ITP16 Overview

Deployment Location: 9/2/2007, 23:00 UTC at 87° 50.3'N, 169° 48.2'W

Last Location: 9/5/2010, 23:01 UTC at 80° 14.8' N, 104° 51.2' W

Duration: 1099 days

Distance Travelled: 3736 km

Number of profiles: 643 in 213 days

Other instruments: Ice Beacon (Meteorological)

ITP16 was deployed from the German icebreaker *Polarstern* as part of the European Union DAMOCLES Program on an approximately 2 m thick ice floe. The ITP operated on a rapid sampling schedule of 3 one-way profiles between 7 and 760 m depth each day for nearly 4 months (365 profiles) until the mooring encountered bottom along the shallowest part of the Lomonsov Ridge north of Ellesmere Island. Afterwards the buoy was driven over the shelf, so that the profiler was largely unable to profile, except down to around 500 m for several days in February (15 profiles) and over a ten-day period in mid-March (22 profiles) in the Lincoln Sea. The profiler ceased communicating on April 3, 2008 but the buoy persisted north of the Sverdrup Islands more than 2 years longer.

ITP 16 Deployment Operations

ITP 16 was the first ITP deployed for DAMOCLES in IPY and took place in early September 2007 from the *Polarstern*. Scientists from the Alfred Wegener Institute for Polar and Marine Research in Germany, Shirshov Institute of Oceanology, Russia and Japan Marine-Earth Science and Technology, Japan all contributed to the deployment efforts of all the ice-based instruments during the expedition. Despite the relative thinness of the ice, the drilling became difficult at the end due to seawater that was encountered near the bottom in the porous rotten ice at end of the melt season. Some problems were encountered while lowering the wire using the winch, as the wire sometimes chafed against the spool and several times the plastic coating had to be repaired (to ensure the integrity of the inductive modem circuit). This particular ITP system was deployed in the evening between 8 PM and midnight (UTC) and the underwater profiler responded to post-deployment interrogation successfully on the second attempt.

More information on the buoy deployments and expedition is provided in the ARK-XXII/2 cruise report.

ITP 16 Data Processing

The 643 profile attempts that were recovered from the ITP were processed according to the procedures described in ITP Updated Data Processing Procedures, but only 372 good profiles

resulted. The processing parameters for ITP 16 are shown in the figures to the right. In particular, this system suffered the greatest percentage of incomplete profiles due to resets (24%) than any other, the vast majority due to the mooring dragging in shallow water between profiles 366 to 505, but 16 earlier misses were due to the 2007 profiler software reset error.

The package drifted through seawaters with three distinct subsurface temperature maxima: 1) between 0.7 and 0.95 deg before mid-November while located in the basin north of 87.25N, 2) between 0.55 and 0.7 deg until January 1, 2008, and 3) rounded around 0.5 deg C in the Lincoln Sea north of Ellsmere Island mid-winter 2008. Staircases were only present in the north basin to determine CTD sensor lags, which were relatively stable and extrapolated over the remainder of the series where lags could not be determined. The drift of the buoy was almost always less than 30 cm/s, so instances when the profiler could not climb the wire due to seawater drag were rare.

After mid-February, the system drifted off of the ridge and over deeper water (>500 m) north of the Ellsmere shelf in the Lincoln Sea, where the profiler resumed profiling down to as much as 515 m for several days, then mostly hovered around 400 m between profiles 510 and 580, resumed profiling again to 511 m, then hovered from profiles 615 to 642. The profiles taken after dragging may have been subject to more contamination as the instrument resumed and may have been profiling closer to the ocean bottom. While the dataset before profile 366 was nearly free of fouling, more T & S data were removed amongst the later profiles, including the last.

ITP 16 Data Description

The ITP profiler was configured to operate with an accelerated sampling schedule of 3 one-way profiles between 7 and 750 m depth each day as it was expected to drift out in only 2 years based on its deployment location. In the surface package, the GPS receiver was powered every hour to obtain locations, and buoy temperature and battery voltage status were recorded. After 213 days (and 643 profile attempts) of reliable operation and data telemetry, the ITP profiler stopped sending data when the instrument likely parted with the surface buoy. The surface package continued to transmit GPS locations and status for another 886 days, when the transmissions ceased.

