

ITP 9 Overview

Deployment Location: 9/11/2007, 21:00 UTC at 87° 4.2'N, 130° 16.5'W

Last Location: 7/9/2010, 23:00 UTC at 79° 38.8' N, 113° 30.9' W

Duration: 1032 days

Distance Travelled: 3952 km

Number of profiles: 1480 in 680 days

Other instruments: IMB 2007-I

ITP9 was deployed on a 2.7 m thick icefloe from the Russian icebreaker *Akademik Federov* as part of the European Union DAMOCLES Program. On the same icefloe, a US Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Mass Balance Buoy (IMB 2007-I) was also installed. The ITP operated on a standard sampling schedule of 2 one-way profiles between 7 and 760 m depth each day.

ITP 9 Deployment Operations

ITP 9 was the third ITP with IMB in three days deployed from the *Akademik Federov* in September 2007. The expedition had yet to find an appropriate site to install Russian North Pole 35 (NP-35) drifting ice camp for IPY, so was still accompanied by the powerful nuclear icebreaker *Rossiya*. As previously, the field party, deployment apparatus, and instruments were flown to a selected ice floe using the MI-8 helicopter. The helicopter then departed to continue searching for an NP-35 ice floe while the two buoys were deployed. By now, the field party expected the long wait for the return of the helicopter after the deployment operations, so were prepared with working tent to shelter from the elements and provisions to snack on.

ITP 9 Data Processing

The 1480 attempted profiles that were retrieved from the ITP profiler were processed according to the procedures described in the ITP Updated Data Processing Procedures. However, only 883 (or about 60%) were uncorrupted or non-stationary, as a result of the mooring and profiler dragging in shallow bathymetry west of Ellesmere Island. The processing parameters are shown in the figures to the right.

Drift speeds were such that the profiler did not seem to be hindered from completing full vertical profiles due to hydrodynamic drag, however, due to a software overflow bug, ITP 9 experienced 99 resets with complete loss of data for these profiles, and typically incomplete vertical coverage for the subsequent profiles. The mooring anchor (tether length = 790 m) was dragged over shallow topography and the profiler was unable to profile at all between profiles 935 to 982 (bathymetry ~600 m, instrument stopped ~250 m) and 1017 to 1086 (bathymetry ~680 m,

instrument stopped ~600 m), although it was able to recover and obtain additional profiles between these intervals up until profile 1100 (bathymetry <500 m, instrument on bottom) when the profiler vertical movement became severely limited. After the bathymetry deepened again (around profile 1170), the profiler remained at the bottom of the mooring for the rest of the deployment.

This unit also experienced a unique apparent failure in the pressure sensor related to the state of the motor operations. Beginning around profile 400, and progressively worse after profiles 500 and 800, the data from the pressure sensor began shifting during the 30 seconds when the motor current ramps up and exhibiting spikiness during the motor operation. A special routine removes and corrects for this noise in the final processing. Thermohaline staircases were found in some profiles enabling estimation of sensor lag corrections (which did not vary greatly).

ITP 9 Data Description

In the surface package, the GPS receiver was powered every hour to obtain locations, and buoy temperature and battery voltage status were recorded. After 4 months (and 274 profiles) of reliable operation and data telemetry, the instrument stopped phoning in. Unexpectedly, 13 months later, the surface package resumed calling in and transferred all of the data acquired by the profiler (nearly 900 more profiles) and surface unit during the gap. This occurred concurrent with a large initial battery voltage drop, and coincident with off shelf drift of the ITP package and the profiler bottoming out at the end of the mooring wire. GPS locations were acquired throughout the period without the phone, so it seems unlikely that the surface buoy was covered in or pushed beneath the ice.

Last contact with the profiler occurred while the system again drifted over the shallow continental shelf in July 2009. The surface buoy continued to transmit location data for another year.

