

ITP 12 Overview

Deployment Location: 9/14/2007, 15:00 UTC at 86° 37.9'N, 134° 37.8'E

Last Location: 10/19/2009, 14:00 UTC at 63° 22.3' N, 20° 5.2' W

Duration: 766 days

Distance Travelled: 13,199 km

Number of profiles: 321 in 106 days

Other instruments: IMB 2007-G, AOFB 14, ITAC, NOAA Webcam

ITP12 was deployed on a 2.2 m thick icefloe in the Transpolar Drift from the German icebreaker *Polarstern* as part of the European Union DAMOCLES Program in 2007. On the same icefloe, a US Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Mass Balance Buoy (IMB 2007-G), a Naval Postgraduate School Arctic Ocean Flux Buoy (AOFB 14), OPTIMARE Ice-Tethered Acoustic Profiler (ITAC), and NOAA webcam were also installed. The ITP operated on a rapid sampling schedule of 3 one-way profiles between 7 and 760 m depth each day until the end of December 2007 when all of the instruments in the “Super Buoy Array” appear to have been swallowed by ice ridging just south of 87° N latitude. The ITP surface package resurfaced in the Denmark Strait between Iceland and Greenland at 66° N eleven months later and continued to send locations as it drifted in the open ocean for another 11 months before ceasing to operate on the south coast of Iceland.

ITP 12 Deployment Operations

In the first summer of the International Polar Year (IPY), over the Lomonosov ridge of the central Arctic Ocean, a “Super Buoy Array” consisting of ITP12, IMB, AOFB and ITAC was deployed overnight by an international team of scientists from Alfred Wegener Institute for Polar and Marine Research, Shirshov Institute of Oceanography, and Japan Agency for Marine-Earth Science and Technology. The ice cover in the region was thin, making floe selection difficult. Helicopter, reconnaissance flights were conducted and floes several were landed on and drilled for thickness determinations. Once the floe was selected and the ship docked to it, a substantial ice thickness survey was conducted using an EM31 on a sled. The equipment for the buoys was lowered over the side and hauled to selected areas of the floe and deployed. Drilling the large diameter hole for the ITAC provided certain difficulties, but otherwise the systems were installed as expected.

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

ITP 12 Data Processing

The 321 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 12 are shown in the figures to the right. Consistent sensor lags are obtained through thermohaline staircases through most of the timeseries, except at the end when the system apparently crossed into a water mass with different characteristics so that lags are extrapolated values. Only one profile was unable to profile the full extent vertically due to excessive ice drift speed, but there were 18 resets with complete loss of data for these profiles, and typically incomplete vertical coverage for the next subsequent profiles due to an operating software bug in the 2007 profilers. Virtually no points were removed for biofouling, and the conductivity sensor was extremely stable between profiles.

ITP 12 Data Description

The ITP profiler was configured to operate with a rapid sampling schedule of 3 one-way profiles between 10 and 750 m depth each day as it was expected to exit the Arctic in less than 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 106 days of reliable operation and data telemetry, the ITP (and rest of “Super Buoy Array”) appear to have been ridged in ice or pushed beneath the ice. At that point, no more information was received from the ITP profiler (possibly the tether could have parted), the surface package temperature hovered in the range of the ice rather than atmosphere, and status data from the surface package ceased. Eleven months later (late November 2008) the surface package resurfaced in the Denmark Strait between Greenland and Iceland and relayed all of the stored status data (but no new profiler information). Now in the open ocean, the drifter completed a wide cyclonic loop and developed a severe operating problem in the surface package which terminated the mission in October 2009 after 739 days.

The plots below are of the final, calibrated, edited data.