The plots below are of the final, calibrated, edited data (as opposed to the raw data presented on the active instrument pages).
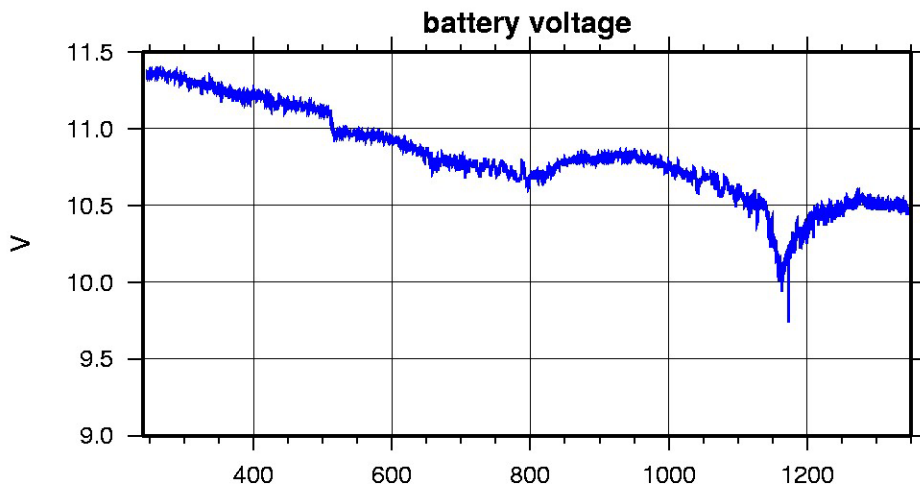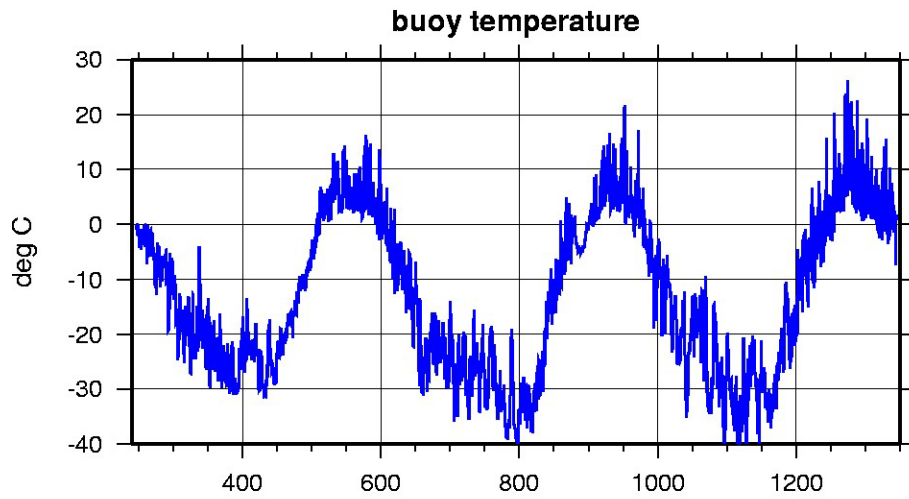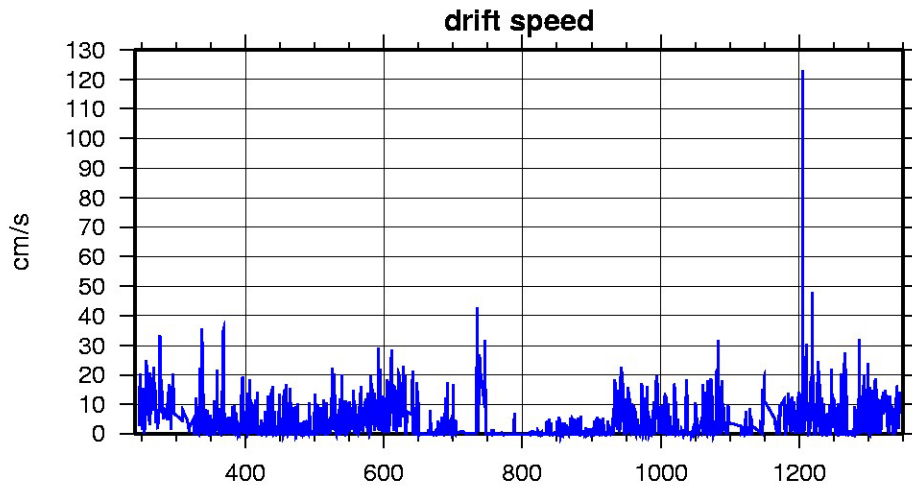
Level II hourly buoy location data in ASCII format: itp16rawlocs.dat

Level III 1-Hz processed profile data in MATLAB format: itp16cormat.tar.Z itp16cormat.zip

