ITP 3 Overview

Deployment Location: 8/23/2005, 23:00 UTC at 77° 36.1'N, 142° 11.8'W

Last Location: 9/9/2006, 22:00 UTC at 74° 15.0' N, 135° 9.0' W

Duration: 382 days

Distance Travelled: 2541 km

Number of profiles: 1532 in 382 days

Other instruments: IMB 2005-B

The third ITP was deployed in the Beaufort Sea on as part of the Beaufort Gyre Observing System (BGOS) during the JWACS 2005 cruise on the CCGS Louis S. St. Laurent. ITP3 and an US Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Mass Balance Buoy were deployed on a 3.5 m thick multiyear ice floe in a location designed to drift through the BGFE array during the following year. The ITP unit operated on a fast sample schedule of 4 one-way profiles between 10 and 760 m depth each day until the unit was damaged during an attempted recovery operation the following summer.

ITP 3 Deployment Operations

ITP 3 and IMB 07950 were the second Ice Based Observatory (IBO) deployed during JWACS 2005. Without either ship's propulsion (while a main shaft bearing on the ship was being repaired) or helicopter support (grounded), the personnel and gear were deployed over the port side of the CCGS Louis S St. Laurent onto a small (50 m diameter) 3.35 m thick ice floe after several days of surveying and false starts interrupted by the formation of cracks in the ice.

On August 23, a bridge was built to cross a large (4 m) gap between floes to the ITP deployment site. It took only about 3.5 hours overall to deliver all the ITP gear to the site, deploy ITP 3, and return with the installation equipment. Meanwhile, deploying IMB 07950 took about an hour and a half to drill the holes and install the sensors and buoy. Subsequently, the wires were covered with snow.

ITP 3 Recovery Attempt

The following summer, during JWACS 2006, an attempt was made to recover ITP, but failed. On September 10, 2006, ITP3 and IMB 07950 were located. The IMB was still partially operating, but the ITP profiler (having obtained over 1500 profiles) would soon expire its battery, so recovery was desirable. Unfortunately, the conditions of the ice floe (small, with extensive melt ponds connected to the ocean) prevented a recovery with the ITP winch system. Instead, the icebreaker attempted to break the ice floe to release the buoy into open water where it could be recovered over the side of the ship. Though small, the icefloe was still

2.5-3 m thick and did not crack along the ITP wire. Recovery attempts were terminated after the ITP surface package was damaged and stopped operating, but while the IMB continued to still partially operate, rather than jeopardize the integrity of the IMB.

ITP 3 Data Processing

The 1532 profiles that were recovered from the ITP were processed according to the procedures described in the ITP Data Processing Procedures report. The processing parameters for ITP3 are shown in the figures to the right. Overall, ITP3 returned remarkably clean and complete profiles. Only towards the end of the time series (after profile 1500) when the profiler battery was getting low and the ice floe was drifting faster, did the instrument have trouble completing full profiles. Only profile 1430 was subject to an instrument reset, so there is no CTD data from that profile. Profiles 430, 431, 622, 623, 624, 929, 1050 and 1136 were too contaminated (presumably from biofouling) to salvage. In the final product, 1520 profiles (99.2%) have no more than one bad temperature measurement, and 1501 (98.0%) have no more than one bad conductivity spike.