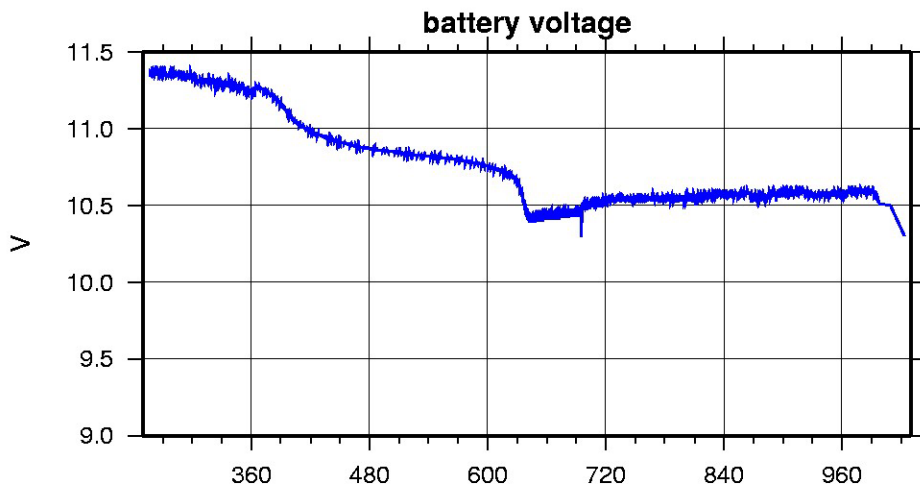
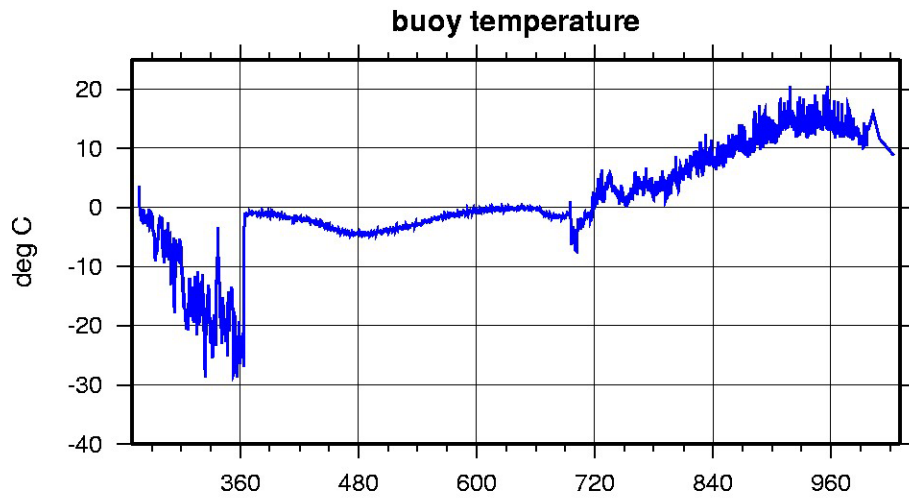
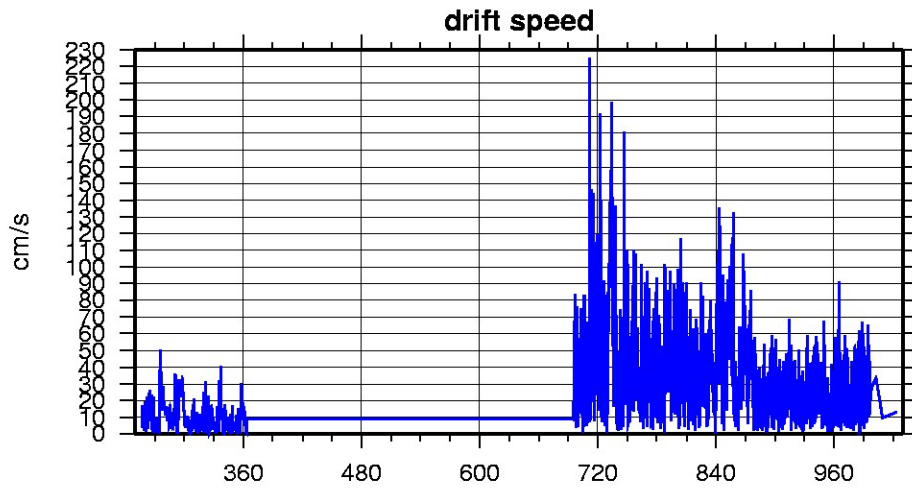
Level II hourly buoy location data in ASCII format: `itp12rawlocs.dat`

Level III 1-Hz processed profile data in MATLAB format: `itp12cormat.tar.Z` or `itp12cormat.zip`

Level III 1-db bin-averaged processed profile data in MATLAB format: `itp12final.mat`

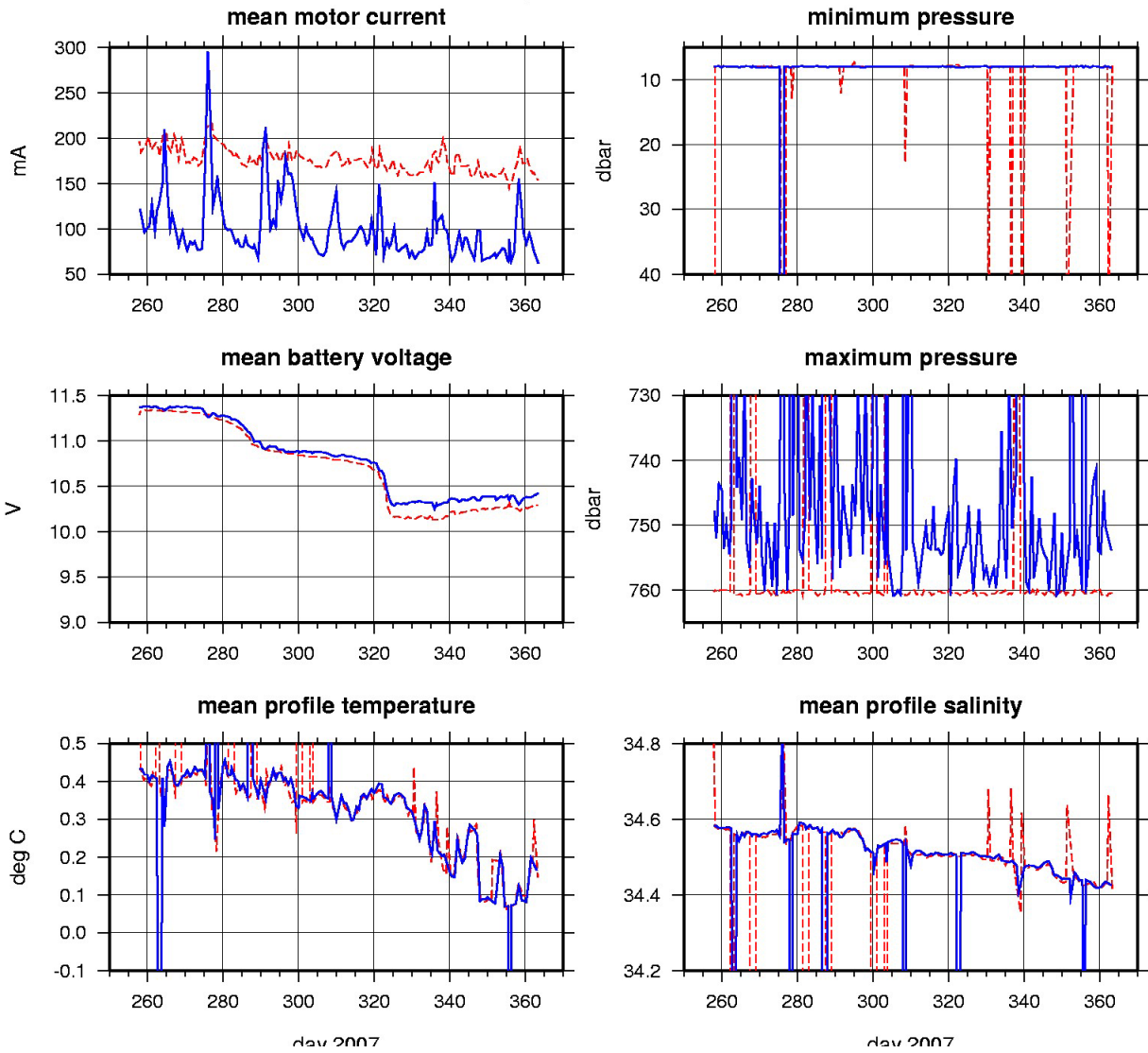
Level III 1-db bin-averaged processed profile data in ASCII format: `itp12final.tar.Z` or `itp12final.zip`