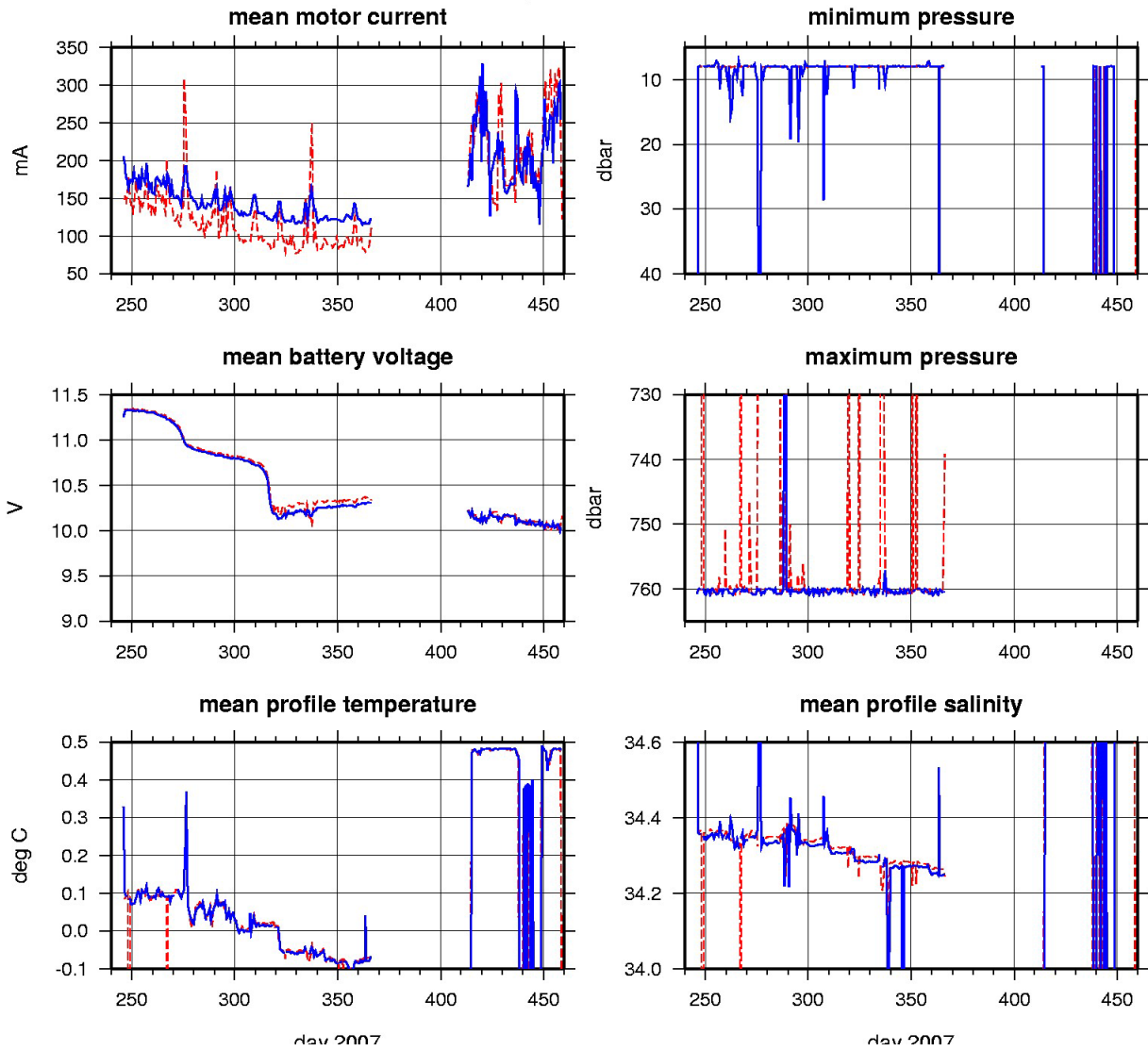Level III 1-db bin-averaged processed profile data in MATLAB format: itp16final.mat
Level III 1-db bin-averaged processed profile data in ASCII
format: itp16final.tar.Z itp16final.zip
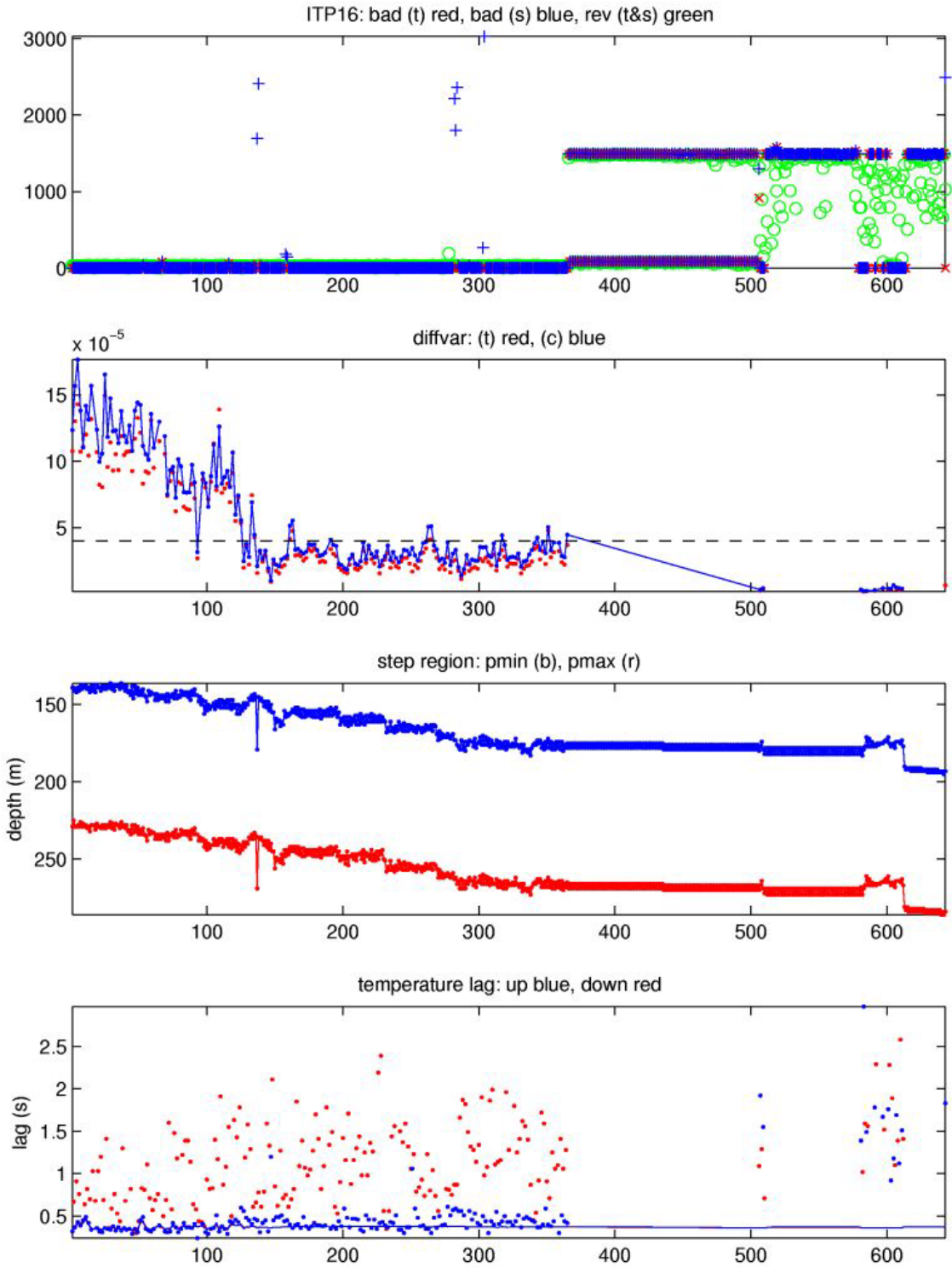
ITP16 Buoy Status (as of 2010/09/05)

