

ITP 60 Overview

Deployment Location: 9/8/2012, 11:00 UTC at 85° 3.4'N, 122° 43.0'E

Last Location: 1/3/2014, 23:01 UTC at 66° 6.79' N, 25° 30.41' W

Duration: 483 days

Distance Traveled: 6565 km

Number of profiles: 259 in 106 days

Other instruments: none

ITP 60 was deployed on a 1.5 m thick icefloe in the Transpolar Drift during the ARK-XXVII/3 cruise (TransArc) on the *R/V Polarstern* as a contribution to the Hybrid Arctic/Antarctic Float Observation System (HAFOS). The ITP included a dissolved oxygen sensor and full biosuite system and a fixed SAMI pCO₂ with SBE-37 microcat at 6 m depth and operated on a pattern profiling sampling schedule including one full one-way profile between 7 and 760 m depth every 1.5 days.

ITP60 Deployment Operations

The last ITP deployed during the 2012 TransArc cruise on the *R/V Polarstern* was ITP 60 with biosuite sensors. It was important to expand the ice hole as much as possible while augering to fit the biosuite profiler, as the sensors on endcap occupy the full 10.5" diameter. The ice floe was large, but the best ice was located near the ship, not too far from the edge where the floe thickness was about 1.5±0.3 m. There were a few hidden meltponds in the vicinity (discovered by skidoo), but the ITP site was bit higher and surrounded by various sized ridges.

ITP60 Data Processing

The 258 profiles that were transmitted from the ITP were processed according to the procedures described in the ITP Updated Data Processing Procedures. The processing parameters for are shown in the figures to the right. The biosuite sensor data handling are described in Laney et al., (2014). Buoy drift speeds were infrequently more than 30 cm/s so the profiler covered nearly the full extent of most profiles that it communicated to the surface package.

The temperature and salinity data were almost entirely free of obvious fouling. Thermohaline staircases were present during the time series in the deep profiles, and the lag correction estimates were in typical ranges and mostly constant over time. The profile-to-profile potential conductivity corrections were also mostly typical and constant. The dissolved oxygen sensor data were also very clean while the profile-to-profile corrections increased gradually. The biosuite sensors all obtained excellent data over the lifetime of the profiler, as well.

Unfortunately, the SAMI pCO₂ sensor mounted at 6 m did not return good data, but the companion microcat did provide time series of temperature, salinity and dissolved oxygen.

References:

Laney, S.R., R.A. Krishfield, J.M. Toole, T.R. Hammar, C.J. Ashjian, and M.-L. Timmermans, 2014. Assessing Algal Biomass and Bio-optical Distributions in Perennially Ice-Covered Ocean Ecosystems. *Polar Science*, Vol. 8, <http://dx.doi.org/10.1016/j.polar.2013.12.003>.

ITP60 Data Description

The ITP profiler was configured to operate on a pattern profiling schedule with different summer and winter schedules. In the summer (between deployment and October 31), the instrument conducted a 1.5 day repeating pattern of an up profile from 750 to 7 m, followed by 4 one-way (down, up, down, up) profiles between 7 and 200 m, followed by a down profile from 7 to 750 m, all spaced 6 hours apart. In the winter (after November 1st), the instrument conducted a 3-day repeating pattern of an up profile from 750 to 7 m, followed 6 hours later by a down profile from 7 to 200 m, followed 24 hours later by an up profile from 200 to 7 m, followed 6 hours later by a down profile from 7 to 750 m, followed by a 36 hour gap before the pattern repeated. The complicated scheme was designed to conserve battery power to extend the lifetime of the instrument, while maximizing the acquisition of the bio-optical data during the summer months. In the surface package, the GPS receiver was powered hourly to obtain locations hourly, and buoy temperature and battery voltage status were recorded.

The buoy generally meandered southward between 85 and 83°N along 130°E during the 6 weeks then circled east, north, and west before communications with the profiler ceased abruptly. At the same time, the temperature of the buoy electronics increased significantly (from -35 to -10 °C) indicating that ridging was likely occurring around the surface package, so that the buoy was pushed down and not covered in ice. Thereafter communications with the SAMI (including microcat) inductive modem were intermittent but with no data until February 2013. The surface package continued to transmit locations until January 2013 as it drifted southward along the Lomonosov Ridge, exiting the Arctic Ocean through Fram Strait, and floated along the east coast of Greenland to the Denmark Strait.

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

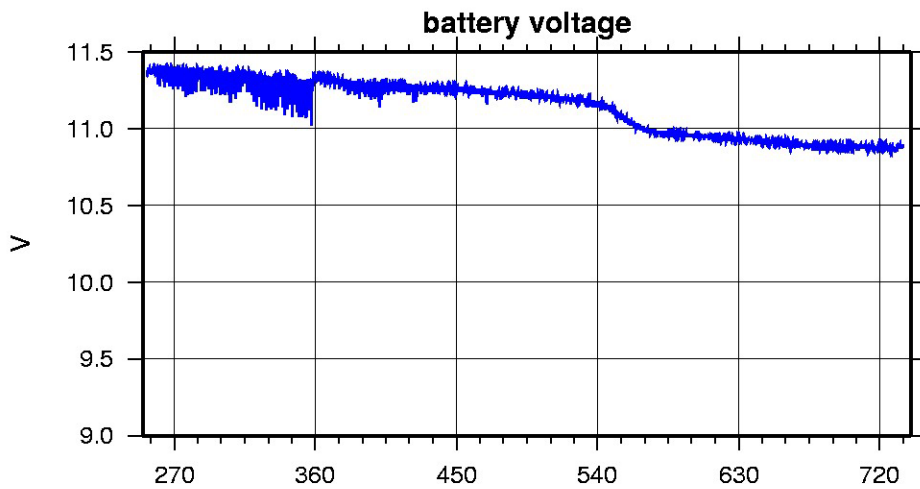
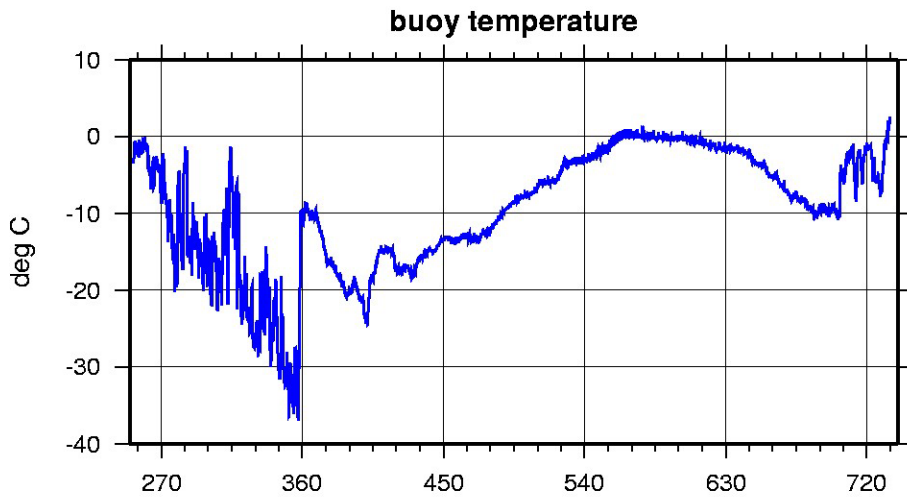
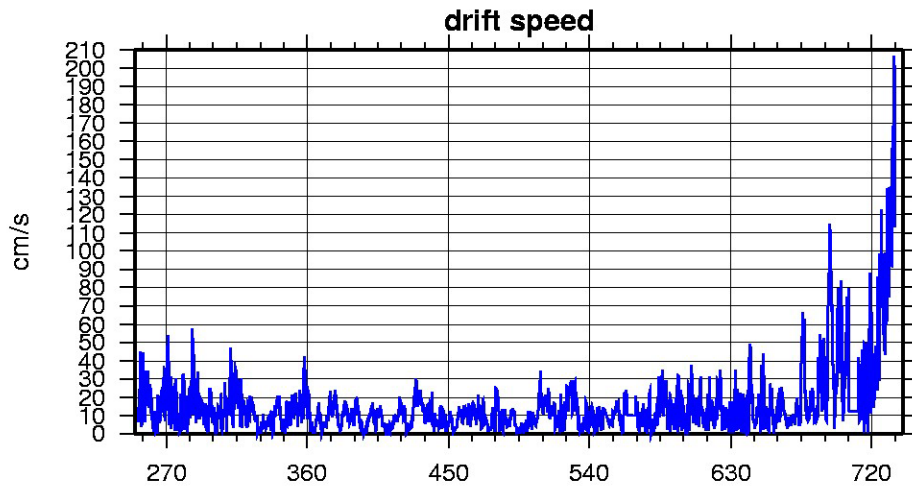
Level II hourly buoy location data in ASCII format: `itp60rawlocs.dat`

Level III 1-Hz processed profile data in MATLAB format: `itp60cormat.tar.Z` or `itp60cormat.zip`

Level III 1-db bin-averaged processed profile data in MATLAB format: `itp60final.mat`

Level III 1-db bin-averaged processed profile data in ASCII format: `itp60final.tar.Z` or `itp60final.zip`

