ITP 7 Overview

Deployment Location: 4/28/2007, 12:00 UTC at 88° 48.6'N, 12° 30.8'W

Last Location: 2/7/2008, 22:00 UTC at 59° 9.2' N, 41° 50.2' W

Duration: 286 days

Distance Travelled: 4842 km

Number of profiles: 746 in 186 days

Other instruments: IMB 2007-D, AOFB 11, Weatherex

ITP 7 was deployed on a 2.5 m thick icefloe in the Transpolar Drift as part of the North Pole Environmental Observatory (NPEO) . On the same icefloe, a Naval Postgraduate School Arctic Ocean Flux Buoy (AOFB) and Climate Change College meteorological mast were also installed. On a separate icefloe approximately 1 km away, a US Army Cold Regions Research and Engineering Laboratory (CRREL) Ice Mass Balance Buoy (IMB 2007-D) and NOAA/PMEL Weatherex station were deployed. The ITP operated on a fast-sampling schedule of 4 one-way profiles between 7 and 760 m depth each day, obtaining 746 profiles until the profiler dragged over the East Greenland shelf. The surface package continued to transmit GPS locations for another 100 days.

ITP 7 Deployment Operations

The first ITP deployed in the Eurasian side of the Arctic Ocean was installed as part of a buoy cluster (or Ice Based Observatory) as a component of the 2007 NPEO. As in previous years, NPEO operated from the Russian ice camp Barneo, which is installed every March-April primarily for commercial tourist purposes. Transport for the NPEO scientists and gear to the North Pole ice camp was through Resolute and Alert, Canada using first a Hawker aircraft, and later a Twin Otter. While the Hawker was supposed to carry all of the NPEO project equipment to Barneo, a crack that formed in the runway after a series of storms at Barneo limited the length of the runway so that only the Twin Otter (with reduced payload) could be used. Consequently, some of the NPEO field program had to be abandoned for the year, but installation of the buoy cluster continued using two Twin Otter flights.

The first half of our deployment team and half of our buoy gear (IMB and Weatherex) were transported from Alert to Barneo (about 60 miles from the North Pole) on April 22. A location on an 1.5 icefloe several hundred meters from Barneo camp was selected to deploy the various buoys making up the IBO. A NOAA/PMEL Weatherex buoy and US Army CRREL Ice Mass Balance (IMB) buoy were installed on the 23rd and 24th of April. The morning after the IMB was installed, a crack formed directly through the IMB buoy hull (and the ice camp runway as well). Fortunately, the crack in the runway healed itself, and the IMB canister was redeployed

by removing it from the crack and inserting into an adjacent new hole, without removing any sensor wires.

After several days of weather delays, on April 27 the remainder of the deployment team and the ITP and AOFB buoys arrived. Due to the cracks that formed on the IMB and Weatherex buoy site, an alternate site was chosen for the rest of the buoys. Nothing near the camp was better than the existing site, so a 2.5 m ice floe over 1 km away was selected requiring snowmobiles for transport to the site. The ITP deployment the next morning concluded successfully in just less than 4 hours, with a few minor difficulties due to the cold air temperatures (-15 C). In particular, trouble keeping a laptop computer drive warm made communicating with the surface electronics difficult during testing before deployment. Meanwhile, a meteorological package installed by the Climate Change College was installed nearby. In the afternoon the AOFB sensor package was installed about 10 m away with a wind generator to provide additional power for fast sampling during windy periods.

ITP 7 Data Processing

The 746 profiles that were obtained from ITP 7 were processed according to the procedures described in ITP Updated Data Processing Procedures. The processing parameters are shown in the figures to the right. Unlike previous ITPs in the western Arctic Ocean, thermohaline staircases for computing sensor lags are absent, so default lag constants were used to produce the final data. The speed of the platform increased after about profile 550 (as it passed through Fram Strait), so that the profiler had more frequent difficulties completing full profiles vertically. After profile 635, increasingly larger lags are needed to correct the T & S data, as an apparent major clog or pumping problem seemingly delayed the rate of the seawater passing the sensors by a few seconds initially and later by over a minute (compared to 0.5 second typical lag). An updated processing procedure to compute the "mega-lag" is implemented to tune these profiles based on comparison in T-S space through the halocline with last known good profiles. Typical Johnson et al. (2007) lag constants are not used when applying the mega-lag procedure, and the pressure lags between consecutive up and down profiles remain uncorrected. The larger lags smooth the signal and reduce the precision in the estimates, **so the corrected data after profile 646 are of lesser quality** but may be useful for some applications.

The profiler hovered around 700 m depth on profiles 725 and 726, and around 300 m depth on profiles 732 through 746 (presumably due the mooring wire and anchor dragging on the bottom) so there are no profile data for those profiles. In the final product, 4% of the temperature and conductivity profiles (number 208 and 29 others after profile 635) were flagged as completely bad due to sensor fouling or pump failure, and another 7.5% (or 56) were corrected for large lags. The apparent constriction of flow past the sensor (lag) was progressively worse at the end of the record when the ITP drifted through Fram Strait and dragged on the East Greenland Shelf, and are probably related to drift speed, freezing in the colder East Greenland water, and/or biofouling.