drift speed

buoy temperature

battery voltage

day 2007

ITP Surface Buoy Status

ITP16 Profiler Status (up to profile 643)
up solid, down dashed

mean motor current

minimum pressure

### mean battery voltage

maximum pressure

mean profile temperature
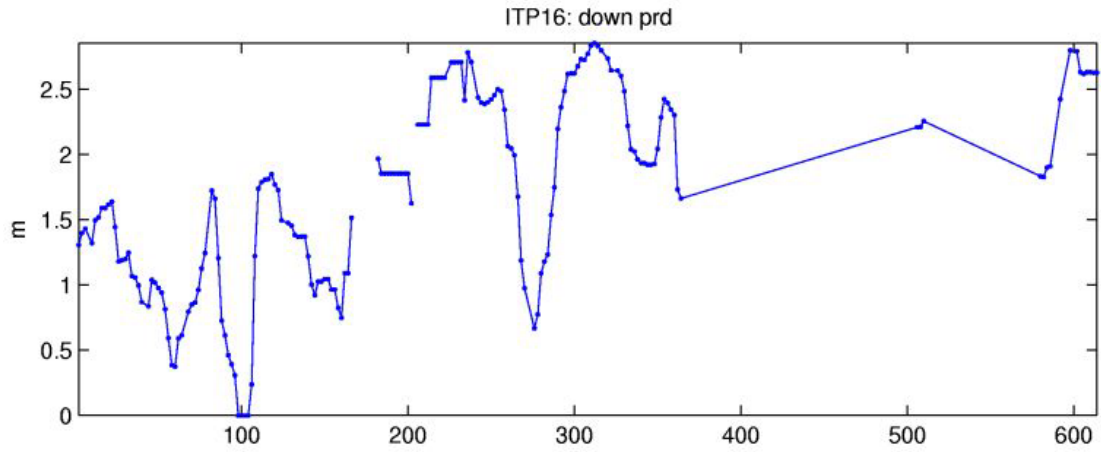
mean profile salinity

