PIESs in Sermilik Fjord—Cruise Notes
Data Report

M. Andres – last update: Sept. 30, 2016

This report summarizes the deployments and recoveries of PIESs in and near Sermilik Fjord, Greenland. It is updated as new cruises occur and data processing continues.

1. 2011/2012 Pilot Study Notes

A PIES borrowed from URI was deployed in the fjord at site P1 from August 2011 through September 2012. This instrument, deployed without an anchor stand, was attached to the bottom weight with a short (~1.5-m length) mooring line. A Microcat was clamped to the PIES (**Figure 1**). Mooring SF4 was nearby with contemporaneous measurements. At recovery (by F. Straneo and D. Sutherland) there was a thin layer of ice forming on the fjord but the PIES was able to punch through.

Figure 1. PIES Pilot study deployment in 2011 (left) and recovery in 2012 from the Fox (right).

2. 2013 Deployment Cruise Notes

Three PIESs from Andres' startup were deployed from the Viking Madsalex in August 2013. Each one had an anchor stand and weight and a Microcat strapped to it. P3 (upper-fjord) also had a pallet and an extra weight attached because we were worried about the unit sinking into the silt on the bottom (**Figure 2**).

Figure 2. Modification to PIES S/N304 to prevent it from sinking into the silt.

3. 2015 Recovery/Re-deployment Cruise Notes

The 2015 Cruise was aboard the Adolf Jensen into and out of Tasiilaq, Greenland. The science party comprised: F. Straneo, M. Andres, W. Ostrom, N. Beaird, M. Cape, R. Jackson and N. Wilson. The ship left port on August 2, 2015 and returned to port on August 11, 2015 (a day ahead of schedule due to a very strong low pressure system offshore).

3.1 Sea ice

This year (2015) there is a lot of sea ice along the east coast of Greenland in comparison to the typical August sea ice distribution (**Figure 3**). The summer has been delayed by about a month (based on sea ice distribution on the shelf, conversations with locals and also, as it turns, out this year's CTD casts' surface T-S properties compared to those of previous years). In contrast, during the Deployment Cruise in 2013 and in August 2014 (**Figure 3**) there was essentially no sea ice on the shelf and only a few isolated big icebergs there.

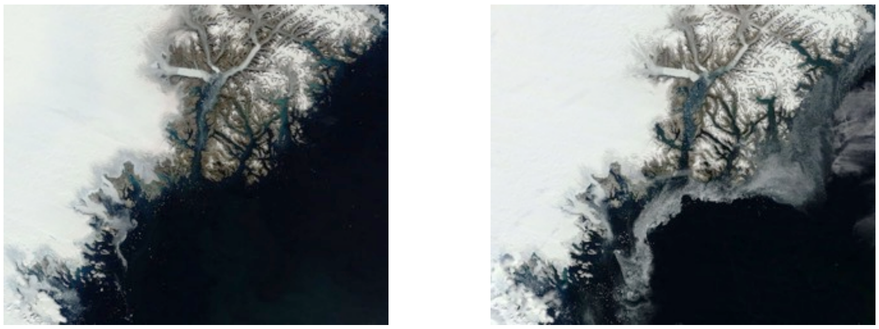


Figure 3. Terra satellite images from August 18, 2014 (left) and August 11, 2015 (right). Images obtained from http://ocean.dmi.dk/arctic/satimg.uk.php.

3.2 Recoveries and deployment

This year (2015), the sea ice concentration was so high that we were not able to reach the PIES site on the shelf (P3) or the nearby SF6 mooring site. We did launch a new SF6 mooring (and left the original SF6 mooring in place) and also left the PIES in the water. This PIES has a 120 Amp-hr battery pack. This should last 4.3 years total (this number includes a 20% safety margin, see IES User's Manual, Section 3.3 for calculation details and also **Table 1**). We were also not able to verify that the P3 PIES instrument is still there and sampling properly, but it is in a channel on the shelf at 640 m depth, well below the depth of iceberg keels. **P3 (S/N 306) has an auto-release date set to September 30, 2017**.