ITP 3 Data Description

The ITP profiler was configured to operate with an accelerated sampling schedule of 4 one-way profiles between 10 and 750 m depth each day in order to more quickly evaluate endurance and component fatigue. In the surface package, the GPS receiver was powered every two hours to obtain locations, and buoy temperature and battery voltage status were recorded. Both operated reliably for 382 days until the system was destroyed. The battery voltage of the profiler had been dropping sharply at the end and would not have likely been able to power the profiler for much longer.
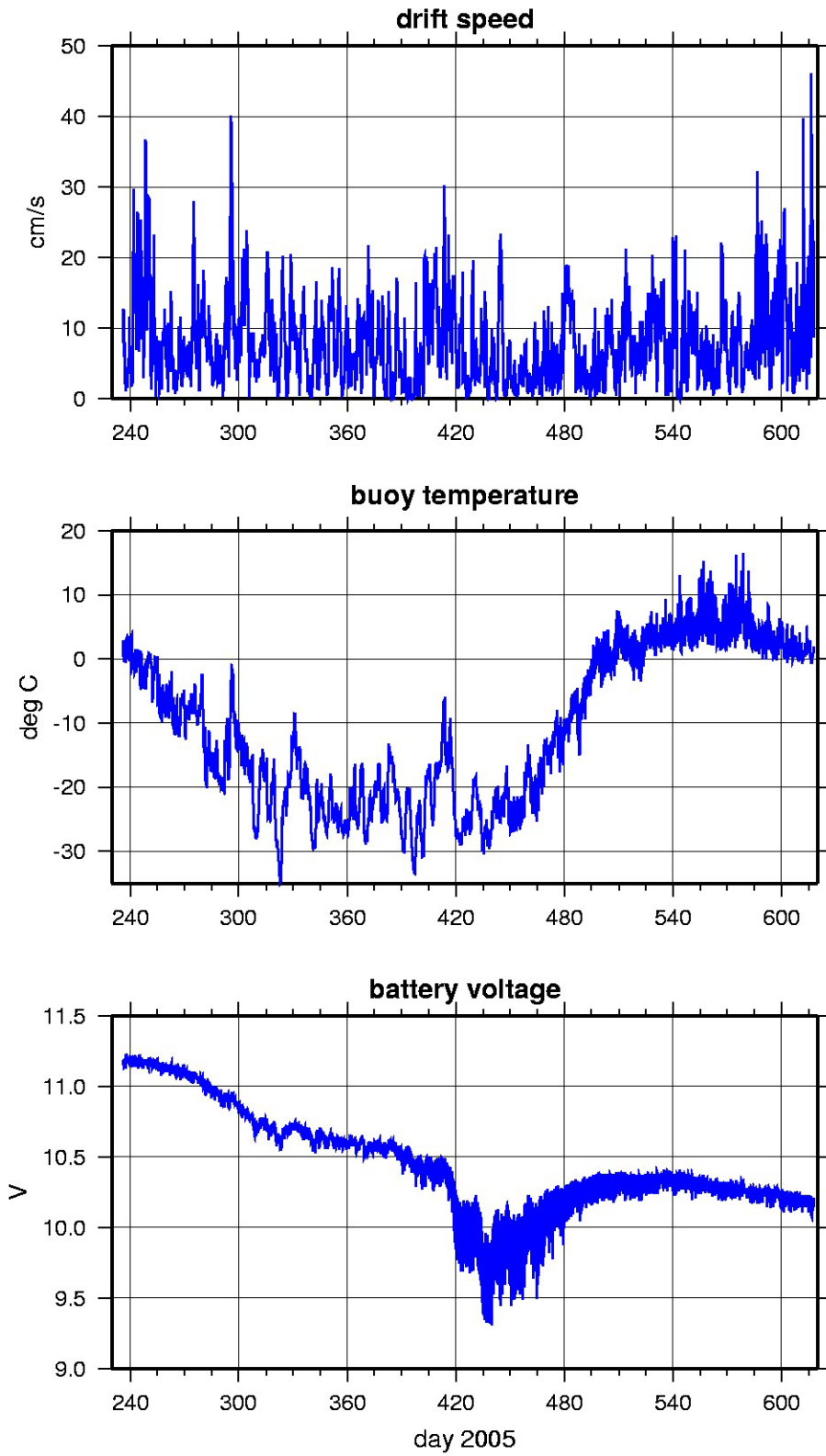
Level II bi-hourly buoy location data in ASCII format: itp3rawlocs.dat

Level III 1-Hz processed profile data in MATLAB format: itp3cormat.tar.Z or itp3cormat.zip