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.
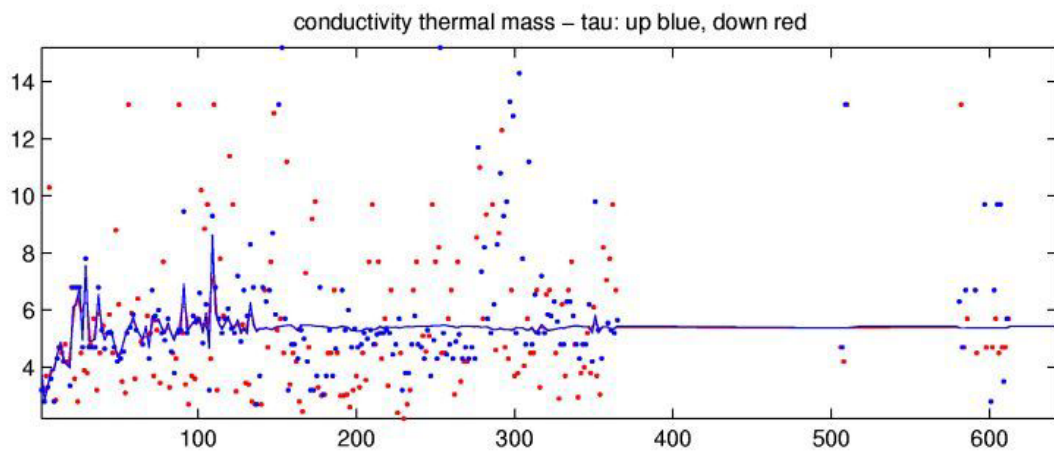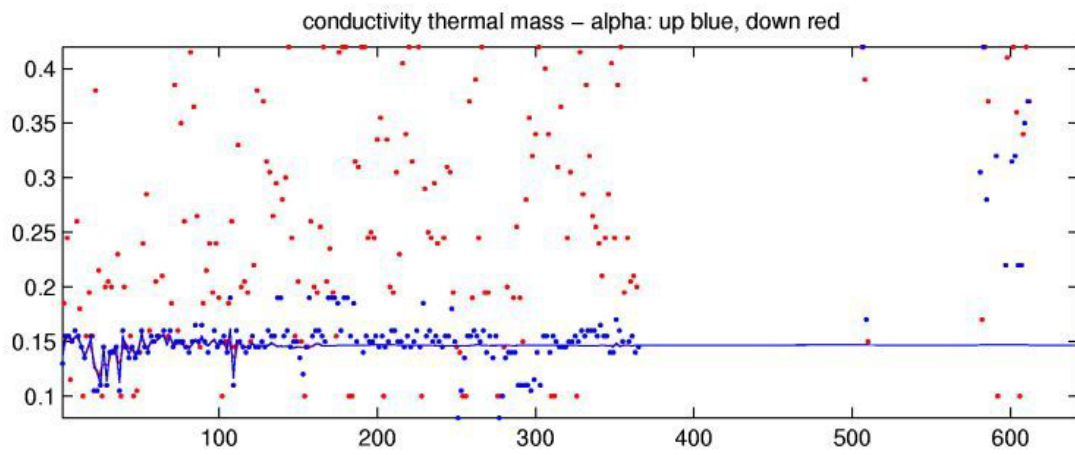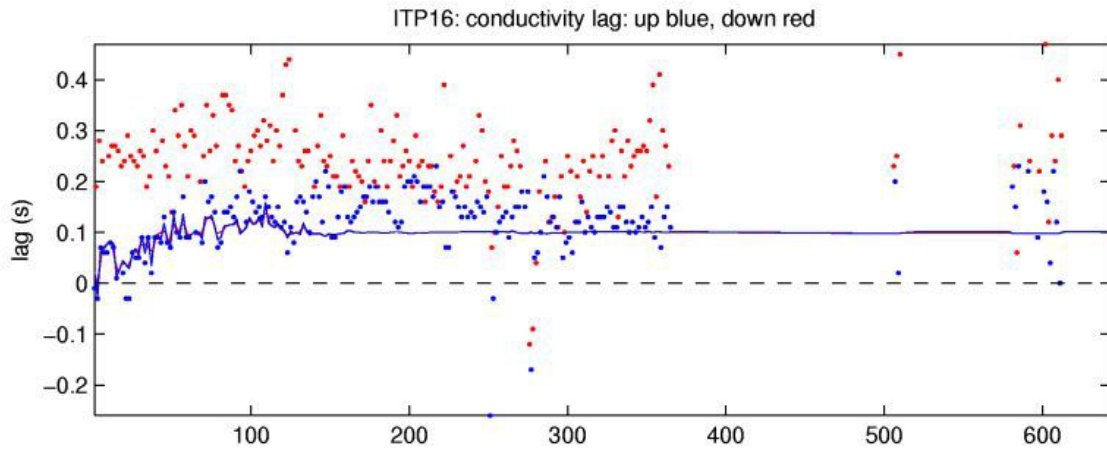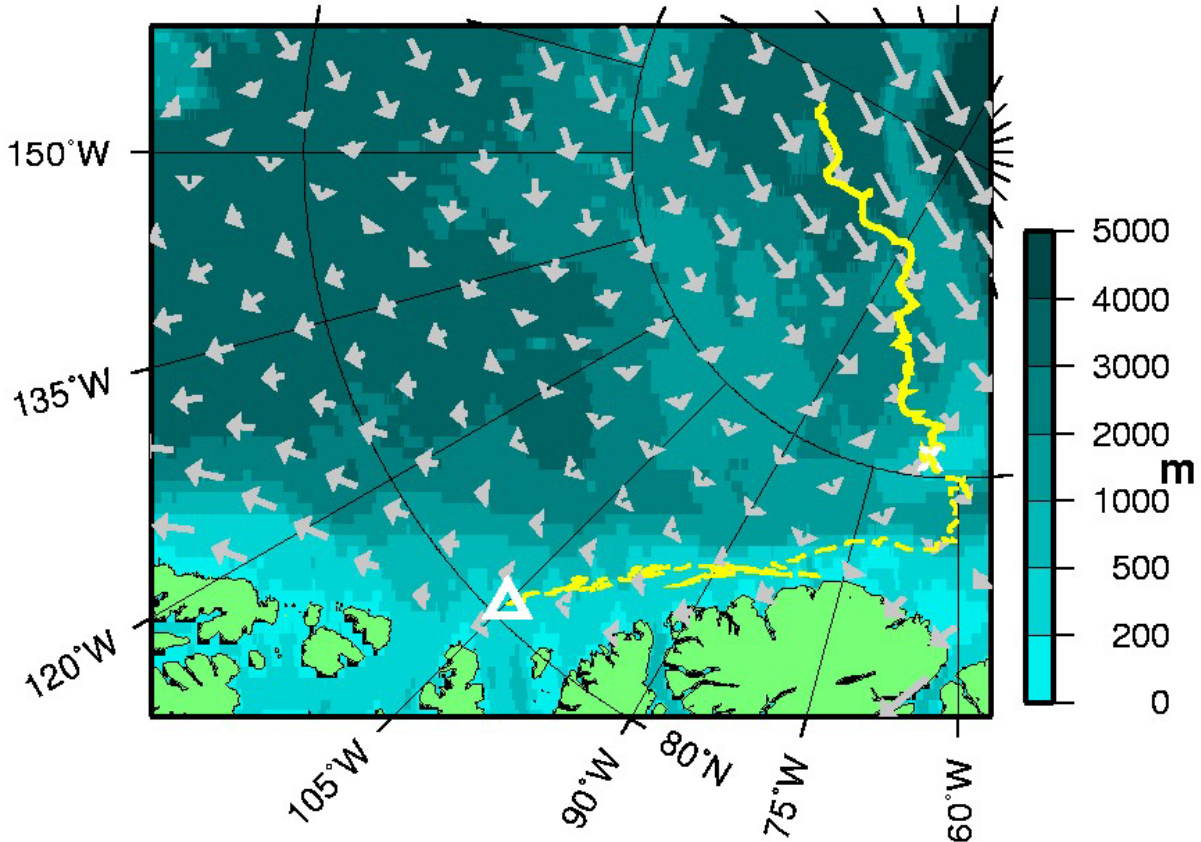
Top: conductivity lag, Middle: conductivity thermal mass amplitude correction, Bottom: conductivity thermal mass lag correction