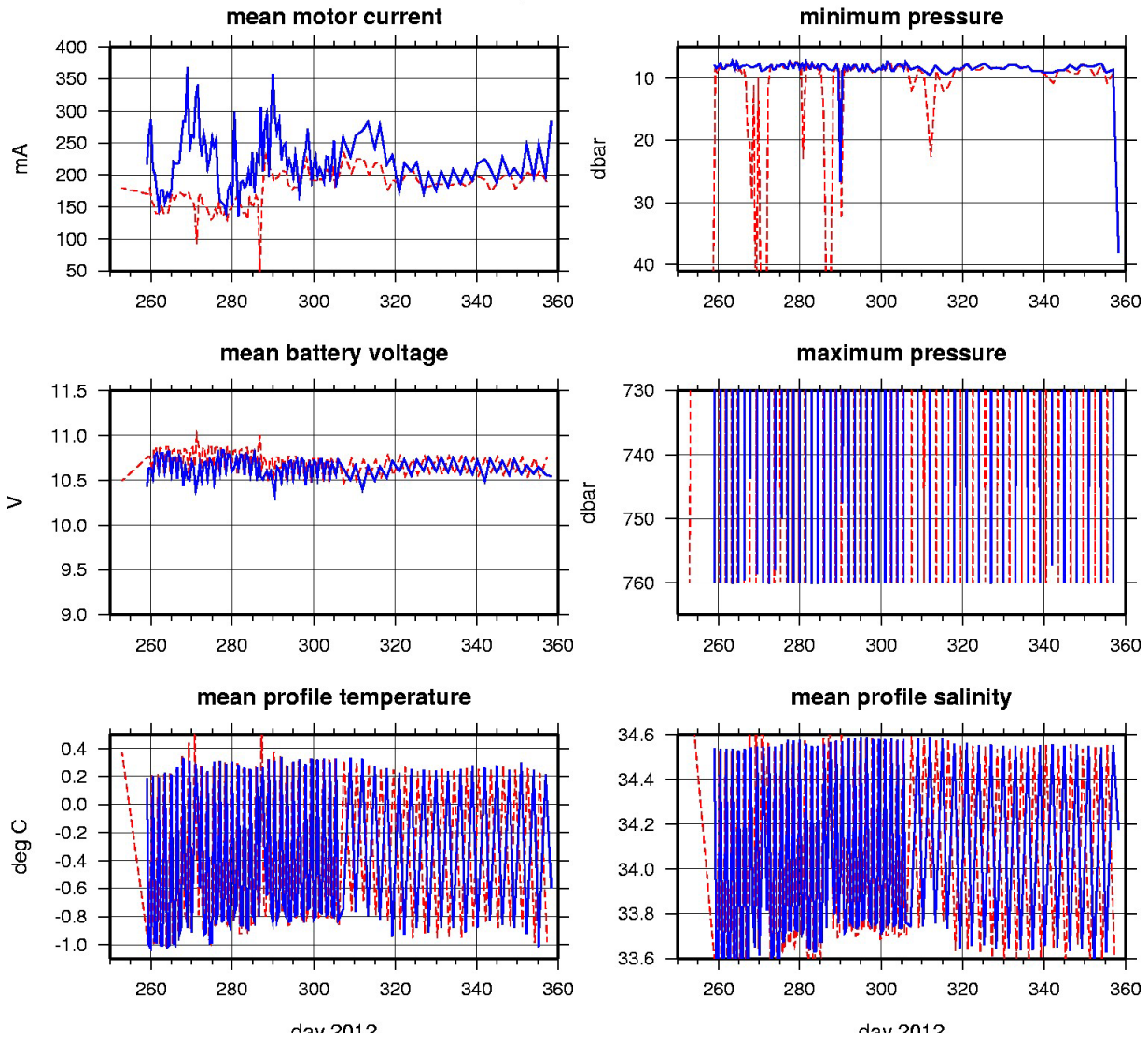
ITP60 Buoy Status (as of 2014/01/03)



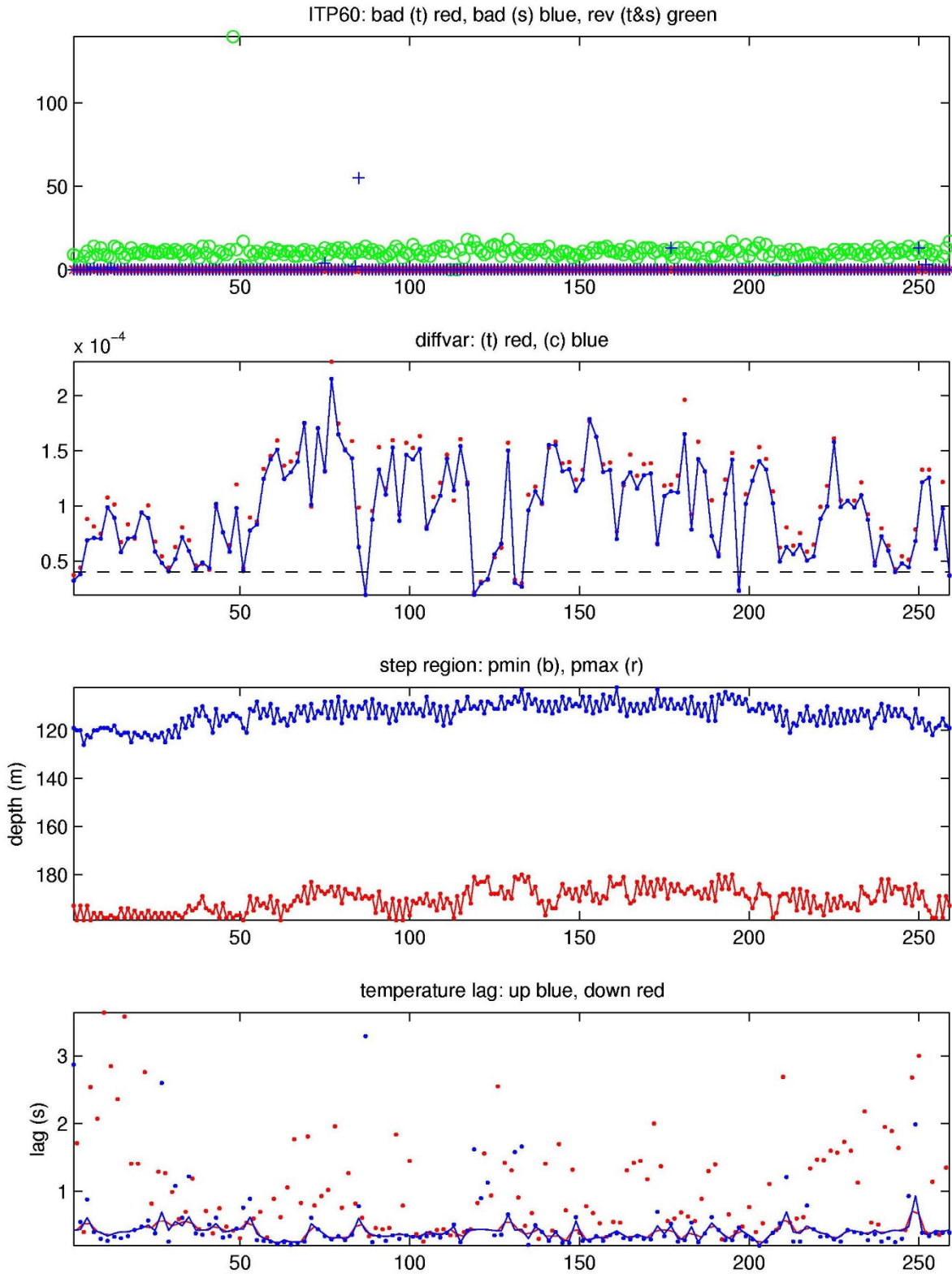
Nov 2012
ITP surface buoy status.

ITP60 Profiler Status (up to profile 259)