Level III 1-db bin-averaged processed profile data in MATLAB format: itp3final.mat
Level III 1-db bin-averaged processed profile data in ASCII
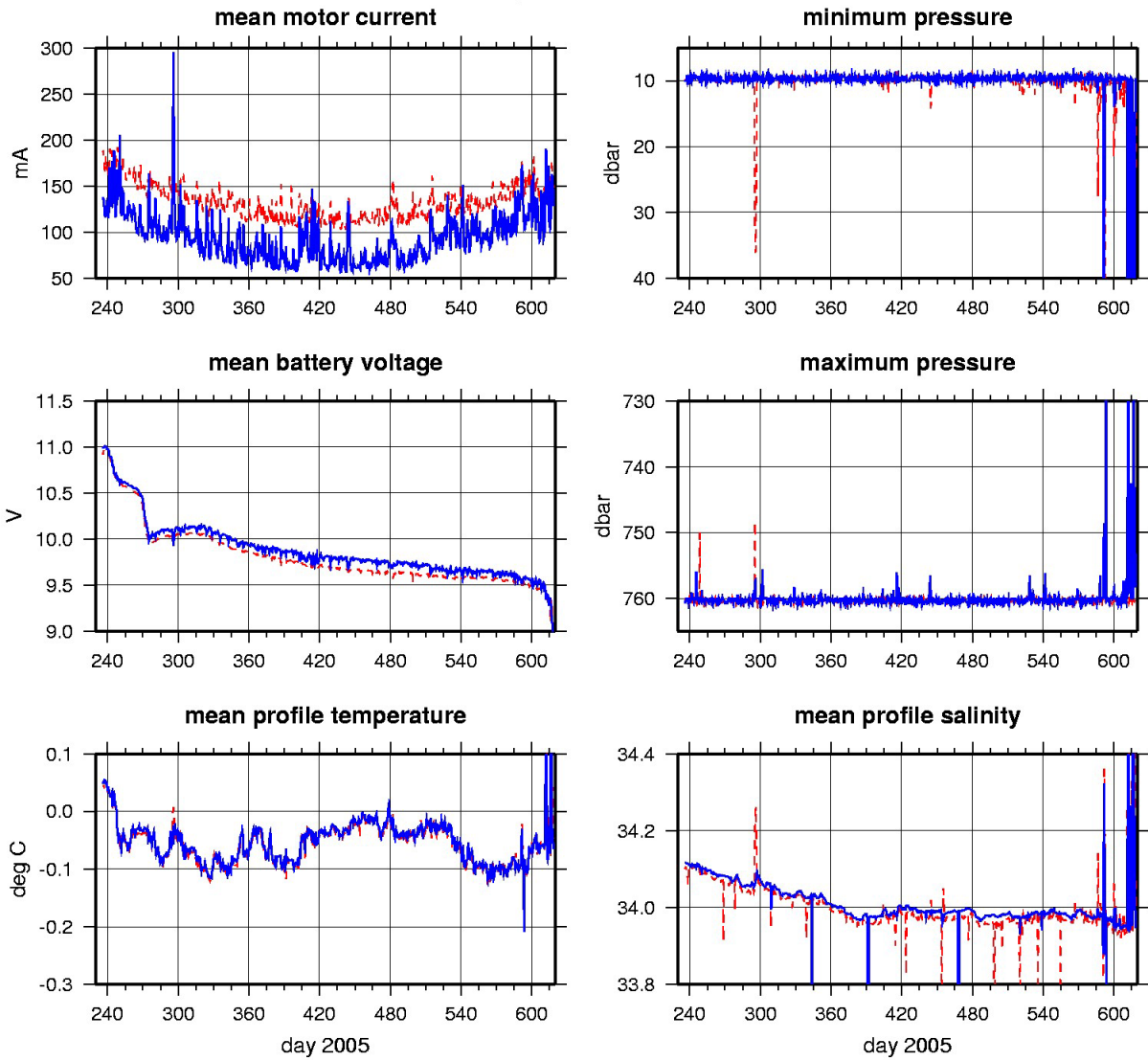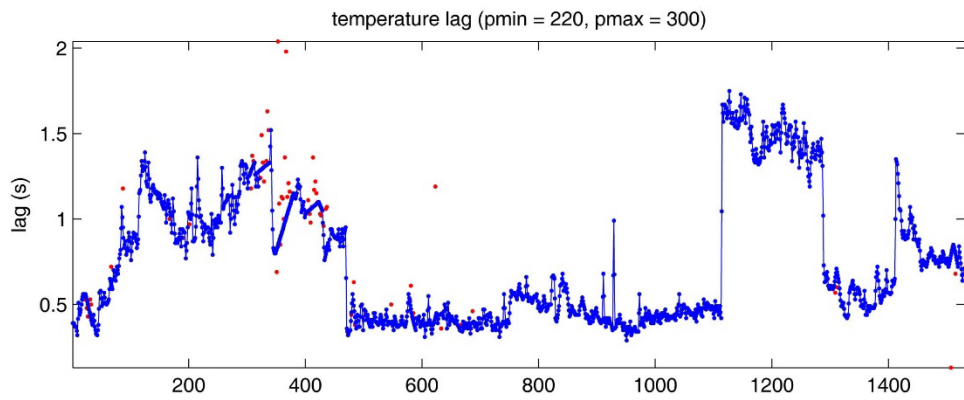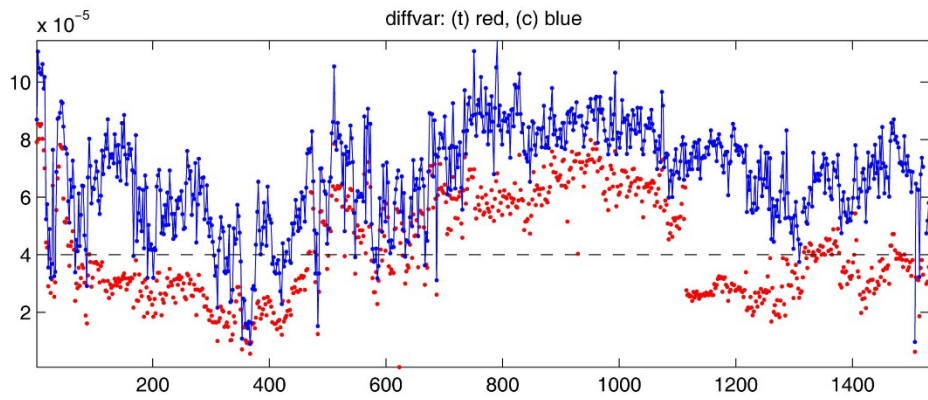format: itp3final.tar.Z or itp3final.zip