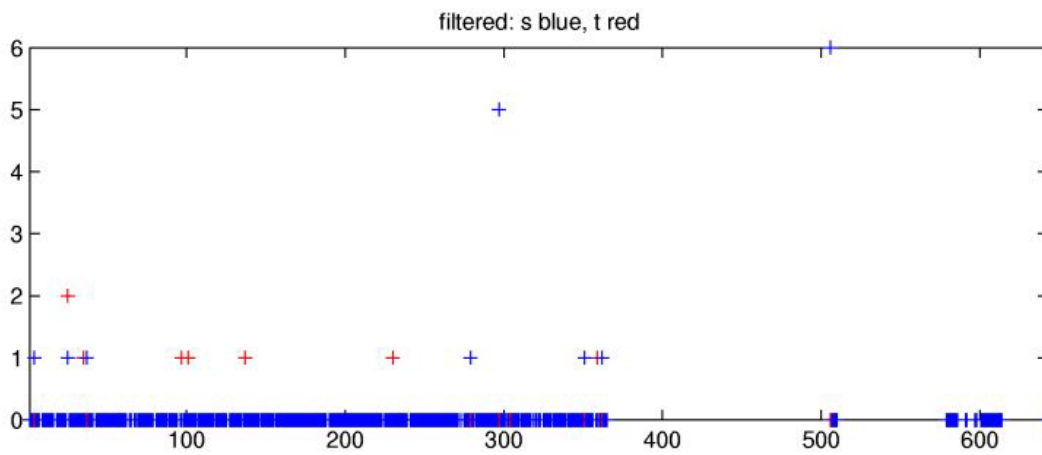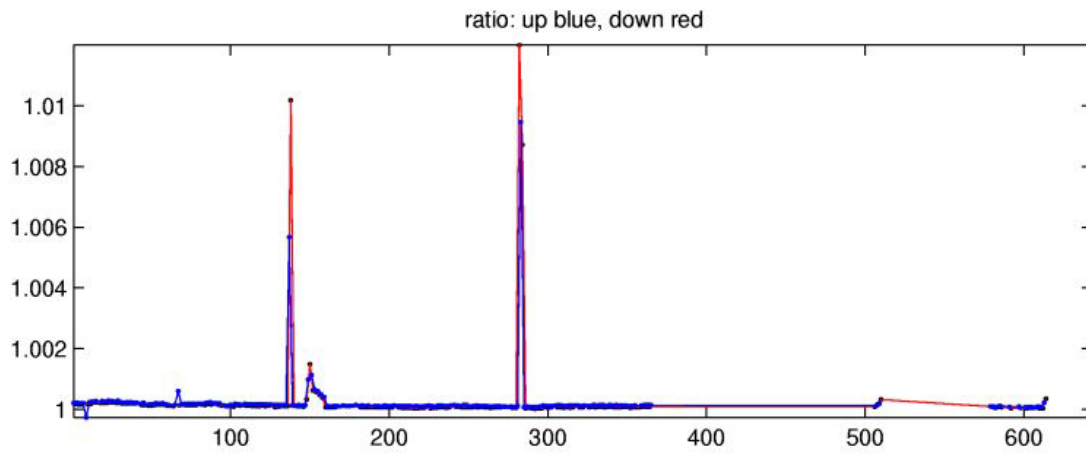
Top: down pressure deviation correction, Middle: salinity ratio adjustment, Bottom: Number of filtered spikes.
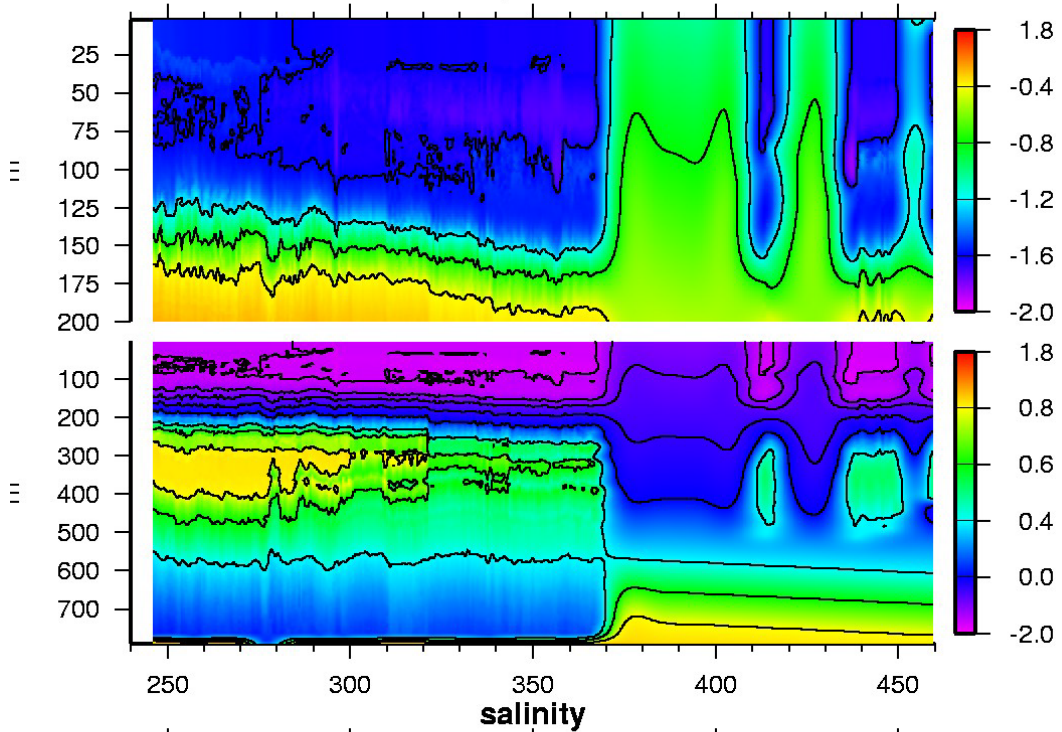
ITP16 Drift Track (as of 2010/09/05)