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

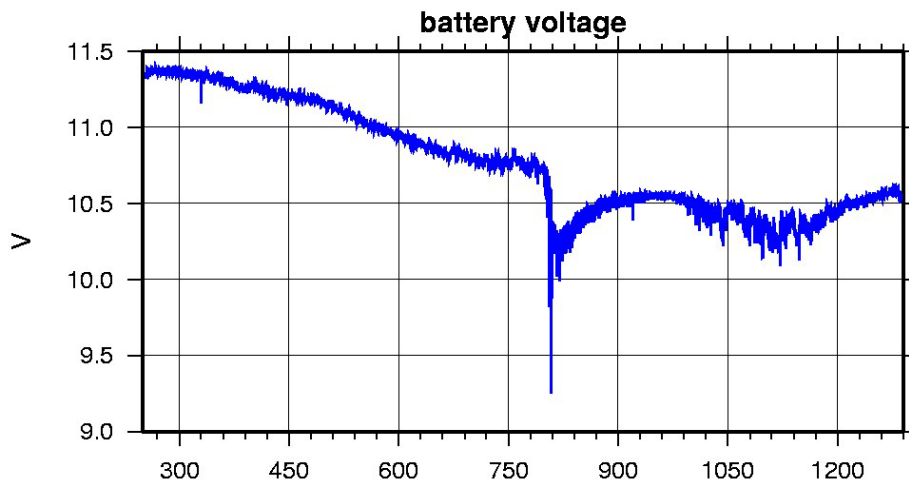
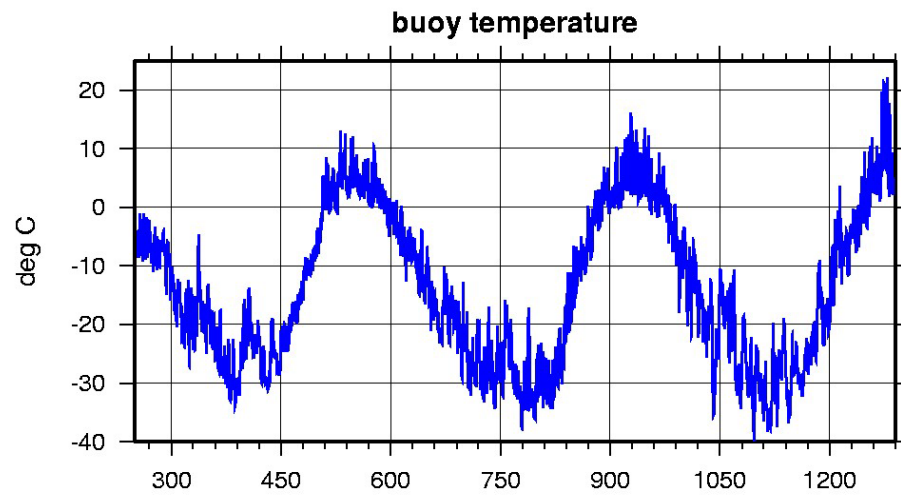
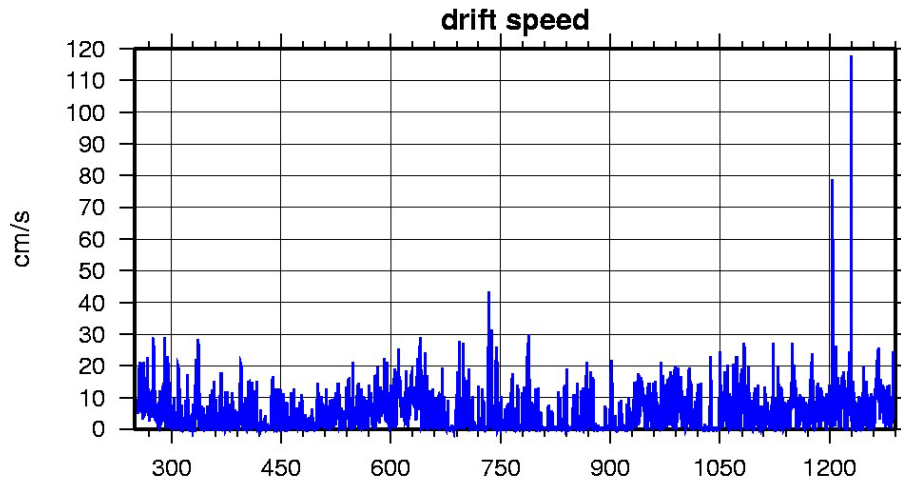
Level II hourly buoy location data in ASCII format: `itp9rawlocs.dat`

Level III 1-Hz processed profile data in MATLAB format: `itp9cormat.tar.Z` or `itp9cormat.zip`

Level III 1-db bin-averaged processed profile data in MATLAB format: `itp9final.mat`

Level III 1-db bin-averaged processed profile data in ASCII format: `itp9final.tar.Z` or `itp9final.zip`