ITP3 Buoy Status (as of 2006/09/09)

drift speed

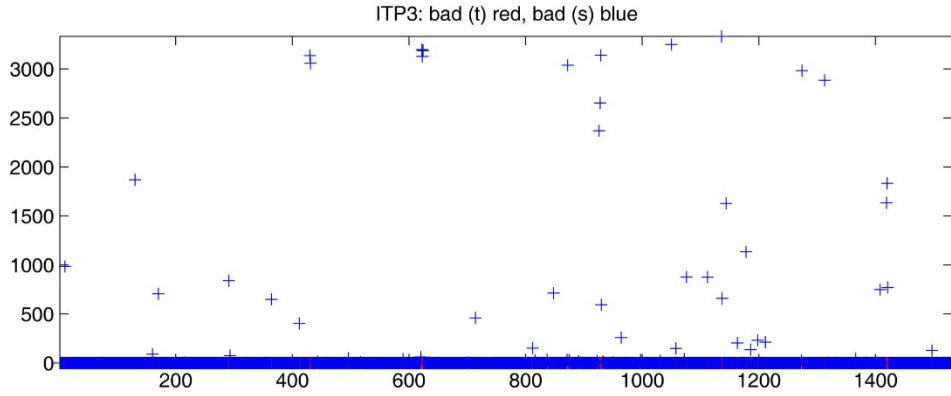## buoy temperature

battery voltage

day 2005

ITP surface buoy status

# ITP3 Profiler Status (up to profile 1532)

up solid, down dashed

mean motor current

minimum pressure

mean battery voltage

maximum pressure

mean profile temperature

## mean profile salinity

day 2005

day 2005

