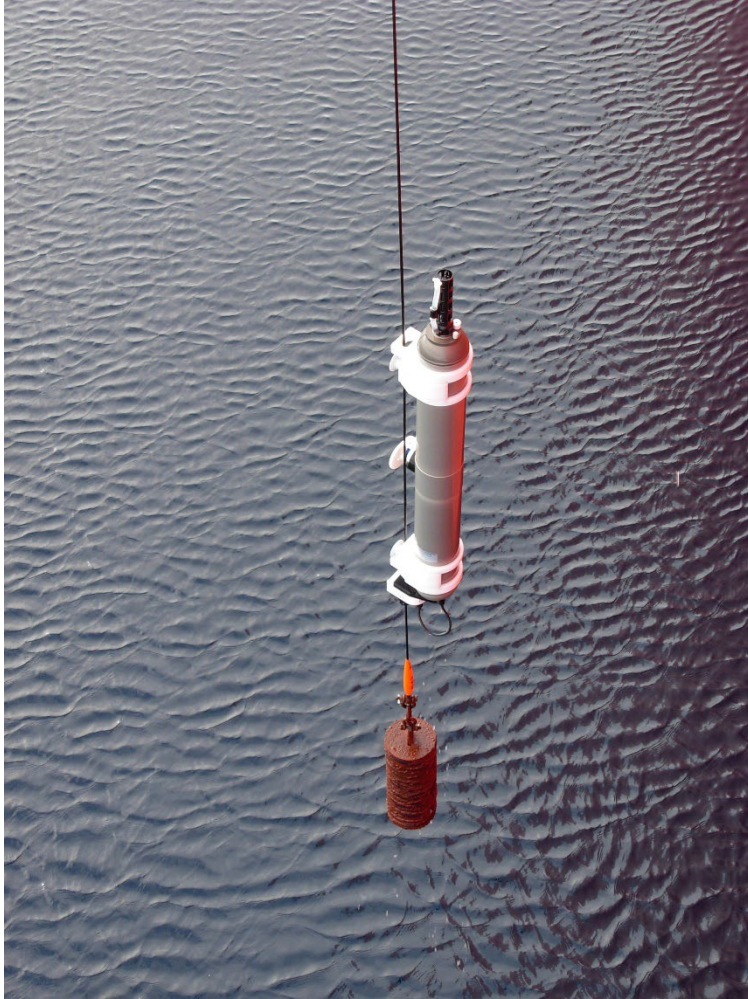
Flying back passengers after the deployment operations are completed. (Kazu Tateyama)



ITP42 as deployed. (Rick Krishfield)



After breaking ITP 42 away from the floe, Seaman Barney Noseworthy attaches the winch cable to the surface package. (Gary Morgan)



The prize arrives when a completely clean and intact ITP 42 profiler emerges from the ocean.
(Rick Krishfield)