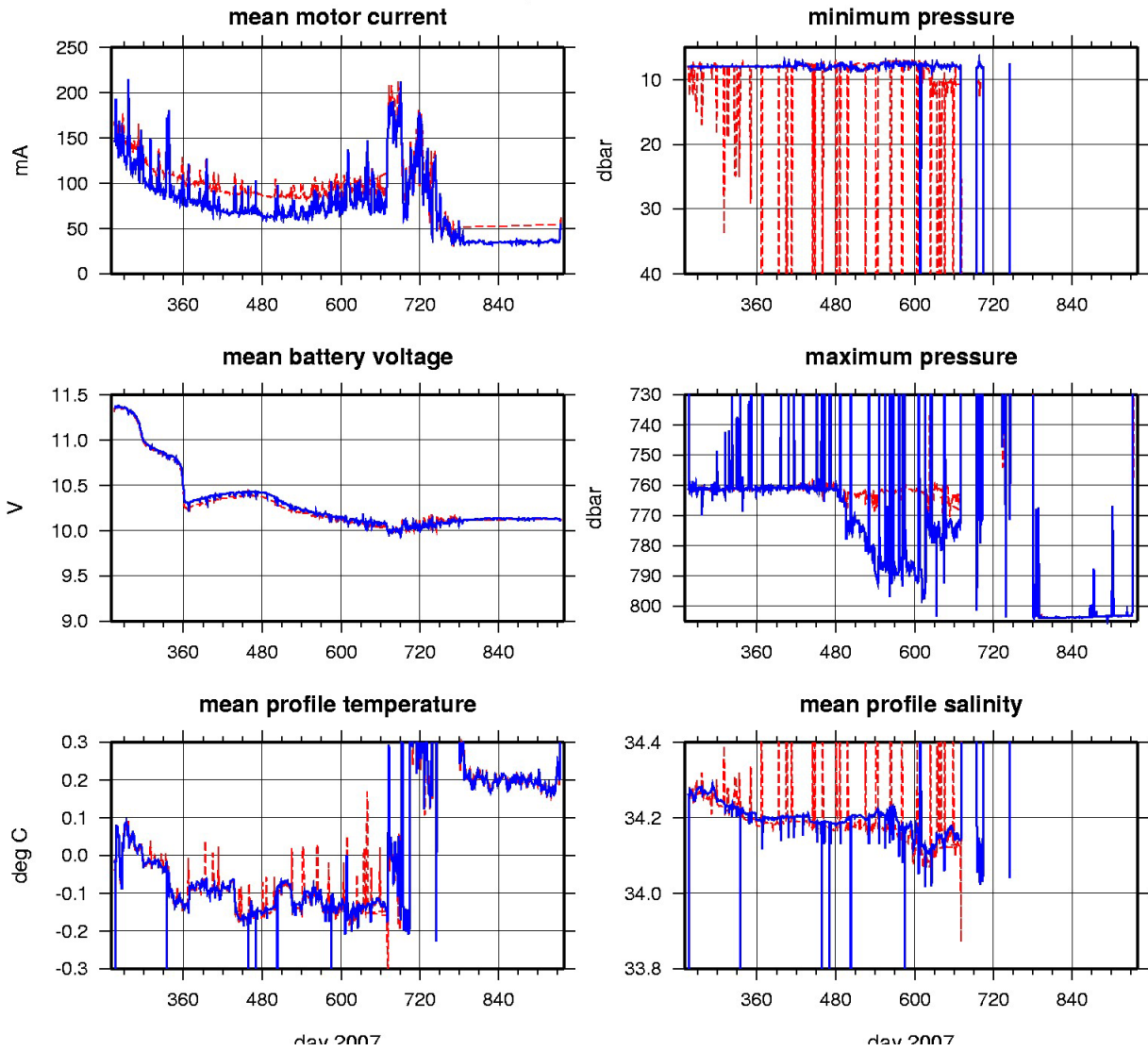
ITP9 Buoy Status (as of 2010/07/09)



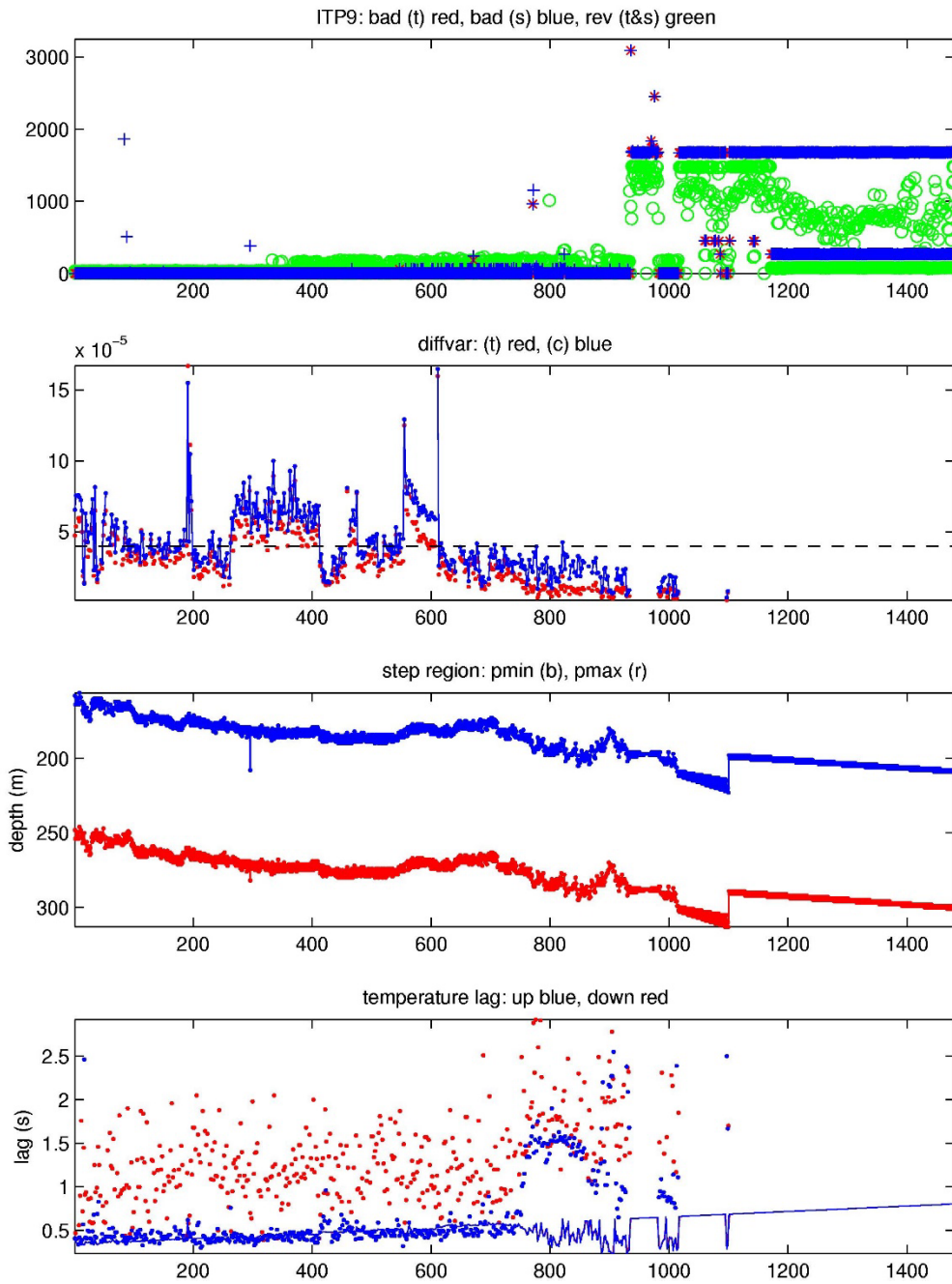
day 2007
ITP surface buoy status.