ITP 7 Data Description

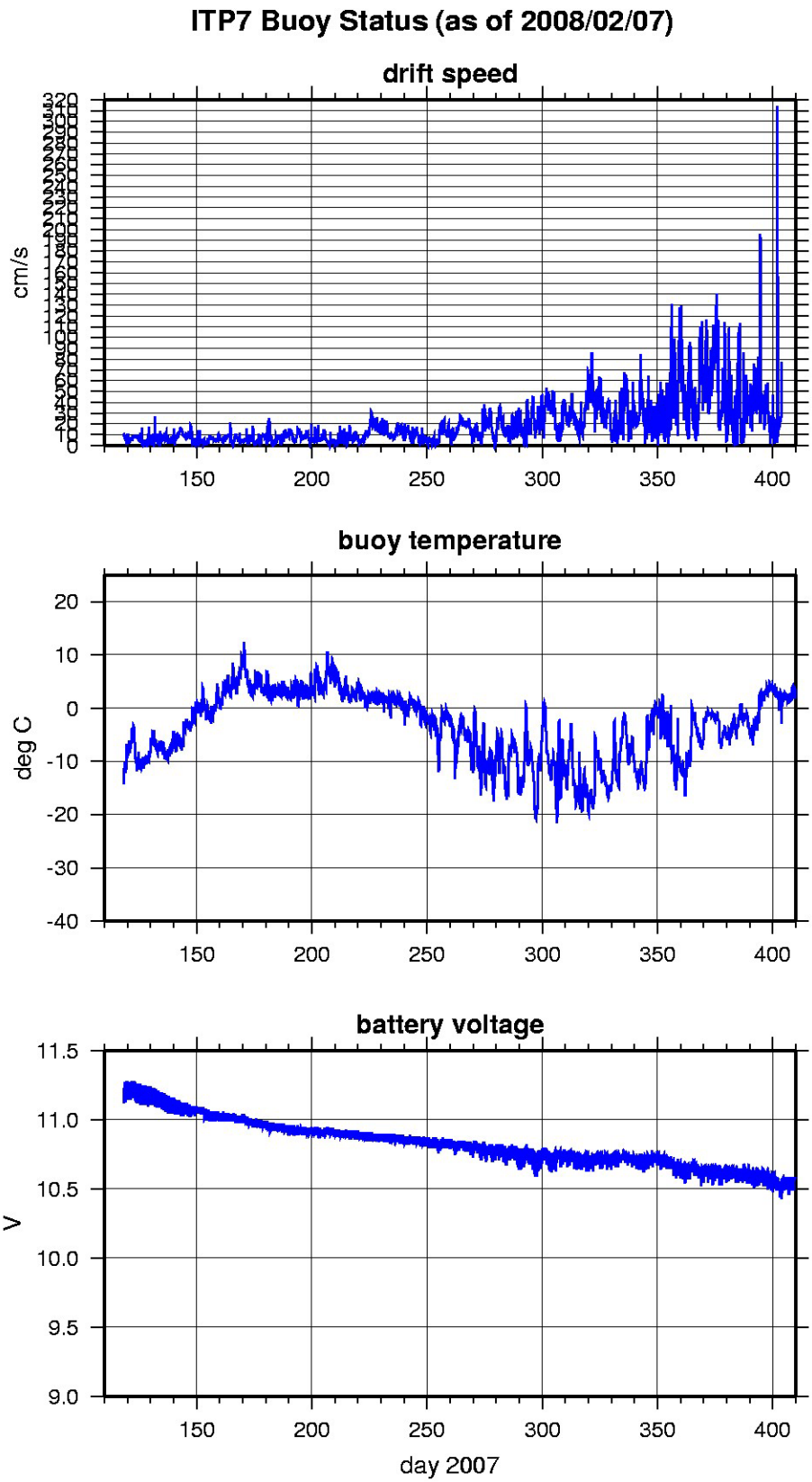
The ITP profiler was configured to operate with an accelerated sampling schedule of 4 one-way profiles between 7 and 760 m depth each day, as it was expected to reach Fram Strait in less than a year. In the surface package, the GPS receiver was powered hourly to obtain locations, and buoy temperature and battery voltage status were recorded.

The profiler operated reliably and transmitted data on schedule while the ITP drifted in the basin, and through Fram Strait. The platform speed increased beginning in mid-September as it accelerated through Fram Strait, and the profiler sensor data became increasing corrupted beginning in early October. However, as much of the later data as possible has been preserved (see Data Processing section), as it able to delineate the water masses of the Arctic Basin, the West Spitsbergen and East Greenland Currents. The mooring apparently began dragging on the shallow East Greenland shelf on October 27, and parted 5 days later. The surface package continued to transmit GPS locations and status for another 100 days, and then was not heard from again.