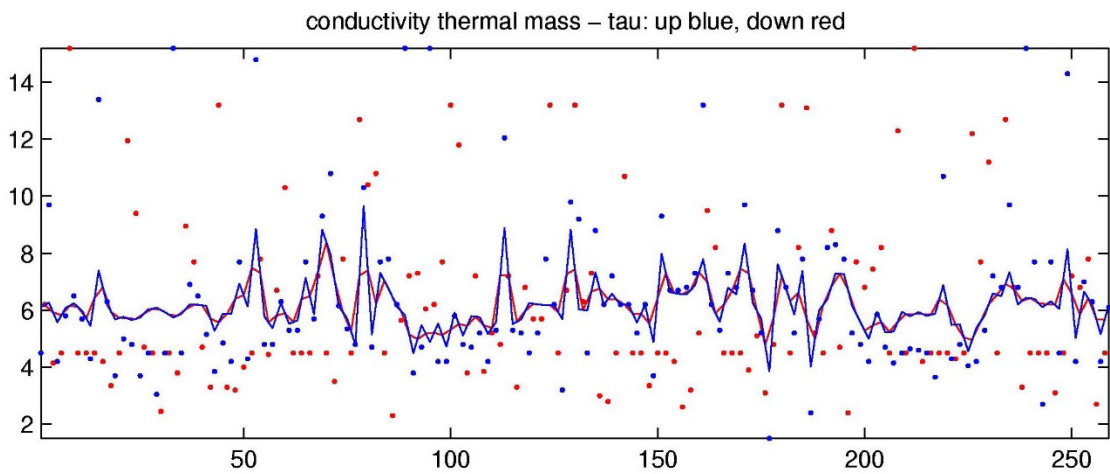
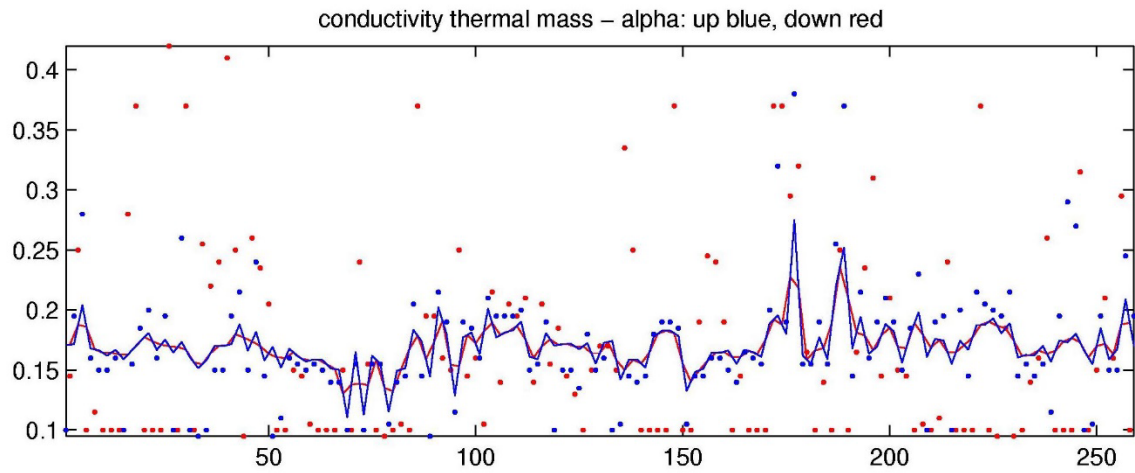
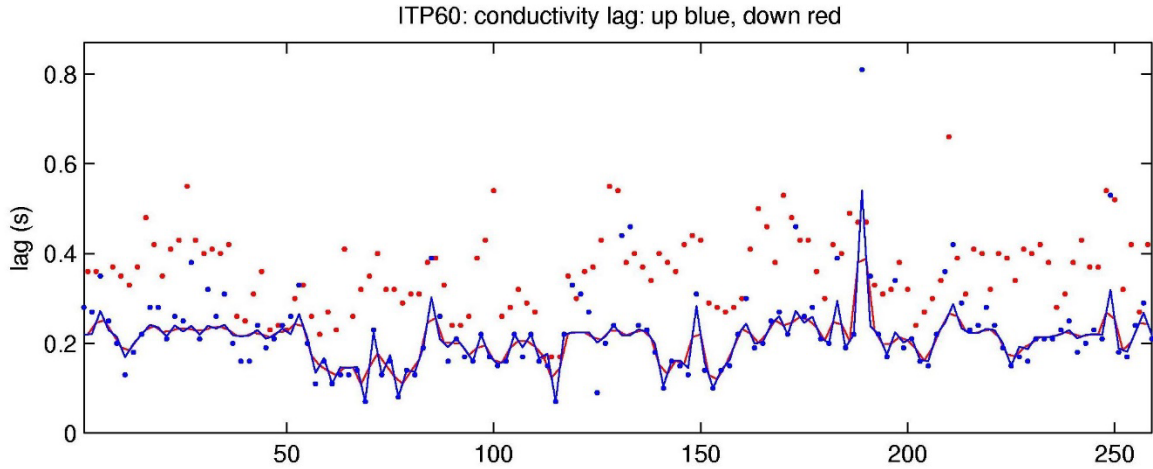
up solid, down dashed



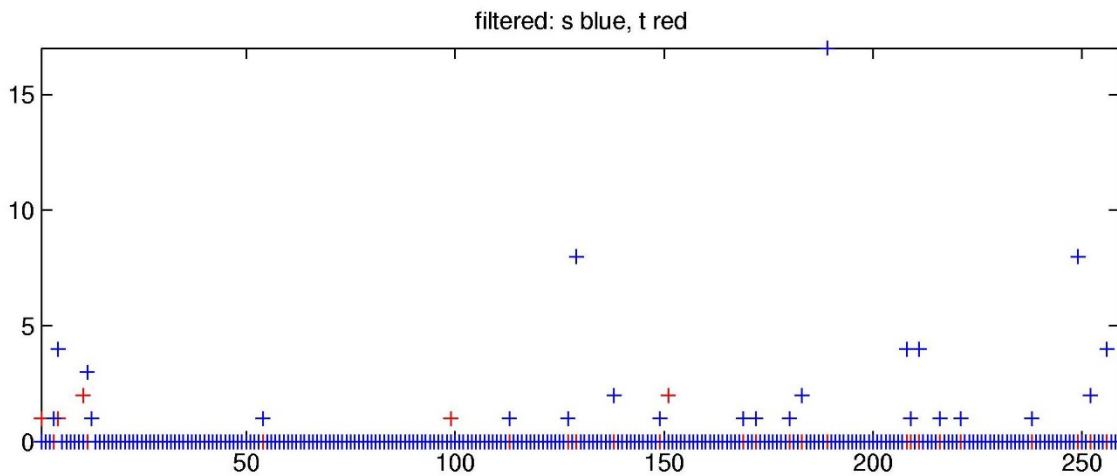
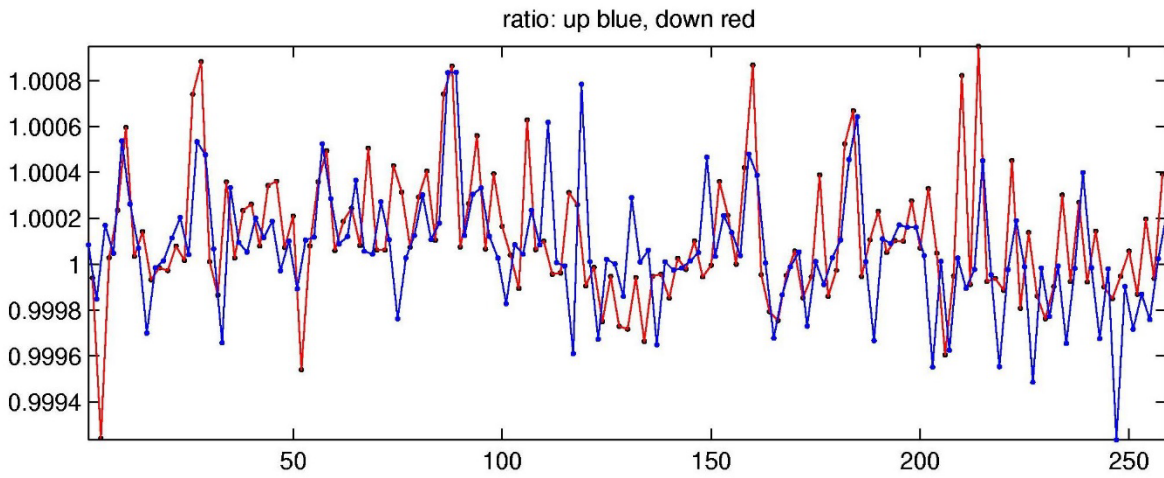
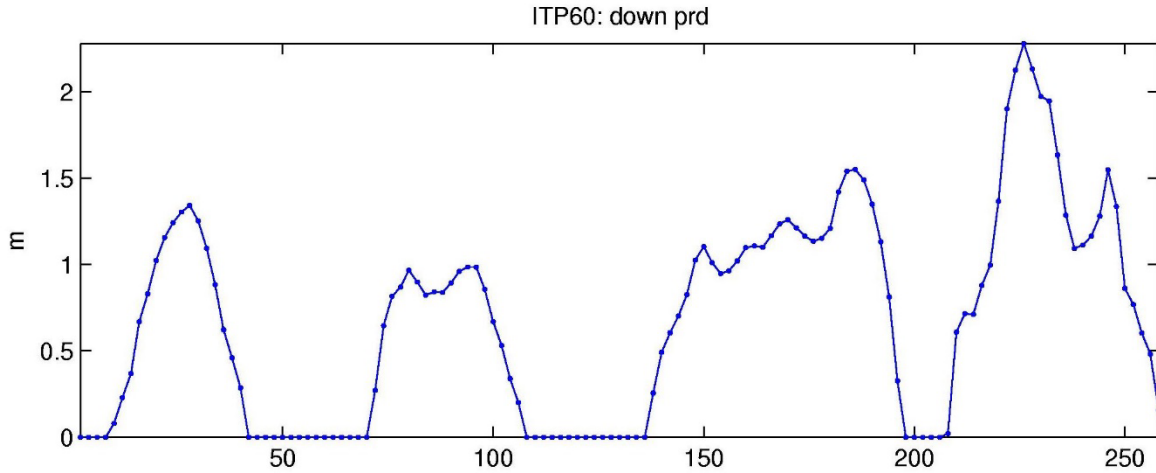
ITP profiler engineering data.