ITP9 Profiler Status (up to profile 1480)

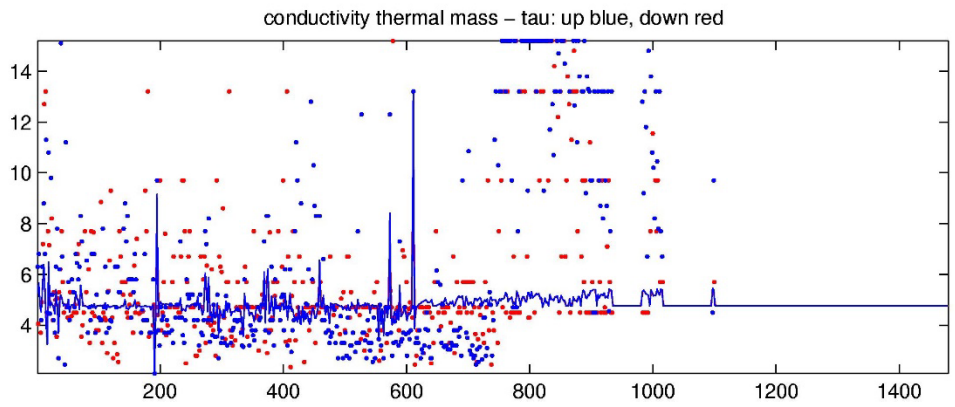
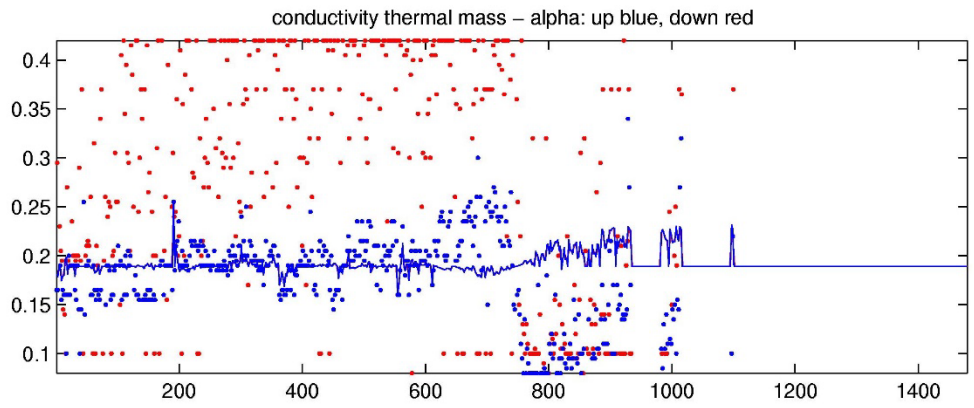
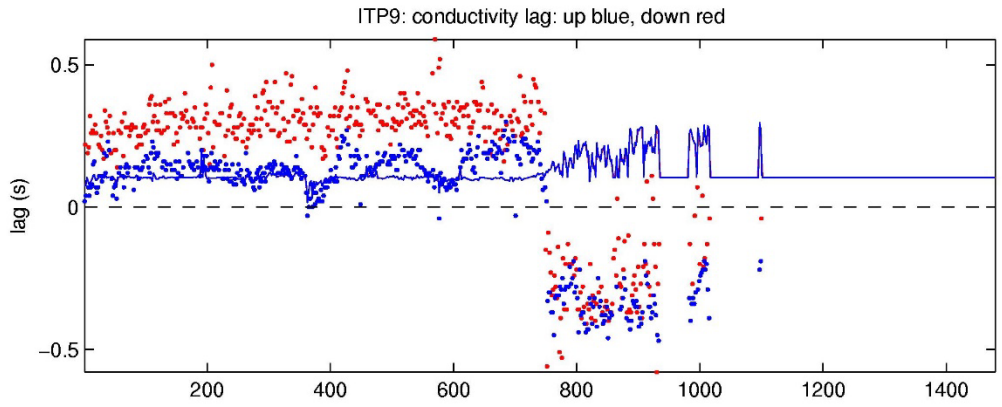
up solid, down dashed