ITP profiler engineering data

Top: number of bad points removed, Middle: variance of vertical difference of temperature and salinity in step region for up-going profiles, Bottom: temperature lag.
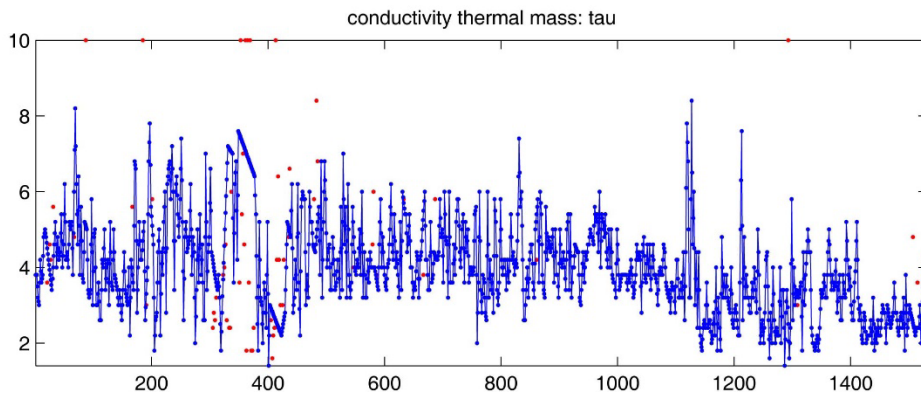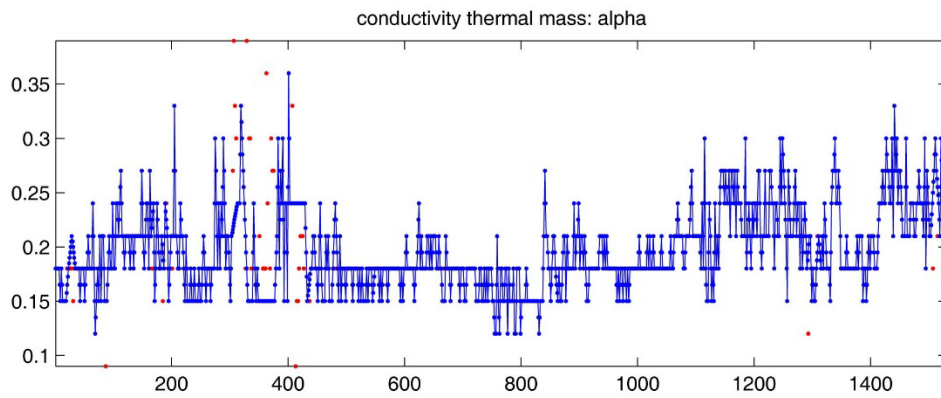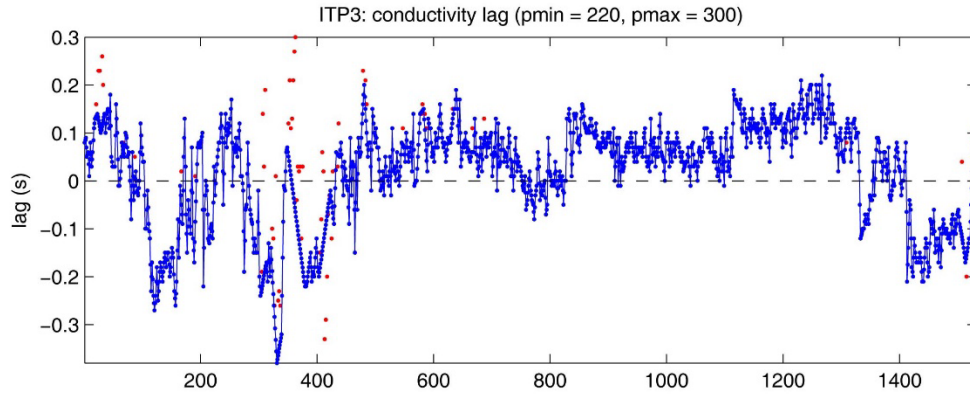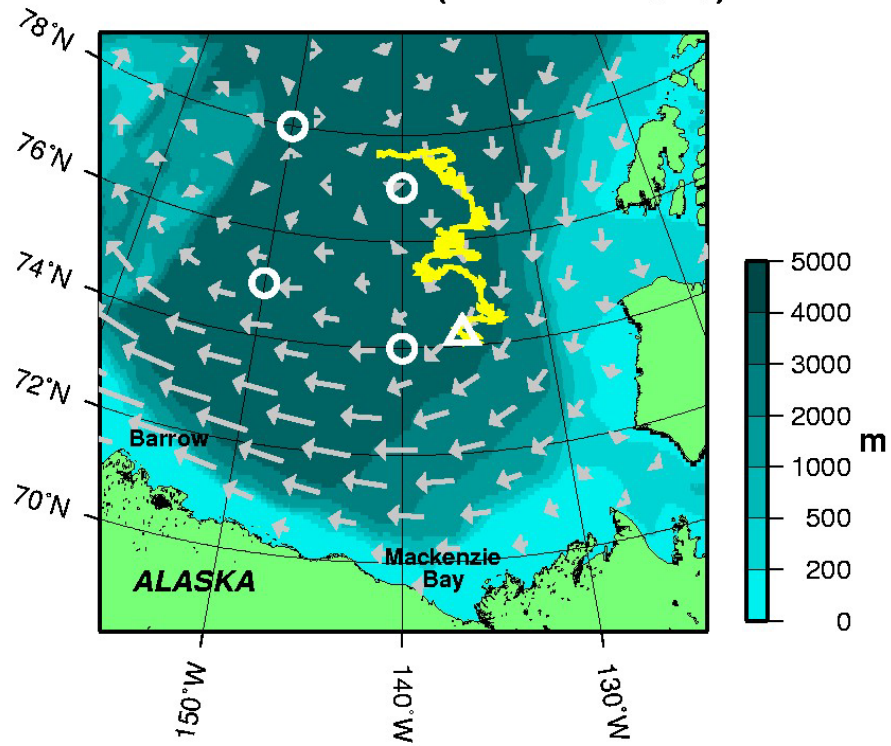