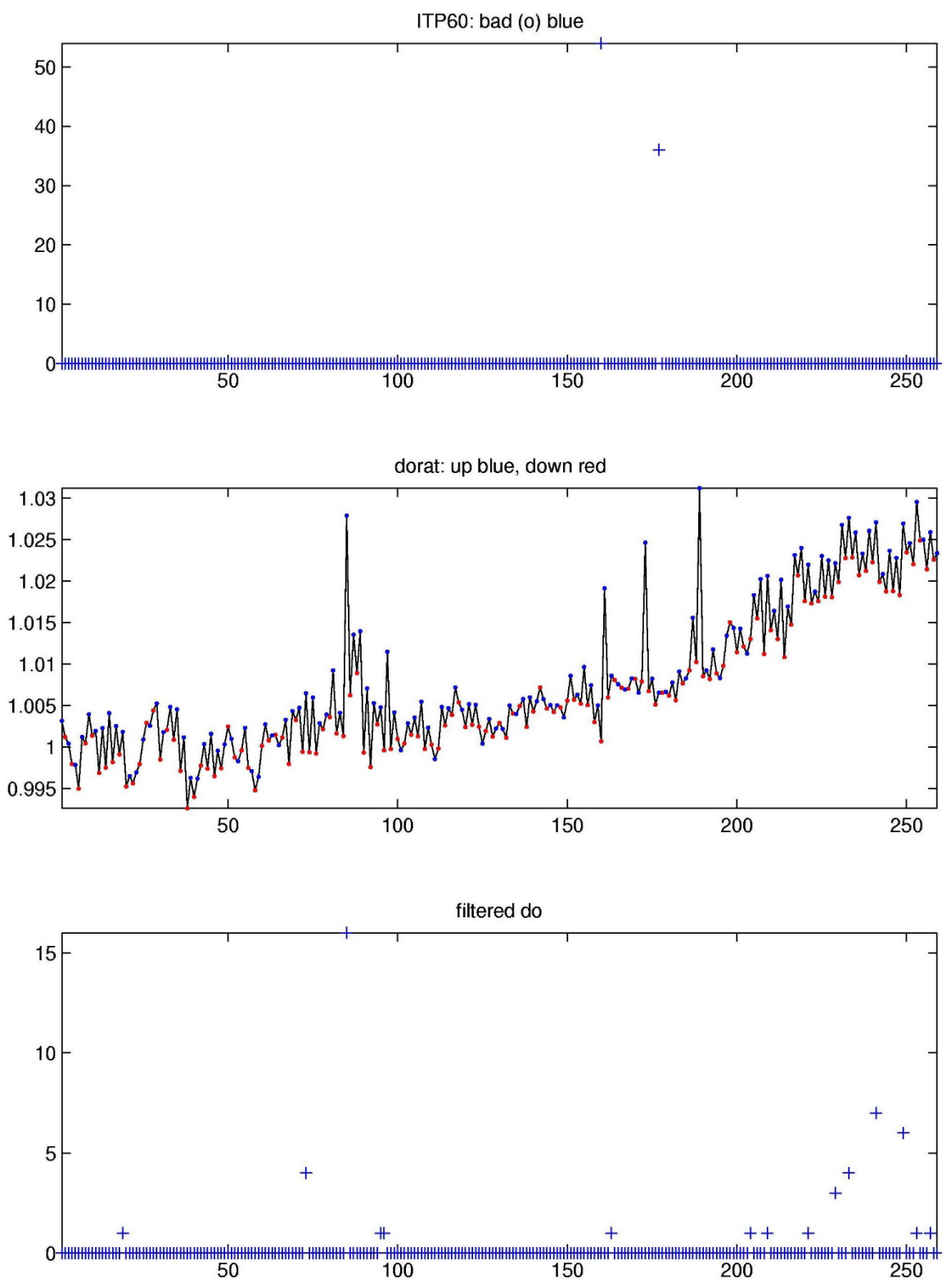
Number of bad points removed (top); variance of vertical difference of temperature and salinity in step region for up-going profiles; depth of staircase layer; temperature lag (bottom).



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

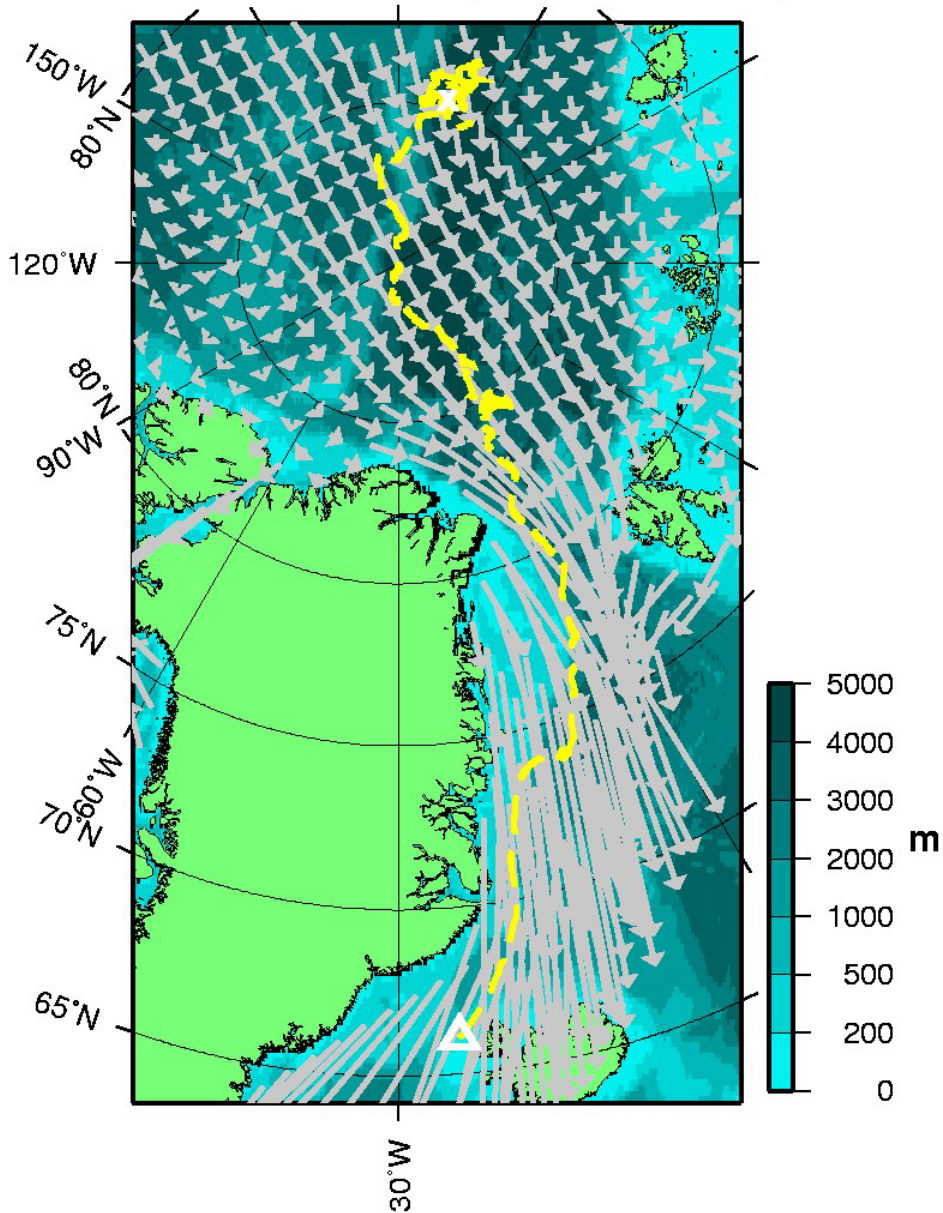


Top: down pressure deviation correction, Middle: salinity ratio adjustment, Bottom: Number of filtered spikes.



Top: number of bad dissolved oxygen points removed, Middle: dissolved oxygen ratio adjustment, Bottom: Number of filtered spikes.

ITP60 Drift Track (as of 2014/01/03)