We successfully recovered two PIESs and their Microcats, deployed in 2013, from sites P1 (S/N 305) and site P2 (S/N 304). We also deployed a new instrument at P1. **P1 (S/N 321) has an auto-release date set to September 30, 2019.** This instrument has a 180A-hr battery pack, so in principle it could last for 6.5 years.

3.3 Deckbox and PIES tracking system

There are two tracking software programs that have been developed by the University of Rhode Island for use with deck gear to aid in PIES recoveries; these are TRAX4 for use with the Edgetech 8011a deckbox and TRAX9000 for use with the UDB9400 deckbox.

The 2015 Sermilik Fjord cruise was the first field test of our UDB9400 with the TRAX9000 system. The UDB9400 (S/N 60142) and TRAX 9000 (operated on a Panosonic Toughbook using the Windows 7 Operating System) worked very well at site P1. The PIES responded clearly to CLEAR and XPOND commands sent by the UDB9400 (PIES's replies were visible on the UDB 9400 screen) and once the BEACON command was sent and the deckbox was switched into continuous listening mode with the TRAX9000 software, the 12 kHz pings at 4 second interval were clearly visible on the TRAX9000 output screen (basically forming a flat line on the screen as pings were recorded since the distance between the PIES and transducer was not changing with time).

At site P2 the UDB9400/TRX9000 system did not work well. This site had a lot of large and small icebergs nearby and was also much closer to the glacier terminus. TRAX9000 recorded a lot of 12 kHz ambient noise, even with no command sent to the PIES, and it was also hard to definitively identify the PIES's communications with the UDB9400 deckbox. There was some indication of the PIES's 2-ping reply to CLEAR commands, but interpreting this on the UDB9400 output screen was ambiguous because of the 12 kHz ambient noise. The first recovery attempt (with the UDB9400/TRAX900 system) failed to release the instrument from the bottom though the RELEASE command was sent twice; apparently the PIES did not hear the command. Also the TRAX9000 was not able to identify any PIES's response to a BEACON command (12 kHz pings at 4 second interval). Once the commands were sent from the Edgetech 8011A (S/N 36066) the PIES's responses were obvious. The 8011A obviously heard the PIES's 2-ping response to the CLEAR command (we were, however, not able to execute a successful TRANSPOND command; we did hear the PIES's 2-ping reply but found no indication of the range; this is likely due to operator error, rather than a system failure). Once the RELEASE command was sent, the 8011a clearly heard the 6-ping response and the 4-second pings after that. At this point, once the UDB9400/TRAX9000 system was set up again, the TRAX9000 clearly identified the PIES's pings and was clearly able to detect the PIES's burn and rise times (with some extra reflection lines as well) and also the flat line when the PIES was at the surface.

In retrospect it seems likely that the PIES was not able to understand the communications from the UDB9400 but the UDB9400 (and TRAX9000) was able to hear the PIES. It is possible that the commands from the UDB9400 became garbled with 12 kHz reflections from nearby ice. In this case, perhaps the power setting was too high on the UDB9400. Once both systems are in the lab after the container arrives at WHOI, we will test the relative strength of the signals sent by the UDB9400 and the Edgetech 8011A. One other note, we were not able to test the Edgetech 8011A with the TRAX4 system because the auxiliary port on the unit we were using needs to be repaired.

3.4 Miscellaneous

For the PIES recovery/deployment operations on the Jensen, empty yellow PIES drums and deck-gear were sent as part of a shipment to Tasiilaq in a 20 ft container and loaded onto the ship there. PIES S/N 321 was airfreighted separately and loaded on the ship earlier in Qaqortoq because it wasn't on the shipping container HAZMAT list.