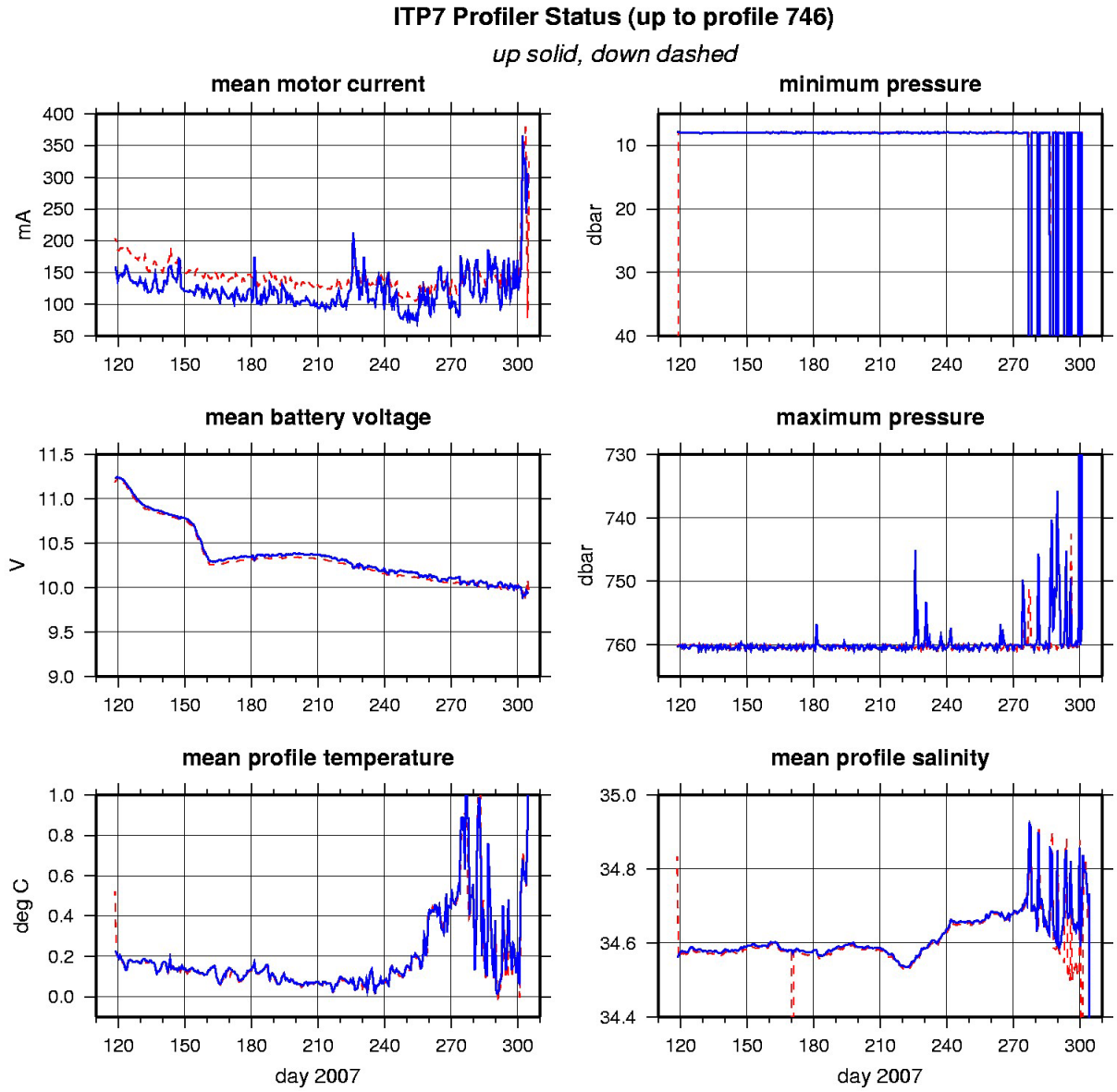
Level II hourly buoy location data in ASCII format: itp7rawlocs.dat

Level III 1-Hz processed profile data in MATLAB format: itp7cormat.tar.Z or itp7cormat.zip