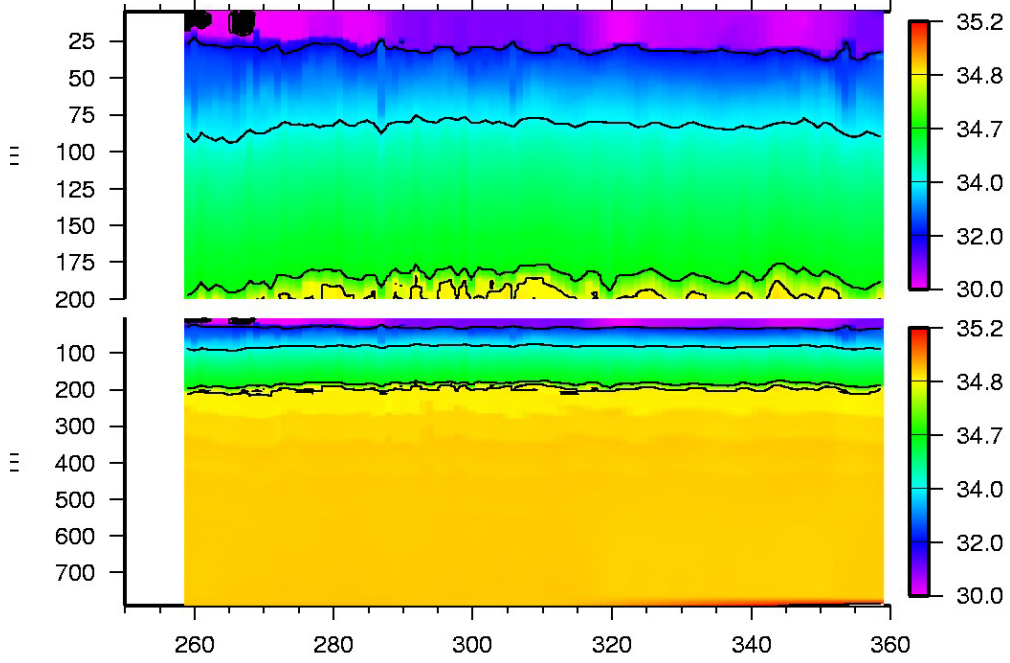
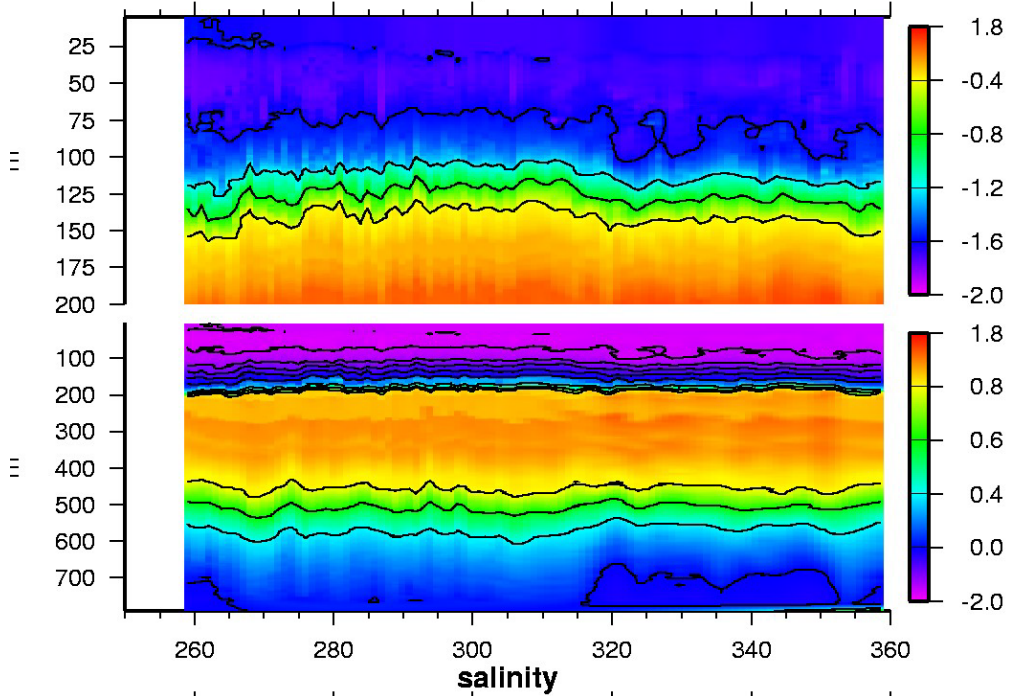


ITP drift (yellow line), last profile (x), last location (triangle), and annual ice drift from IABP (grey vectors) on IBCAO bathymetry (shading).

Plot of buoy locations.

ITP60 Up Profile Contours (to profile 259)

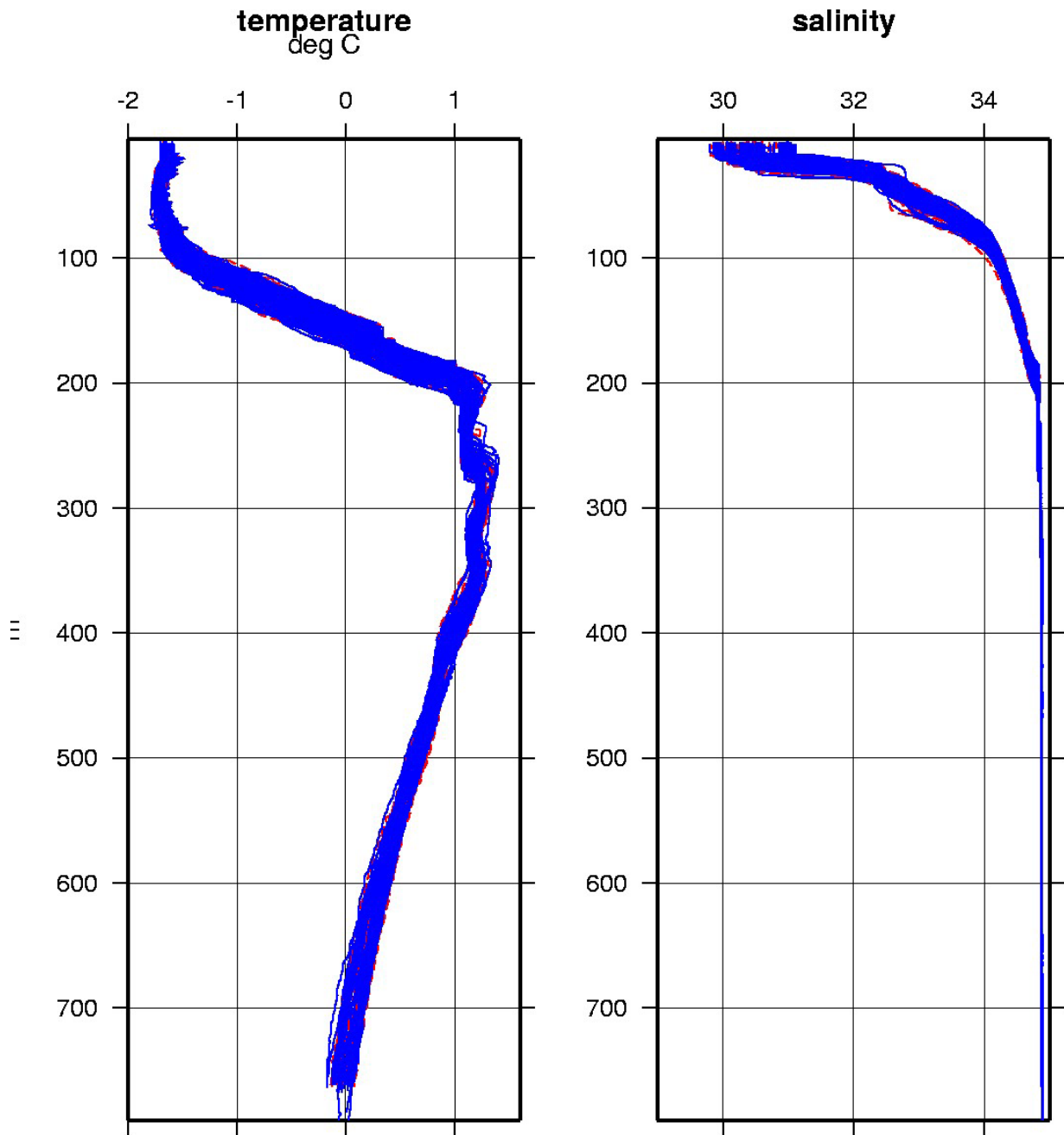
temperature



day 2012

ITP 60 Temperature and Salinity contours.

All ITP60 Profiles (up to profile 259)

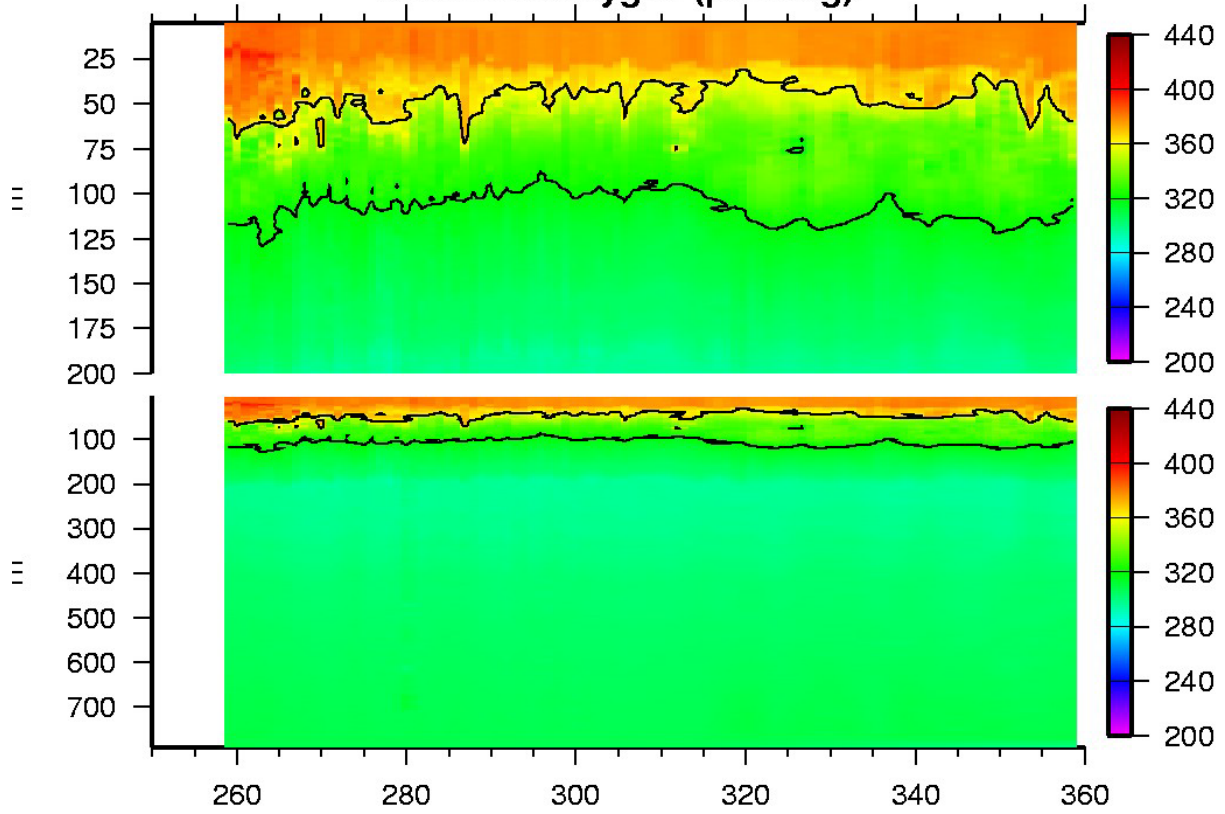


up solid, down dashed

Composite plot of ITP temperature and salinity profiles.