Top: conductivity lag, Middle: conductivity thermal mass amplitude correction, Bottom: conductivity thermal mass lag correction.
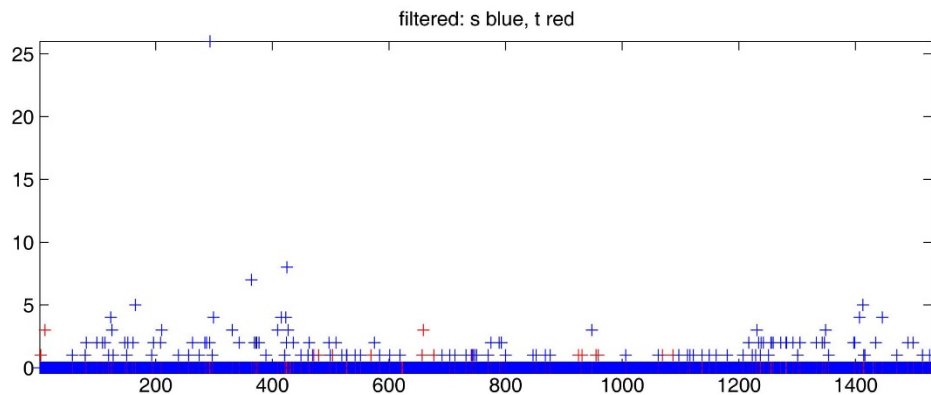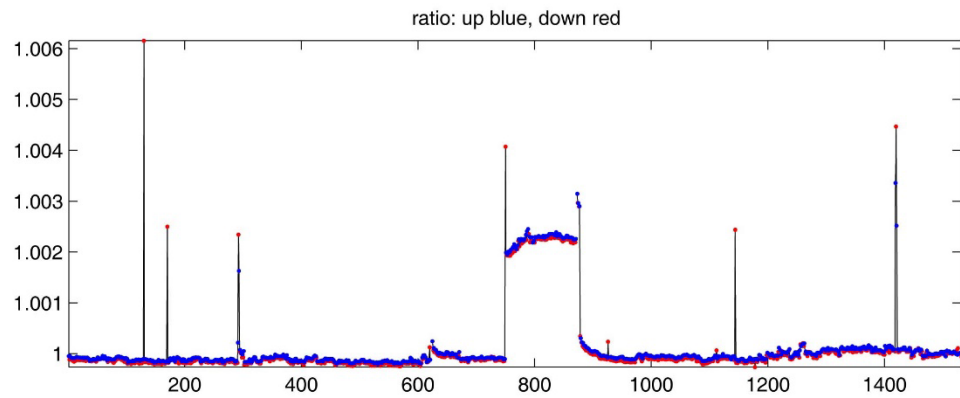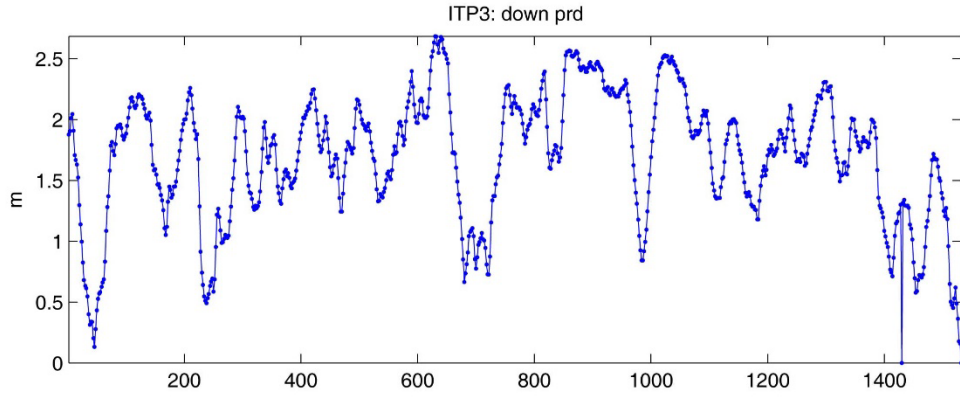
Top: down pressure deviation correction, Middle: salinity ratio adjustment, Bottom: Number of filtered spikes.
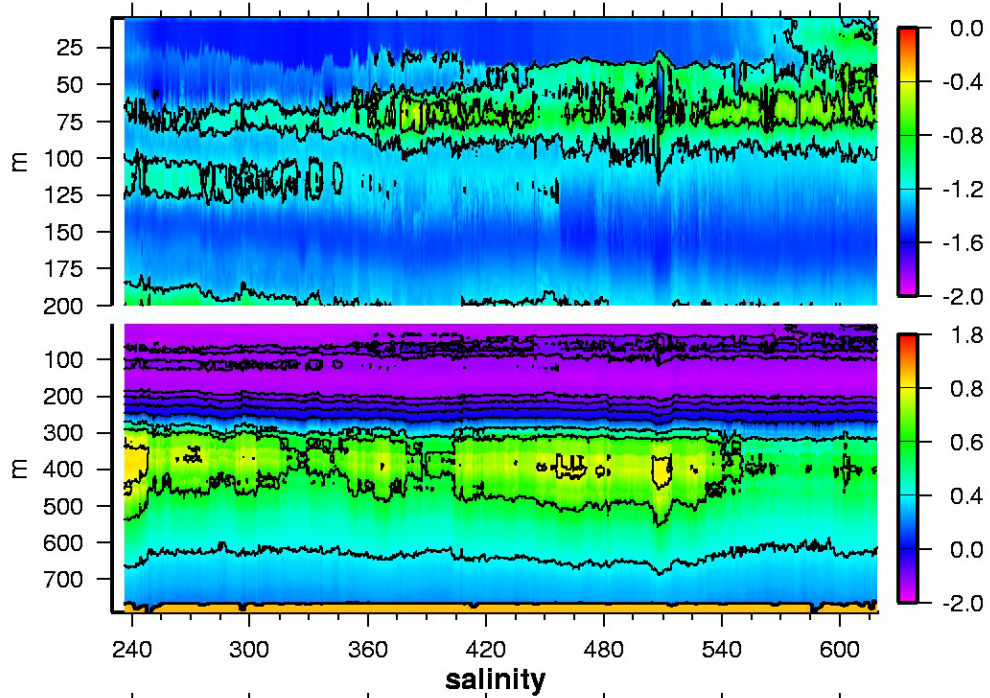
ITP3 Drift Track (as of 2006/09/09)