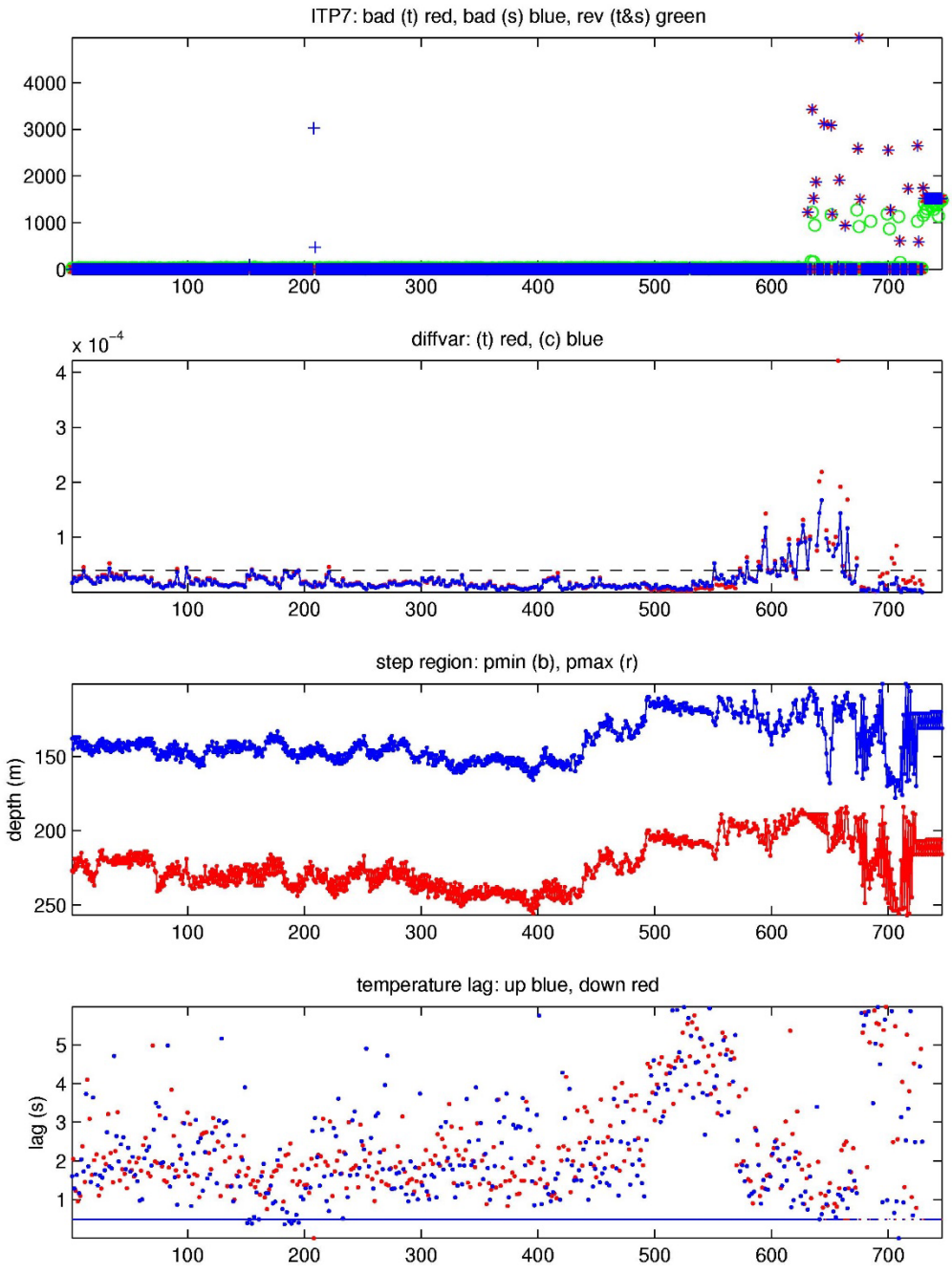
Level III 1-db bin-averaged processed profile data in MATLAB format: itp7final.mat
Level III 1-db bin-averaged processed profile data in ASCII
format: itp7final.tar.Z or itp7final.zip