ITP60 Up Profile Contours (to profile 258)

dissolved oxygen ($\mu\text{mol/kg}$)

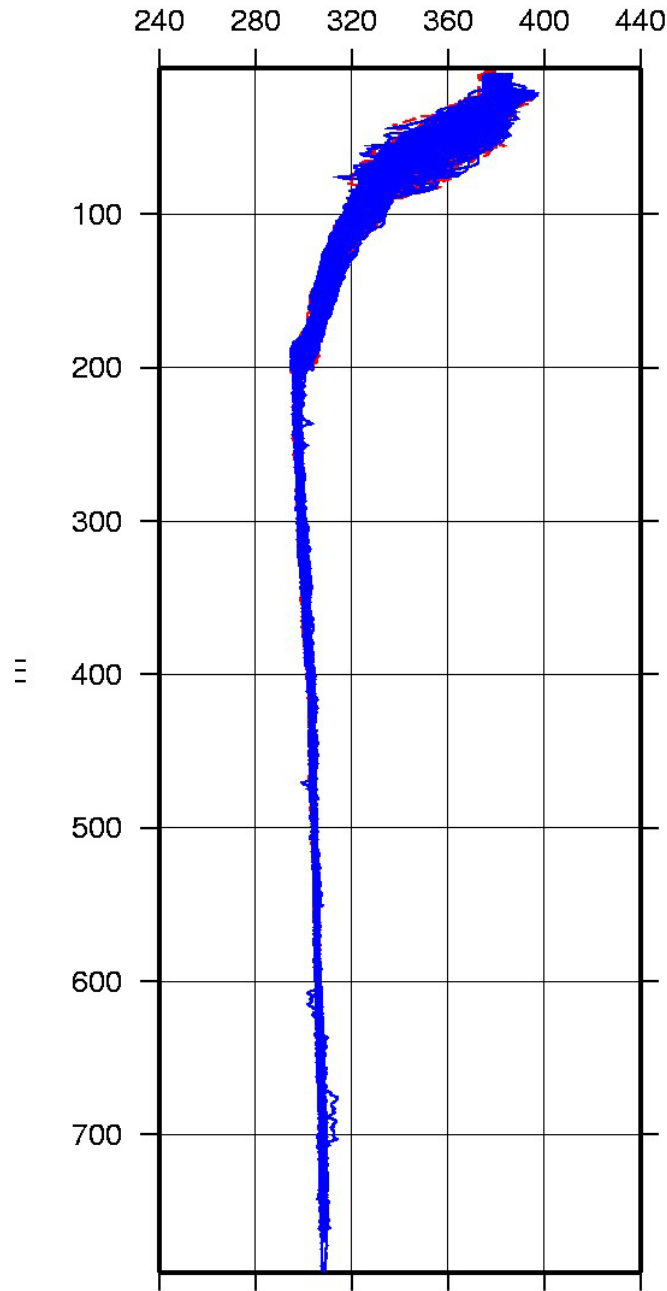


day 2012

ITP 60 dissolved oxygen contours.

All ITP60 Profiles (up to profile 258)

dissolved oxygen
 $\mu\text{mol/kg}$

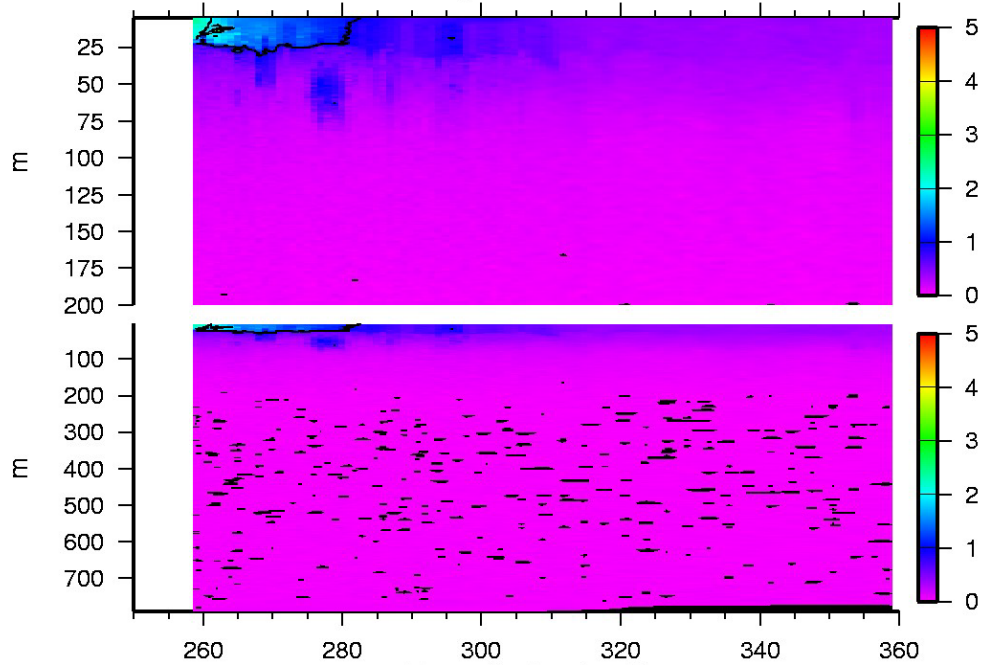


up solid, down dashed

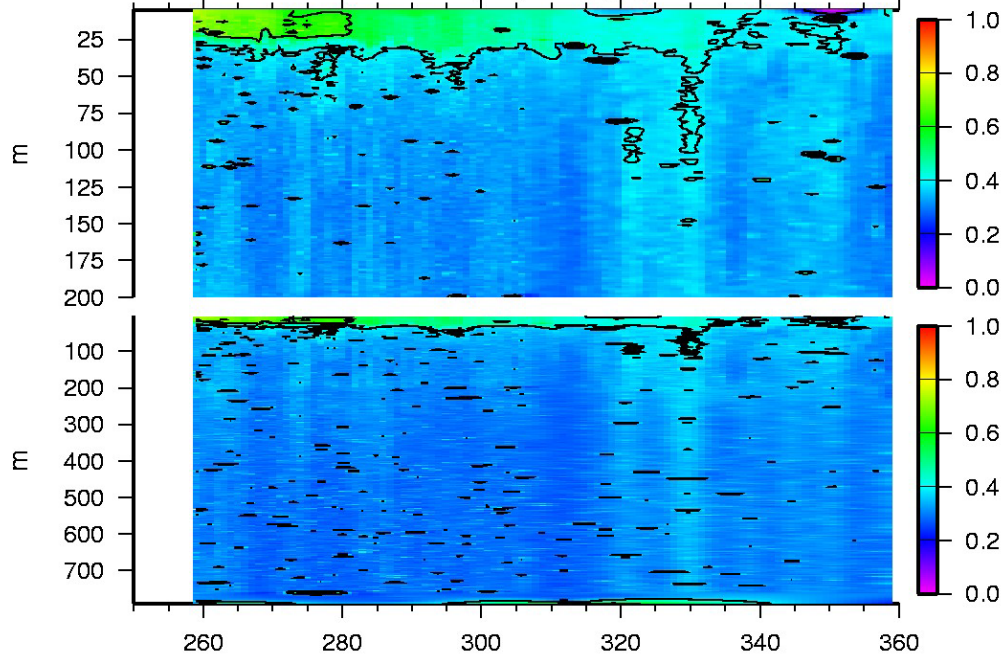
Composite plot of ITP dissolved oxygen profiles.