ITP drift (yellow line) and latest location (triangle), BGOS moorings (white circles) and annual ice drift from IABP (grey vectors) on IBCAO bathymetry (shading).
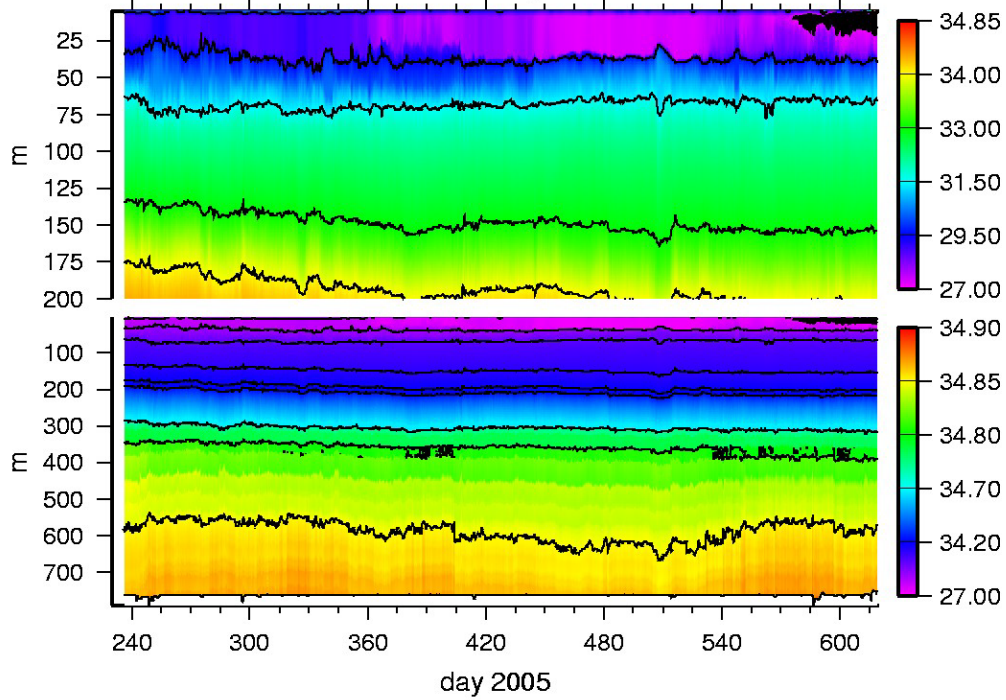
Plot of buoy locations.
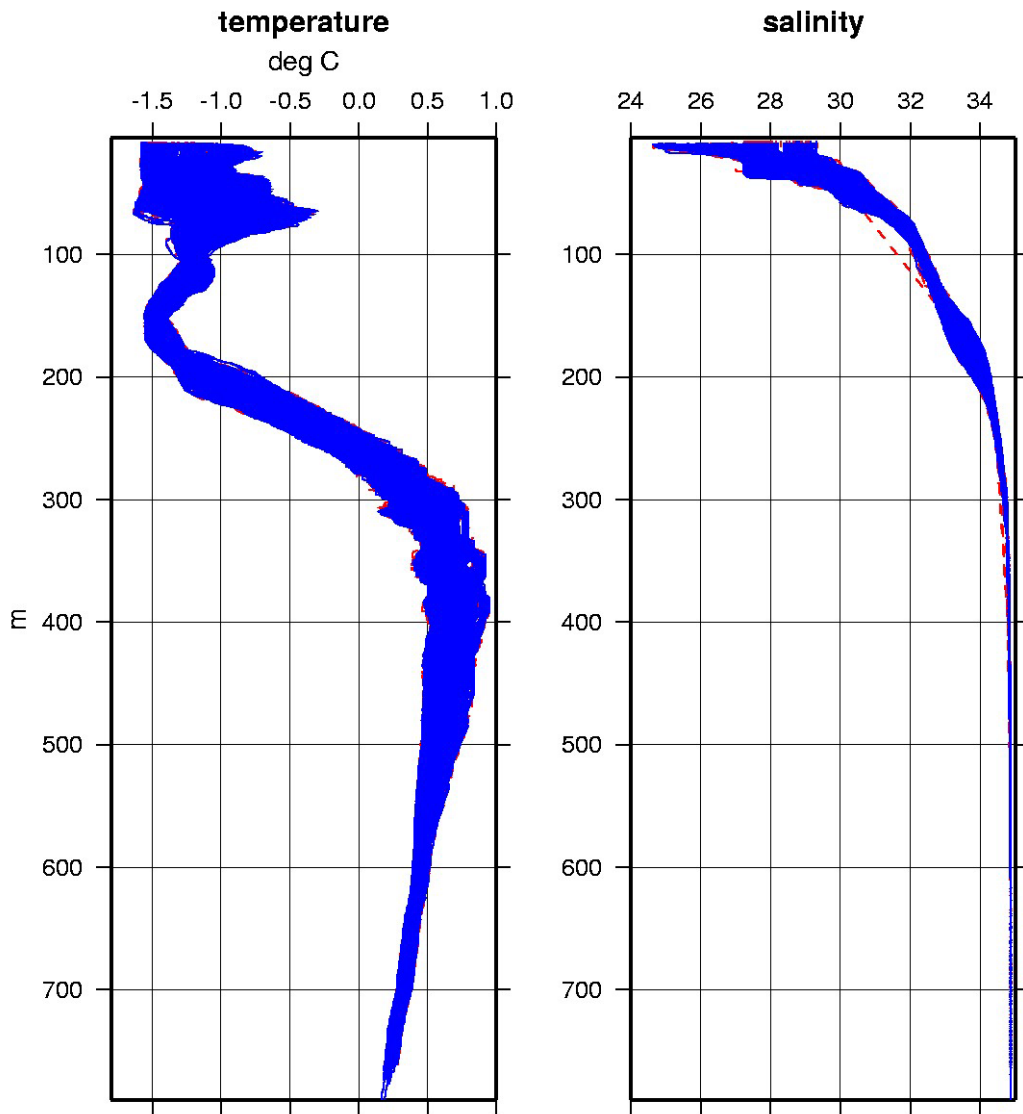
ITP3 Up Profile Contours (to profile 1531)

temperature

salinity

day 2005

All ITP3 Profiles (up to profile 1531)

temperature
deg C

salinity

up solid, down dashed

Composite plot of ITP profiles.

ITP3, IMB 2005-B, and CCGS Louis S St. Laurent on August 23, 2005. Photo by Chris Linder.

A little more than one year later (September 9, 2006), ITP3 and IMB 07950 were found still intact on their tiny ice floe covered nearly completely by melt ponds.

The IMB transmissions were inhibited because the antenna was partially underwater. This was rectified. Sitting in the melt pond, the ITP could not be recovered from the ice with the equipment on hand. Instead, a float was attached to the buoy and the ship would attempt to break the buoy out of the ice floe.

The great icebreaker Louis St. Laurent was expertly maneuvered to crack the 2.5 m thick ice floe just next to the ITP buoy.

Only half a meter of ice separates the buoy from the open water.

In the end, the ice would not give up the ITP, and the IMB was left to continue its observations.