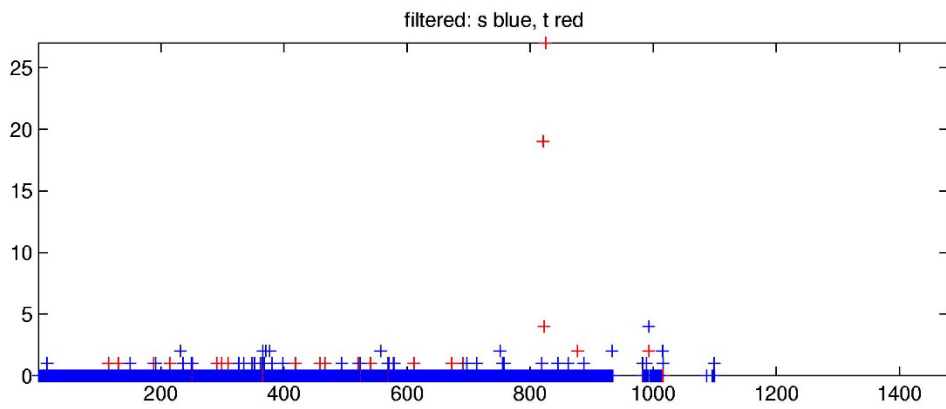
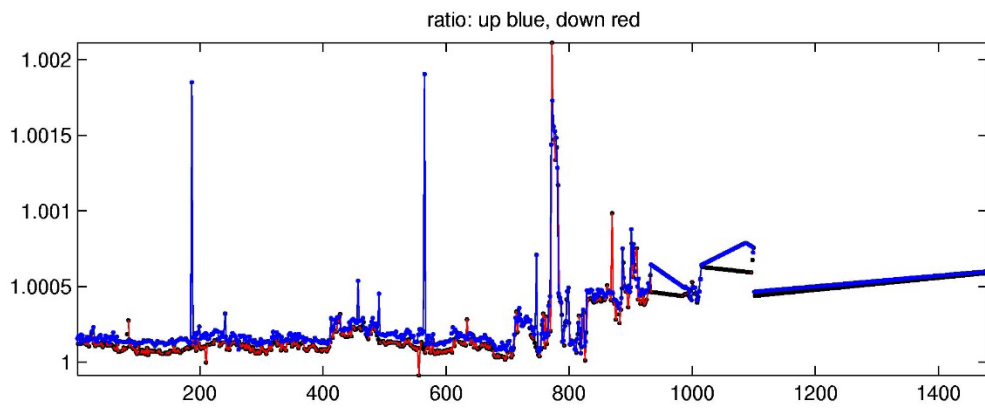
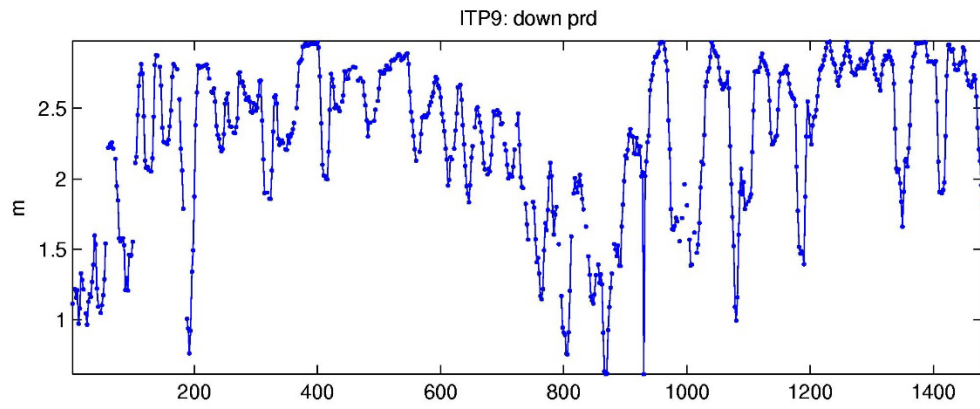
ITP profiler engineering data.



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.