ITP60 Up Profile Contours (to profile 258)

turbidity ($m^{-1}sr^{-1} \times 10^{-4}$)



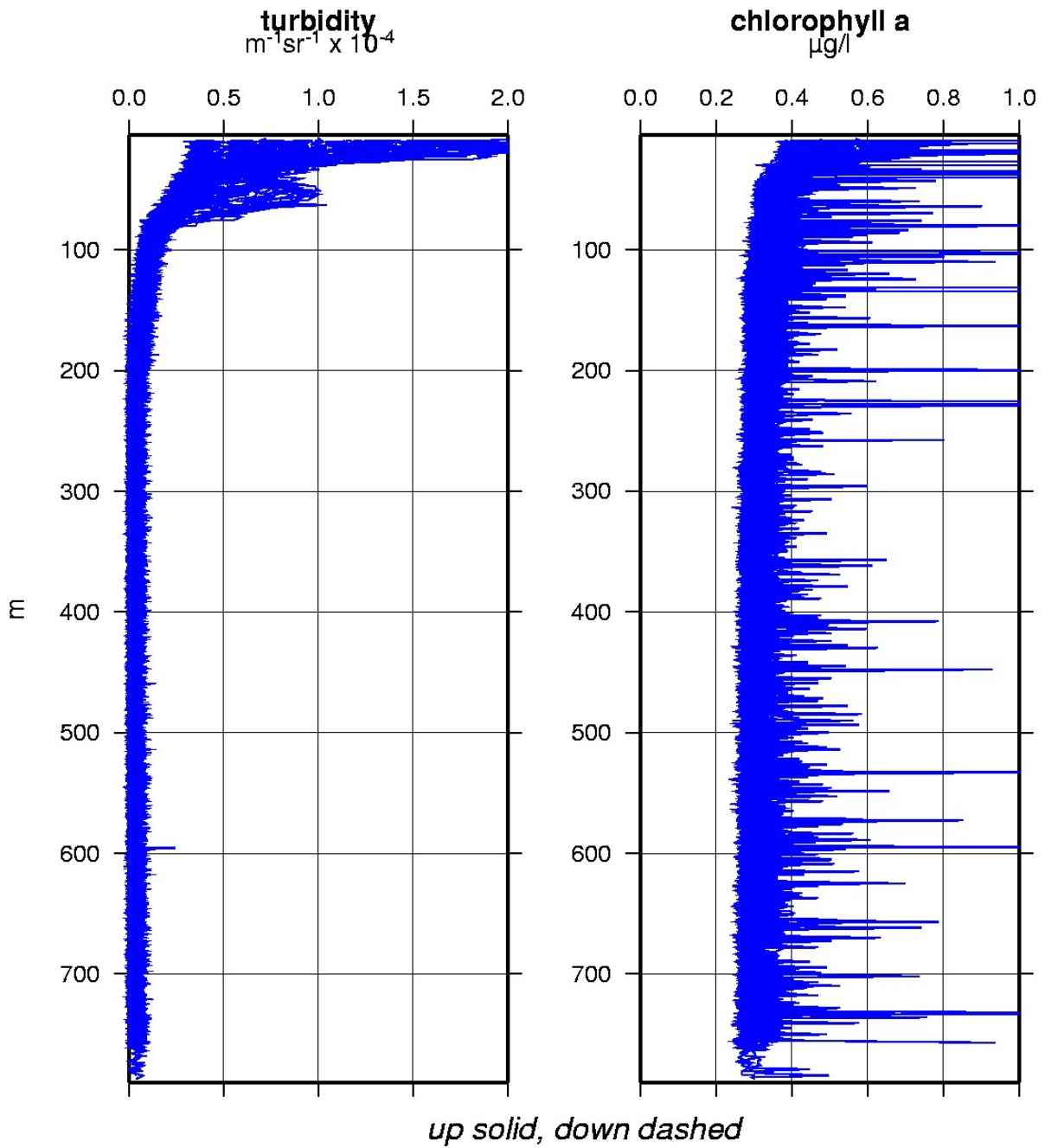
chlorophyll a ($\mu g/l$)



day 2012

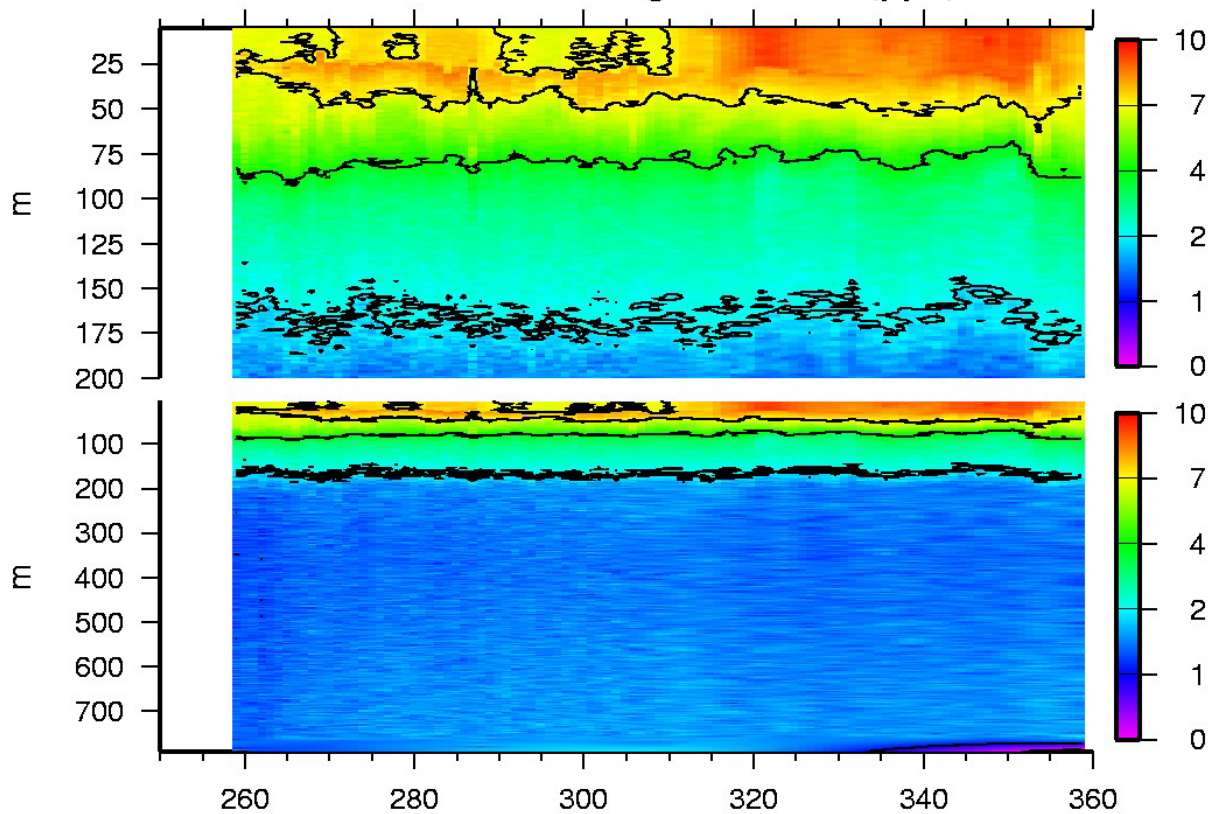
ITP 60 Turbidity and Chlorophyll a contours.

All ITP60 Profiles (up to profile 258)



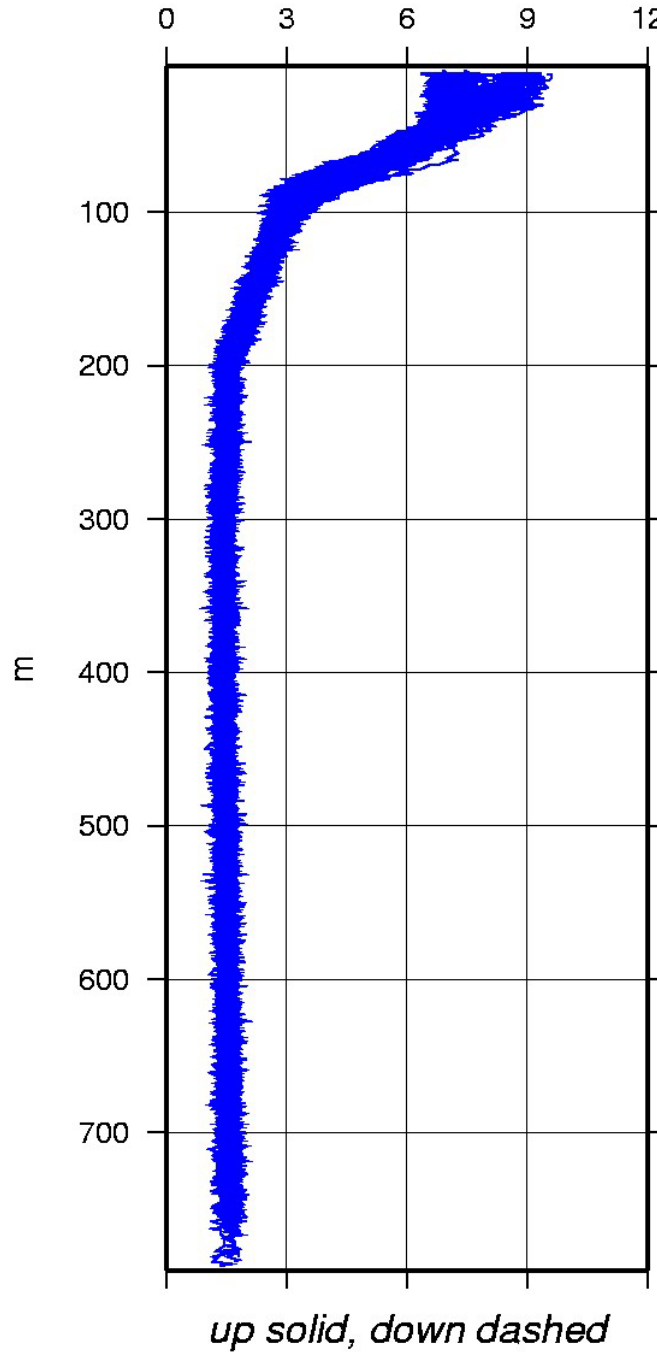
Composite plot of ITP turbidity and chlorophyll a profiles.