4. 2016 Recovery Notes

The 2016 shipboard work was done from a small-boat (~7 m), Suluk, operating day charters out of Tasiilaq. The purpose of the fieldwork was to (1) recover the shelf PIES (P3) and mooring (CM6) that we could not access last year (2015) due to heavy sea ice on the shelf, (2) drag from a lost mooring that is did communicate but did not release last year (CM1), (3) take XCTDs launched from the ship and a helo. The science party comprised M. Andres, F. Straneo and J. Pietro. Helo operations were conducted on August 10, 2016 and day-work on the ship was conducted on August 11, 2016 (shelf) and August 12, 2016 (mid fjord).

4.1 XCTDs

Eight XCTDs were deployed from the helo from sites near the glacier terminus to approximately mid-fjord. The XCTD closest to the glacier was deployed in a turbulent melt plume at the Helheim glacier terminus face that had pushed the mélange, opening up access to the fjord right at the glacier/fjord interface. XCTDs were also launched from the ship to complete the along-fjord section. Notably for the PIES-study an XCTD was deployed prior to recovering the PIES at site P3 () and one was also deployed at site P1, where there is a PIES presently sampling (to be recovered in 2017).

4.2 PIES at P3

PIES S/N 306 and the Microcat clamped to its housing were successfully recovered on August 11, 2016 after an XCTD at the site. It was detected on the surface first with the radio direction finder and then via visual identification. Due to the long deployment (3 years) and relatively shallow depth, there was a lot of growth on the PIES and its float line. The recovery was conducted with an Edgetech 8011M deckbox (SN 35510), newly upgraded with the URI PIES codes.

Table 1. PIES Deployments and Expected Battery-Life.

PIES S/N	Site	Battery (A-hr)	Deployment Date	Auto Release Date	Depth (m)	hourly tau sampling	pressure and temp sampling	Inst. Life estimate
304	P2	120	22-Aug-13	30-Sep-17	570	4 pings/ 6 sets	6 sets	4.3
305	P1	120	24-Aug-13	30-Sep-17	860	4 pings/ 6 sets	6 sets	4.3
306	P3	120	18-Aug-13	30-Sep-17	640	4 pings/ 6 sets	6 sets	4.3
321	P1	180	4-Aug-15	30-Sep-19	874	4 pings/ 6 sets	6 sets	6.5

Table 2. Deployments/Recoveries.

2011 Deployment/2012 Recovery

				from deployment sheets:									
	Site	PIES S/N	Microcat S/N	Lat		Lon		Approx. Depth	Depl. Date	Depl. Time (GMT)	Depl. CTD	Recovery Date	Recovery CTD(s)
Mid-Fjord	P1	156	5926	37° 53.990' E	37.89983	65° 53.859' N	65.89765	860	23-Aug-11	16:32		12-Sep-12	

2013 Deployment/2015 Recovery info/2016 Recovery Info

				from deployment sheets:									
	Site	PIES S/N	Microcat S/N	Lat		Lon		Approx. Depth	Depl. Date	Depl. Time (GMT)	Depl. CTD	Recovery Date	Recovery CTD(s)
Shelf	P3	306		37° 52.593' E	37.87655	65° 31.605' N	65.5268	640	18-Aug-13	19:05		11-Aug-16	N/A
Mid-Fjord	P1	305	6664	37° 53.966' E	37.8994	65° 53.855' N	65.8976	860	24-Aug-13	11:39		3-Aug-15	CTD006
Upper-Fjord	P2	304	7593	37° 38.013' E	37.6336	66° 14.694' N	66.2449	570	22-Aug-13	15:18		6-Aug-15	CTD008, 009

2015 Deployment

				from deployment sheets:									
	Site	PIES S/N	Microcat S/N	Lat		Lon		Approx. Depth	Depl. Date	Depl. Time (GMT)	Depl. CTD	Recovery Date	Recovery CTD(s)
Mid-Fjord	P1	321	6666	37° 53.972' E	37.89953	65° 53.868' N	65.8978	874	4-Aug-15	20:43	CTD020	N/A	N/A