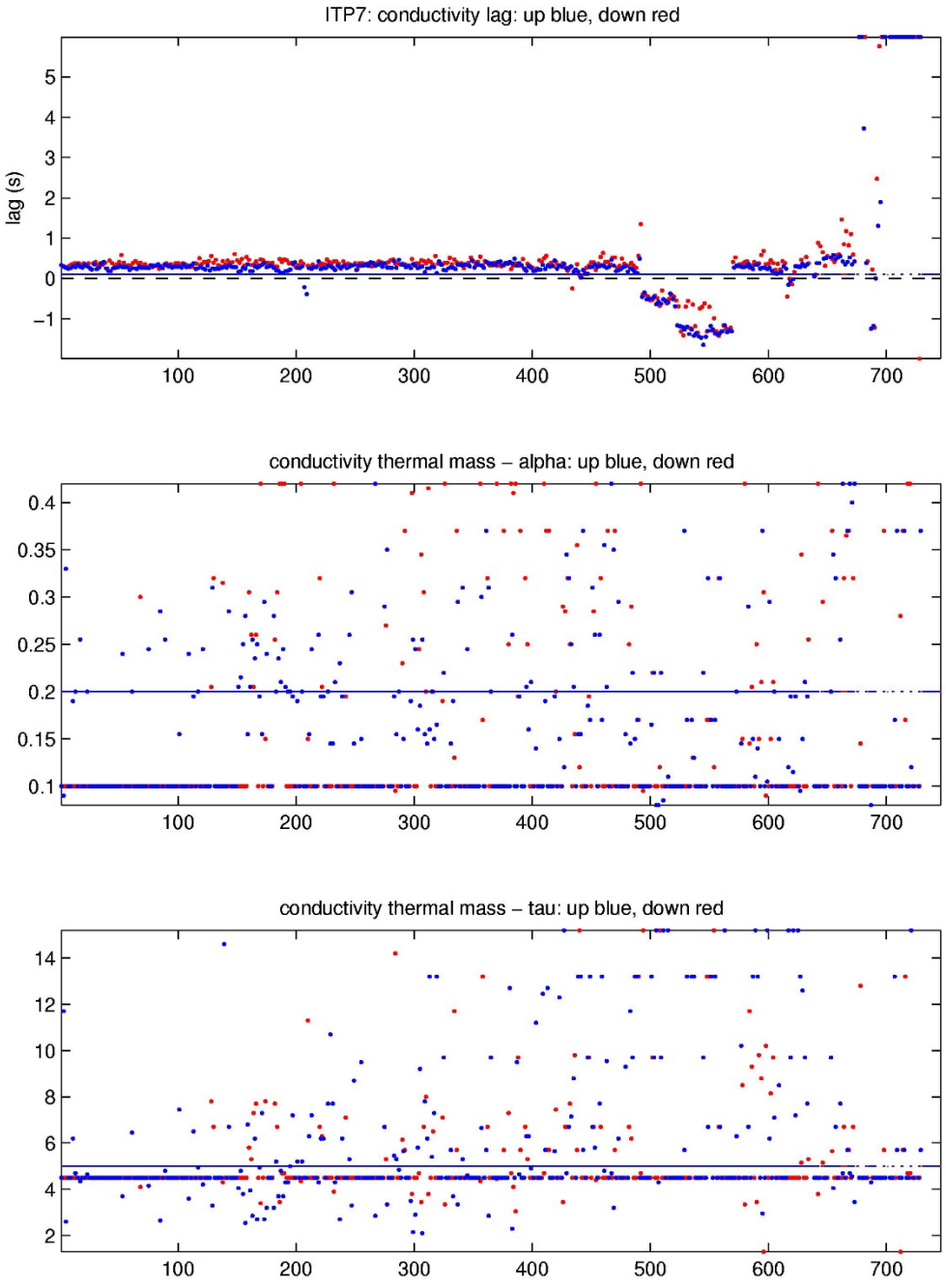
ITP surface buoy status



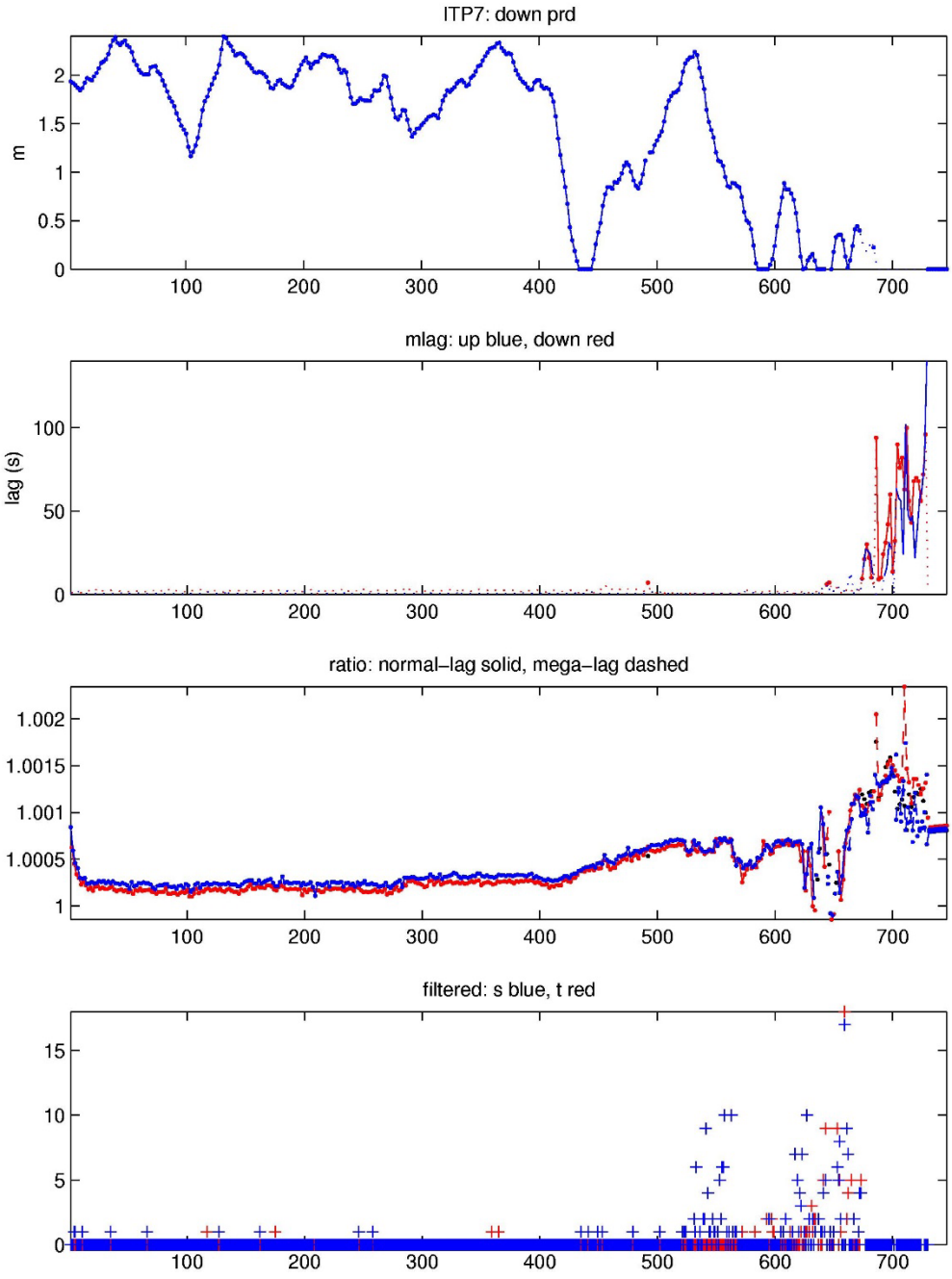
ITP profiler engineering data



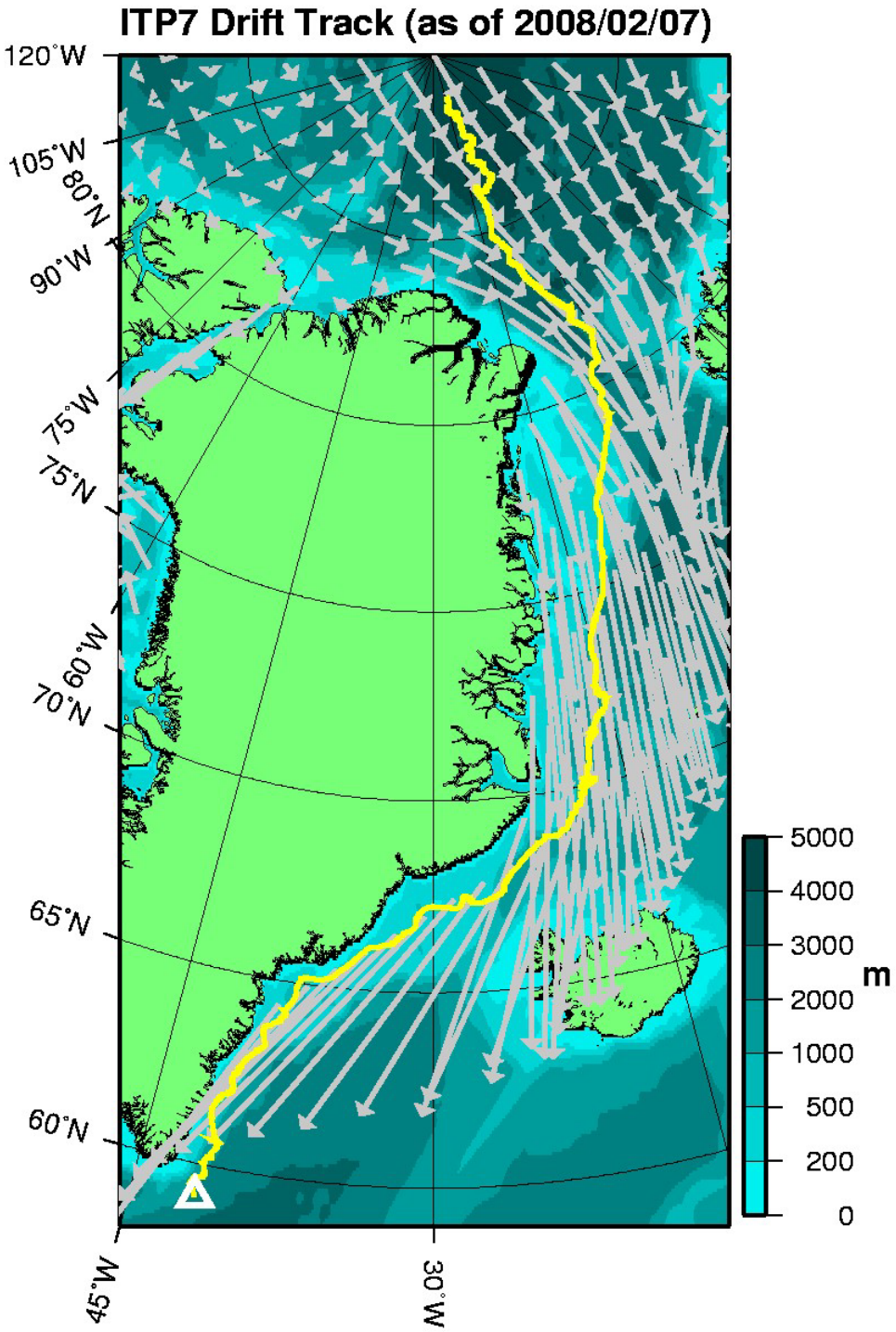
Number of bad points removed (top); variance of vertical difference of temperature and salinity in step region for up-going profiles; depth of staircase layer; temperature lag (bottom).



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

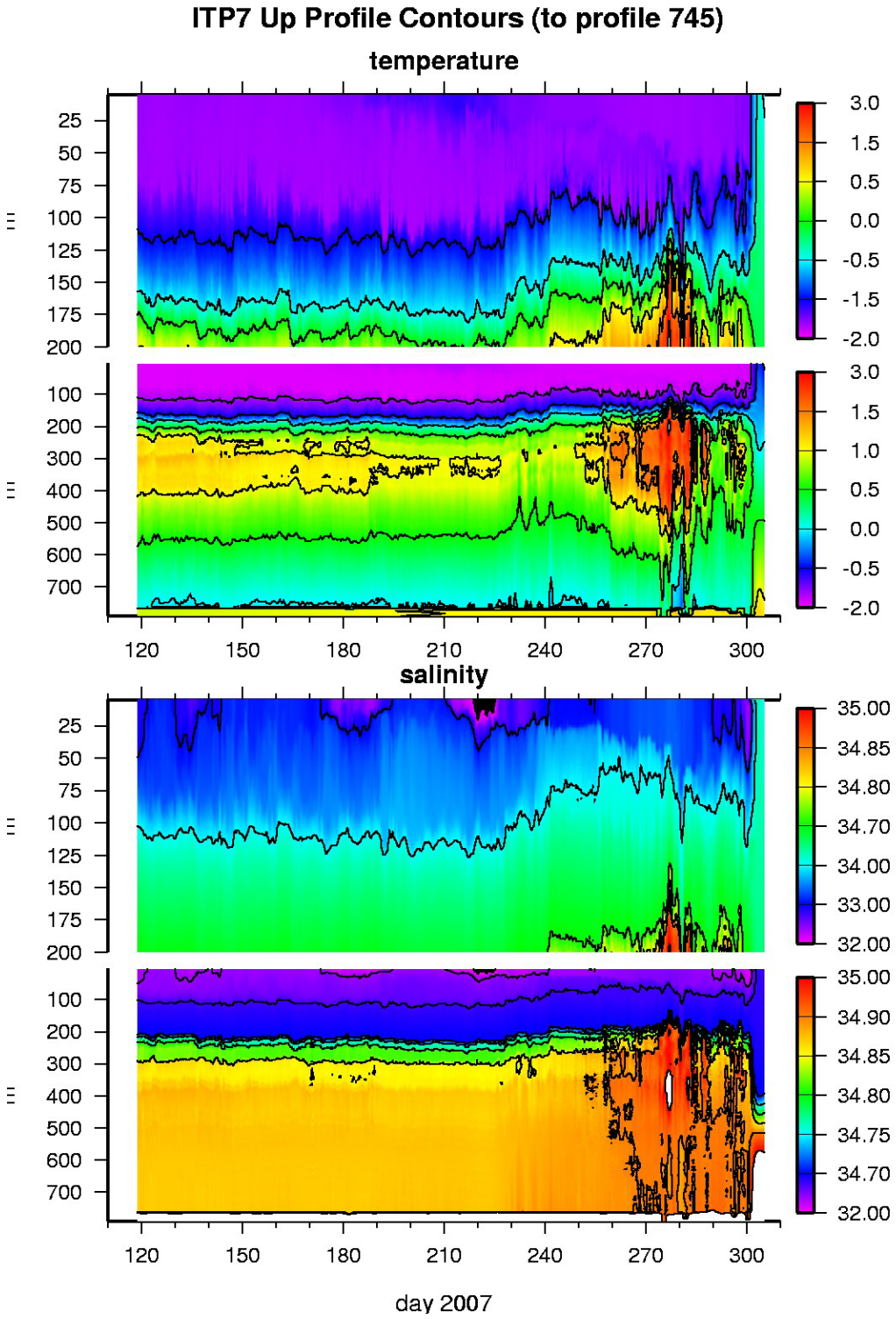


Down pressure deviation correction (top); mega-lag adjustment; salinity ratio adjustment; number of filter spikes (bottom).

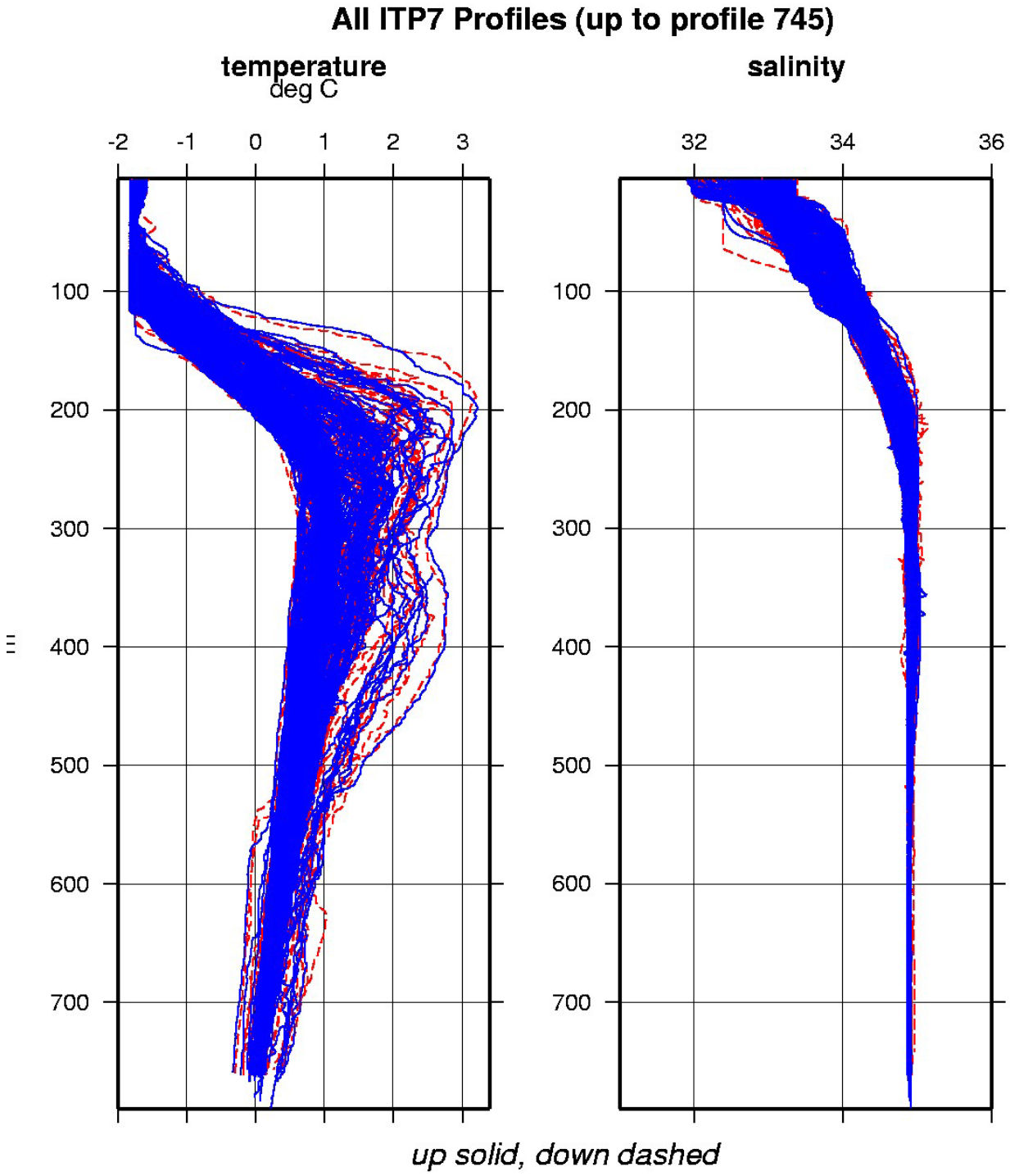


ITP drift (yellow line) and latest location (triangle), and annual ice drift from IABP (grey vectors) on IBCAO bathymetry (shading).

Plot of buoy locations



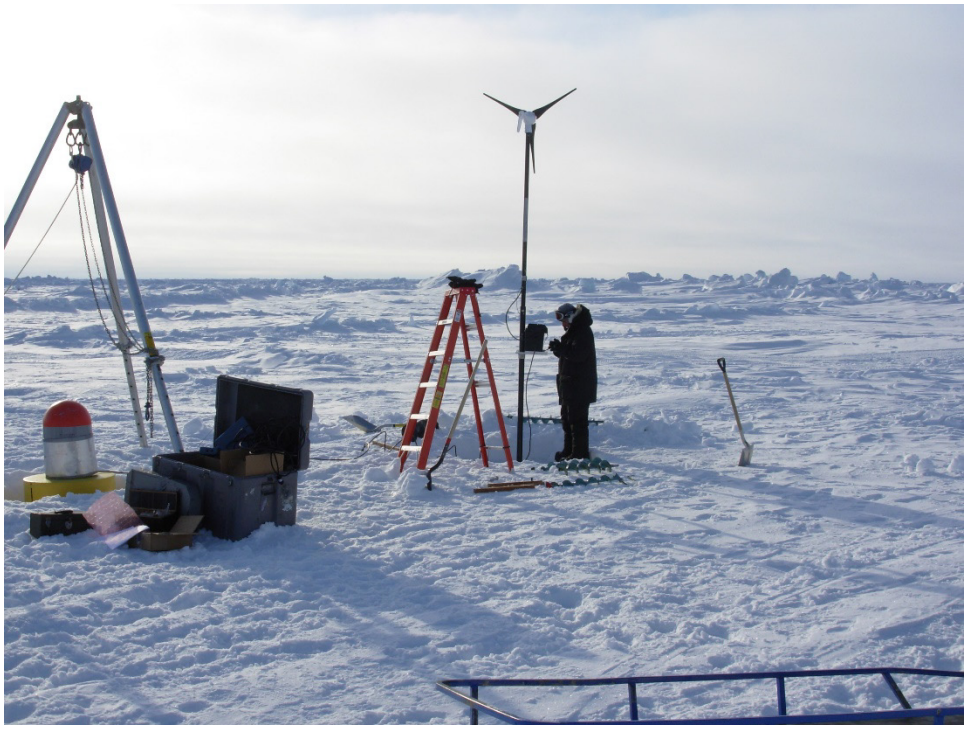
ITP 7 temperature and salinity contours



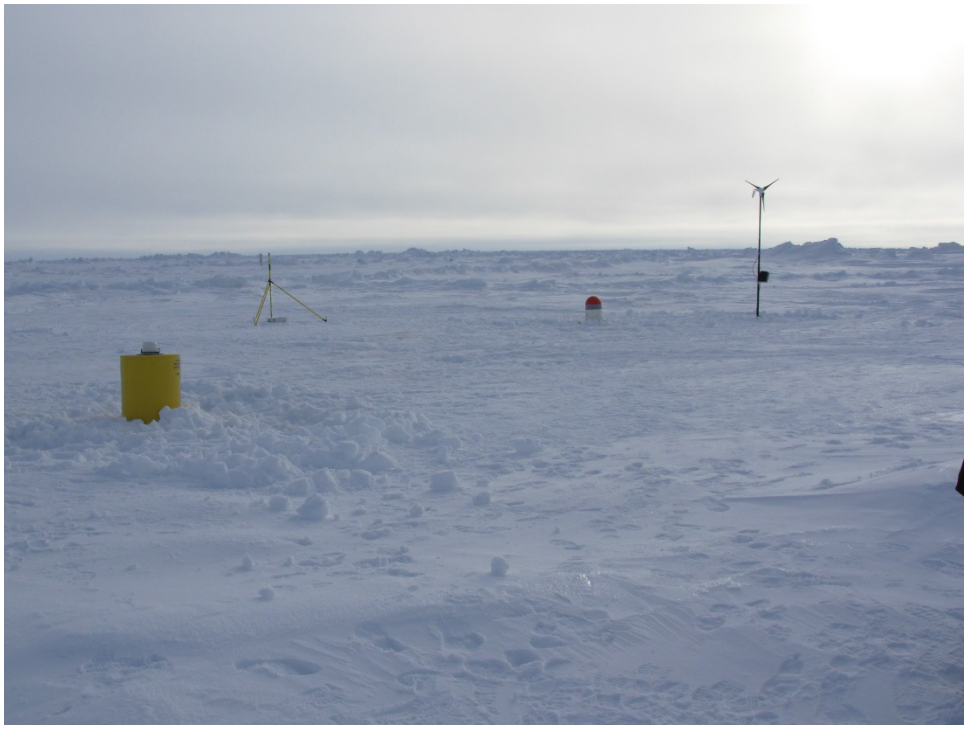
Composite plot of ITP temperature and salinity contours

Only 70 miles from the North Pole, ITP 7 as deployed in April 2007. The ITP was one component of an IBO installed as a component of the NPEO.

The installation site with working tent for the first half of the IBO (including IMB and Weatherex) on April 23, 2007. In the background are the tents making up ice camp Barneo and the Twin Otter aircraft parked on the runway.



After the AOFB has been installed, Newhall connects an external wind generator to provide additional power for increased sampling by the AOFB between regular battery powered intervals.



Installed 1 km away from Barneo and several days later, the second half of the IBO consists of the ITP, a meteorological package installed by the Climate Change College, and AOFB with wind generator.