**ITP60 Up Profile Contours (to profile 258)
colored dissolved organic matter (ppb)**



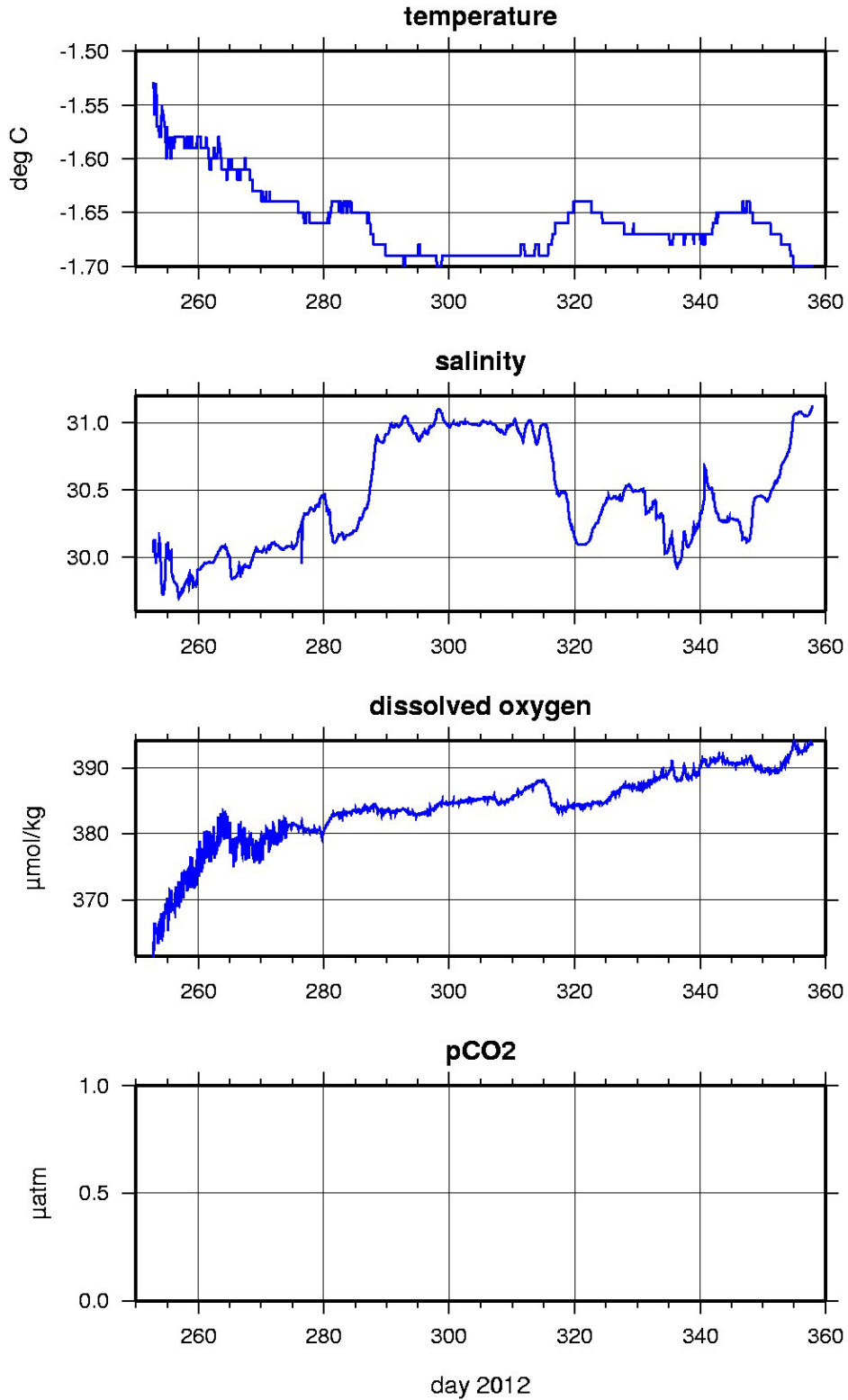
ITP 60 CDOM and PAR contours.

All ITP60 Profiles (up to profile 258)
colored dissolved organic matter
ppb



up solid, down dashed
Composite plot of ITP CDOM and PAR profiles.

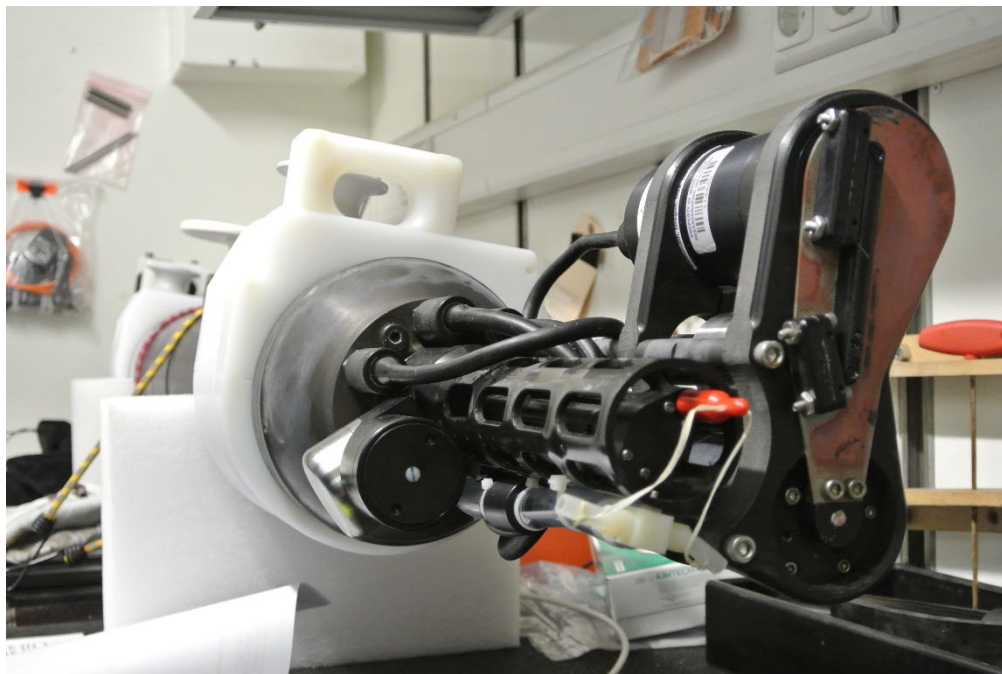
ITP60 SAMI data (as of 2012/12/22)



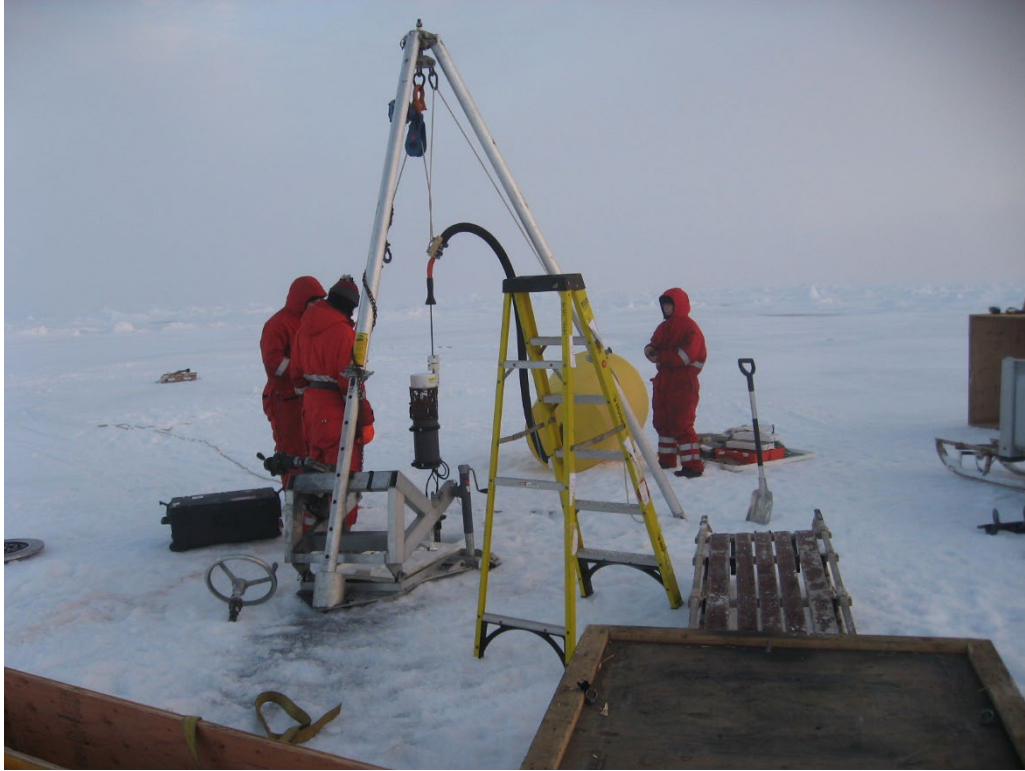
Plot of SAMI time series.



ITP 60 after deployment and before the team has hauled the deployment apparatus back to the Polarstern on sleds. (Daniel Scholz)



ITP 60 biosuite endcap on a lab bench before deployment. (BenRabe)



The SAMI pCO₂ was mounted just below the 5 m urethaned section of tether. (Daniel Scholz)