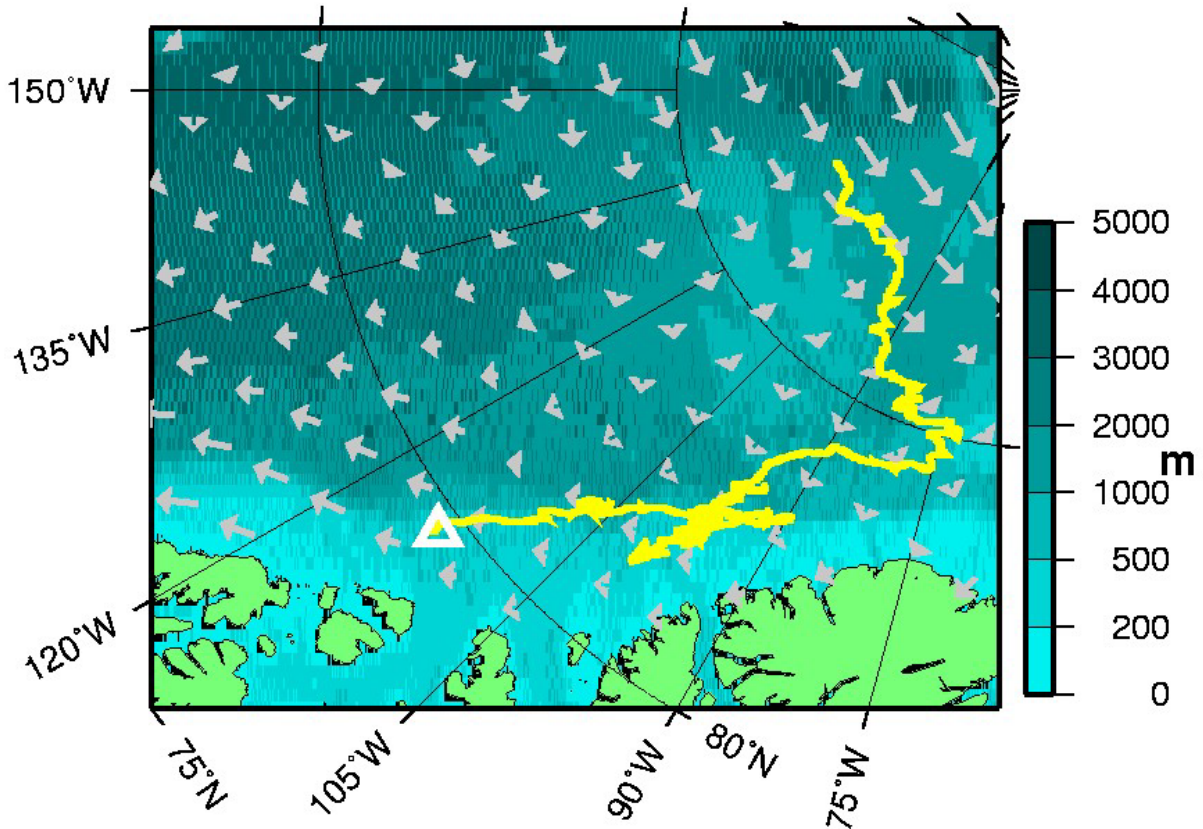


Top: conductivity lag, Middle: conductivity thermal mass amplitude correction, Bottom: conductivity thermal mass lag correction.



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

ITP9 Drift Track (as of 2010/07/09)