ITP12 Buoy Status (as of 2009/10/19)

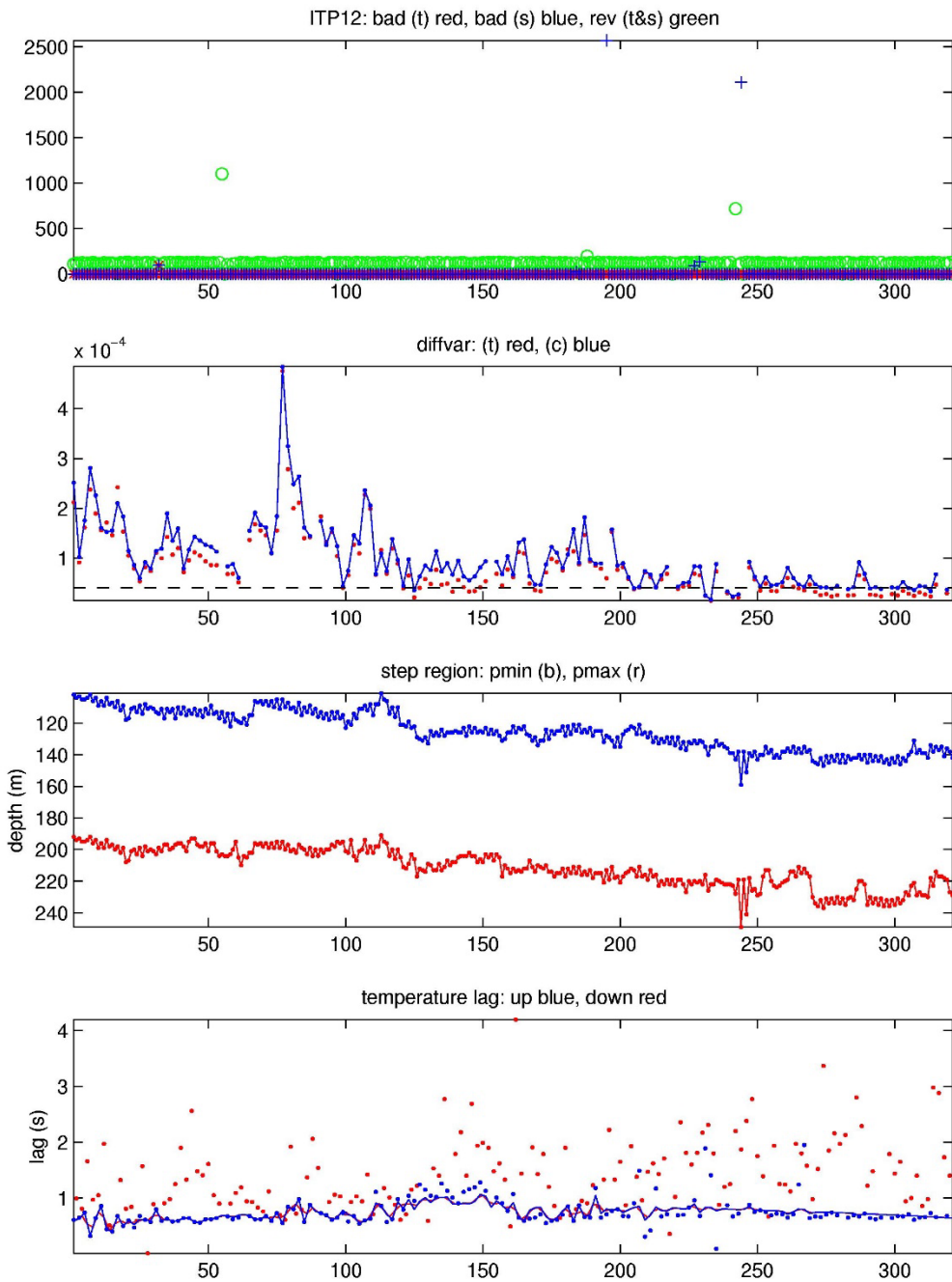


ITP12 Profiler Status (up to profile 321)

