

CRYOVEX 2006

Data Acquisition Report

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Danish National Space Center, August 2006

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Contents

1	Introduction	1
2	Summary of the DNSC Operations	1
3	Recorded Data	7
3.1	GPS	7
3.2	INS	8
3.3	Laser Scanner	8
3.4	ASIRAS	13
3.5	Auxiliary Data	17
3.6	Summary	18
4	Examples of Preliminary Processed Data	18
4.1	EGIG line	19
4.2	Austfonna Ice Cap	19
4.3	Alert Sea Ice	19
4.4	Additional Sites	22
5	Conclusions	26
A	Airborne Log with GPS Track Plot	28
B	Airborne Log of the ASIRAS Operations	47

1 Introduction

The European Space Agency (ESA) CryoSat Validation Experiment, CryoVEx 2006, took place during April and May 2006. During the period April 18 to May 18 the airborne part of this campaign was successfully carried out by the Danish National Space Center (DNSC) using a chartered Air Greenland Twin-Otter aircraft.

The DNSC work consisted of:

- Airborne data collection with the ASIRAS and laser scanner system following installation and certification of ASIRAS in the Air Greenland Twin Otter (Reg. OY-POF). The airborne operations were coordinated with ground and helicopter activities over land and sea ice in polar areas in Greenland, Svalbard, Canada, and the Arctic Ocean.
- Logistical support for participants in the CryoVEx 2006 experiment especially concerning access to military facilities in Thule Air Base and Canadian Forces Station Alert and aircraft support to the UK teams on the Greenland Ice Sheet.
- Support for the sea ice ground truth work by Finnish and UK teams off Alert.

In general the airborne activities were successful and the objectives were met. A few survey lines were cancelled due to the weather conditions as well as the time plan had to be adjusted during the campaign, but overall the expected data collection was carried out.

This report outlines the field operations and the data collected by DNSC during the CryoVEx 2006 campaign. In addition a few examples of preliminary processed data are shown; these were produced for and presented at the CryoSat CVRT (Calibration, Validation, and Retrieval Team) meeting, ESA-ESTEC, June 2006.



Northeast tip of Greenland

2 Summary of the DNSC Operations

After successful installation and certification in March 2006 of the joint ASIRAS and DNSC laser scanner system in the Air Greenland Twin Otter, the system was ready for operation for the April–May campaign. The re-installation of the system was carried out in the Air Greenland hangar in Kangerlussuaq after the first two days of the charter (April 18 and April 19) had been used to deploy the UK teams on their positions on the EGIG line on the ice sheet. This transport consisted of all together four flights from Kangerlussuaq to the T05 and T12 sites with cargo and personnel. A test flight was performed on April 20 after instrument installation and ground tests with assistance from Raumfahrt Systemtechnik's (RST) engineer. The next days were spent on a Danish project surveying the sea ice west of Greenland near the Disko Island until the UK teams were ready for over-flights. These local flights were used for more extensive testing of the ASIRAS system and training of the DNSC scientists in operation and backup of the system.

The first main site over-flight was carried out on April 25 with a repeated survey of one site (T05) on April 26. This was done since the over-flight of T05 on April 25 was not optimal. The campaign flight tracks can be seen in Figure 1. Thereafter a few days of waiting followed caused by poor weather on the Greenland east coast and Svalbard. We succeeded in reaching Svalbard on April 30 in between low-pressure systems. Because of the delay, we decided to base our Svalbard operations out of Longyearbyen instead of Ny Ålesund as planned. Before the Austfonna over-flight the Starlab Oceanpal GPS system was mounted on the aircraft to be tested during that flight. A planned sea ice flight on an Envisat track was cancelled due to lack of sea ice near Svalbard. On April 2 and 3 the team transited to Thule Air Base via Station Nord, Northeast Greenland. The flight out of Svalbard was over the Kongsvegen glacier coordinated with the ground team there. Unfortunately the wind conditions made it difficult to follow the planned track. Over the Fram Strait an Envisat track was followed with some ASIRAS and laser scanner data acquired despite of some clouds in the area. Also a local flight out of Station Nord was carried out to re-measure previously surveyed lines in the Arctic Ocean.

From Thule Air Base the Devon site was over-flown on April 5. The southern part of the track had to be aborted due to dangerous wind conditions. This was afterwards discussed with the Devon ground team and it was agreed that they would focus their work near the summit of the ice cap where the best data was obtained. After transit to Canadian Forces Station Alert, Ellesmere Island, on May 8 sea ice flights were done in cooperation with the ground and helicopter work on the ice. Two sites on first year ice and multi year ice close to the station were selected where the work was focused. On May 10 corner reflector over-flights were performed repeatedly for each site at different elevations together with runway and building calibration survey. Also longer flights of coordinated Twin Otter (laser scanning and ASIRAS radar altimetry) and helicopter EM data acquisition were done. One of these flights

involved placing of UK-SAMS GPS buoys along the line transmitting positions by satellite, as a test for aligning helicopter and Twin-Otter tracks during the future CryoSat calibration campaign. The aim of the last part of the airborne work was to re-measure previously surveyed sea ice and inland ice margin lines and to assist a Danish glaciology team at Station Nord with transport of equipment and personnel to a local ice cap, Flade Isblink. On May 12 the Twin Otter transited from Alert to Station Nord with data acquisition over the sea ice in the Arctic Ocean and on May 14 the cargo flights to Flade Isblink was carried out. In order to protect the instruments, the ASIRAS system was un-mounted before these local flights. The last flights back to Kangerlussuaq were over the East Greenland ice sheet margin including several outlet glaciers with landings at airfields in Constable Pynt and Kulusuk. After returning to Kangerlussuaq on May 17 the equipment was un-installed before a cargo flight could be done on May 18 to pick up equipment for the UK teams.

Table 1 gives an overview of the specific flights in chronological order and below a short day-to-day description is found.

- April 18-19: Deployment of UK teams to T05 and T12 on the ice sheet. Two flights per day. Installation of the instruments were started on April 19 after the last cargo flight.
- April 20: Installation and local test flight.
- April 21-24: West-coast sea ice project based in Qaarsut near Uummannaq. Extensive tests and training with RST on the ASIRAS system including the backup system.
- April 25-26: EGIG line over-flights including the T05 and T12 sites with corner reflectors. The April 26 flight also included a sea ice flight off the west coast coordinated with helicopter landings on the ice and a medical evacuation of the team on T12 due to illness.
- April 27-28: No flights due to bad weather on the Greenland east coast.
- April 29-30: Transit flights from Kangerlussuaq to Svalbard via the EGIG line, Constable Pynt, and Danmarkshavn. High level ASIRAS data acquisition over the ocean between East Greenland and Svalbard.
- May 1: Over-flight of the Austfonna ice cap including 3 of the 4 corner reflectors. Small leg over sea ice east of Svalbard to test the Oceanpal GPS system.
- May 2: Transit flight to Station Nord, Greenland via Kongsvegen glacier and Envisat track in the Fram Strait. Local sea ice survey from St. Nord.

- May 3: Transit to Thule with survey of the northern part of the Greenland ice sheet.
- May 4: No flight.
- May 5: Devon ice cap survey. Southern part of the track was aborted due to dangerous wind conditions. Upon consultation with the pilot it was decided not to re-fly the southern part of Devon due to the continued dangerous conditions at the low flight elevations and a heavy aircraft.
- May 6-7: No flight.
- May 8: Transit to Alert via Politikens Bræ, Qaanaaq, Peterman Glacier, and the ice sheet margin. Change of personnel (R. Forsberg and H. Skourup replaces L. Stenseng and S. M. Hvidegaard, Susanne Hanson continue to Alert for in-situ work).
- May 9-11: Alert sea ice flights coordinated with sea ice ground observations and helicopter EM flights (HEM).
- May 12: Transit flight to Station Nord with sea ice survey (with HEM). Un-mounting of ASIRAS.
- May 13: No flight.
- May 14: Cargo flight to local ice cap for Danish glaciologists.
- May 15: No flight.
- May 16-17: Transit flight to Kangerlussuaq via Constable Pynt and Kulusuk, East Greenland. Un-mounting of equipment.
- May 18: Cargo flight to pick-up equipment for UK team.
- May 19: Shipment of equipment.

Airborne field team:

DNSC: R. Forsberg (RF), S. M. Hvidegaard (SMH),
H. Skourup (HSK), and L. Stenseng (LS).

RST: H. Lentz.

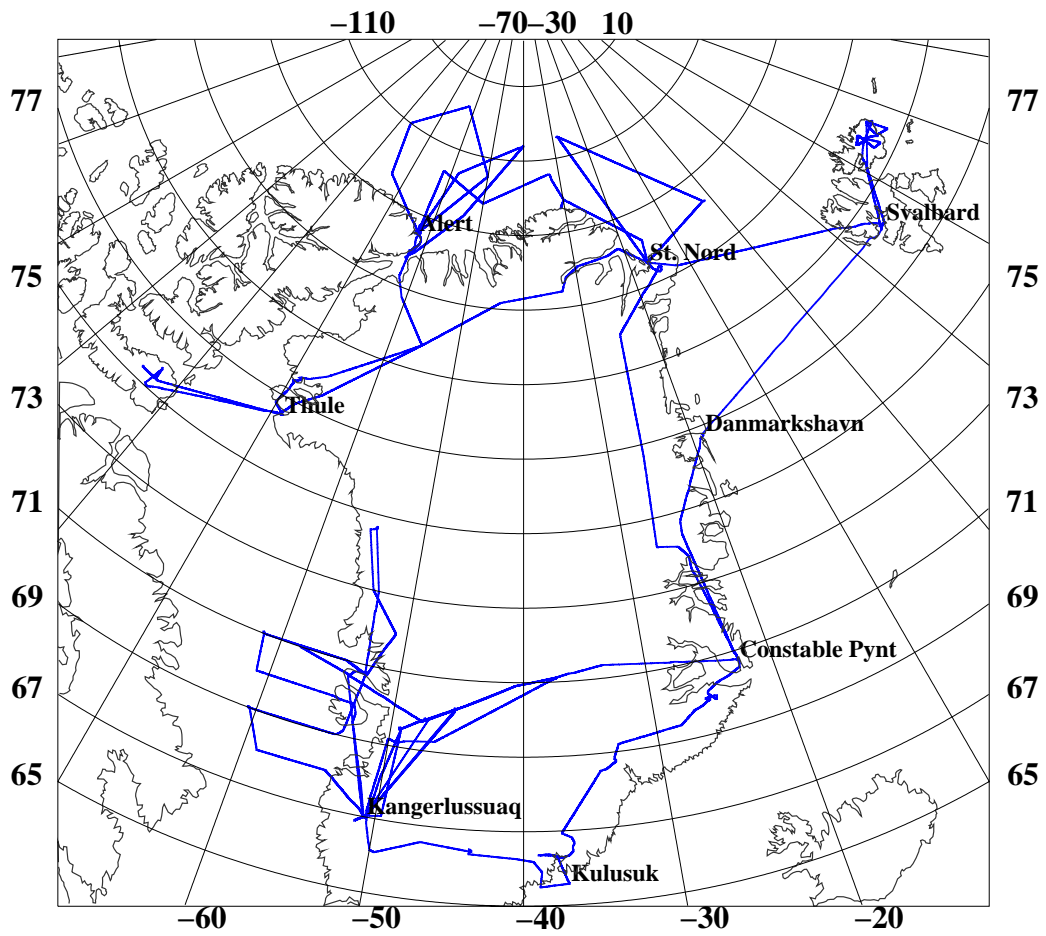


Figure 1: Tracks flown during CryoVEx 2006 by the Air Greenland Twin Otter equipped with the DNSC laser scanner system and the ASIRAS radar.

Table 1: GRL06 Flights. Off B: Off Bloc, T O: Take Off, L: Landing, On B: On Bloc, Air: Airborne.

JD - Date	Flts	Track	Off B	T O	L	On B	Air	Operator
108 - April 18 th	A	SFJ-T5	13:29			15:03	1h34	none
108 - April 18 th	B	T5-T12	15:15			15:49	0h34	none
108 - April 18 th	C	T12-SFJ	15:51			17:53	2h02	none
108 - April 18 th	D	SFJ-T12	18:40			20:23	1h43	none
108 - April 18 th	E	T12-SFJ	20:30			22:31	2h01	none
109 - April 19 th	A	SFJ-T12	10:41			12:31	1h50	none
109 - April 19 th	B	T12-SFJ	12:36			14:34	1h58	none
109 - April 19 th	C	SFJ-T5	15:19			16:54	1h35	none
109 - April 19 th	D	T5-SFJ	17:00			18:40	1h40	none
110 - April 20 th		test	18:52	18:54	19:31	19:36	0h44	LS
111 - April 21 st		V1-V4	11:10	11:15	15:49	15:54	4h44	LS/SMH
113 - April 23 rd		A	21:49	21:54	01:54	01:59	4h10	SMH
114 - April 24 th		V5-V8	17:21	17:26	22:11	22:16	4h55	SMH
115 - April 25 th		X-EGIG	11:54	11:59	18:49	18:54	7h00	SMH
116 - April 26 th	A	SFJ-JQA	12:53	12:58	14:57	15:02	2h09	SMH
116 - April 26 th	B	JQA-V-T12	16:02	16:07	19:40	19:45	3h43	SMH
116 - April 26 th	C	T12-SFJ	19:46	19:51	21:42	21:47	2h01	SMH
119 - April 29 th	A	EGIG	11:07	11:11	16:54	16:59	5h52	SMH
119 - April 29 th	B	B	17:43	17:48	20:53	20:58	3h15	SMH
120 - April 30 th		DMH-LYR	08:22	08:27	11:57	12:02	3h40	SMH
121 - May 1 st		AUSTFON	10:13	10:18	15:38	15:43	5h30	SMH
122 - May 2 nd	A	KV-EN	08:33	08:38	11:50	11:55	3h22	SMH
122 - May 2 nd	B	F	13:09	13:14	18:18	18:23	5h14	SMH
123 - May 3 rd		H	10:42	10:47	16:06	16:11	5h29	SMH
125 - May 5 th		DEVON	12:56	13:01	17:29	17:34	4h38	HSK
126 - May 6 th	Weekend Thule Closed							
127 - May 7 th	Weekend Thule Closed							
128 - May 8 th	A	TAB-NAQ	14:25	14:30	15:05	15:10	0h45	HSK
128 - May 8 th	B	NAQ-YLT	15:33	15:38	18:50	18:55	3h22	HSK/RF
129 - May 9 th		YLT-YLT	15:59	16:04	20:51	20:56	4h57	RF
130 - May 10 th		YLT-YLT	17:47	17:52	19:45	19:50	2h03	RF
131 - May 11 th		YLT-YLT	14:40	14:45	20:08	20:13	5h33	RF
132 - May 12 th		YLT-NRD	14:43	14:48	19:29	19:34	4h51	RF
133 - May 13 th	Station Nord							
134 - May 14 th		Flade Isblink uplift, 8 flts					6h03	
135 - May 15 th	no flights							
136 - May 16 th		NRD-CNP	09:50	09:55	15:42	15:47	5h57	RF
137 - May 17 th		CNP-KUS	08:40	08:45	13:39	13:44	5h04	RF
138 - May 18 th		KUS-SFJ	14:30	14:35	18:01	18:06	3h36	RF
139 - May 19 th		JAV-T5	11:57			17:11	3h56	
Total							127h00	

Table 2: The (dx, dy, dz) offsets. The lever arm from the GPS antennas to the origin of the laser scanner, and to the back centre of ASIRAS antenna frame (see arrow). Off set definition: x positive to the front, y positive to the right and z positive down.

to laser scanner	dx (m)	dy (m)	dz (m)
from AIR1/ AIR3 (front)	-3.70	+0.52	+1.58
from AIR2/ AIR4 (rear)	+0.00	-0.35	+1.42
to ASIRAS antenna	dx (m)	dy (m)	dz (m)
from AIR1/ AIR3 (front)	-3.37	+0.47	+2.005
from AIR2/ AIR4 (rear)	+0.33	-0.40	+1.845

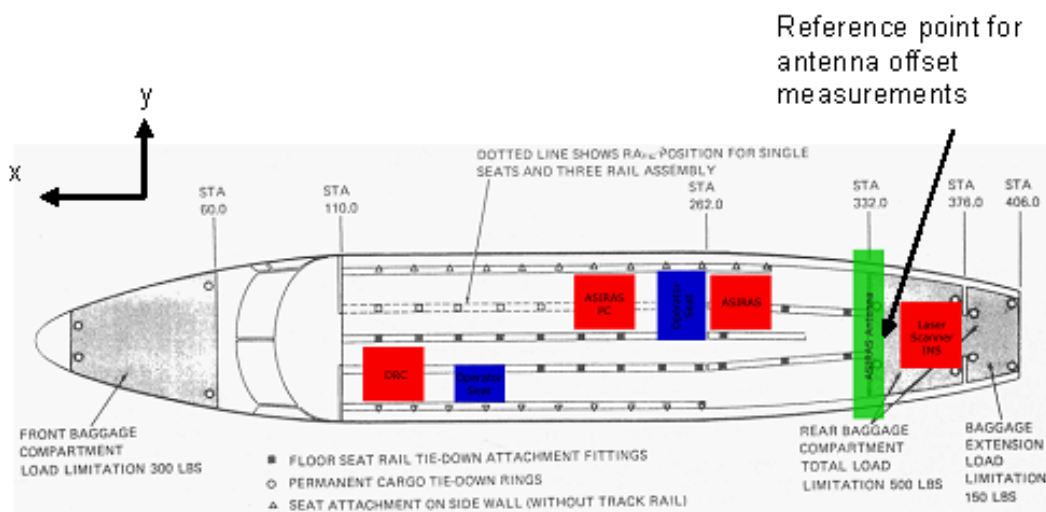


Figure 2: *Instrument installation.*

3 Recorded Data

In the Air Greenland hangar in Kangerlussuaq the equipment was installed in the Twin Otter according to the experience from the test campaign in Nuuk in March 2006. No major difficulties were encountered. Table 2 gives to offsets between the instruments and Figure 2 sketches the instrument installation in the aircraft.

3.1 GPS

Kinematic GPS is the key positioning method of the aircraft. GPS dual-frequency phase data were logged at 1 Hz using 1-2 ground base receivers at one or more ref-

erence sites, and 4 aircraft receivers; one of these dedicated to the ASIRAS system. The aircraft GPS receivers are named AIR1 (Trimble, 4000-SSI), AIR2 (Ashtech, Z-extreme), AIR3 (Javad, Legacy), and AIR4 (Trimble, 4000-SSI, connected to ASIRAS). AIR1 and AIR3 share the front GPS antenna; AIR2 and AIR4 the rear antenna. Antenna offsets are given in Table 2. Data were logged in the receivers during flights and downloaded upon landing on laptop PCs. Most data were recovered and only a few files missing, see Table 3, but the redundancy of receivers meant that GPS data are available for all flights. The AIR2 Ashtech receiver had a problem with the memory card and failed on the last 3 flights.

The GPS base stations to be used as reference stations for differential post processing of the GPS data are listed in Table 4. The stations were mounted on roofs or tripods in the field near the landing sites; the reference points were generally not marked. Also a few permanent GPS stations have been used.

3.2 INS

A Honeywell medium-grade inertial navigation system H764-G, EGI, was used throughout the surveys to record inertially integrated position, velocity and attitude information. Data were logged on a rack mounted PC with a 2 Gb Compact Flash memory card in binary format through a 1558 mil-spec communications bus. Data from all flights have been secured except for two cases:

- On the test flight errors occur reading the file; a closer inspection might resolve this.
- The last hour of data from the flight on May 12th is missing due to an operator error.

Recordings and comments can be found in Table 3.

3.3 Laser Scanner

A Riegl laser scanner (LMS-Q140i) was used to measure the distance between the aircraft and the snow or ice surface. The laser scanner data were logged as hourly files on a laptop PC. The files are time tagged by a 1 PPS signal from the AIR1 GPS receiver with start time of the scans given by the operator as the file name. It should be noted that this procedure gives a slight risk of uncorrected timing errors of 1 second (approximately 60 m on ground). Table 5 shows the laser scanner files logged during the campaign. The nominal data-logging rate is 40 scans/second; each scan consists of 208 single laser shots. This corresponds to a typical files size of about 200

JD - Date	AIR1	AIR2	AIR3	AIR4	SCAN	EGI	ALT	CAM	CNP0	JQA1	KELY	LYR1	NRD1	NRD2	SCOR	SFJ1	TAB1	THU2	THU3	UMD1	YLT1	YLT2	Remarks	
110 - April 20 th	X	X	X		X	X ^a		X								X							^b	
111 - April 21 st	X	X	X	X	X	X										X								^c
113 - April 23 rd	X	X	X	X	X	X		X												X				^d
114 - April 24 th	X	X	X	X	X	X		X																^e
115 - April 25 th	X	X	X	X	X	X		X								X								^f
116 - April 26 th	X	X	X	X	X	X		X		X						X								^g
119 - April 29 th	X	X	X	X	X	X		X				X												^h
120 - April 30 th	X	X	X	X	X	X		X				X												ⁱ
121 - May 1 st	X	X	X	X	X	X		X				X												^j
122 - May 2 nd	X	X	X	X	X	X			X				X	X				X						^m
123 - May 3 rd	X	X ^k	X	X	X	X		X					X ^l					X						ⁿ
125 - May 5 th	X	X	X	X	X	X		X								X								
128 - May 8 th	X	X	X	X	X	X		X								X								
129 - May 9 th	X	X	X	X	X	X		X									X							
130 - May 10 th	X	X	X	X	X	X		X									X					X	X	^o
131 - May 11 th	X	X	X	X	X	X		X									X					X	X	
132 - May 12 th	X		X	X	X	X ^p		X					X											
136 - May 16 th	X		X	X	X	X		X					X											
137 - May 17 th	X		X	X	X	X		X					X											

Table 3: Data acquired from reference stations and aircraft instruments.

^aEGI file errors when read by readegi, output to screen OK^bTest Flight, WEBCAM PC stopped halfway^cwebcam PC error^d1 hour side-looking radar^eEGI logging started late^fno data in 2 scanner files^gno scanner data^hASIRAS HAMⁱ4 reflectors possible^jreflectors at KV. ASIRAS 2nd leg^ktwo files, mem card full^lref. GPS too short 14:34 landing 16:06^mASIRAS: Acad.+H6-7ⁿreflector at Devon^oreflectors at sea ice^pEGI disc full, last hour missing; scan file missing due to accidental closure of PC

Table 4: *Grl 2006 GPS Reference Stations*

Name	Location	Hardware (ant. type)
CNP0	Constable Pynt, near runway	Javad (Marant)
JQA	Western part of Nuussuaq, near Qaarsut, tripod on ground	Javad (Marant)
KELY	Kellyville, Kangerlussuaq, permanent station	Ashtech Z-XII3
LYR1	Longyearbyen, tripod on ground near NPI Hotel	Javad (Regent)
NRD1	Station Nord, on building 7 roof (light pole)	Javad (Regent)
NRD2	Station Nord, on snow next to apron	Javad (Regent)
NYA2	Ny Ålesund, permanent station	AOA Benchmark ACT
SCOR	Scoresbysund, permanent station	Ashtech UZ-12
SFJ1	Kangerlussuaq, on KISS building roof (between tile 16 & 17 of the outermost row)	Trimble 4000 SSI
T12	On the ice sheet (8 m west of T12 corner reflector)	Leica SR530
TAB1	Thule Air Base, on snow pile near Air Greenland hangar	Javad (Regent)
THU2	Thule Air Base, permanent station	Javad Legacy
THU3	Thule Air Base, permanent station	Ashtech UZ-12
UMD1	Uummannaq, at airfield point	Ashtech
YLT1	CFS Alert, tripod on ground near Spinnaker Building	Javad (Regent)
YLT2	CFS Alert, tripod on ground near garage	Javad (Marant)

Mb for the standard binary file format. Backup of the data was made on harddisk and CDroms after flights.

After initial quality control of the laser scanner data, it was seen that scans was missing on a regular basis. The reason for this was believed to be increased vibrations of the laptop PC in the new aircraft installation. This lead to a shift in storage method in the PC from the standard harddisk to a 2 Gb Compact Flash memory card. This reduced to data loss from approximately 1 out of 4 to 1 out of 40 scans.

Laser scanner data were recovered for most flight lines except a few cases where fog or low clouds were encountered or system/operator errors occur. Also a loss of INS data will hinder the laser scanner data in being processed. Preliminary processed examples of the laser scanner data over campaign core sites are given in Section 4.

Table 5: Recorded Laser Scanner Files.

JD – Date	Filename	2dd	Start	Stop	Comments
110 – April 20 th	184530.2dd	T	18.760840	19.483950	scans missing
111 – April 21 st	111530.2dd	T	11.258335	11.384583	scans missing each 40 line approximately
	120600.2dd	T	12.100001	13.007563	
	130130.2dd	T	13.025007	13.551934	
	133400.2dd	T	13.566669	14.932408	
113 – April 23 rd	231800.2dd	T	22.583340	23.282623	
	223500.2dd	T	23.300004	0.175676	
	001130.2dd	T	0.191668	1.124059	
114 – April 24 th	173030.2dd	T	17.508333	18.498814	
	183030.2dd	T	18.508333	19.430473	
	192630.2dd	T	19.441673	20.402421	
	202500.2dd	T	20.416670	21.071510	
115 – April 25 th	121000.2dd	T	12.166669	13.178247	scans missing
	131130.2dd	T	13.191670	13.915370	
	135530.2dd	T	13.925001	14.755536	
	144600.2dd	T	14.766673	15.742513	
	154530.2dd	T	15.758338	16.893572	
	165430.2dd	T	16.908335	17.790917	
116b – April 26 th	161130.2dd	T	16.191669	17.063527	scans missing no data recorded no data recorded
	170430.2dd	T	17.075005	17.075660	
	184900.2dd	T	18.816671	18.817555	
	195130.2dd	T	19.858335	20.763953	
	204630.2dd	T	20.775000	21.047358	
	210900.2dd	T	21.150003	21.421910	
119a – April 29 th	121800.2dd	T	12.300005	13.007190	scans missing
	130100.2dd	T	13.016668	14.001007	
	140100.2dd	T	14.016673	14.870217	
	145300.2dd	T	14.883334	15.755477	
119b – April 29 th	193630.2dd	T	19.608338	19.645226	scans missing
120 – April 30 th	083300.2dd	T	8.550001	9.533487	scans missing every 4-5 scan missing
	093230.2dd	T	9.541673	9.759714	
121 – May 1 st	111700.2dd	T	11.283337	12.244791	every 30-40 missing
	121500.2dd	T	12.250004	13.175074	
	131230.2dd	T	13.208338	13.932468	
	135700.2dd	T	13.950001	14.762312	
122a – May 2 nd	084030.2dd	T	8.675005	9.262118	scans missing
	102815.2dd	T	10.470840	10.471224	
	103930.2dd	T	10.658340	11.436391	
	112700.2dd	T	11.450001	11.839090	
122b – May 2 nd	131300.2dd	T	13.216667	14.186186	scans missing
	141200.2dd	T	14.200004	15.093821	
	150600.2dd	T	15.100007	15.614641	
	161100.2dd	T	16.183338	17.165768	
	171030.2dd	T	17.175002	18.303756	

Continued on next page

Table 5: Recorded Laser Scanner Files.

JD – Date	Filename	2dd	Start	Stop	Comments	
123 – May 3 rd	104930.2dd	T	10.825005	11.961294	scans missing	
	115830.2dd	T	11.975001	12.964702		
	125830.2dd	T	12.975006	13.902230		
	135500.2dd	T	13.916673	14.936772		
	145700.2dd	T	14.950000	15.482581		
125 – May 5 th	130900.2dd	T	13.150001	14.128076	scans missing	
	140900.2dd	T	14.150006	14.626117		
	143900.2dd	T	14.650005	15.629081		
	153900.2dd	T	15.650004	15.749702		
	162000.2dd	T	16.333337	17.439360		
128 – May 8 th	143500.2dd	T	14.583336	15.050474	scans missing	
	162800.2dd	T	16.466767	17.022718		
	171400.2dd	T	17.233503	18.375890		
	182400.2dd	T	18.400105	18.847553		
129 – May 9 th	160300.2dd	T	16.050005	17.071888	scans missing	
	170530.2dd	T	17.091673	18.119551		
	180800.2dd	T	18.133334	19.118778		
	190800.2dd	T	19.133339	20.128485		
	200900.2dd	T	20.150005	20.887151		
130 – May 10 th	175500.2dd	T	17.916670	19.283643	scans missing	
	193200.2dd	T	19.533335	19.759668		
131 – May 11 th	154300.2dd	T	15.716668	16.903191	scans missing	
	165500.2dd	T	16.916669	17.982145		
	180000.2dd	T	18.000006	19.189834		
	191200.2dd	T	19.200006	19.205010		
132 – May 12 th	143500.2dd	T	14.583334	15.857933	scans missing	
	155300.2dd	T	15.883336	16.951398		
	165800.2dd	T	16.966667	18.206486		
	181330.2dd	T	–	–		no data
	190200.2dd	T	19.033336	19.501453		
136 – May 16 th	095300.2dd	T	9.883336	11.013569	scans missing	
	110730.2dd	T	11.125007	11.219440		
	112130.2dd	T	11.358338	12.585829		
	123600.2dd	T	12.600002	13.699031		
	134300.2dd	T	13.716669	14.550885		
137 – May 17 th	083900.2dd	T	8.650003	8.865336	scans missing	
	091400.2dd	T	9.233336	9.611292		
	095700.2dd	T	9.950005	11.244140		
	111600.2dd	T	11.266668	12.223921		
	121400.2dd	T	12.233336	13.284667		
	143100.2dd	T	14.516668	15.641005		
	153900.2dd	T	15.650003	16.808849		
	165000.2dd	T	16.833335	17.499100		
	174900.2dd	T	17.816671	18.088543		



Photos of the ASIRAS installation.

3.4 ASIRAS

The ASIRAS system was installed and run as tested during the test campaign in March 2006. The system was timed using a 1 PPS signal and an ASCII datation string from the AIR4 GPS receiver.

Extensive tests of the ASIRAS instrument and backup system were performed on the first flights: The tests flight near Kangerlussuaq and the lines off the Greenland west coast. The logged data were stored on the dedicated harddisks in the ASIRAS PCs during flight and transferred to the PCs for backup after flights. The data were then stored on SONY magnetic tapes and on harddisks. No data compression was done as this method was tested to be more time consuming than regular data backup. All together 1 hr of ASIRAS data acquisition demanded approximately 7 hours of backup time.

ASIRAS data were obtained primarily in the LAM mode at 20 MHz. Data were acquired continuously over the main sites and limited to parts of the other survey lines. Tests of the HAM mode over open ocean were carried out on April 30 between Greenland and Svalbard. Operator log files regarding the ASIRAS data can be found in Appendix B and Table 6 lists the recorded data files.

The data quality has been checked after each survey flight with the "Quicklook viewer" software from RST. Especially for the corner reflector sites the data were checked. Examples from the "Quicklook-Viewer" can be found at the end of this report. The final processing of the acquired ASIRAS data will be the responsibility of the Alfred Wegener Institute (AWI) with input of GPS and INS position and attitude data from DNSC.

Table 6: Recorded ASIRAS Files. GPS Time Tag in UTC Time. RW: Range Window (MHz), Length is given in seconds.

JD - Date	Filename	Start	Stop	RW	Total Puls	Length
110 - April 20 th	A060420_00.log	19:04:43	19:06:22	20	246280	98.521
	A060420_01.log	19:08:19	19:16:03	20	1159249	463.729
111 - April 21 st	A060421_00.log	12:08:15	12:16:09	20	1184251	473.730
	A060421_01.log	12:17:41	12:23:47	20	914398	365.783
	A060421_02.log	12:35:04	12:40:43	20	846196	338.501
	A060421_03.log	13:09:34	13:14:50	20	788700	315.501
	A060421_04.log	13:43:46	13:51:36	20	1173724	469.519
	A060421_05.log	14:00:54	14:08:05	20	1076147	430.486
	A060421_06.log	14:16:32	14:23:02	20	973683	389.498
	A060421_07.log	14:34:04	14:40:21	20	941186	376.498
113 - April 23 rd	A060423_00.log	22:37:38	22:43:22	20	858621	343.471
	A060423_01.log	23:04:30	23:10:47	20	941188	376.499
	A060423_02.log	23:26:29	23:33:51	20	1104617	441.874
	A060423_03.log	23:50:47	23:56:00	20	781186	312.495
	A060423_04.log	00:00:41	00:05:00	20	646228	258.509
	A060423_05.log	00:18:58	00:19:17	20	47186	18.879
	A060423_06.log	00:35:00	00:42:02	20	1053787	421.541
	A060423_07.log	00:53:55	01:04:35	20	1599461	639.822
114 - April 24 th	A060424_00.log	17:56:03	18:06:56	20	1631240	652.535
	A060424_01.log	18:07:00	18:17:09	20	1521149	608.496
	A060424_02.log	18:17:12	18:36:51	20	2946007	1178.469
	A060424_03.log	18:36:54	18:59:58	20	3458491	1383.473
	A060424_04.log	20:51:27	20:56:04	20	691195	276.497
	A060424_05.log	20:58:11	21:02:42	20	676182	270.491
115 - April 25 th	A060425_00.log	13:04:11	13:11:44	20	1131189	452.503
	A060425_01.log	13:24:08	13:37:25	20	1991067	796.472
	A060425_02.log	13:38:15	13:41:46	20	526236	210.510
	A060425_03.log	13:41:52	13:48:56	20	1059263	423.732
	A060425_04.log	13:49:00	13:54:24	20	808771	323.530
	A060425_05.log	13:54:27	14:08:30	20	2106125	842.49
	A060425_06.log	14:12:30	14:15:53	20	506886	202.769
	A060425_07.log	14:17:59	14:20:25	20	364372	145.761
	A060425_08.log	14:20:28	14:33:06	20	1893760	757.548
	A060425_09.log	14:33:11	14:43:31	20	1548704	619.518
	A060425_10.log	14:44:20	14:54:15	20	1486291	594.552
	A060425_11.log	14:54:18	15:07:56	20	2043572	817.476
	A060425_12.log	15:07:59	15:42:41	20	5203392	2081.471
	A060425_13.log	17:14:57	17:43:02	20	4211819	1684.822
A060425_14.log	17:43:28	17:46:55	20	516272	206.524	
116 - April 26 th	A060426_00.log	16:37:03	17:03:24	20	3950999	1580.487
	A060426_01.log	18:58:42	19:04:34	20	878695	351.501
	A060426_02.log	19:04:37	19:10:01	20	809263	323.726
	A060426_03.log	19:10:04	19:22:53	20	1921173	768.514
	A060426_04.log	20:16:32	20:29:10	20	1893628	757.496

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Table 6: Recorded ASIRAS Files. GPS Time Tag in UTC Time. RW: Range Window (MHz), Length is given in seconds.

JD – Date	Filename	Start	Stop	RW	Total Puls	Length
119 – April 29 th	A060429_00.log	12:19:21	12:32:23	20	1953626	781.496
	A060429_01.log	12:32:25	12:45:18	20	1931543	772.662
	A060429_02.log	12:45:21	13:11:29	20	3918435	1567.461
	A060429_03.log	13:11:32	13:25:41	20	2121847	848.788
	A060429_04.log	13:31:03	13:52:51	20	3268624	1307.523
	A060429_05.log	13:52:55	14:14:24	20	3220971	1288.461
	A060429_06.log	14:14:27	14:36:32	20	3310905	1324.436
	A060429_07.log	14:36:35	14:53:04	20	2470962	988.441
	A060429_08.log	14:53:41	14:59:26	20	861137	344.477
	A060429_09.log	14:59:29	15:05:31	20	903601	361.464
	A060429_10.log	15:05:35	15:13:09	20	1133674	453.498
	A060429_11.log	15:13:13	15:34:43	20	3223482	1289.465
	A060429_12.log	15:34:45	15:45:16	20	1577106	630.880
120 – April 30 th	A060430_00.log	08:47:48	09:11:24	20	3538362	1415.423
	A060430_01.log	09:15:39	09:38:10	20	3376505	1350.678
	A060430_02.log	09:38:13	09:45:38	20	1111157	444.491
	A060430_03.log	10:08:50	10:23:07	– ¹	2140958	856.433
	A060430_04.log	10:24:10	10:35:16	– ²	3327947	665.673
121 – May 1 st	A060501_00.log	11:18:23	11:42:40	20	3642142	1456.938
	A060501_01.log	11:44:10	12:11:10	20	4048484	1619.484
	A060501_02.log	12:11:12	12:21:35	20	1556903	622.798
	A060501_03.log	12:29:47	12:47:20	20	2631113	1052.505
	A060501_04.log	12:54:02	13:09:50	20	2368610	947.498
	A060501_05.log	13:17:13	13:34:54	20	2651081	1060.493
	A060501_06.log	13:35:16	13:44:24	20	1368699	547.513
	A060501_07.log	13:51:40	13:55:41	20	601210	240.501
	A060501_08.log	14:01:35	14:35:42	20	5116580	2046.745
	A060501_09.log	14:35:55	14:39:27	20	528720	211.503
A060501_10.log	14:44:38	14:45:23	40	111164	44.472	
122 – May 2 nd	A060502_00.log	08:58:14	09:05:14	20	1048544	419.444
	A060502_01.log	10:16:22	10:24:37	60	1236767	494.737
	A060502_02.log	10:25:51	10:31:18	20	816085	326.455
	A060502_03.log	10:33:58	10:39:38	60	848712	339.507
	A060502_04.log	10:40:11	11:01:32	20	3202041	1280.888
	A060502_05.log	11:01:37	11:25:56	20	3645989	1458.477
	A060502_06.log	14:18:58	14:40:40	20	3253433	1301.446
	A060502_07.log	14:40:48	15:03:01	20	3330922	1332.444
	A060502_08.log	15:03:05	15:24:08	20	3156834	1262.805
	A060502_09.log	15:24:16	15:39:18	20	2253439	901.427
	A060502_10.log	15:39:45	15:46:10	40	961120	384.472
	A060502_11.log	15:47:57	15:57:15	40	1393608	557.477
	A060502_12.log	15:58:17	16:08:43	60	1563637	625.492

Continued on next page

¹SARIn

²Enhanced SARIn

Table 6: Recorded ASIRAS Files. GPS Time Tag in UTC Time. RW: Range Window (MHz), Length is given in seconds.

JD – Date	Filename	Start	Stop	RW	Total Puls	Length
122 – May 2 nd	A060502_13.log	16:10:54	16:13:01	20	16138	126.467
123 – May 3 rd	A060503_00.log	12:01:01	12:05:53	20	728624	291.469
	A060503_01.log	12:05:57	12:06:42	20	111253	44.508
	A060503_02.log	12:06:46	12:07:32	20	113685	45.481
	A060503_03.log	12:07:35	12:08:18	20	106180	42.478
	A060503_04.log	12:08:55	12:30:33	20	3243529	1297.485
	A060503_05.log	12:30:38	12:55:38	20	3748393	1499.441
125 – May 5 th	A060505_00.log	13:26:51	13:49:29	20	3393528	1357.487
	A060505_01.log	13:49:31	14:10:25	20	3134000	1253.670
	A060505_02.log	14:40:50	14:54:50	20	2098571	839.477
	A060505_03.log	14:57:54	15:10:46	20	1929025	771.655
	A060505_04.log	15:23:02	15:36:23	20	2000997	800.446
128 – May 8 th	A060508_00.log	17:09:19	17:12:02	60	406216	162.499
	A060508_01.log	17:14:43	17:25:44	20	1651878	660.790
	A060508_02.log	17:45:41	18:14:05	20	4258502	1703.495
129 – May 9 th	A060509_00.log	16:13:17	16:34:57	20	3249316	1299.799
	A060509_01.log	16:35:01	16:58:49	20	3568404	1427.441
	A060509_02.log	17:15:14	17:34:39	20	2910968	1164.453
	A060509_03.log	17:34:42	17:56:17	20	3236051	1294.493
	A060509_04.log	18:18:24	18:40:07	20	3256076	1302.504
	A060509_05.log	18:40:12	19:03:39	20	3516015	1406.485
	A060509_06.log	19:18:46	19:48:30	20	4458452	1783.480
	A060509_07.log	19:58:44	20:10:14	20	1723647	689.500
130 – May 10 th	A060510_00.log	17:57:51	18:10:55	20	1958635	783.500
	A060510_01.log	18:11:00	18:13:39	20	396275	158.522
	A060510_02.log	18:14:55	18:19:09	20	633741	253.514
	A060510_03.log	18:21:58	18:27:04	20	763769	305.528
	A060510_04.log	18:29:21	18:35:08	20	866157	346.485
	A060510_05.log	18:35:44	18:43:37	20	1181184	472.503
	A060510_06.log	18:45:49	18:51:07	20	793573	317.450
	A060510_07.log	18:54:36	18:59:22	20	713756	285.522
	A060510_08.log	19:02:15	19:16:01	40	2063542	825.465
	A060510_09.log	19:19:46	19:25:26	60	848688	339.497
	A060510_10.log	19:28:25	19:32:48	60	656166	262.484
	A060510_11.log	19:35:33	19:37:36	40	306820	122.739
	A060510_12.log	19:39:37	19:41:08	20	226700	90.689
131 – May 11 th	A060511_00.log	16:12:54	16:32:39	20	2960140	1184.123
	A060511_01.log	16:32:42	16:56:15	20	3530980	1412.472
	A060511_02.log	16:56:19	17:20:22	20	3605984	1442.474
	A060511_03.log	17:20:26	17:39:43	20	2890839	1156.401
	A060511_04.log	17:41:29	18:08:13	20	4009473	1603.878
	A060511_05.log	18:08:17	18:24:44	20	2466870	986.805
	A060511_06.log	18:24:48	18:46:39	20	3276726	1310.764
	A060511_07.log	18:46:42	19:08:31	20	3271766	1308.780

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Table 6: Recorded ASIRAS Files. GPS Time Tag in UTC Time. RW: Range Window (MHz), Length is given in seconds.

JD – Date	Filename	Start	Stop	RW	Total Puls	Length
131 – May 11 th (continued)	A060511_08.log	19:18:45	19:40:34	20	3271039	1308.489
	A060511_09.log	19:40:37	20:02:39	20	3304079	1321.706
132 – May 12 th	A060512_00.log	14:52:22	14:57:36	20	783744	313.519
	A060512_01.log	15:03:28	15:20:28	20	2549752	1019.959
	A060512_02.log	15:20:31	15:42:47	20	3338965	1335.661
	A060512_03.log	15:42:52	16:03:16	20	3058505	1223.471
	A060512_04.log	16:03:20	16:24:47	20	3216861	1286.817
	A060512_05.log	16:26:00	16:49:14	20	3483461	1393.462
	A060512_06.log	16:49:28	17:09:39	20	3026042	1210.485
	A060512_07.log	17:34:16	17:54:45	20	3070965	1228.455
	A060512_08.log	17:58:54	18:04:59	20	911186	364.498
	A060512_09.log	18:12:16	18:28:43	20	2467079	986.888
	A060512_10.log	18:47:40	19:09:21	20	3251614	1300.719
A060512_11.log	19:09:30	19:18:50	20	1399217	559.721	
136 – May 16 th	A060512_00.log	10:02:24	10:08:59	20	987127	394.876
	A060512_01.log	10:13:29	10:14:37	40	168766	67.514
	A060512_02.log	10:15:03	10:34:34	20	2925943	1170.443
	A060512_03.log	11:23:49	11:39:53	20	2408484	963.449
	A060512_04.log	11:39:57	12:01:35	20	3243639	1297.529
	A060512_05.log	12:01:51	12:23:22	20	3226657	1290.735
	A060512_06.log	13:49:21	14:14:46	20	3811973	1524.874
	A060512_07.log	14:14:49	14:24:21	20	1429365	571.780
137 – May 17 th	A060517_00.log	09:27:56	09:33:53	80	892149	356.883
	A060517_01.log	09:34:27	09:47:13	80	1913639	765.501
	A060517_02.log	11:01:45	11:13:12	20	1715988	686.436
	A060517_03.log	11:16:43	11:19:11	60	369431	147.784
	A060517_04.log	11:19:22	11:26:08	40	1013621	405.474
	A060517_05.log	12:12:30	12:39:47	20	4090929	1636.463
	A060517_06.log	12:46:42	13:01:29	20	2216067	886.478
	A060517_07.log	13:02:31	13:15:26	20	1937122	774.894
	A060517_08.log	13:18:12	13:18:46	60	83807	33.528
	A060517_09.log	13:19:13	13:20:06	80	131104	52.448
	A060517_13.log	15:26:45	15:35:06	20	1251099	500.470
	A060517_14.log	15:35:38	15:45:06	20	1418624	567.484
	A060517_15.log	15:58:40	16:24:12	20	3828536	1531.499
	A060517_16.log	16:49:47	17:09:16	20	2920864	1168.412
	A060517_17.log	17:54:28	17:59:04	20	689314	275.744

3.5 Auxiliary Data

During the survey flights operator logs were kept for both the DNSC laser scanner system and the ASIRAS radar system. These logs have been stored as separate files together with the data files and can also be found in the Appendix A and B.

A downward looking web-camera was installed next to the laser scanner and operated during most flights to acquire visual documentation of the observed surface. Images were obtained every 1-2 seconds with a resolution of 640 by 480 pixels, with one pixel roughly corresponding to 1 by 1 m. These were logged directly on a dedicated laptop PC after initial tests on a rack-mounted PC was un-successful. The images were timed by the PC (PC time adjusted to GPS time) and can after data processing be geolocated more precisely together with the laser scanner data. Flights with web-camera images are listed in Table 3.

In addition to the web-camera, the operators took digital photographs and digital video out of the Twin Otter windows on irregular basis during flights. These photos have been gathered and stored together with the survey data files. As a backup for the laser scanner instrument a profiling laser altimeter (Optech) was mounted next to the scanner. The instrument was tested but data were only sporadically stored as most flights were out of range of this altimeter.

3.6 Summary

Nearly all data were recovered during the campaign except for the few cases discussed above. The full set of raw data is now stored on the DNSC server system (with tape backup) and copies are kept on CDroms except for the ASIRAS data, as described above. The harddisks with ASIRAS data have been delivered to AWI and the backup tapes are at DNSC.

4 Examples of Preliminary Processed Data

The main sites of the CryoVEx 2006 campaign were located at the Greenland Ice Sheet on the EGIG line named T05 and T12, the Austfonna Ice Cap, Svalbard, the Devon Ice Cap, and the sea ice north of Alert, Ellesmere Island. An opportunity site was situated on the Kongsvegen Glacier, Svalbard. At all these sites ground teams were observing the ice and snow conditions on the surface and corner reflectors were raised to serve as calibration targets for the ASIRAS radar measurements. Flying at a nominal height above ground of 300 m the reflector needs to be hit within a 10 metres wide footprint on ground. This turned out to be quite a challenge even with the use of the DNSC navigation software that displays the track accuracy in real-time. Therefore it was decided to over-fly the reflectors 2-3 times at each site whenever possible. With this procedure 9 of the total of 12 reflectors were hit. Preliminary data processing has been carried out of the data from the main sites. This included delivery of GPS and INS data to AWI for test processing of ASIRAS data from these sites. The results were presented at the CryoSat CVRT (Calibration, Validation, and Retrieval Team) meeting at ESA-ESTEC on June 15th and 16th, 2006. A summary of these preliminary results is given in the following.

4.1 EGIG line

Two sites on the EGIG line had field teams and corner reflectors on the ground: T05 (UK1 team lead by P. Nienow) in the percolation zone and T12 (UK2 team lead by L. Morris) in the dry snow zone. The sites were over-flown by the Twin Otter on April 25 where only the corner reflector at T12 was hit properly. A repeated flight over T05 was performed on April 26 with 2 successful hits of the reflector. Laser scanner data of the full EGIG line were obtained on April 25 only and Figure 3 shows the full April 25 flight. Figure 4 and 5 show, in more detail, the laser scanner data close to the sites together with the ASIRAS radar response (parabola form) from the corner reflectors as can be seen with the "Quicklook-Viewer" software.

4.2 Austfonna Ice Cap

Four corner reflectors were placed on the Austfonna Ice Cap, mainly placed at track crossings. The flight over the ice cap took place on May 1st and the full flight track, colour-coded elevations, are seen in Figure 6 together with the reflector positions (R1-R4). Due to problems with the DNSC navigation software at the beginning of the survey the first reflector (R3) was not hit. The other reflectors were observed at least once. For the last part of the survey the laser scanner data were only sporadically sampled due to low clouds starting to form over the ice; see the southwesterly line.

During this flight the Starlab Oceanpal GPS system was tested. For this test a flight line was extended to cover the sea ice east of Austfonna. Figure 7 shows an example of laser scanner data from a corner reflector over-flight along with the corresponding ASIRAS radar reflection. Figure 8 is a photograph of the Austfonna ice camp taken with the downward looking web-camera.

4.3 Alert Sea Ice

On the Arctic Ocean sea ice near CFS Alert on Ellesmere Island, Canada, two sites were selected; one on multi-year (MY) ice and one on first-year (FY) ice. At these sites corner reflectors were raised (two at each site) and extensive ground observations of the snow and ice conditions were carried out. GPS buoys were used to monitor the drift of the sea ice.

Airborne Twin Otter survey flights were performed on May 10th. The flight path with colour-coded surface elevations are shown on Figure 9. The MY (south) and

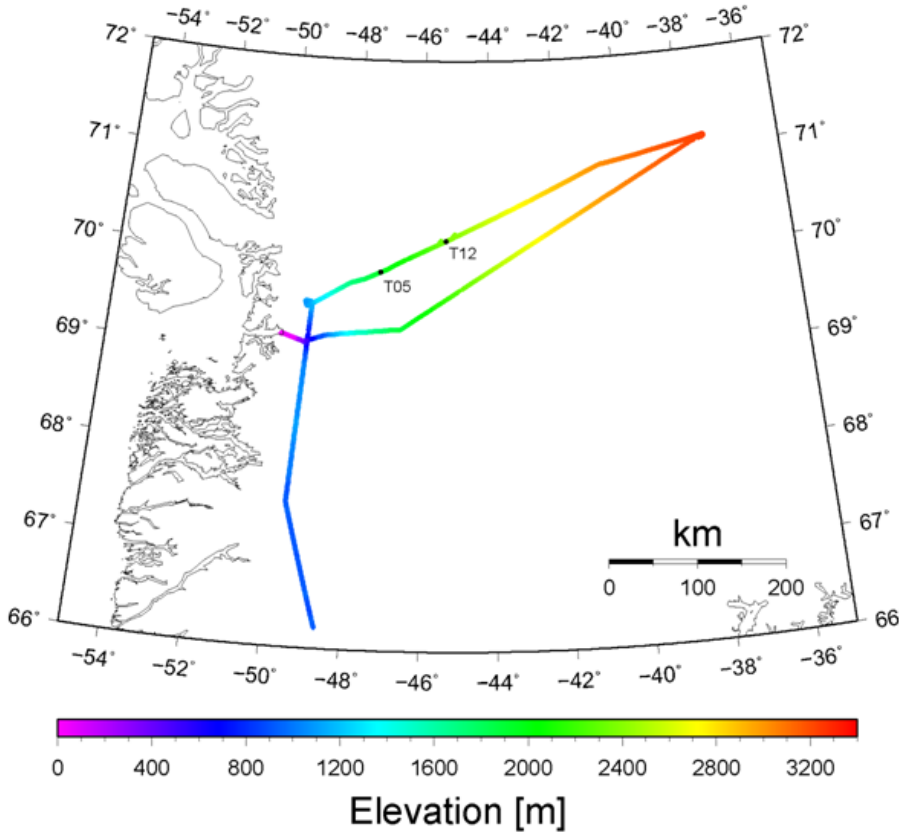


Figure 3: Colour coded laser scanner elevations (ellipsoidal heights) from the April 25 survey flight.

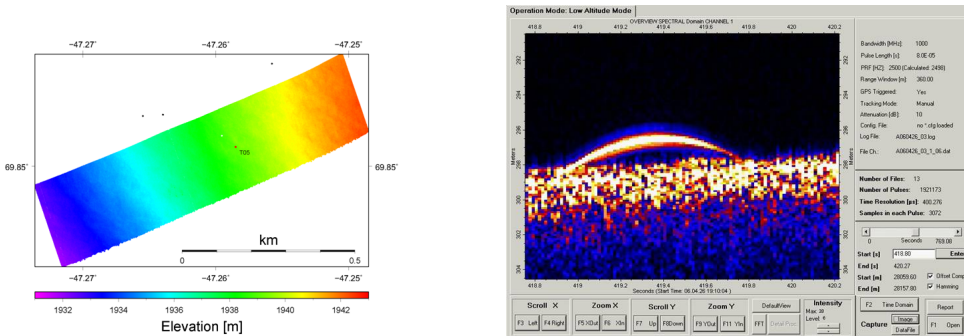


Figure 4: Laser scanner elevations in approximately 300 m wide swath near T05. Right: Radar response from the T05 corner reflector.

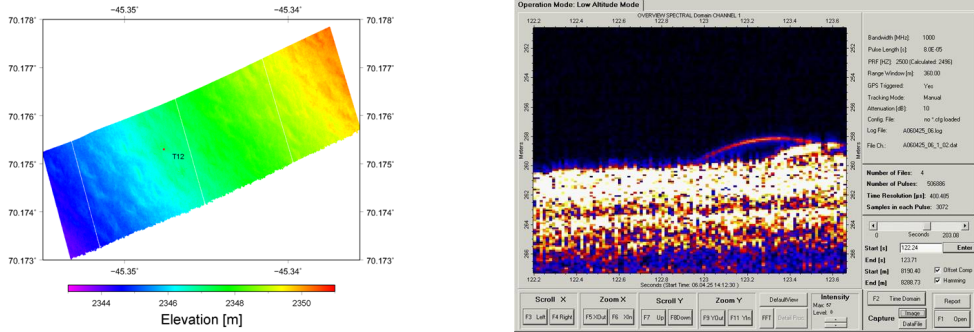


Figure 5: *Left: Laser scanner elevations in approximately 300 m wide swath near T12. Right: Radar response from the T12 corner reflector.*

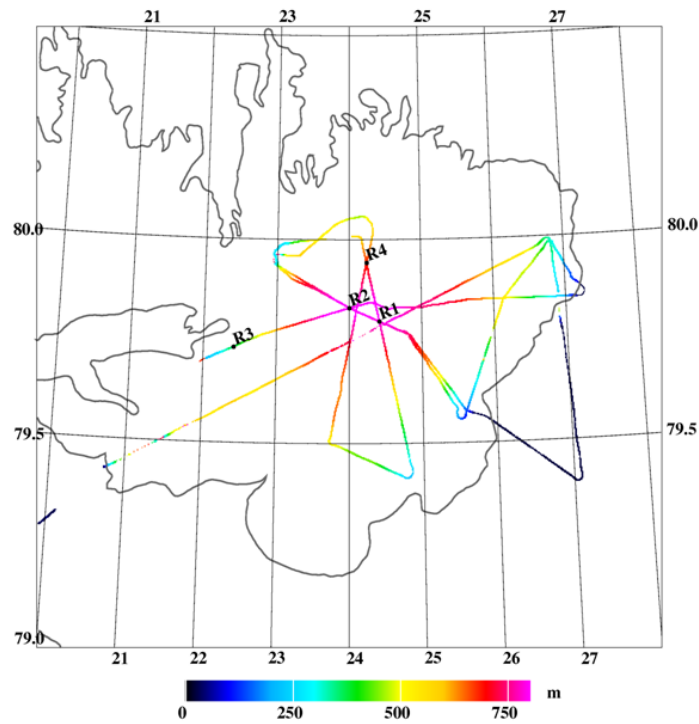


Figure 6: *Austfonna Ice Cap flight on May 1; colour-coded elevations from laser scanner data. Corner reflector sites are marked R1-R4.*

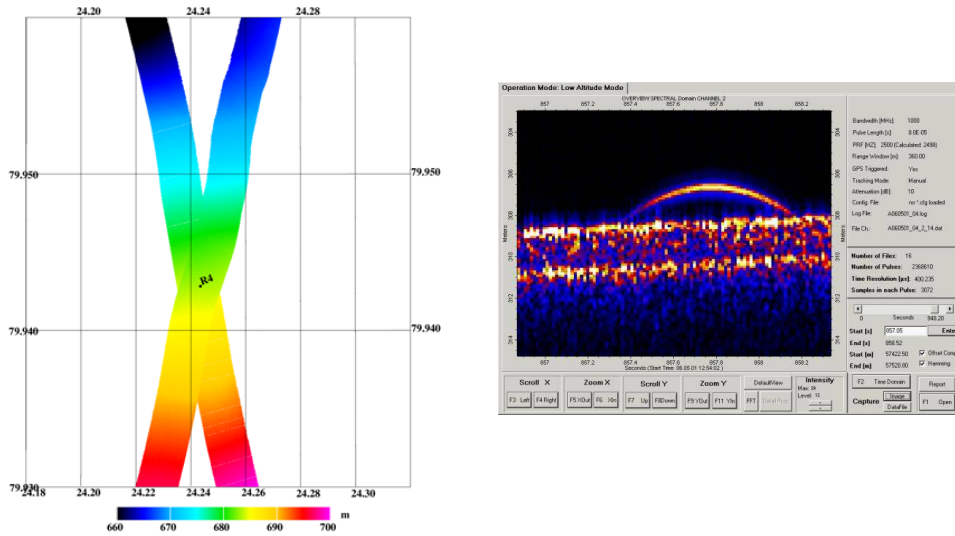


Figure 7: Example of Austfonna corner reflector over-flight along with ASIRAS radar reflection.

FY (north) sites were located at the line crossings. All reflectors were sampled several times at different altitudes. Together with these observations calibration flights over the runway and a building near the runway were done. Figure 10 shows examples from the two sites of laser scanner elevations and ASIRAS radar reflections from the second over-flight. On May 11th and 12th longer flight lines over the sea ice were coordinated with the AWI helicopter EM system.

4.4 Additional Sites

Corner reflectors were also located at the Kongsvegen Glacier, Svalbard and at the Devon Ice Cap where ground observations were carried out. The Kongsvegen over-flight was done on May 2nd during the transit from Svalbard to Northeast Greenland. This survey suffered from strong winds in the valley where the glacier is located and it turned out to be difficult to follow the flight line exactly and the corner reflectors were not hit precisely. Both laser scanner and ASIRAS data were obtained from the ice, though.

The Devon flight, out of Thule Air Base, took place on May 5th. Flight tracks across and along the survey line were carried out. One corner reflector was located near the summit of the ice cap, but preliminary studies of the ASIRAS data shows no hit



Figure 8: *Web-camera photograph of the Austfonna ice camp.*

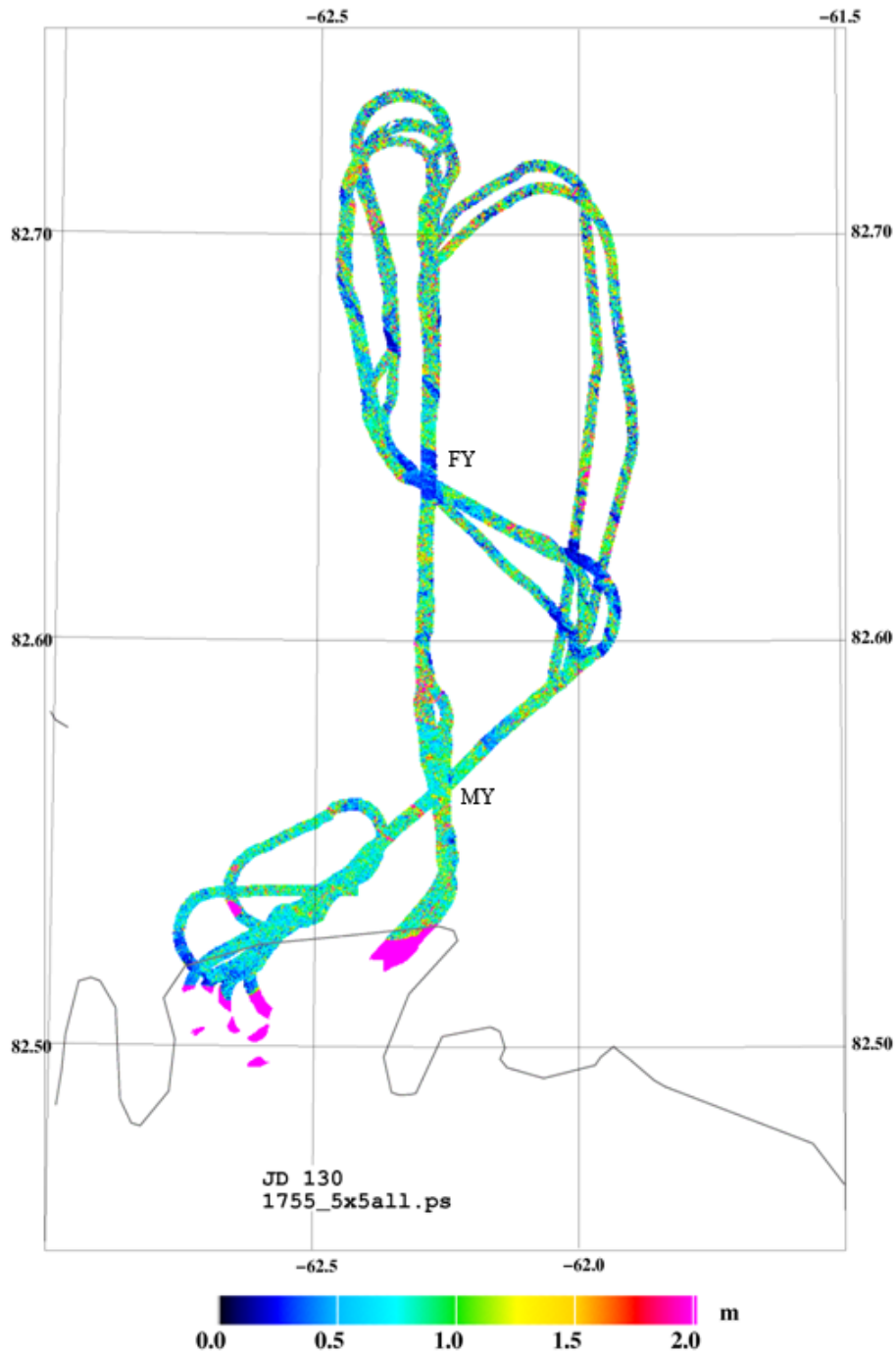


Figure 9: Alert sea ice flight track, laser scanner elevations; MY ice site at southern line crossing and FY ice site at northern line crossing.

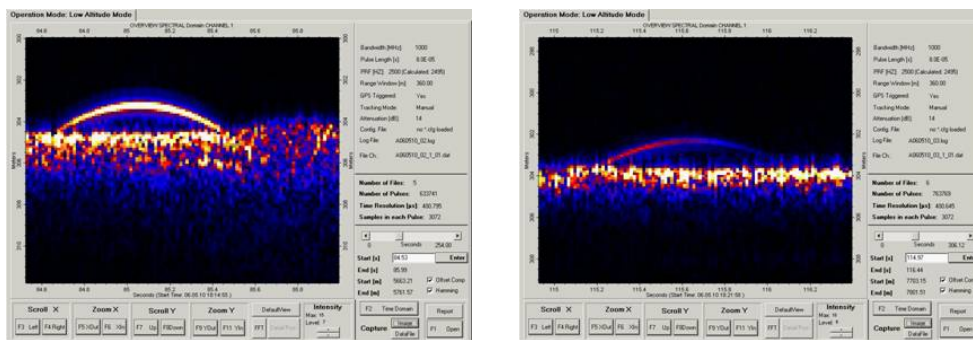
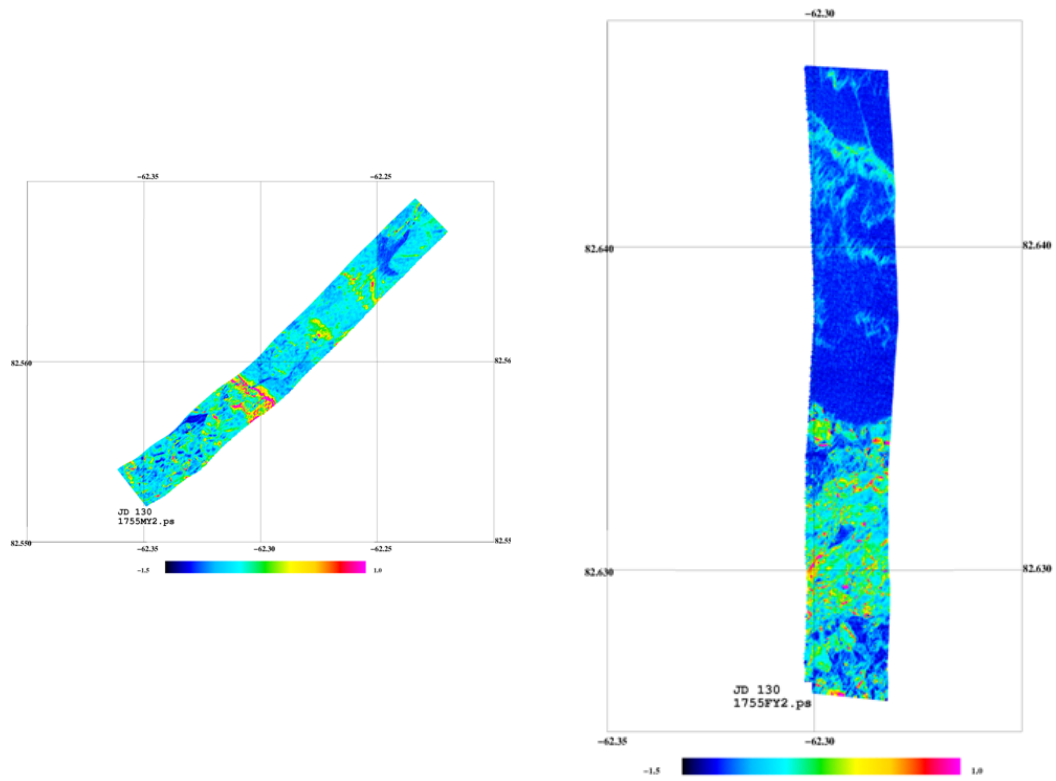


Figure 10: Examples of laser scanner and ASIRAS radar data from the two Alert sea ice sites from the second over-flight. Left: Multiyear site, laser (top), radar (below); Right: First year site.

of the site. Some uncertainty in communication of the site position occurred. This has been investigated after the campaign and there was a (about 1 m) inaccuracy in the position from the ground team but the flight lines were still within approximately 10 m of the planned lines. This means that the ASIRAS ground observations should be close to the edge of the footprint. More thorough investigation of the data should be carried out. The southern part of the Devon survey line had to be aborted due to dangerous wind conditions.

For calibration of the Twin Otter systems dedicated surveys over buildings and runways were performed. Calibration flights were done at Kangerlussuaq (beginning and end of campaign), Alert, and Station Nord. One example from a building over-flight in Kangerlussuaq can be seen in Figure 11. The building has previously been positioned with GPS.

5 Conclusions

The airborne part of the CryoVEx 2006 campaign has successfully been carried out by DNSC and the gathered data sets are now stored and secured at DNSC. A total of 127 hr were flown with the Air Greenland Twin-Otter where laser scanner data were acquired most of the time. ASIRAS radar data were gathered on the main campaign sites and on parts of the survey lines. About 25 hr were spend on flights over the main sites, 20 hr on positioning of the British ground teams on the ice sheet, 25 hr on different other project, and the rest on transit flights and repeated coverage of sea ice and land ice lines previously flown by DNSC. Preliminary analysis of the data sets show good results, which were presented to the involved parties at the June 15th-16th, 2006 CryoSat CVRT meeting at ESA-ESTEC. At the writing of this report, the post processing of the GPS, INS and laser scanner data is in progress at DNSC. The GPS and INS information will be delivered to AWI to be used for the ASIRAS data analysis. The standard processing will be finalised during the last half of 2006.

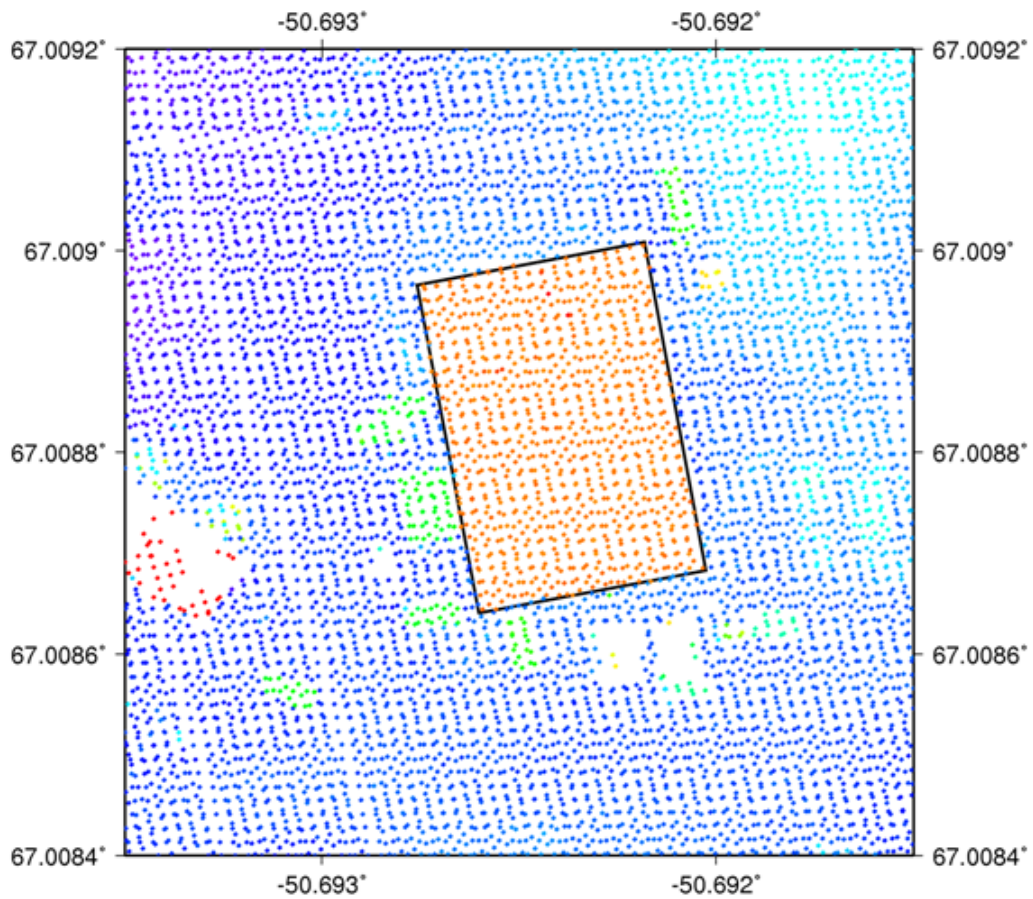
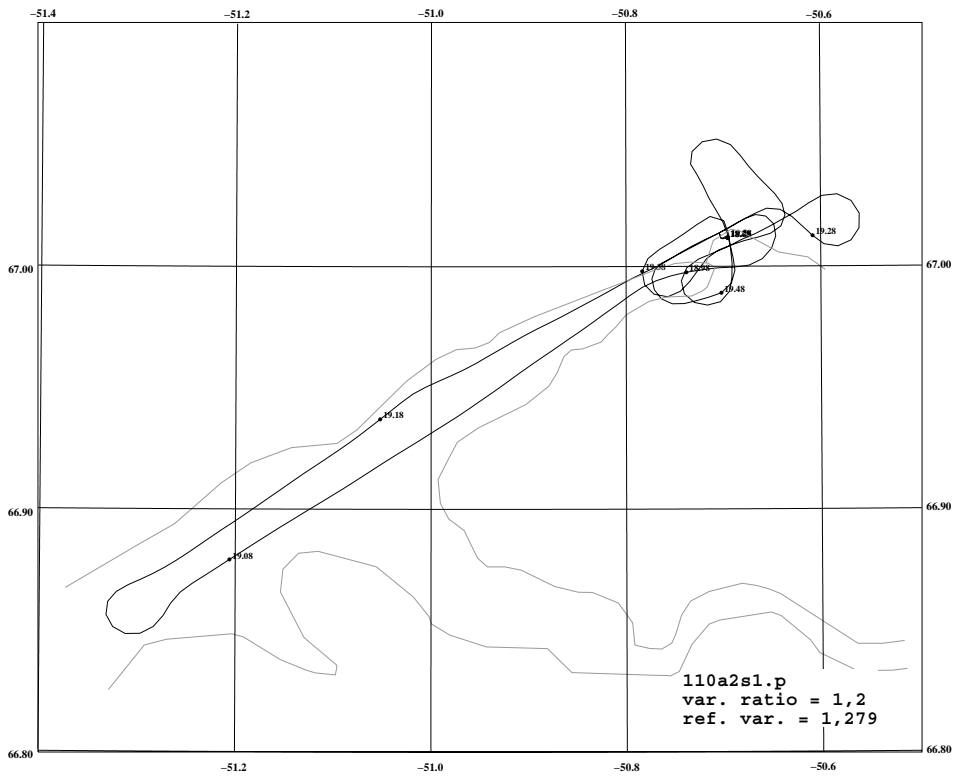


Figure 11: *Example of laser scanner data from a calibration survey of a building in Kangerlussuaq.*

A Airborne Log with GPS Track Plot

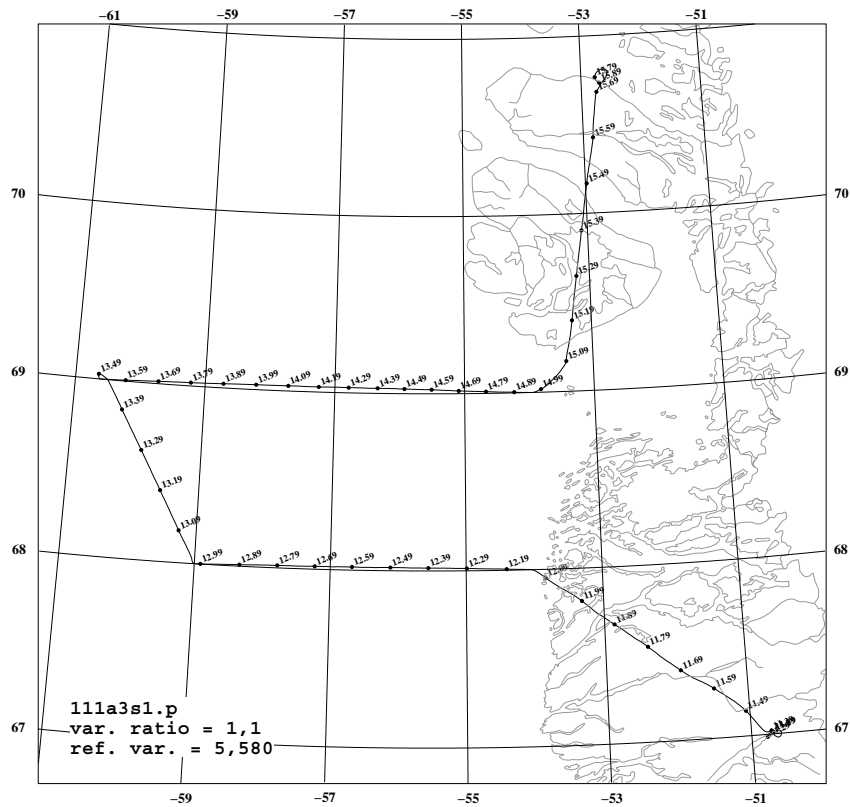
JD 110 – 2006 April 20th
GPS week 1371 (day 4)

18:45:30	new scanner file	19:00	out through the fjord
18:48	engines on	19:15:30	over the runway
18:53	taxi	19:18	webcam PC rebooted
18:56	start Trimble logging	19:31	landing



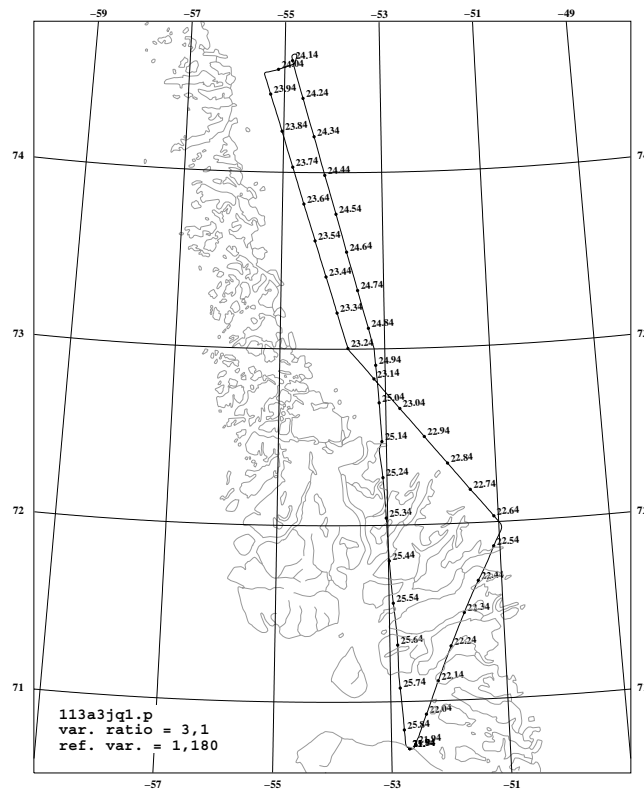
JD 111 – 2006 April 21st
GPS week 1371 (day 5)

11:06	engines on	12:14	broken floes in bands
11:15:30	new scanner file	13:01:30	new scanner file
	cross over building	13:34:00	new scanner file just after V3
	close scanner file, transit to V1		few min of video
11:43	webcam rebooted	13:57	few min of video
12:06:00	new scanner file	14:23	91 knots and fog
	over water near coast		67N 55 57W lead
12:07:20	V1	14:56	scanner file closed at V4
12:09	thin ice and water	15:49	landing



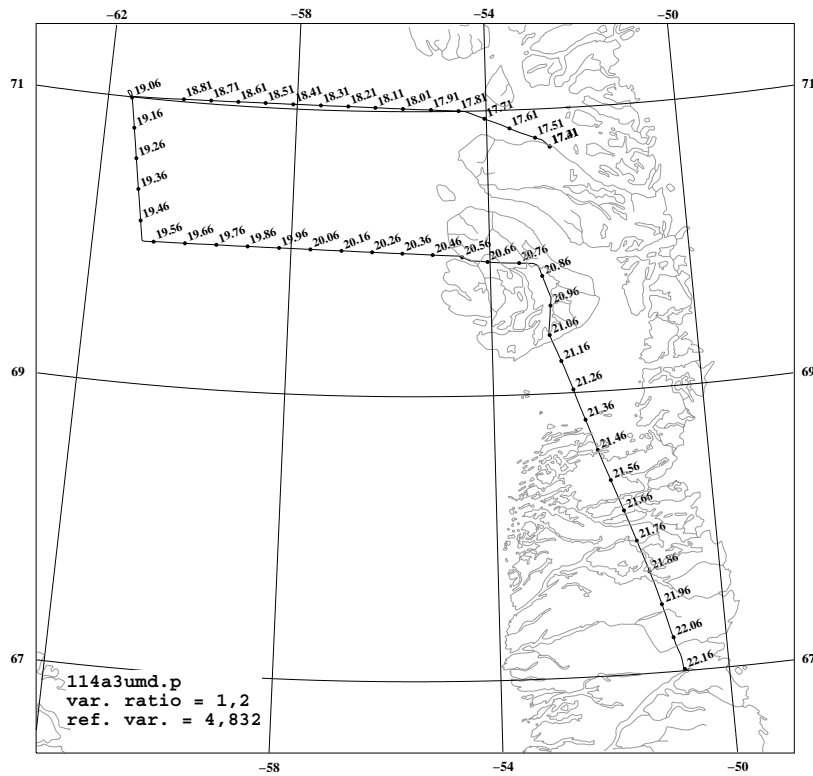
JD 113 – 2006, April 23rd
GPS week 1372 (day 0)

21:50	taxi	23:34	ASIRAS on 73° 25'N - 73° 40'N
21:54	take off	23:59	A3
22:35:00	new scanner file	23:59	tear drop turn at A4
22:31:30	A1	00:08:40	at A4, start line A4-A5
23:05 - 23:10	ASIRAS on	00:11:30	new scanner file
	where lines cross	00:53	A5
23:14	A2	01:10	scanner file closed at ice edge
23:18:00	new scanner file	01:54	landing



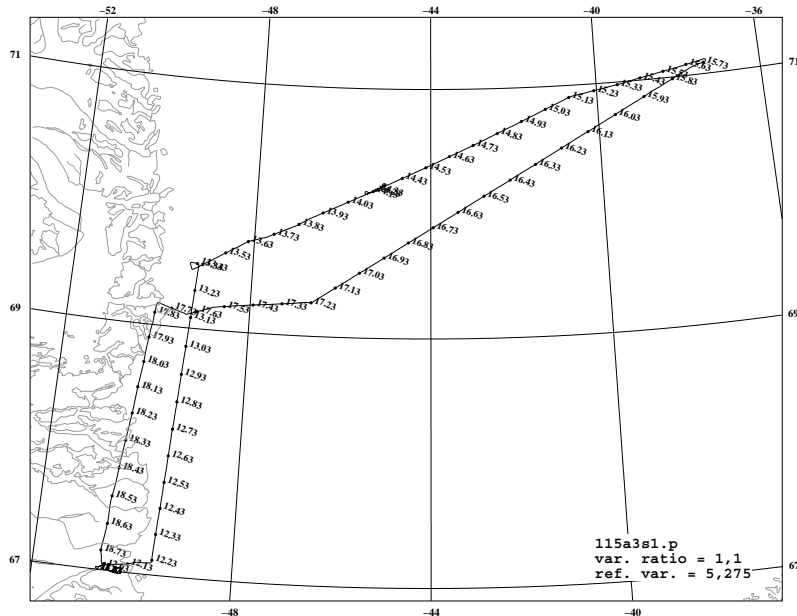
JD 114 – 2006, April 24th
GPS week 1372 (day 1)

17:23	taxi	19:31	V7
17:26	take off	20:23	V8, climb towards Disko
17:47	V5	20:25:00	new scanner file
18:05	video on, right window	20:51	DI1
18:30:30	new scanner file	21:03	DI3
18:46	video off		scanner file closed
18:59	tear drop turn at V6	22:11	landing
19:26:30	new scanner file		



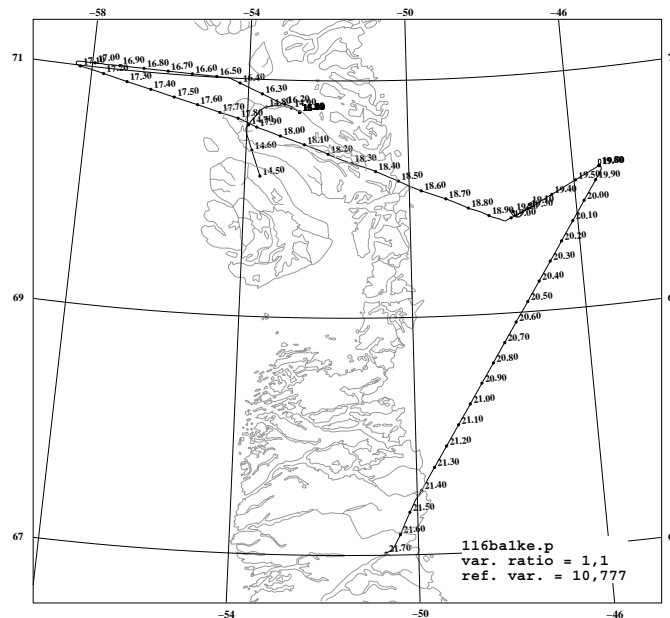
JD 115 – 2006, April 25th
GPS week 1372 (day 2)

11:57	taxi	14:43	T21
11:59	take off	14:46:00	new scanner file
12:10:00	new scanner file	14:54	T25
12:23	EGI logging started	15:08	T31
13:11:30	new scanner file	15:18	T35
13:19	X2, tear drop turn	15:36	T41
13:38	T1	15:43	T43
13:42	T3	15:45:30	new scanner file
13:46	T5, over corner reflector	16:54:30	new scanner file (1 sec late?)
13:54	T8	17:13	I5
13:55:30	new scanner file	17:28	I6
14:09	T12, over corner reflector, off by 20 m better 2 nd time	17:34	I7
14:18:30	T17	17:40	I8
19:26:30	new scanner file	17:47	I9, end of line, scanner file closed
		18:49	landing



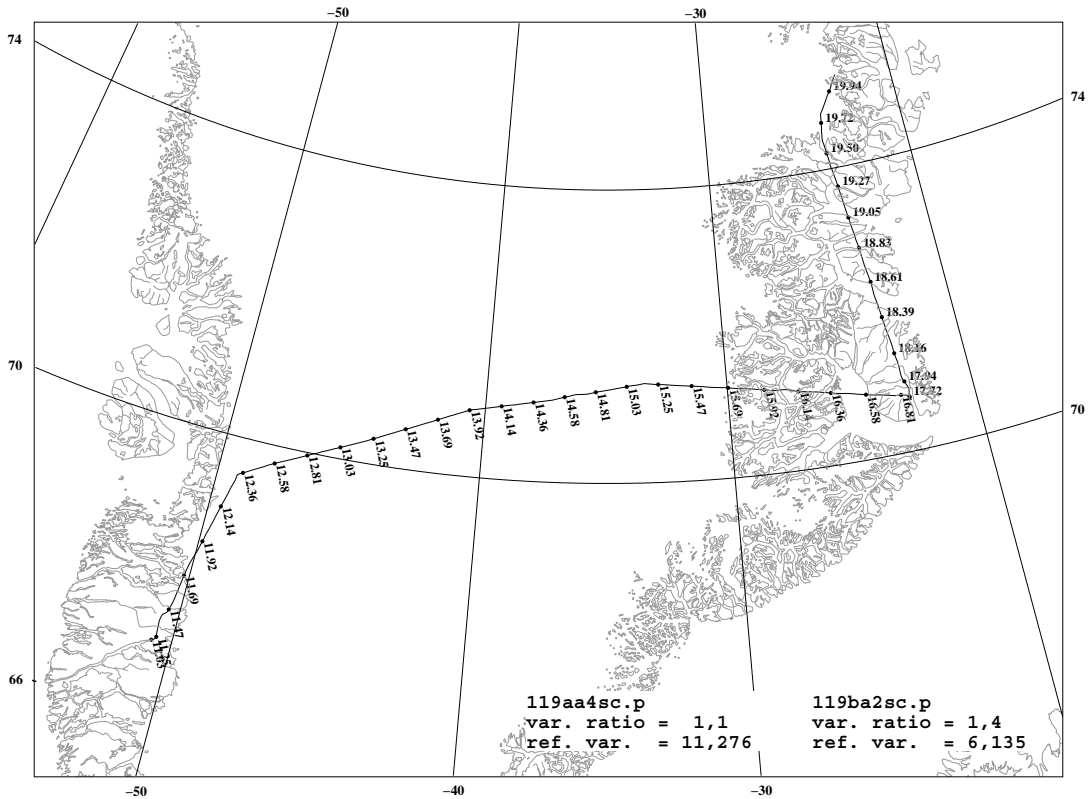
JD 116 – 2006, April 26th
GPS week 1372 (day 3)

12:55	taxi	17:03	V17, towards T3
12:58	take off	17:04:30	new scanner file - no data
14:29	Trimble logging stopped, stopped to delete file	18:49:00	new scanner file - no data
14:30	Trimble logging started	19:05 - 15	3 times over T5, 1 st and 3 rd best hit
14:41	deviate line to land in JQA, helicopter not departed	19:15	direct to T12 to pick up UK1, one is ill
14:57	landing JQA, air2, air3 logging stopped	19:40	landing at T12 on ice sheet
16:02	EGI logging stopped	19:49	take off T12 towards SFJ
16:03	EGI, air2, air3 logging started	19:51:30	new scanner file
16:04	taxi	20:46:30	new scanner file, memory out on PC-card at 2100
16:07	take off JQA	21:09:00	new scanner file
16:11:30	new scanner file	21:26	scanner file closed
16:26	V5	21:42	landing
16:57	over helicopter (on ice floe)	21:46	engines off



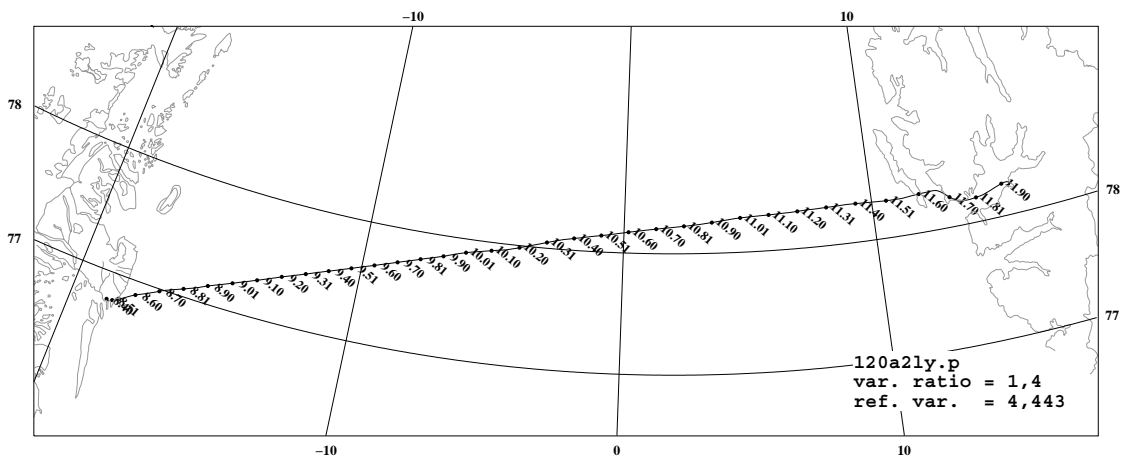
JD 119 – 2006, April 29th
GPS week 1372 (day 6)

11:01	engines on	15:45	scanner file closed, ice margin
11:09	taxi	16:54	landing CNP
11:11	take off		logging stopped all instruments
12:18:xx	new scanner file	17:43	on
12:19	EG1	17:44	taxi
13:01:00	new scanner file, 1 sec late?	17:48	take off
13:12	EG3	17:49	EGI logging, Trimble started
13:57	EG4	19:36:30	B1, new scanner file
14:01:00	new scanner file	19:47	break off line, scanner cannot reach surface, strong winds, ice crystals in air?
14:28	EG5		EGI stopped some time before B1?
14:38	slightly off line – retype pos in GPS < 2 km off	20:53	landing
14:53:00	new scanner file		



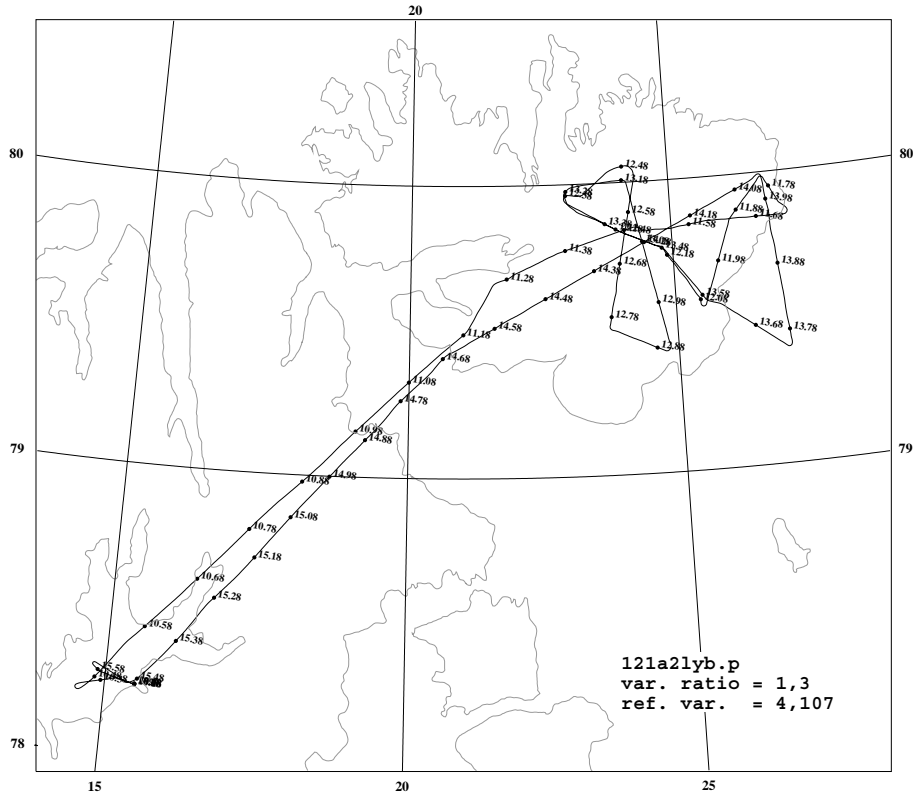
JD 120 – 2006, April 30th
GPS week 1373 (day 0)

08:27	take off	10:10	2 · 10 min HAM radar data at 2800 m
08:33:00	new scanner file		some wind at surface, waves, see photo before climb
08:46	EMAP started, PC rebooted twice		
09:32:30	new scanner file, follow ice edge	11:58	landing
09:44:40	end of sea ice, scanner file closed		



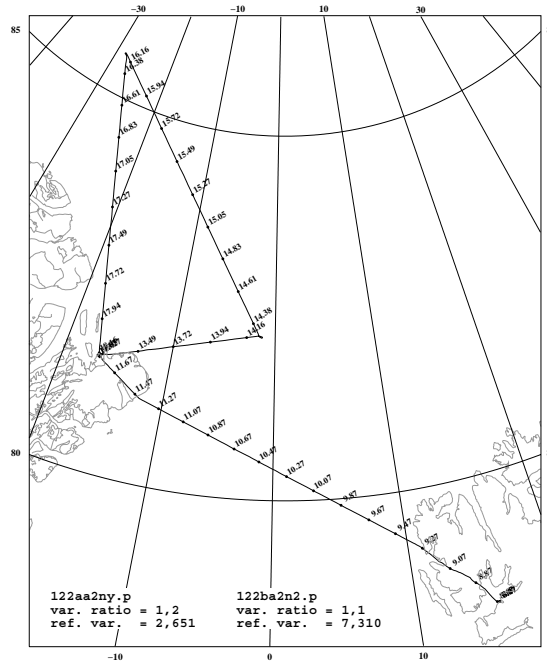
JD 121 – 2006 May 1st
GPS week 1373 (day 1)

10:18	take off	13:12:30	new scanner file (131235?)
11:17:00	new scanner file	13:35	NV11
	problems with EMAP on Trimble		deviate line to fly over sea ice,
	changed to Javad after several tries		SE of island
12:15:00	new scanner file (121504/05)		back to K5 afterwards
12:32	4-1	13:57:00	new scanner file
12:32:30	R4	14:00	K5
12:50	some fog is starting to reoccur	14:16	clouds on top of ice cap
13:04	R1	14:47	end of survey,
13:08:40	R4		too much wind over mountains
13:09:40	end of line	15:38	landing



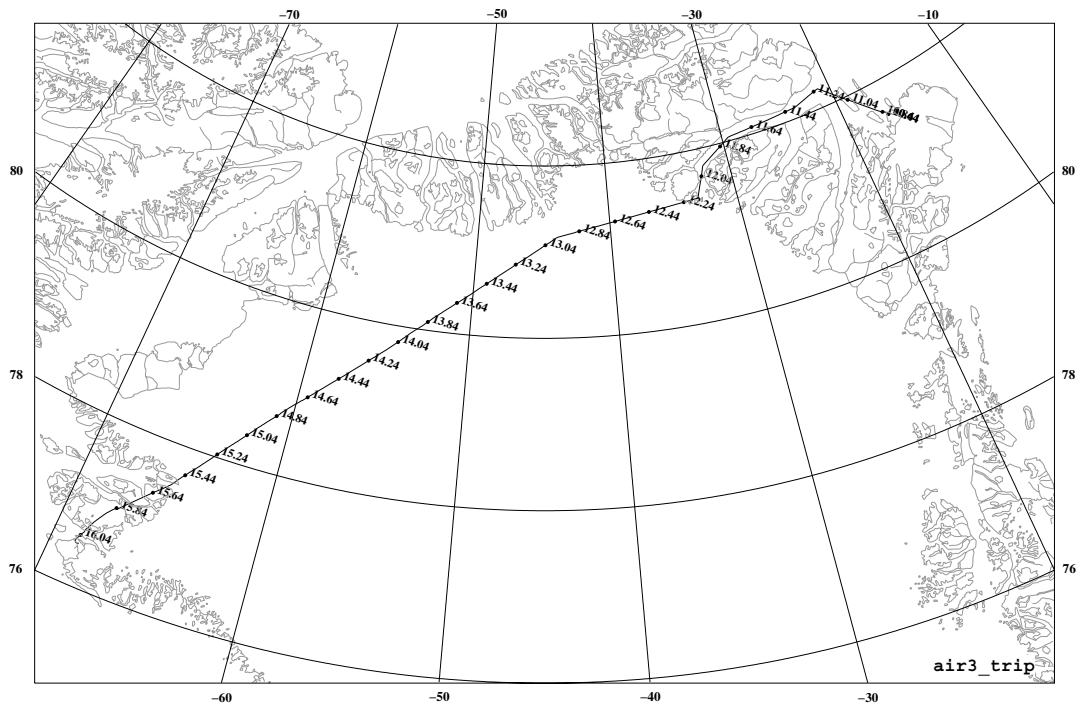
JD 122 – 2006, May 2nd
GPS week 1373 (day 2)

	engines on early, EGI restarted	13:11	taxi
08:35	taxi	13:14	take off
08:38	take off	13:13:00	new scanner file
08:40:30	new scanner file	13:29:30	lead, shear zone
09:04	end of glacier	14:12:00	new scanner file
10	clouds to altitude 80 m	14:13	F1
10:20	descend to observe cloud cover	14:14	tear drop turn
10:28	clouds too low, some ASIRAS data gathered	15:06:00	new scanner file
10:39:30	new scanner file, only few higher clouds now	15:33	fog, scanner file closed, ASIRAS still on
10:43	large ice floe	16:11:00	new scanner file
11:25	EN8	17:10:30	new scanner file
11:27:00	new scanner file, (1 sec early?)	18:12	cross over building, (Ebbe Kold hal)
11:50	landing	18:15	second pass
		18:18	landing



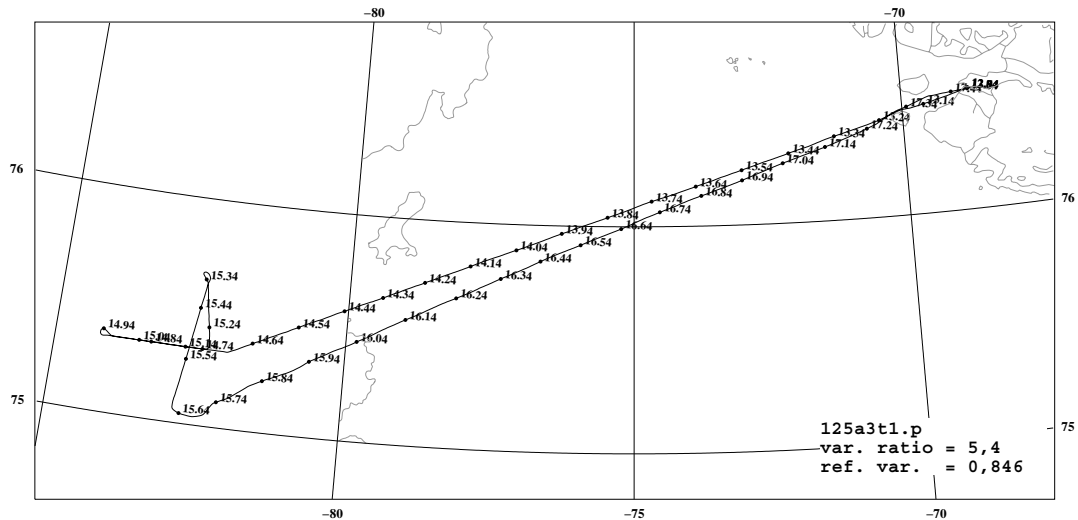
JD 123 – 2006, May 3rd
GPS week 1373 (day 3)

10:44	taxi	12:55	AIR2 second file on
10:47	take off	12:56	H7
10:49:30	new scanner file	12:58:30	new scanner file
11:12	H1	13:55:00	new scanner file
11:22	H2	14:06	H8
11:34	H3	14:57:00	new scanner file
11:45	H4	15:27	ice sheet margin scanner file closed
11:58	H5	16:06	landing
11:58:30	new scanner file		
12:02	glacier start (margin in fjord)		
12:09	H6		
	AIR2 PC-card full, stopped and files deleted		



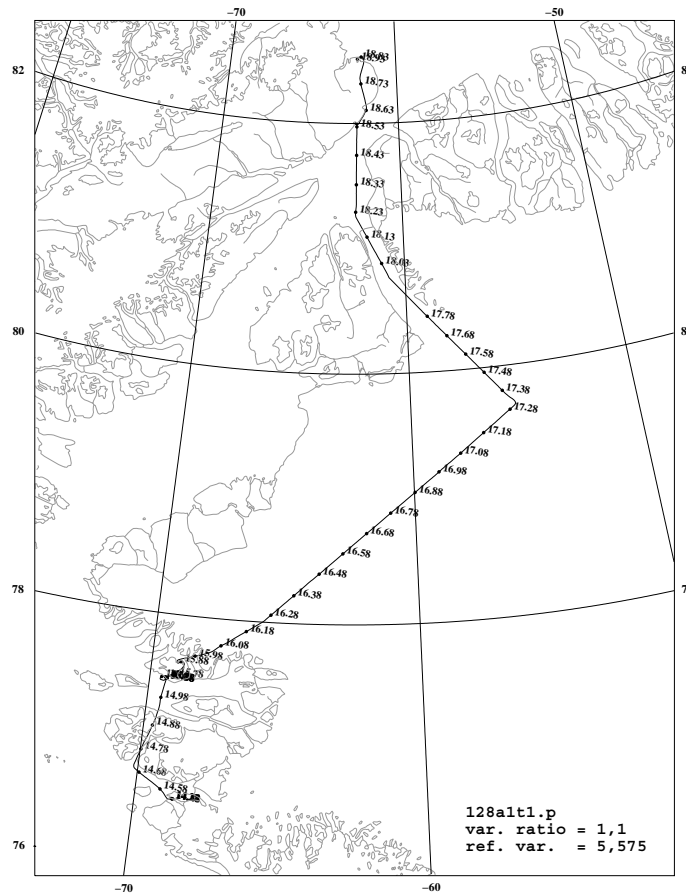
JD 125 – 2006, May 5th
GPS week 1373 (day 5)

12:50	EGI start	15:22	DE5
12:55	taxi	15:31	R1
13:01	take off	15:37	DE3
13:09:00	new scanner file	15:39:00	new scanner file
14:09:00	new scanner file	15:45	scanner file stopped
14:39:00	new scanner file	16:20:00	new scanner file
14:45	reflector R1	17:26	scanner file stopped
14:54	DE6	17:26	landing
14:08	R1		



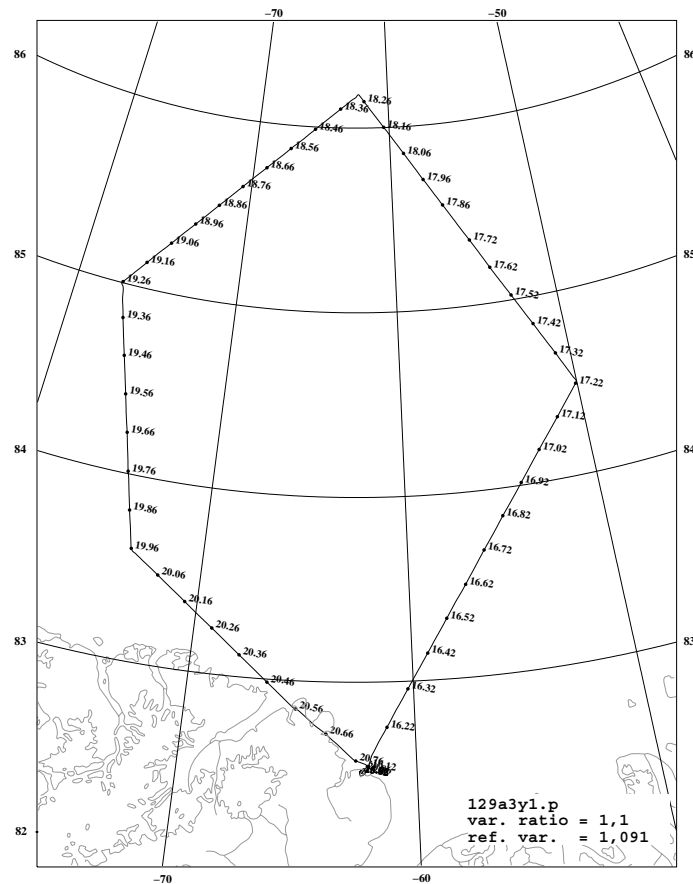
JD 128 – 2006, May 8th
GPS week 1374 (day 1)

14:20	system start up	17:02	clouds
14:24	taxi	17:14:00	new scanner file
14:30	take off	17:18	C2
14:35:00	new scanner file	18:00	C3
14:54	Politikens isbræ (POL)	18:08	edge of Petermann, nearly no snow on sea ice
15:05	on ground NAQ	18:24:00	new scanner file
15:34	engine on	18:32	end of line
15:37	taxi	18:32	on ground
15:38	take off		
16:28:00	new scanner file		



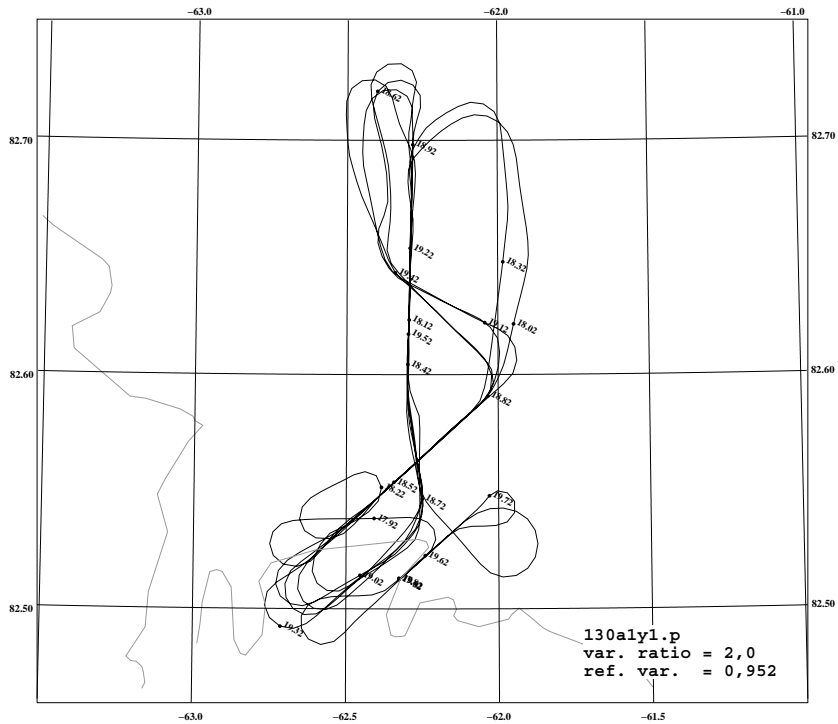
JD 129 – 2006, May 9th
 GPS week 1374 (day 2)

16:00	INS aligned, start taxi (1200 local)	18:17	wpt D3A, turn
16:03:00	new scanner file	19:08:00	new scanner file
16:05	take off	19:15	wpt H3 turn
16:33	video tape #2	19:58	turn wpt H2
17:05:30	new scanner file	20:09:00	new scanner file
17:13	Trn, wpt D4	20:48	rwyt overflight
18:08	new scanner file	20:52	landing



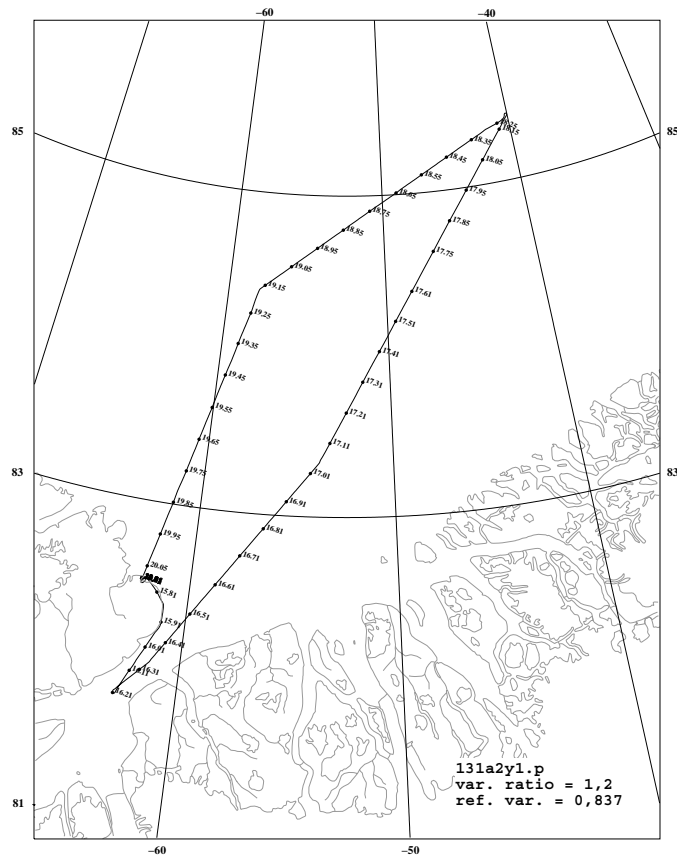
JD 130 – 2006, May 10th
GPS week 1374 (day 3)

17:52	take off	19:04:40	MY 1500 ft
17:55:00	new scanner file	19:08:00	FY cross
17:58:43	MY reflector, xte -31m	19:13:20	FY 1500 ft
18:06:30	FY reflector	19:15:40	MY cross
18:08:38	MY cross		climb to 2500 ft, scanner
18:16:09	MY refl #2 -2 m		stopped giving data at 500 m
18:24:00	MY refl #2 1.7 m	19:20:50	MY 2500 ft
18:26:10	MY cross	19:24:40	FY cross
18:31:25	MY #3 -2 m	19:30:30	FY 2500 ft
18:34:20	FY cross refl	19:32:00	new scanner file
18:40:10	FY #3	19:32:30	MY cross
18:42:25	MY cross		descend 1500 ft to rwy overflt
18:47:50	MY #4	19:37	rwyt overflight 1500 ft
18:50:42	FY cross	19:40	rwyt overflt 1000 ft
18:56:50	FY #4	19:45	landing
18:59:14	MY cross		



JD 131 – 2006, May 11th
GPS week 1374 (day 4)

15:20	Heli take off	16:55:00	new scanner file
15:30	start engines		(misnamed 165400.2dd)
	INS not aligned (after 45 min)	17:54	descend, fog 250 m
	set to NAV=NVRF	18:00:00	new scanner file
15:43:00	new scanner file	18:11	end of line, turn
15:45	take off	19:10	climb 1000 ft
16:15	G0	19:12:00	new scanner file
16:33	overhead helicopter	20:04	over Spinaker bldg,
	82 26.0 N 59 19 W		not aligned to rwy
16:51	fog patches	20:08	on ground

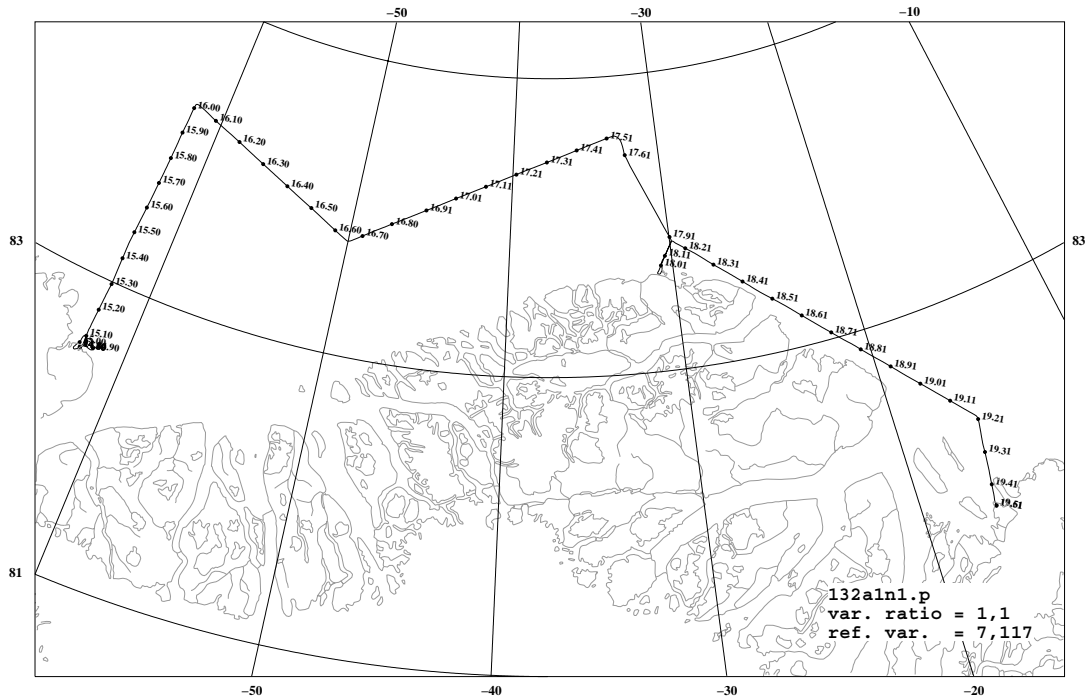


JD 132 – 2006, May 12th
GPS week 1374 (day 5)

14:35:00	new scanner file	16:58	new scanner file
14:48	airborne, departure	18:02	overhead Ultima Thule island
	shortly after heli	18:13:30	new scanner file
	EM helicopter returns	18:57	INS close output file?
	40 miles out from Alert		warning – disc full
15:26	descend 700 ft.	18:58	PC on standby by accident
15:53	new scanner file	19:02	new scanner file on c:scanner
16:00	abort line, to wpt. E0, thick fog	19:29	on ground, Station Nord

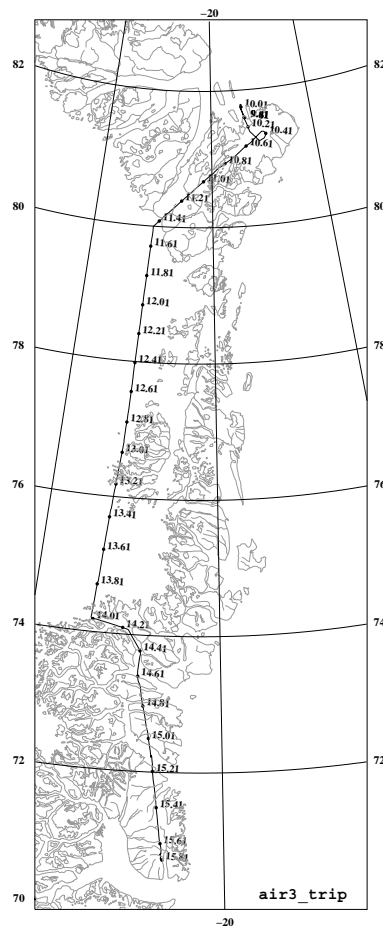
Buoy waypoints

B3	82° 33.832' N	62° 15.511' W	B7	83° 17.142' N	62° 16.725' W
B4	82° 38.402' N	62° 17.509' W	B8	83° 35.500' N	62° 10.932' W
B5	82° 59.921' N	62° 12.142' W	B9	83° 50.776' N	62° 7.745' W



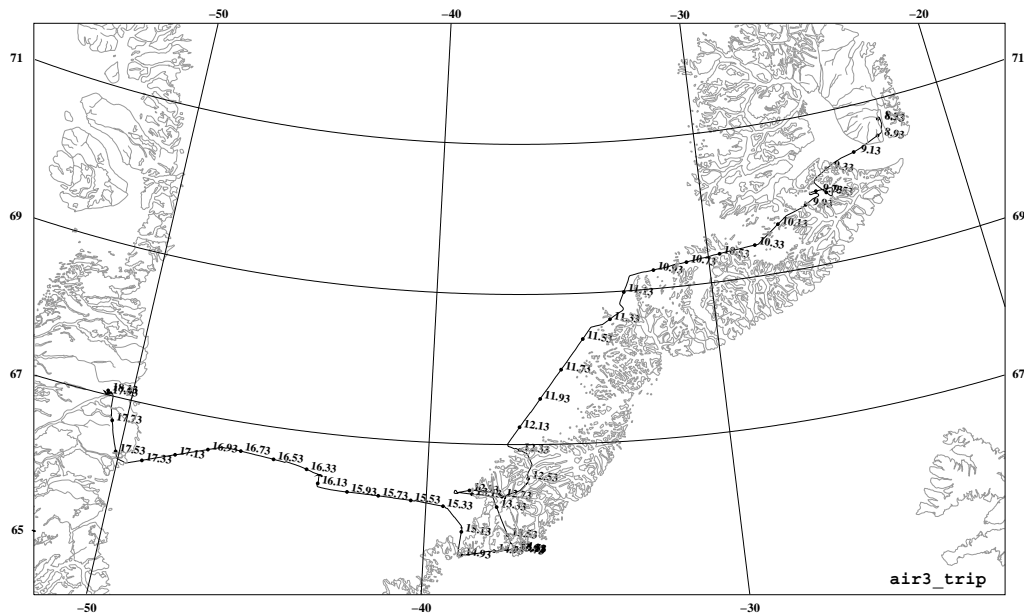
JD 136 – 2006, May 16th
GPS week 1375 (day 2)

09:53:00	new scanner file	12:36:00	new scanner file
09:55	take-off Nord	13:05	Nunatak zone
10:10	rwyt overflight		few laser returns
10:30	over flade isblink	13:43:00	new scanner file
	drilling camp	14:00	wpt. J2
10:07:30	new scanner file		flight down
	stopped short due to high topo		Waltershausen Glacier
11:21:30	new scanner file	14:33	fjord sea ice
	inland ice edge		stop logging, climb
11:28	wpt. J1	15:42	on ground CNP



JD 137 – 2006, May 17th
GPS week 1375 (day 3)

08:39	new scanner file	13:17	stop scanner after Helheim
08:44	take-off CNP	13:39	on ground KUS
08:52	stop scan	14:31	start scanner
09:14	new scanner file	14:35	airborne KUS
09:27	Geikie ice cap, clouds, ASIRAS only	15:03	fog on ice edge
09:36	stop scanner, too high	15:39	new scanner file
09:57	start logging	16:50	new scanner file
11:10	Kangarlussuaq, wind crevasses	17:28	ice edge, stop scanner
11:16	new scanner file	17:49	new scanner file runway overflight blue building
12:14	new scanner file	18:01	landing SFJ



B Airborne Log of the ASIRAS Operations

JD 111 – 2006 April 21st

GPS week 1371 (day 5)

PC1+PC2 on, ASIRAS on, CPC on
12:08 record on (0), open water
12:09 thin ice
12:10 open water
12:13 thin ice, floes
12:16 record off, descend due to snow
12:17 record on (1)
12:21 open water
12:23 record off
Sine gets ill
Harald takes over ASIRAS
Lars takes over DNSC system
13:40 Sine is better. Lars returns to ASIRAS
13:43 record on, sea ice with snow and some leads
13:51 record off
14:00 record on, some large leads
14:07 record off
14:15 record on, thick sea ice with snow
14:17 ice thickness decreases, bigger leads
14:22 record off
14:34 record on, open water scattered sea ice
12:40 record off
12:40 PC1+PC2 off, ASIRAS off, CPC off

JD 113 – 2006, April 23rd

GPS week 1372 (day 0)

21:54 take off
22:00 PC1+PC2 on, ASIRAS on, CPC on
22:37 record on (00)
22:43 record off
23:04 record on (01), 1. crossline
23:10 record off
23:26 record on (02), 73 25'
23:34 record off, 73 40'
23:50 record on (03), rugged ice
23:53 event (snow filled cracks)
23:54 event (bare ice)
23:55 record off
00:00 record on (04), up the ice
00:04 record off
00:18 record on (05), record off, operator error
00:34 record on (06), 73 40'
00:42 record off, 73 25'
00:53 record on (07), 2. crossline
01:04 record off
01:10 PC1+PC2 off, ASIRAS off, CPC off
01:54 on ground

JD 114 – 2006, April 24th
GPS week 1372 (day 1)

17:26 take off
17:27 PC1+PC2 on, ASIRAS on, CPC on
17:56 record on (00), start of seaice line
17:58 event (lead)
18:06 record off
18:06 record on (01)
18:16 record off
18:16 record on (02)
18:36 record off
18:36 record on (03)
18:59 record off, end of seaice line
20:51 record on (04), Disko Island
20:55 record off
20:58 record on (05)
21:02 record off
21:10 PC1+PC2 off, ASIRAS off, CPC off
22:11 on ground

JD 115 – 2006, April 25th**GPS week 1372 (day 2)**

11:59	take off	15:35	T41 → T43
12:07	PC1+PC2 on, ASIRAS on, CPC on	15:42	record off
13:04	record on (00), X-line Illuliat	16:10	IRF calibration
13:11	record off	17:14	record on (13), Illuliat
13:23	record on (01), EGIG X2 → T01	17:43	record off, PC2 disk full
13:37	record off	17:43	switch to PC1
13:38	record on (02), EGIG T01 → T03	17:43	record on (14)
13:41	record off	17:46	record off
13:41	record on (03), EGIG T03 → T05	17:55	PC1+PC2 off, ASIRAS off, CPC off
13:46	event, T05 camp	18:49	on ground
13:49	record off		
13:49	record on (04), EGIG T05 → T08		
13:54	record off		
13:54	record on (05), EGIG T08 → T12		
14:07	event, T12 camp		
14:08	record off		
14:12	record on (06), EGIG T12		
14:14	event, T12 camp		
14:15	record off		
14:17	record on (07), EGIG T12		
14:18	event, T12 camp		
14:20	record off		
14:20	record on (08), EGIG T12 → T17		
14:33	record off		
14:33	record on (09), EGIG T17 → T21		
14:42	record off		
14:44	switch to PC2		
14:44	record on (10), EGIG T21 → T25		
14:54	record off		
14:54	record on (11), EGIG T25 → T31		
15:07	record off		
15:07	record on (12), EGIG T31 → T35		

JD 116 – 2006, April 26th
GPS week 1372 (day 3)

12:58 take off
13:01 PC1+PC2 on, ASIRAS on, CPC on
14:48 PC1+PC2 off, ASIRAS off, CPC off
14:57 on ground
16:07 take off
16:10 PC1+PC2 on, ASIRAS on, CPC on
16:37 record on (00)
16:56 event, nothing
16:57 event, helicopter
17:03 record off, transit to T03
18:58 record on (01), T03->T05
19:02 event, nothing
19:03 event, T05 camp
19:04 record off
19:04 record on (02)
19:08 event, T05 camp
19:10 record off
19:10 record on (03)
19:17 event, T05 camp
19:22 record off
19:23 PC1+PC2 off, ASIRAS off, CPC off
19:25 on ground at T12 to pick up UK team
19:45 take off
19:50 PC1+PC2 on, ASIRAS on, CPC on
20:04 IRF calibration
20:16 record on (04), X-line Illulisat
20:29 record off
20:36 PC1+PC2 off, ASIRAS off, CPC off
21:42 on ground

JD 119 – 2006, April 29th**GPS week 1372 (day 6)**

11:12 take off
11:16 PC1+PC2 on, ASIRAS on, CPC on
12:19 record on (00)
12:32 record off
12:32 record on (01)
12:45 record off
12:45 record on (02)
13:04 passed UK team
13:11 record off
13:11 record on (03)
13:25 record off
13:26 PC1+PC2 off, ASIRAS off, CPC off
changed to pressure disks
13:30 PC1+PC2 on, ASIRAS on, CPC on
13:31 record on (04)
13:52 record off
13:52 record on (05)
14:14 record off
14:14 record on (06)
14:36 record off
14:36 record on (07)
14:53 record off
14:53 switch to PC2
14:54 record on (08)
14:59 record off, PC state bad
14:59 record on (09)
15:05 record off, PC state bad
15:13 record on (10)
15:45 record off
15:47 IRF calibration
15:50 PC1+PC2 off, ASIRAS off, CPC off
16:54 on ground, Constable Pynt
17:48 take off
18:40 PC1+PC2 on, ASIRAS on, CPC on
19:45 record on (11), 60MHz
19:46 record off, line aborted due to bad weather
19:48 PC1+PC2 off, ASIRAS off, CPC off
20:53 on ground

JD 120 – 2006, April 30th
GPS week 1373 (day 0)

08:27 take off
08:32 PC1+PC2 on, ASIRAS on, CPC on
08:47 record on (00)
09:11 record off
09:11 PC1+PC2 off, ASIRAS off, CPC off
change disks on PC1
09:14 PC1+PC2 on, ASIRAS on, CPC on
09:15 record on (01)
09:38 record off
09:38 record on (02)
09:46 record off
10:08 record on (03), InSAR mode
10:24 record off
10:24 record on (04), EInSAR mode
10:35 record off
10:35 IRF calibration
11:17 PC1+PC2 off, ASIRAS off, CPC off
11:58 on ground

JD 121 – 2006 May 1st
GPS week 1373 (day 1)

10:18 take off
10:22 PC1+PC2 on, ASIRAS on, CPC on
11:18 record on (00)
11:28 event, camp
record off
record on (01)
12:11 record off
12:11 record on (02)
12:15 event, black thing on ice
12:16 event, camp
12:21 record off
12:30 record on (03)
12:33 event, reflector position
12:48 record off
12:54 record on (04)
13:04 event, reflector position
13:08 event, reflector position
13:09 record off
13:17 record on (05)
13:24 event, camp
13:26 event, reflector position
13:35 record off
13:35 record on (06)
13:51 record off
13:51 record on (07)
13:55 record off
14:01 record on (08)
14:35 record off
14:35 record on (09)
14:44 record off
14:44 record on (10), 40 MHz
14:45 record off
14:47 IRF calibration
14:51 PC1+PC2 off, ASIRAS off, CPC off
15:38 on ground

JD 122 – 2006, May 2nd
GPS week 1373 (day 2)

08:38 Take off (LYR)
08:48 ASIRAS turn on - OK
08:59 Record on
09:05 Record off
10:16 Record on 720 m 60 MHz
10:25 Record off
10:26 Record on 240 m 60 MHz
10:31 Record off
10:34 Record on 720 m 60 MHz
10:39 Record off
10:40 Record on 240 m 20 MHz
11:01 Record off
11:02 Record on
11:26 Record off
11:27 ASIRAS off
11:50 On ground (St. Nord)
13:14 Take off (St. Nord)
13:21 System on
14:19 Record on 240 m 20 MHz
14:40 Record off
14:41 Record on
15:03 Record off
15:04 Record on
15:24 Record off
15:25 Record on
15:40 Record off
15:41 Record on 480 m 40 MHz
15:46 Record off PC1 full
15:48 Record on PC2 480 m 40 MHz
15:57 Record off
15:58 Record on 720 m 60 MHz
16:08 Record off
16:10 Record on 240 m 20 MHz
16:14 Record off End of Line
17:46 ASIRAS shut down
18:18 On ground (St. Nord)

JD 123 – 2006, May 3rd
GPS week 1373 (day 3)

10:47 Take off (NRD)
Minus altimeter
PC1
12:01 Record on 240 m 20 MHz
12:06 Record off due to error on "DATA PC REC"
Record on
12:07 Record off due to error on "DATA PC REC"
Record on
12:08 Record off due to error on "DATA PC REC"
Switch to PC2
12:09 Record on
12:30 Record off (25%)
Record on
12:55 Record off - End of Line (55%)
16:06 On ground (TAB)

JD 125 – 2006, May 5th
GPS week 1373 (day 5)

13:00 take off
13:10 PC1+PC2 on, ASIRAS on, CPC on
13:26 record on (00)
13:44 record off
13:44 record on (01)
14:10 record off
14:40 record on (02)
14:45 event, reflector position
14:54 record off
14:57 record on (03)
15:08 event, reflector position
15:11 record off
15:22 record on (04)
15:30 event, reflector position
15:36 record off
15:46 IRF calibration
15:55 PC1+PC2 off, ASIRAS off, CPC off
17:28 on ground

JD 128 – 2006, May 8th
GPS week 1374 (day 1)

14:24 Taxi
14:30 Take off
16:32 System start up
17:09 Record on 720m 60MHz
17:12 Record off
17:14 Record on 240m 20MHz
17:25 Record off
17:45 Record on 240m 20MHz
17:57 C3
18:12 C4
18:14 Record off
18:30 System shut down
18:50 On ground YLT

JD 129 – 2006, May 9th
GPS week 1374 (day 2)

16:00 Taxi
16:04 Take off YLT
16:07 System on
16:12 Record on _00 (240m, 20MHz)
16:35 Record off (25%)
Record on _01
16:58 Record off (52%)
17:13 WP D4
17:15 Record on _02
17:34 Record off (75%)
Record on _03
17:55 Record off, PC1 full
18:16 WP D3
18:18 Record on _04, PC2
18:40 Record off (25%)
Record on _05
19:03 Record off (52%)
19:15 WP H3
19:18 Record on _06
19:48 Record off (86%)
19:57 WP H2
19:58 Record on _07
20:09 Record off, PC2 full
20:10 IRF Calibration
20:12 System shut down
20:48 Overflight runway (1,000ft)
20:51 On Ground

JD 130 – 2006, May 10th

GPS week 1374 (day 3)

17:51	Taxi	19:08	RFY (E/W), event 1
17:52	Take off YLT	19:13	RFY (N/S)
17:55	System on	19:15	RMY (N/S)
17:57	Record on _00, 1st loop (240m, 20MHz) RMY	19:16	Record off Climb to 25,000 ft
18:06	RFY	19:20	Record on _09 (720m, 60MHz) RMY (W/E)
18:10	Record off Record on _01, 2nd loop Record off _01, no reflector	19:24:48	RFY (E/W)
18:15	Record on _02, Line MY	19:25	Record off
18:16	RMY	19:28	Record on _10
18:19	Record off	19:30	RFY (N/S), event 1
18:23	Record on _03, Line FY	19:32	Record off, descending 15,000 ft
18:24	RFY	19:35	Record on _11 (420m, 40MHz)
18:27	Record off	19:36	Overflight runway
18:29	Record on _04, 3rd loop	19:37	Record off, descending 10,000 ft
18:31	RMY, event 1	19:39	Record on _12 (240m, 20MHz)
18:34	RFY (E/W), event 2 Record off	19:40	Overflight runway Record off
18:55	Record on _05	19:44	On ground
18:40	RFY (N/S), event 1		
18:42	RMY		
18:43	Record off		
18:45	Record on _06, 4th loop RMY (W/E)		
18:50:39	RFY (E/W), event 1		
18:51	Record off		
18:54	Record on _07		
18:57	RFY (N/S)		
18:59	RMY (N/S)		
19:00	Record off Climb to 15,000 ft		
19:02	Record on _08 (480m, 40MHz) RMY		

JD 131 – 2006, May 11th**GPS week 1374 (day 4)**

15:30 Engine on
15:42 Taxi
15:44 Take off YLT
15:47 System on
16:13 G0
Record on _00 (240m, 20MHz)
16:32 Record off (22%)
Record on _01
16:33 Helicopter EM-bird
16:56 Record off (50%)
Record on _02
17:21 Record off (77%)
Record on _03
17:39 Record off PC1 full (100%)
17:41 Record on PC2 _04
17:55 Descending to 270m due to low clouds
18:08 Record off (30%)
Record on _05
18:11 G3
18:24 Record off (50%)
Record on _06
18:46 Record off (75%)
Record on _07
19:08 Record off PC2 (100%)
System shutdown
climb to 320m (1,000 ft)
change HDD PC1
19:18 Record on _08 PC1
19:41 Record off (25%)
Record on _09
20:02 Record off
IRF calibration
20:05 System shut down
20:08 On ground YLT

JD 132 – 2006, May 12th
GPS week 1374 (day 5)

14:29	Engine on	18:05	Record off (80%)
14:45	Taxi on	18:09	E2
14:48	Take off YLT on	18:20	Record on _09
14:49	System on on	18:28	Record off (PC2 100%)
14:52	Record on _00 on (240m, 20MHz) on	18:29	IRF calibration
14:57	Record off (6%) on	18:32	System shut down Change HDD PC1
15:03	Record on _01 on B1 on	18:47	Record on _10
15:20	Record off (25%) on Record on _02 on	19:09	Record off (25%) Record on _11
15:26	Decend to 200m, low clouds on	19:11	E3
15:42	Record off (51%) on Record on _03 on	19:18	Record off (36%)
16:03	Record off (75%) on Record on _04 on	19:21	IRF calibration
16:24	Record off (PC1 100%) on Change to PC2 on	19:27	System shut down
16:26	Record on _05 on	19:29	On ground
16:49	Record off (27%) on Record on _06 on		
17:09	Record off (50%) on		
17:31	E1a on		
17:34	Record on _07 on		
17:54	E2 on Record off (73%) on		
17:59	Record on _08 on "Odaq" ø ?? on		

JD 136 – 2006, May 16th
GPS week 1375 (day 2)

09:39 Engine on
09:51 Taxi
09:55 Take off NRD
09:59 System on
10:02 Record on _00 (240m, 20MHz)
Measure line North of NRD
10:07 Overflight runway NRD
10:09 Record off (8%)
10:13 Fl. Isblink
Record on _01 (480m, 40MHz)
10:14 Record off (9%)
10:15 Record on _02 (240m, 20MHz)
10:30:45 Icecamp
10:34 Record off (31%)
11:23 Record on _03
11:28 J1
11:39 Record off (50%)
Record on _04
12:01 Record off (75%)
Record on _05
12:24 Record off (PC1 100%)
13:49 Record on _06
13:59 WH1
14:14 WH2
Record off (29%)
Record on _07
14:15 Low clouds
14:26 Record off
14:28 IRF calibration
14:29 System shut down
15:42 On ground CNP

JD 137 – 2006, May 17th
GPS week 1375 (day 3)

08:36	Engine on	13:19	Record on _09
08:40	Taxi	13:20	Record off (16%)
08:45	Take off NRD		IRF Calibration
	System on	13:21	System shut down
09:28	Record on _00 (1200m, 80MHz)	13:38	On ground KUS
	Geikie, high altitude due to clouds	14:29	Engine on
09:33	Record off (7%)	14:30	Taxi
09:34	Record on _01	14:34	Take off KUS
09:47	L4		System on
	Record off (22%)		log files 10-12, test
11:01	Record on _02 (240m, 20MHz)	15:26	Record on _13
11:02	L7, Kangerdlussuaq		(240m, 20MHz)
11:13	Record off (34%), survey stopped	15:35	Record off (10%)
	due to strong winds		Record on _14
11:16	Record on _03 (720m, 60MHz)	15:45	Record off (20%)
11:18	Record off	15:58	Record on _15
	Record on _04 (480m, 40MHz)	16:06	SN4
11:25	Record off	16:24	Record off (50%)
12:12	Record on _05 (240m, 20MHz)	16:49	Record on _16
12:14	MG1	17:09	Record off (72%)
12:32	Record off (77%)	17:54	Record on _17
12:46	Record on _06	17:55	Overflight runway
13:00	Record off (93%)	17:58	Overflight building
13:02	Record on PC2 _07	17:59	IRF calibration
13:15	Record off (15%)	18:01	On ground SFJ
13:17	Record on _08, Fjord (720m, 60MHz)		
	Record off		