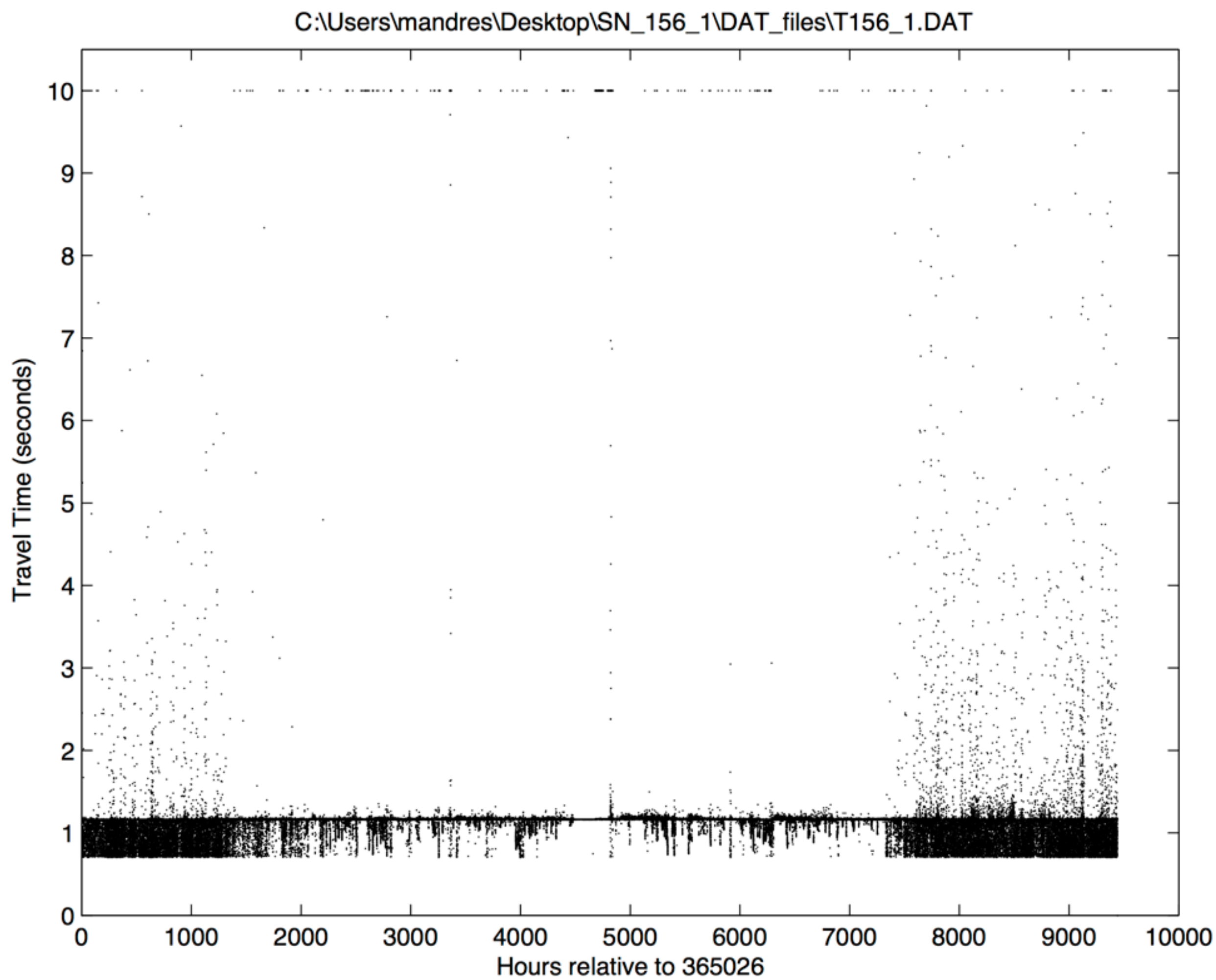
in the water
info to be added

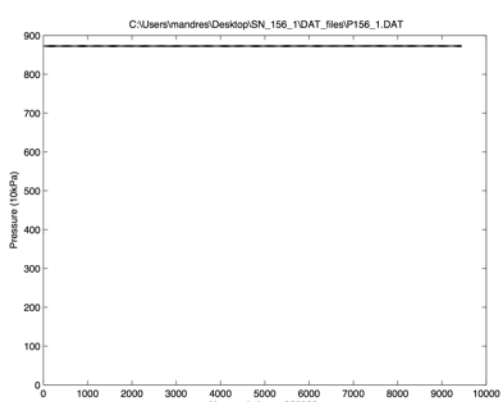
5. Data

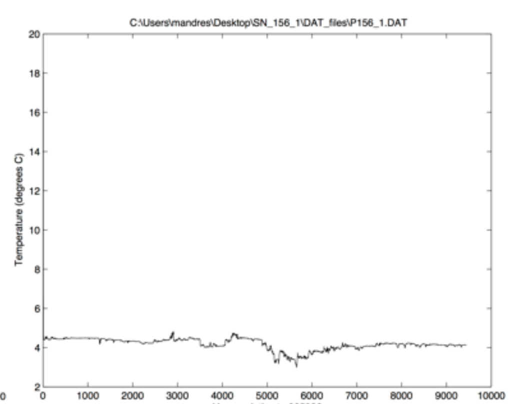
The following shows the data from each PIES deployment in the fjord, minimally processed.

5.1 Pilot study

PIES S/N 156 (URI-owned); site P1; 2011-2012:



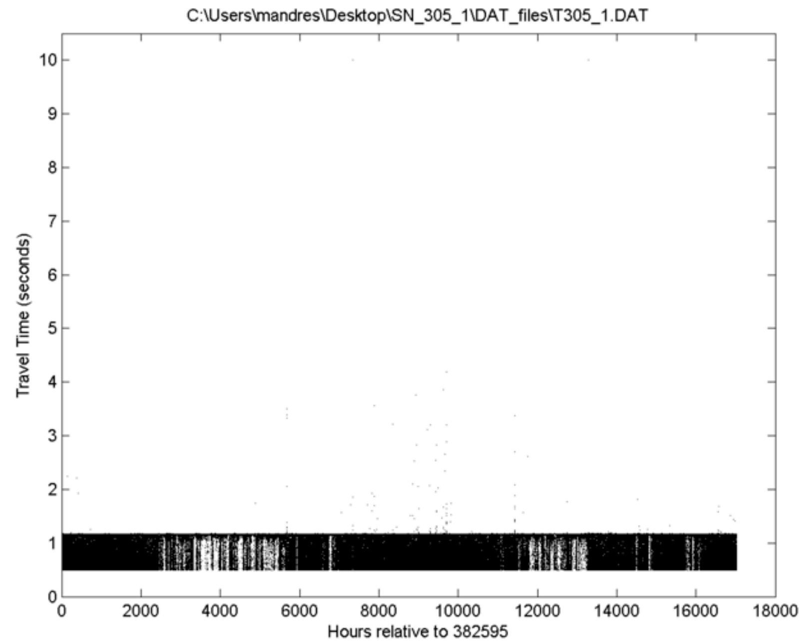


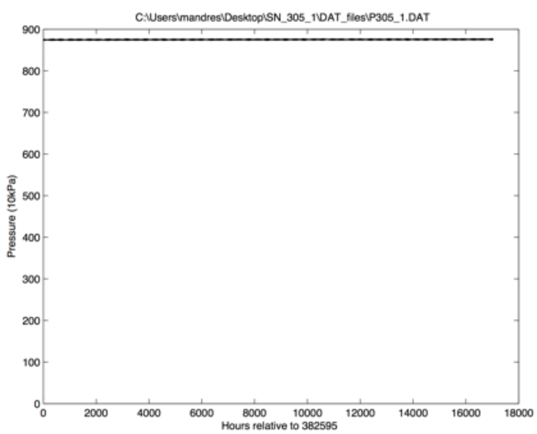


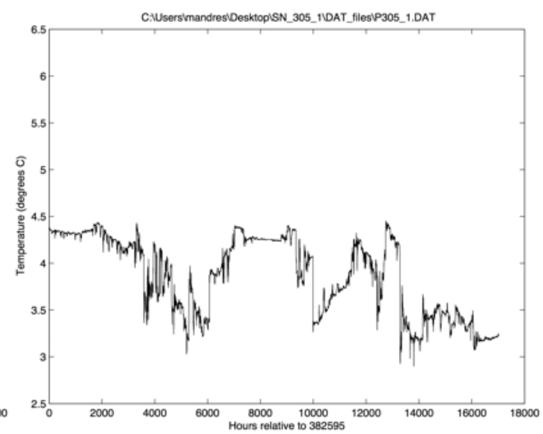
Microcat S/N 5926:

5.2 Along-fjord study