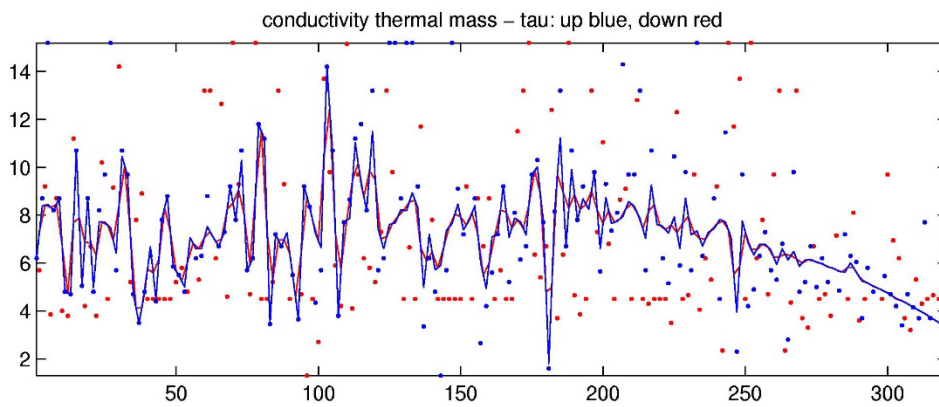
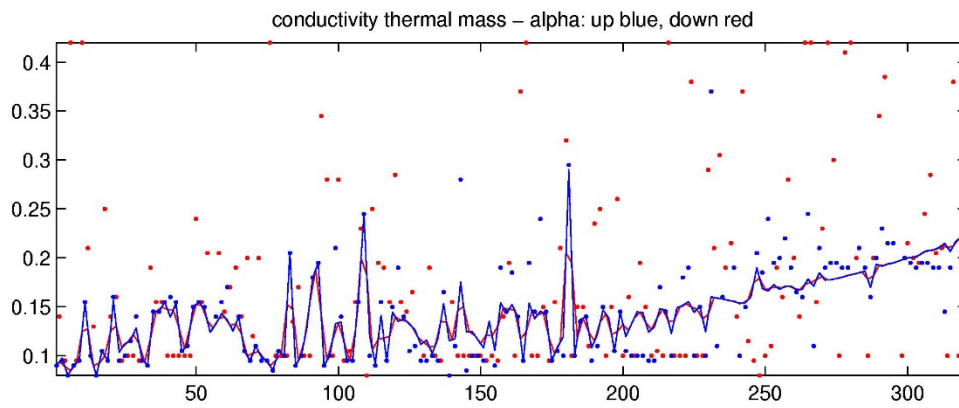
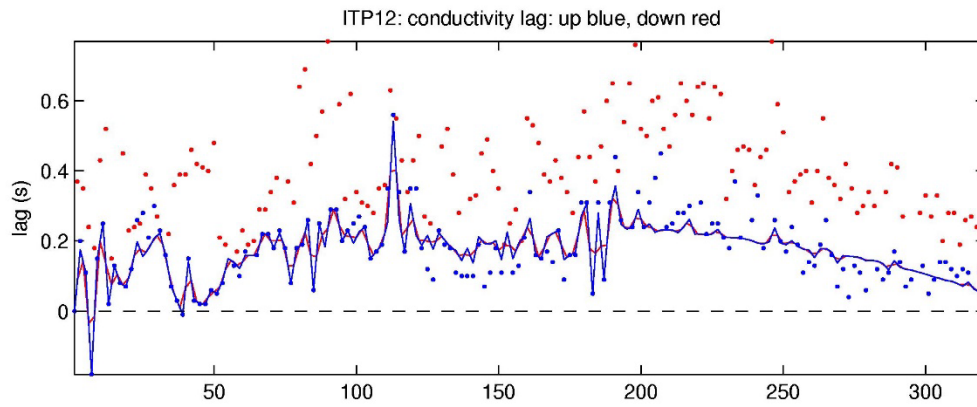
up solid, down dashed



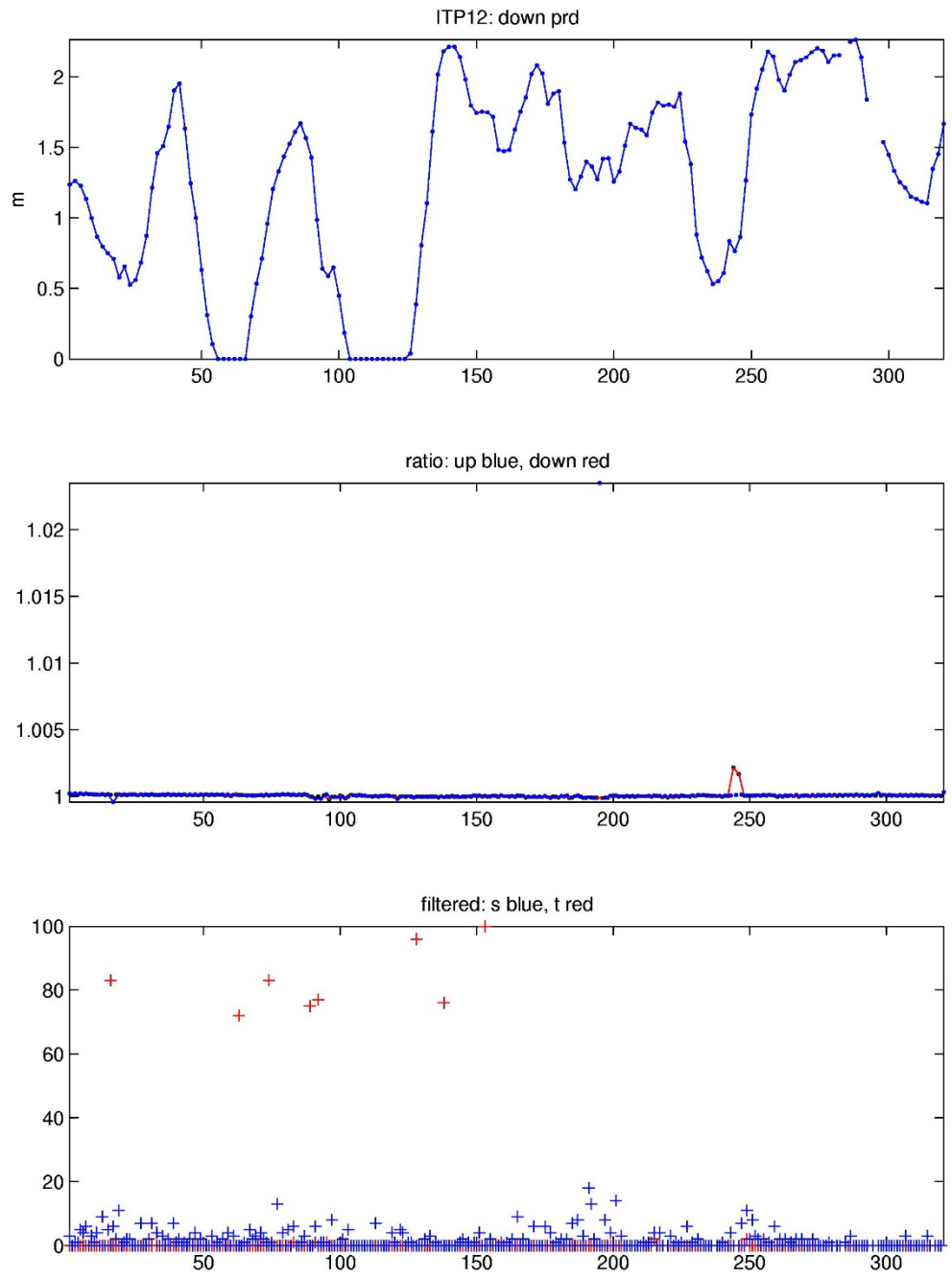
ITP profiler engineering data



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).

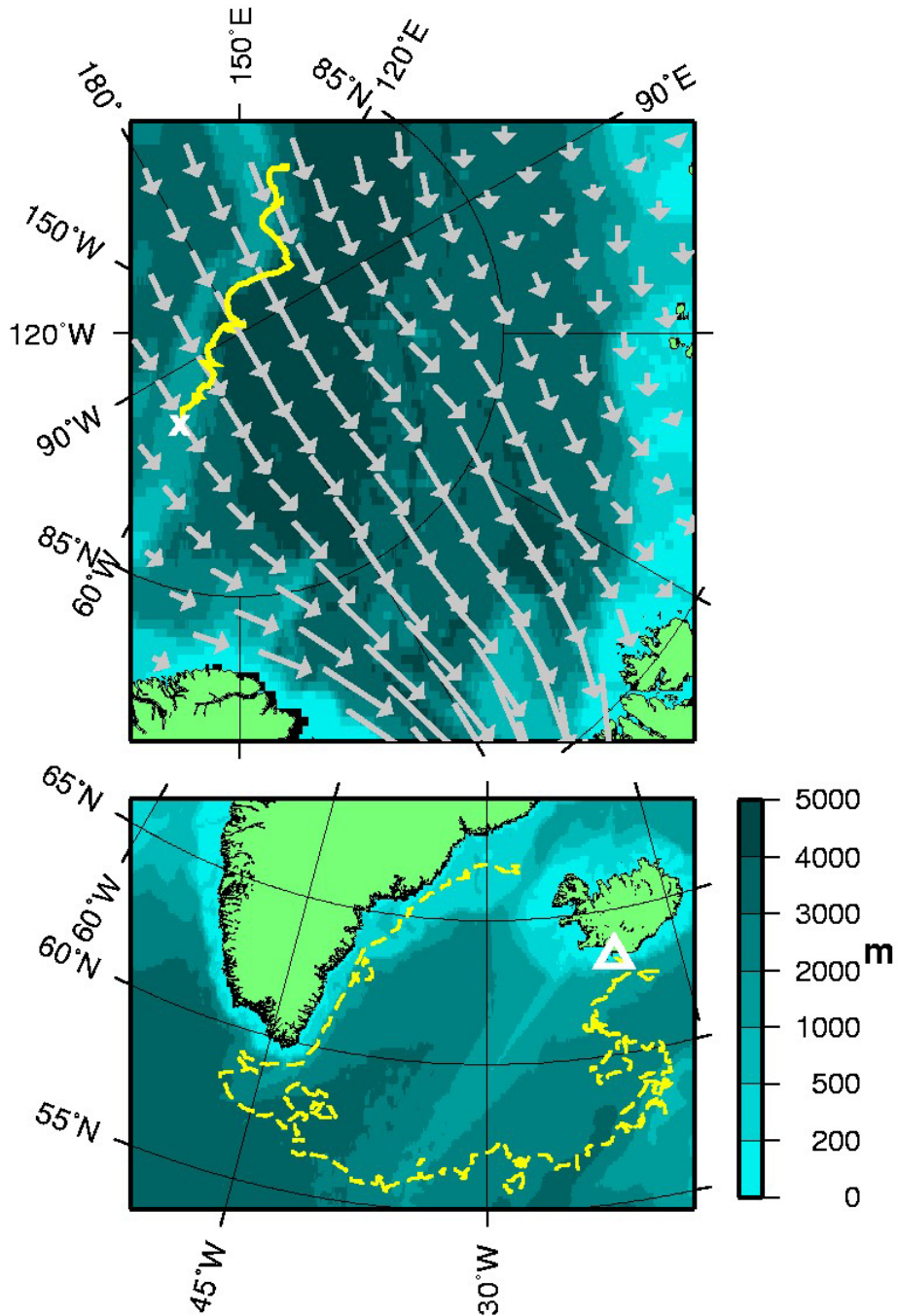


Top: conductivity lag, Middle: conductivity thermal mass amplitude correction, Bottom: conductivity thermal mass lag correction.



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

ITP12 Drift Track (as of 2009/10/19)

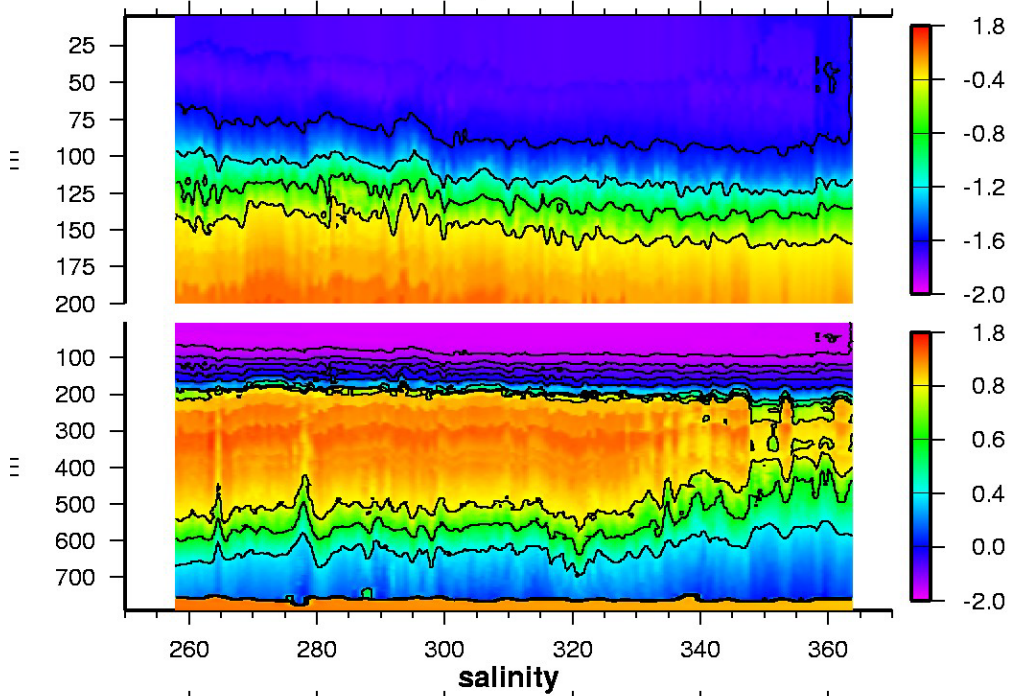


ITP drift (yellow line), last profile (x), last location (triangle), and annual ice drift from IABP (grey vectors) on IBCAO bathymetry (shading).

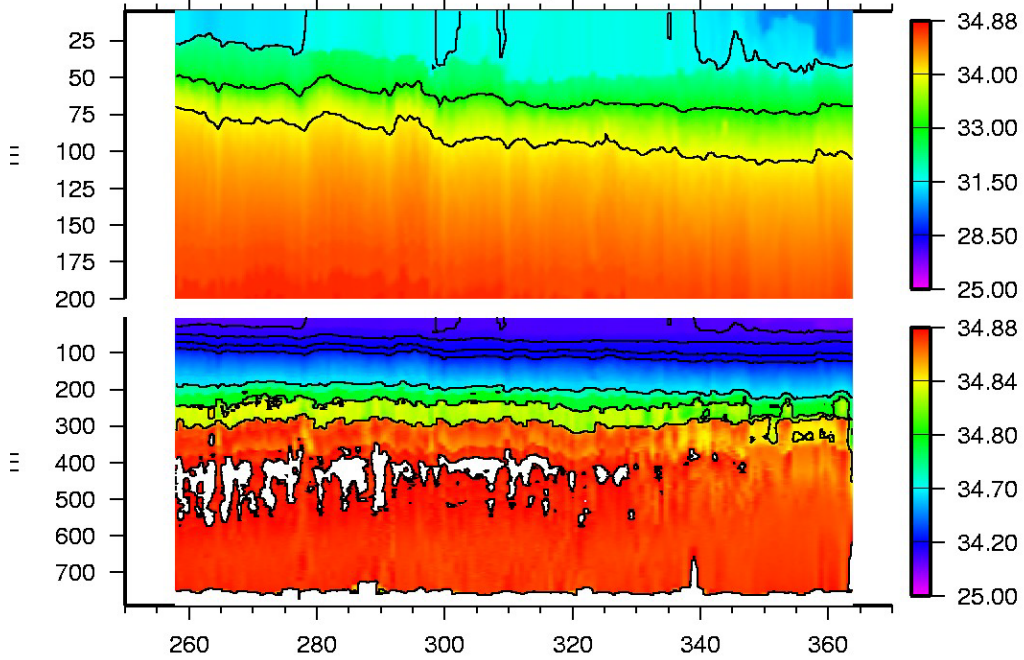
Plot of buoy locations.

ITP12 Up Profile Contours (to profile 320)

temperature



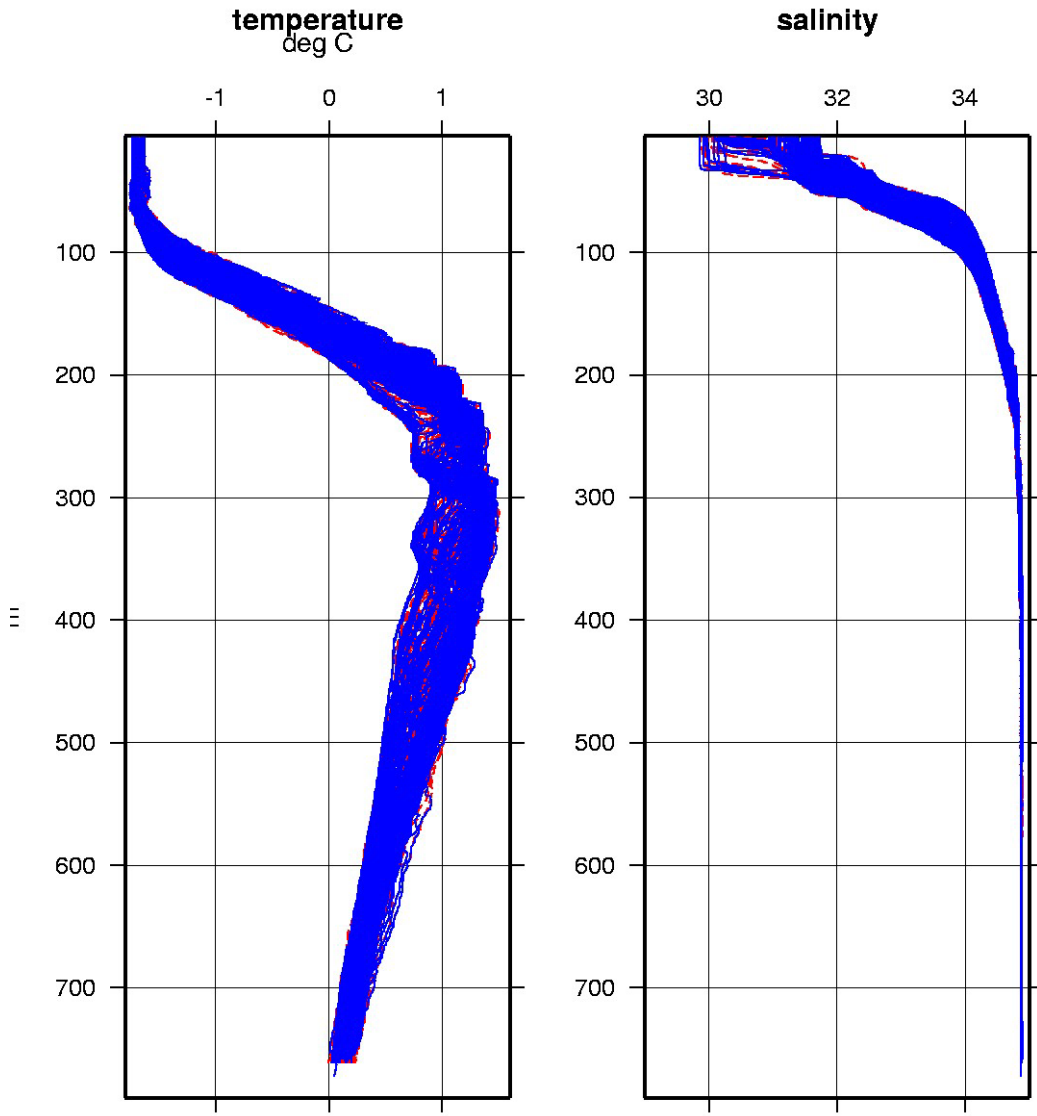
salinity



day 2007

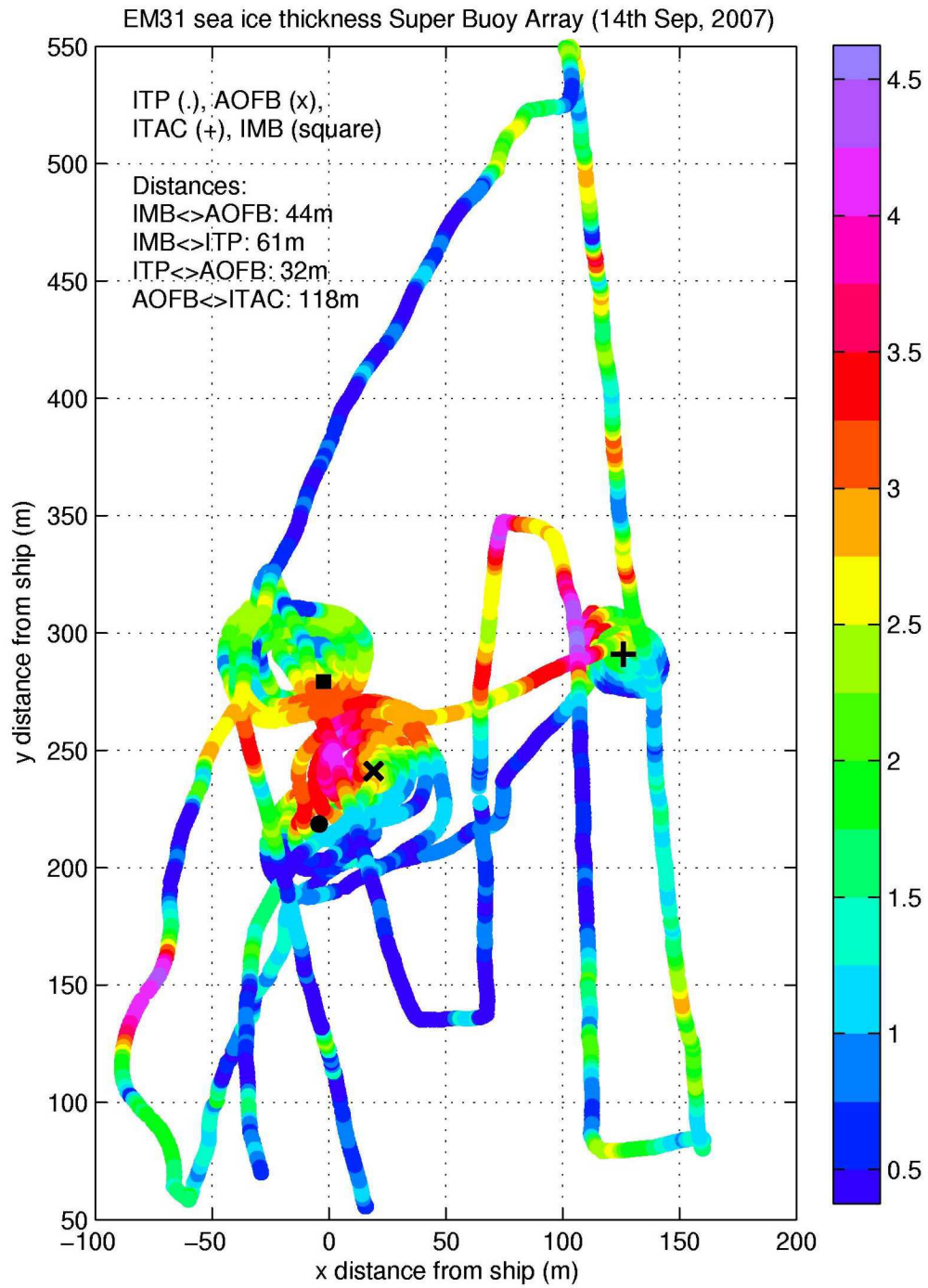
ITP 12 temperature and salinity contours.

All ITP12 Profiles (up to profile 320)



up solid, down dashed

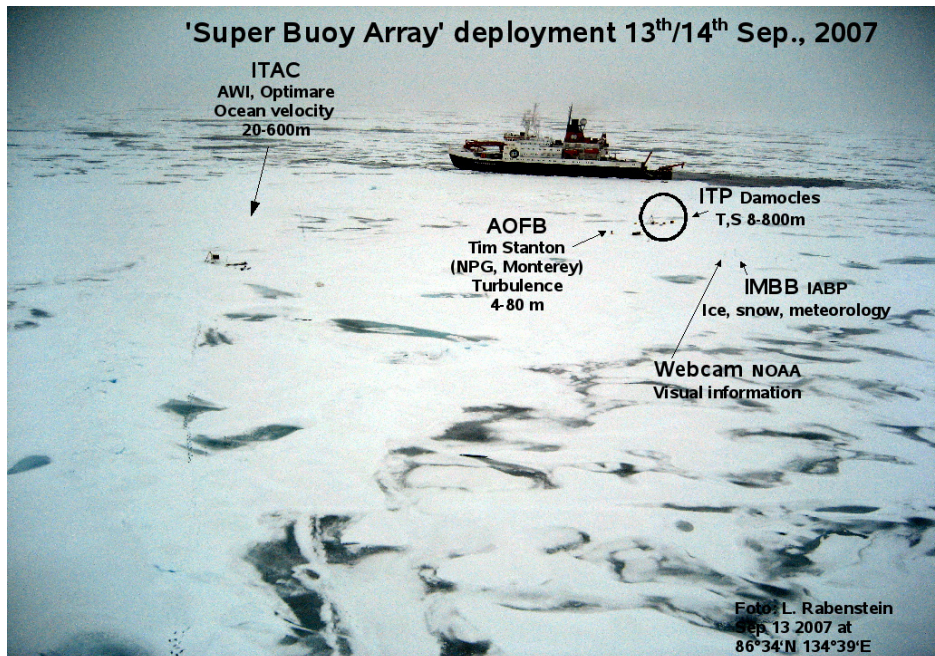
Composite plot of ITP temperature and salinity profiles.



Ice thickness survey using the EM31 sled at the “Super Buoy” site, with marks at buoy deployment locations. (Courtesy of Ben Rabe)



Aerial photo of the ITP deployment site after drilling the 11" diameter hole, but before deploying the instrument. (Photo by Ben Rabe)



SuperBuoy array as deployed. (Photo by L. Rabenstein)