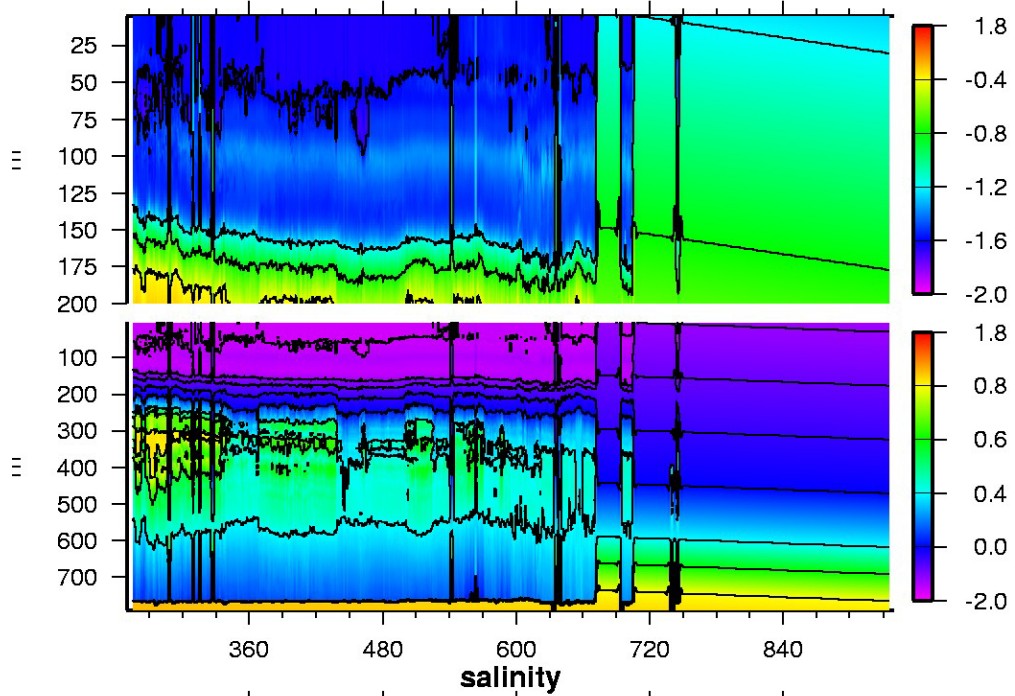


**ITP drift (yellow line) and latest location (triangle),
and annual ice drift from IABP (grey vectors) on
IBCAO bathymetry (shading).**

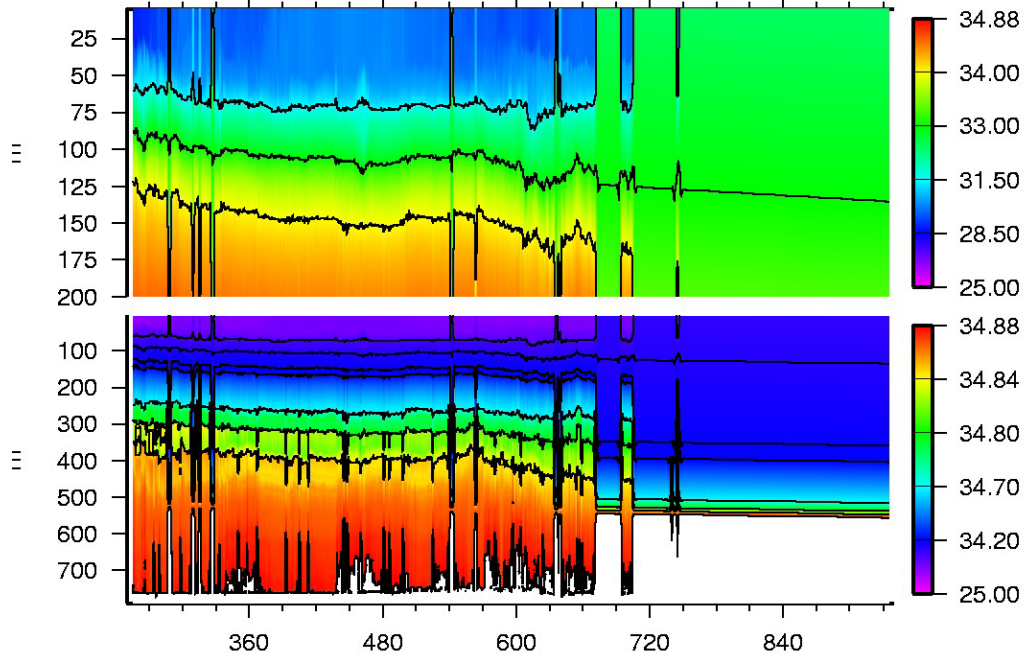
Plot of buoy locations.

ITP9 Up Profile Contours (to profile 1479)

temperature



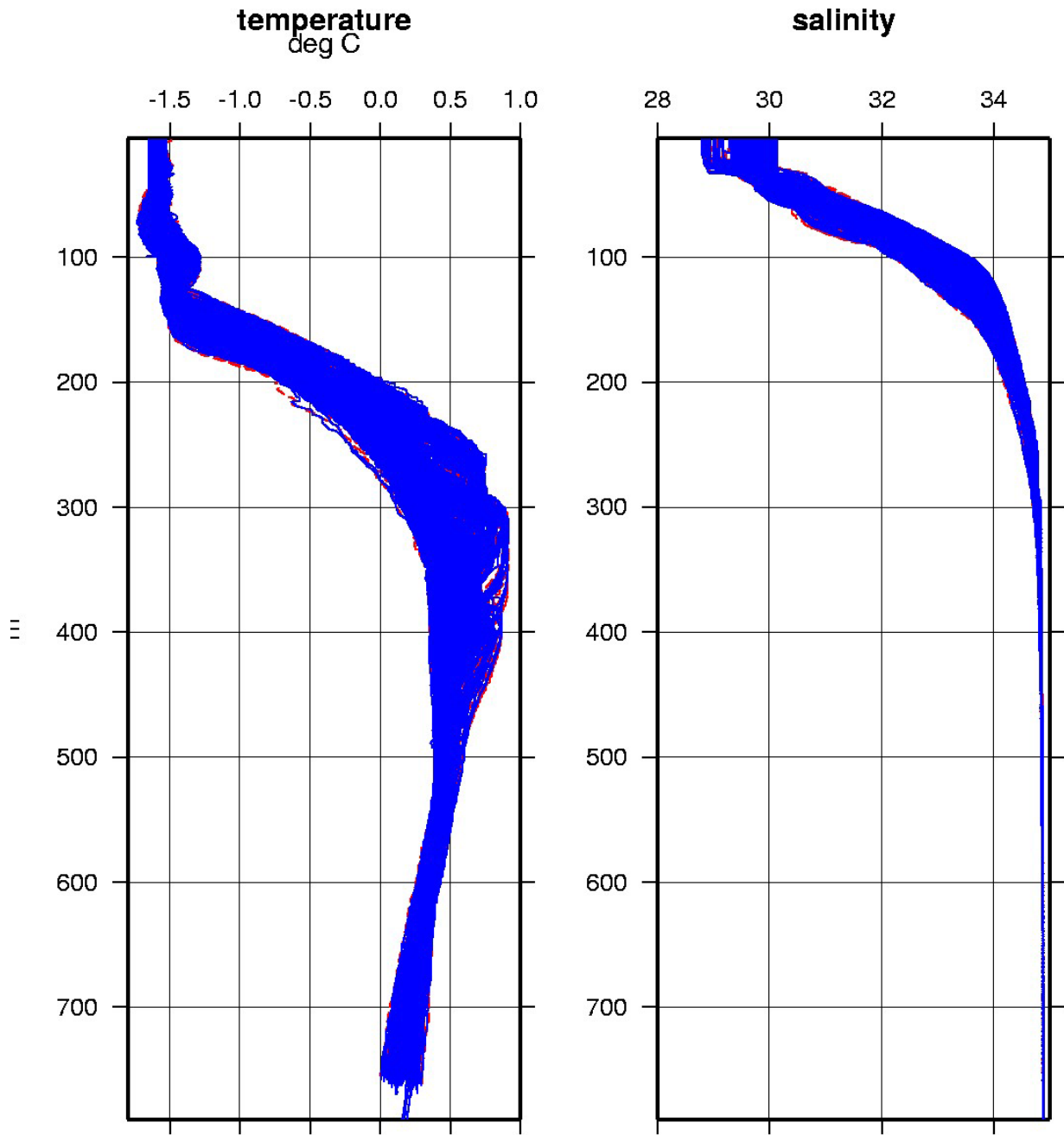
salinity



day 2007

ITP 9 Temperature and Salinity contours.

All ITP9 Profiles (up to profile 1479)



up solid, down dashed

ITP 9 Temperature and Salinity contours.



ITP9 (foreground) and IMB (background) with installation apparatus (to be removed from the ice) after deployment from a helicopter supported remote ice camp operation from the Russian research vessel "Akademik Federov". Photo by John Kemp.



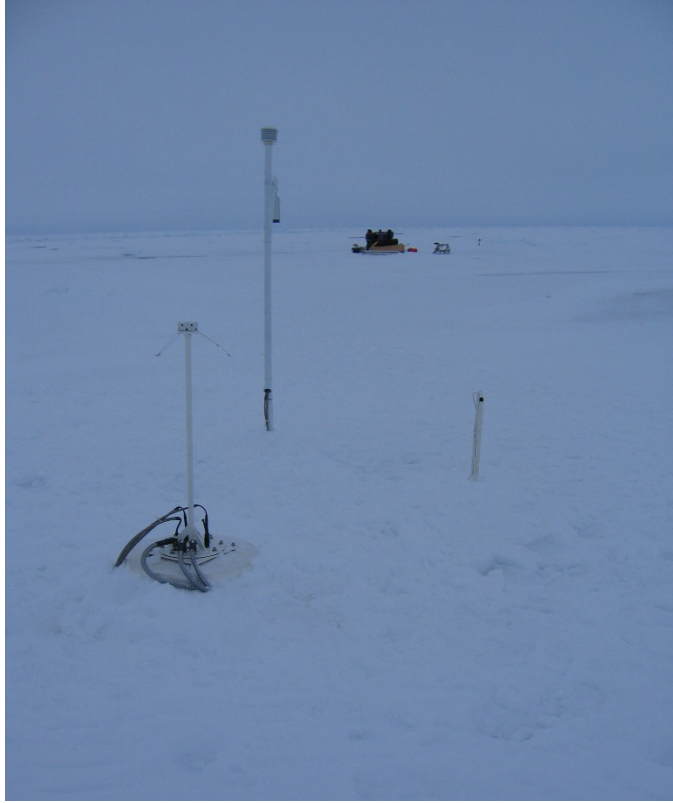
Just prior to ITP deployment operations, the helicopters on the stern helicopter deck of the research vessel "Akademik Federov" are prepared, with the nuclear icebreaker "Rossiya" following in the distance. Photo by John Kemp.



After unloading ITP 9, deployment apparatus, and field party on the multiyear ice floe, the Russian MI-8 helicopter prepares to depart while the ITP is deployed. Photo by John Kemp.



The field party on the ice congregates around the working tent behind the surface buoy of ITP 9 shortly after the profiler instrument and mooring were deployed. Photo by John Kemp.



The Ice Mass Balance Buoy (IMB) as deployed. Photo by John Kemp.