ITP drift (yellow line), last profile (x), last location (triangle), and annual ice drift from IABP (grey vectors) on IBCAO bathymetry (shading).
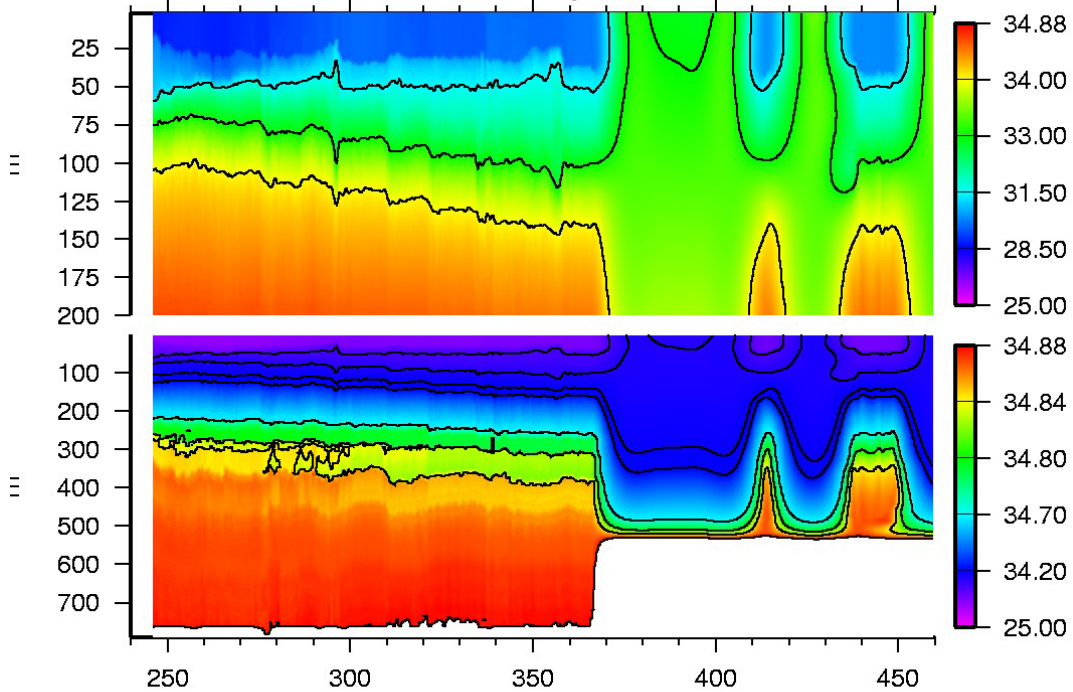
Plot of buoy locations.

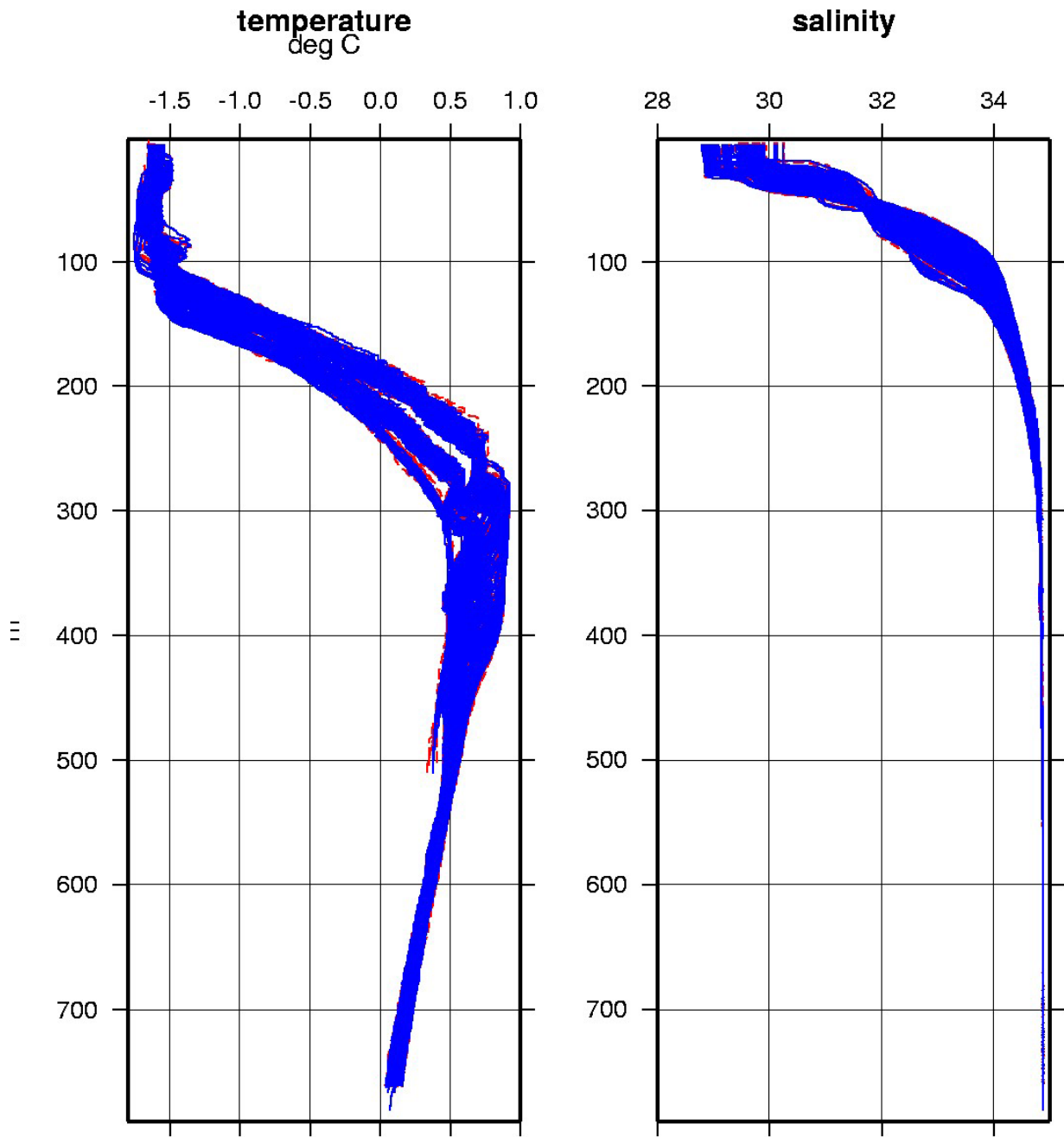# ITP16 Up Profile Contours (to profile 643)

temperature

salinity

day 2007

ITP16 temperature and salinity contours

All ITP16 Profiles (up to profile 643)

temperature
deg C

salinity

up solid, down dashed

Composite plot of ITP temperature and salinity contours.

The Polarstern provides the background to the first buoy cluster deployed on the ARKXXII-2 expedition in 2007 consisting of ITP 16 and a meteorological ice beacon. The sun became less direct as it was local midnight by the end of the deployment. (Photo by Takashi Kikuchi.)