5.2.1 PIES S/N 305; site P1 (mid-fjord); 2013-2015

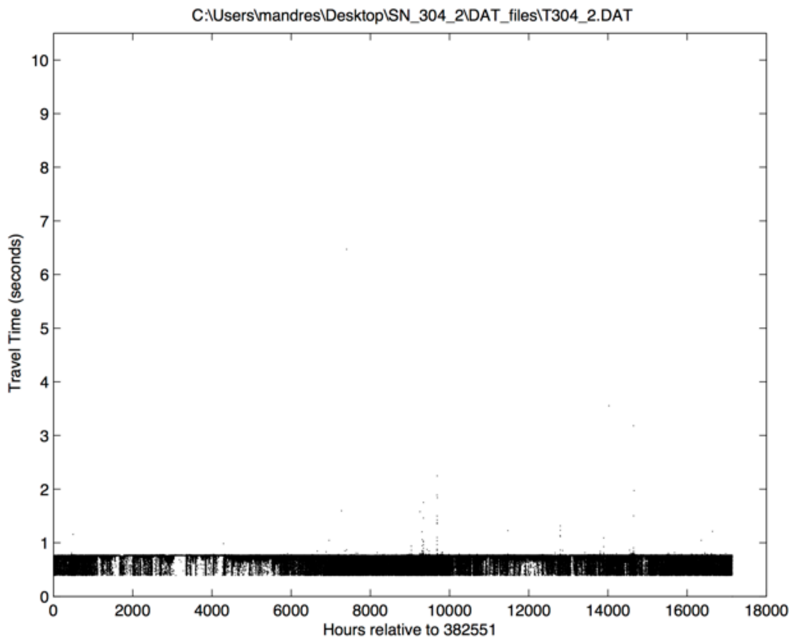


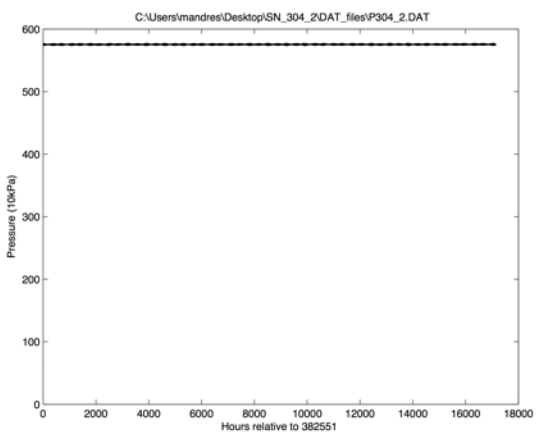


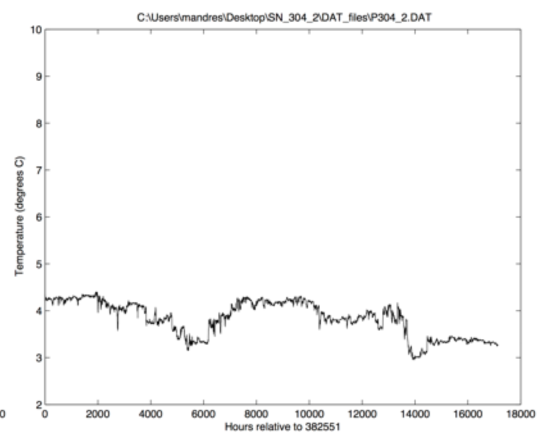


Microcat S/N 6664:

5.2.2 PIES S/N 304; site P2 (glacier); 2013-2015

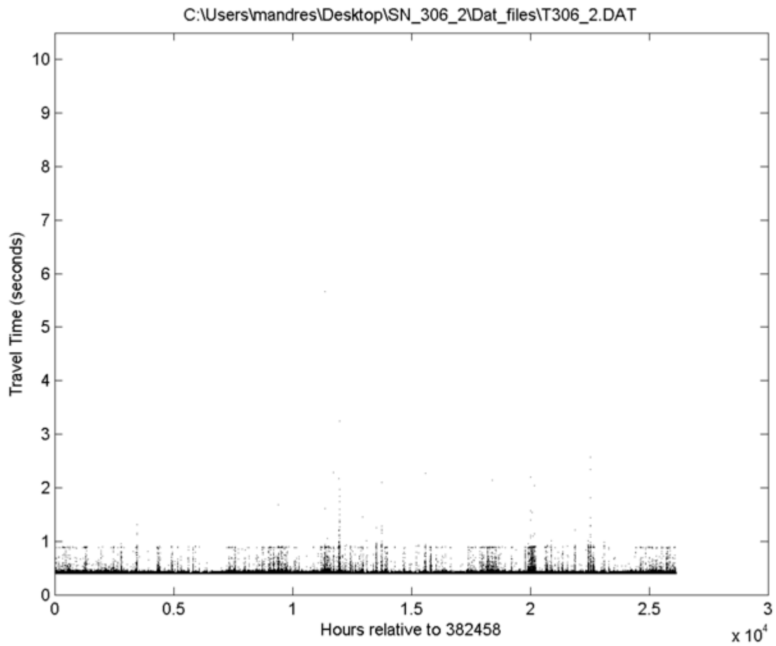


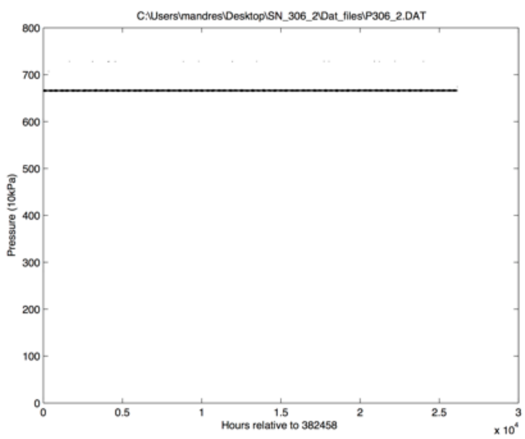


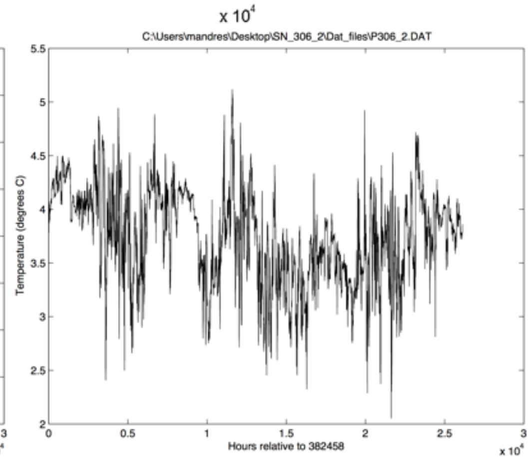


Microcat S/N 7593:

5.2.3 PIES S/N 306; site P3 (shelf); 2013-2016







Microcat S/N 7593: