Report
on the flight missions of the research aircraft Falcon in the area north of Spitsbergen in April 2003 as part of the Arctic Boundary Layer and Sea Ice Interaction Study 2003 (ABSIS)

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1. Introduction

The **A**rctic **B**oundary Layer and **S**ea Ice **I**nteraction **S**tudy (ABSIS) 2003 was a field experiment which took place in the area north of Spitsbergen (Figure 1) during April 2003. The main focus of the study was on the investigation of the Arctic inversion and the processes which determine the main inversion properties such as height, depth and strength. The investigation included measurements of the turbulent fluxes, the radiation fluxes, the cloud coverage and the sea-ice conditions. The synoptic situation which sets the frame for the large-scale conditions such as the geostrophic wind, thermal wind and mean vertical motion was analysed in great detail.

To cover the range of scales of physical processes involved in the formation of inversions various measurement platforms were employed. These were:

- two ice-breaking research vessels, the German Polarstern and the Finnish Aranda,
- the German research aircraft Falcon,
- and eleven autonomous ice buoys.

In addition, satellite imagery and operational weather model analyses were used.

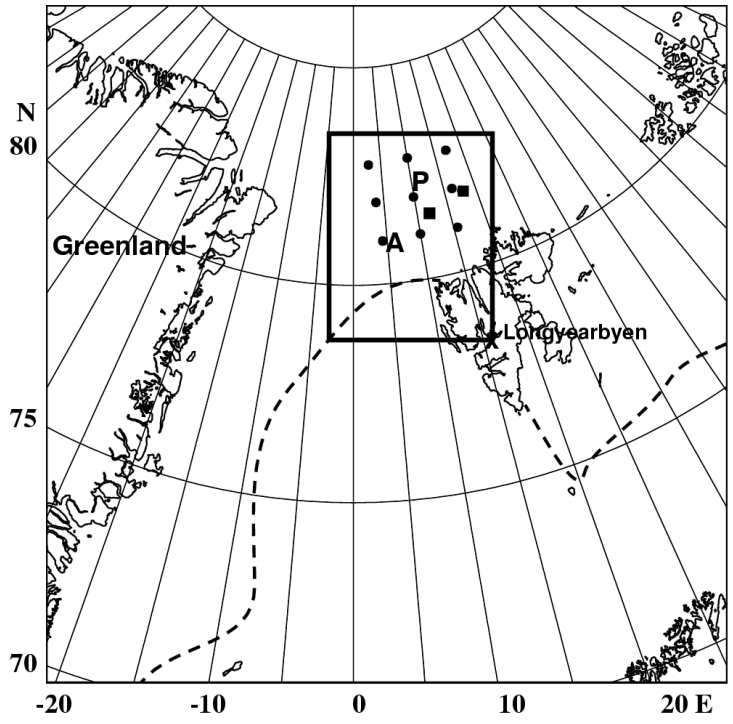


Figure 1: Experimental area of ABSIS 2003. The frame marks the area of Falcon aircraft flight missions, A and P is Aranda and Polarstern, respectively. Dots mark drift buoys which have position and pressure instrumentation only, and squares mark buoys which have additional wind, temperature and moisture sensors.

The ice buoys were deployed in an area of initially 200 km x 200 km. Research vessels Polarstern and Aranda were placed in the northern and southern part of the area, respectively, and drifted, like the buoys, with the sea ice field. The research aircraft Falcon flew in total eight missions within the experimental area. The flight paths included the positions of the research vessels where continuous ship-based meteorological measurements and regular three-hourly radiosonde measurements were taken. In addition, a station on the ice floe near Polarstern was installed for surface-layer meteorological measurements.

In this report, only the measurements of the research aircraft Falcon-20 are described and summarized. The Falcon aircraft (Figure 2) is owned and operated by the Deutsches Zentrum für Luft- und Raumfahrt (DLR).

Figure 2: The FALCON-20 aircraft on the airfield of Longyearbyen.

The Falcon-20 is a twin engine jet aircraft with a wingspan of about 16 m and a length of about 17 m. The typical flight speed during low-level operations in the boundary layer is about 100 m/s and about 250 m/s during high-level transit flights. The maximum operation height is 41000 feet and the operational endurance at low levels is approximately 5 hours.

The Falcon was equipped with two temperature sensors, three humidity sensors, sensors for static and dynamic pressure, and a gust probe system (5-hole pressure sonde) to measure the three-dimensional wind vector in connection with an inertial reference system. Furthermore, it was equipped with a GPS navigation system, a radio altimeter, a surface temperature infrared radiometer, upward and downward facing pyranometers and pyrgeometers to measure short- and longwave radiation fluxes from above and below. A forward facing video camera was fixed at the cockpit window and recorded the experimental conditions during the entire flight mission. The Falcon instrumentation and the specifications of accuracies and sampling frequencies of all sensors are listed in Table 1. Apart from the relative wind measured at a 1.8 m long carbon fibre boom in the undisturbed flow ahead of the aircraft, all parameters were measured at the fuselage of the plane.

Parameter	Accuracy	Resolution	Sampling Rate (Hertz)	Sampling Dist. (m)	Sensor type, hardware, manufacturer
Wind					
u,v	± 1.0 m/s	± 0.02 m/s	100	1	5-Hole Probe (Rosemount 858J) and Honeywell Inertial
w	± 0.5 m/s	± 0.02 m/s	100	1	Reference System 1761
Temperature					
T	± 0.5 K	± 0.006 K	100	1	Pt-100 (Rosemount 102 BM/BV)
T	± 0.5 K	± 0.006 K	10	10	Pt-500 (Rosemount 102 AU2AG)
Humidity					
ρ_v	± 0.5 g/m^3	± 0.002 g/m^3	100	1	Lyman-α Humidometer (El. Res. Corp. BLR) Water Vapour Density
RH	± 2 %	± 0.007 %	10	10	Humicap Vaisala HMP 11, Relative Humidity
T_D	± 1 K	± 0.006 K	10	10	Dew Point Sensor (General Eastern 1011B)
Pressure					
p	± 1 hPa	± 0.07 hPa	100	1	Pitot tube (Rosemount)
Altitude					
z	± 5 m	± 0.5 m	10	10	Radio Altimeter
Position					
Lat., Long.	~ 400 m/h	± 0.0003´´	10	10	Honeywell Inertial Reference System 1761
					GPS
Lat., Long.	± 10 m	± 1 m	10	10	
Surface Temp.					
T_S	± 1.0 K	± 0.01 K	10	10	Infrared Radiation Thermometer Heimann KT-19
Radiation					
S↓, S↑	± 4 W/m^2	± 0.1 W/m^2	10	10	Pyranometer (Eppley PSR)
L↓, L↑	± 10 W/m^2	± 0.2 W/m^2	10	10	Pyranometer (Eppley PIR)
Cloud Particles					
1D-Probe	± 0.2 %	± 1	50	2	PMS FSSP-100 modified (2-49 µm)
1D-Probe	± 0.2 %	± 1	50	2	PMS FSSP-100 ER modified (5-95 µm)
2D-Probe	± 0.2 %	± 1	50	2	PMS OAP 2D2-C modified (25-800µm)
Precipitation Particles					
2D-Probe	± 0.2 %	± 1	50	2	PMS OAP 2D2-P modif. (200-6400µm) (PMS= Particle Measuring Systems, FSSP= Forward Scattering Spectrometer Probe, OAP = Optical Array Probe)

Table1: Instrumentation of the research aircraft Falcon-20.

The Falcon flight missions started and ended on the airfield in Longyearbyen on Spitsbergen. The times of the eight flight missions together with the weather conditions encountered in the experimental area are given in Table 2.

Flight No.	Day in 2003	Time UTC	Clouds	Wind Direct.	Wind Speed m/s	Temp. in °C	Synoptic situation
1	04 April	10.09-13.35	Cloudless	N	8-9	-26/-28	High pressure influence.
2	05 April	10.04-12.23	Cloudless	N/NW	4-6	-24/-28	High pressure influence.
3	07 April	09.09-11.24	Overcast	SW/W	2-6	-15/-22	Behind NE-ward moving low.
4	09 April	10.54-14.05	8/8 in the S, 0/8 in the N	W/NW	8-10	-21/-23	Behind E-ward moving low.
5	10 April	11.05-13.14	Overcast	S/SE	2-4	-20/-21	Low pressure zone over Fram Strait.
6	13 April	15.11-17.44	8/8 in the S, 2/8 in the N	S/E	5-10	0/-5	Approaching low from Fram Strait.
7	14 April	09.54-12.56	4/8 in the S, 8/8 in the N	SW/W	8-12	-3/-8	South of E-ward moving low.
8	15 April	10.00-13.05	8/8 in the S, 0/8 in the N	SW	4-6	-15/-18	Weak high pressure ridge behind disappearing low.

Table 2: Overview over the eight Falcon flight missions: days, times (start-landing), cloud coverage, wind and temperature in the surface layer at about 20 m height, and synoptic situation during the flight.

A typical Falcon flight mission consisted of a sequence of vertical profiles to measure the horizontal distribution of the vertical structure of the boundary layer and inversion layer within a mesoscale area of 100 to 200 km diameter. The profile flights were interrupted by horizontal flight legs of about 20 km length at low levels (50 to 100 feet altitude) to measure the turbulent and radiation fluxes near the snow/ice/water surface. To measure the vertical distribution of the turbulent and radiation fluxes with height, vertical stacks of horizontal legs in the boundary and inversion layer were flown. These stacks were placed near the RVs Aranda and Polarstern to use the additional information from the ship´s measurements and the radiosondes. A sketch of a typical stack is presented in Figure 3.

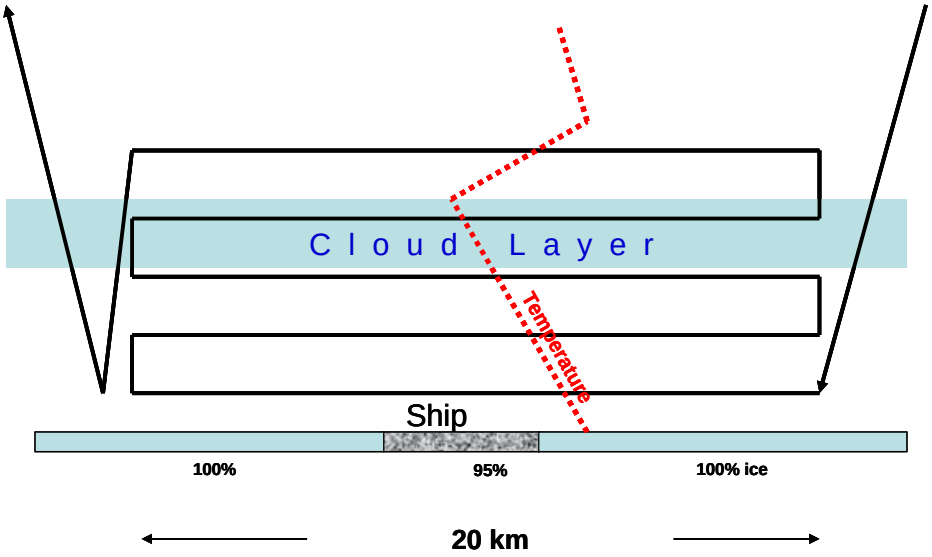


Figure 3: Sketch of a vertical stack in the vicinity of the research vessel sAranda and Polarstern with 5 horizontal legs in the boundary and inversion layer and two accompanying lateral vertical profiles.

The following institutions and persons were involved in the Falcon aircraft flight operations:

- University of Hamburg:
  Burghard Brümmer, Gerd Müller. Christian Kreutzmann
- Deutsches Zentrum für Luft- und Raumfahrt (DLR), Oberpfaffenhofen:
  Roland Welser, D. Günther, Wolfgang Meier, D. Wolf, Volker Dreiling
- Norsk Polarinstitutt, Longyearbyen,
- Det Norske Meteorologiske Institutt (Met.No), Longyearbyen,
- Longyearbyen Airport and Tower Team.

Critical view on the data after a Falcon flight in the Norsk Polarinstitutt office in Longyearbyen: B. Brümmer, C. Kreutzmann, V. Dreiling and W. Meier (from left).

In the Norsk Polarinstitutt office room: B. Brümmer (left), G. Müller.

ABSIS participants visit RV Aranda in the harbour in Longyearbyen at the beginning of the ABSIS experiment.

Before the start of a Falcon flight mission from Longyearbyen airport.

Snow storm in Longyearbyen: The Falcon aircraft team is accomodated in house no.2 in Nybyen. Any aircraft mission is cancelled.

The storm is over: On the way to the next aircraft planning meeting.

2. Timetable of Falcon flight missions and aircraft scientists´ notes

Falcon Flight No. 1

Date: 4 April 2003 10.09-13.35 UTC
Area: 78.2-81.4°N, 01°W-17°E
Mission: Boundary layer structure and turbulent fluxes over sea ice north of Spitsbergen during northerly air flow with temperatures below -25°C. Two vertical stacks of horizontal legs are flown at RV Polarstern and Aranda.

Time (UTC)	Pattern P = Profile H = Hor. Leg	Height (feet (') (1000'=305m)	Heading (°)	Remarks
10.09.13		Long.-15000		Take-off at Longyearbyen. QNH=1006 hPa, T=-15 °C.
10.25.30-10.34.47	Transit	15000	340	8/8 Cirrus over Spitsbergen. Cirrus ends over the ice edge. Sunny in experimental area.
10.34.47-10.42.41	P01	15000-500	340	Sunny. 85% ice, 30% flat new ice. Some cracks and openings with sea smoke. Turbulence begins below 600'.
10.42.41-10.46.22	H00	500	340	Run to calibrate Johnson-Williams LWC. Much sea smoke. After 10.46 UTC 100% ice with high ridges.
10.45.54-10.47.50	P01a	500-100	340	100% ice. QNH=1013 hPa, T=-26°C.
10.47.50-10.50.35	P02	100-5000	340	Turbulent until 600'. 10.48.36 many open areas with 90% ice coverage.
10.50.35-10.53.18	P03	5000-100	340	Couds 0/8. Only sea smoke over open ice areas.
!0.53.18-10.56.24	H01	100	340	100% ice. Many ridges. Rather turbulent. T=-27°C. Wind FF=17 kn, DD=5°.
10.26.24-10.59.00	P04	100-5000	340	100% ice. QNH=1017 hPa. Turbulence until 700/800'. The two leads on the NOAA satellite image are well discernible from 5000' height.
10.59.00-11.02.00	P05	5000-100	340	100% ice. Clouds 0/8.
11.02.26-11.04.26	P06	100-4000	340	100% ice. Clouds 0/8.
11.04.30-11.06.48	P07	4000-100	340	QNH=1019 hPa.
11.06.48-11.11.58	H02	100	270	Stack: 1.level. After 15 s passing RV Polarstern (at 81°21´N, 10°21´E) on the left side in a lead with many sea smoke. Otherwise 100% ice and 0/8 clouds.
11.11.58-11.14.10	P08	100-4000	270	
11.14.10-11.16.50	P09	4000-200	Turn/ 90	100% ice. Clouds 0/8.
11.26.50-11.22.33	H03	200	90	100% ice. Clouds 0/8.
11.24.57-11.28.45	H04	300	270	Stack: 2.level. 100% ice and 0/8 clouds. Except near RV Polarstern with sea smoke in the lead. Polarstern on right side at 81°20´N, 10°21´E passed at 11.21.30 UTC.
11.31.54-11.35.00	H05	400	90	Stack: 3.level. 300' is still in PBL. 11.25.45 UTC Polarstern on left side. Falcon is above sea smoke. 11.27.00 UTC small opening in ice. QNH=1019 hPa.
11.36.36-11.41.24	H06	500	270	Stack: 4.level. 100% ice. Clouds 0/8. Intermittent turbulence at 400'; mostly within turbulence. 11.34.17 UTC at Polarstern in turbulence. During the following climb turn: turbulence ends at 550´.
11.43.12-11.47.36	H07 / P09a	1000-20	90	Stack: 5.level. Little turbulence only occasionally.
11.49.32-11.55.42	P10	200-10000	240	Stack: 6.level. Diagonal profile run with 250'/min descent rate as a test run for a turbulence profile. Distinct turbulence below 400'. Crossing the sea smoke over the lead near Polarstern. Sea smoke extends up to the ship´s mast.
11.55.42-12.01.11	P11	10000-100	240	100% ice.Clouds 0/8. Profile towards RV Aranda.
				2 photos from 10000' altitude: towards 14 h: large polynia (discernible on

12.01.11-12.04.08	H08	100	240	NOAA image) with much sea smoke; towards 10 h: sea smoke in the same polynia. Overall 80% ice. At many places freshly frozen ice. Turbulence below 700'. At 100´: T=-26°C, FF=21 kn, DD=17°.
12.04.08-12.07.00	P12	100-5000	240	100% ice. At first flat ice. Since 12.02 UTC older ice with many ridges. At 12.03.50 UTC new ice for a short distance.
12.07.00-12.09.50	P13	5000-200	240	100% ice. Clouds 0/8. Snow-drift stripes. Turbulence ends at 800'.
12.09.50-12.13.40	H09	200	240	Profile ends over large polynia (visible in NOAA image).
12.14.00-12.16.27	P14	100-5000	240	Run over large open polynia without any ice and with breaking waves. At 200' in dense sea smoke clouds with partly no sun visible. 12.12.30 ice below, but still clouds above. 12.13.00 clouds end, but still hazy with 100% ice below.
12.16.27-12.19.15	P15	5000-100	240	100% ice. Sunny. Partly haze stripes.
12.19.18-12.21.58	P16	100-5000	240	Profile is over large open polynia (visible in NOAA image).
12.21.58- 12.24.34	P17	5000-100	240	Very hazy.
12.25.39-12.28.45	H10	100	270	Inversion base at 1200'. Cloud base at 700´. T=-27°C. QNH=1022 hPa.
12.28.45-12.30.28	P18	100-2500	270	Stack: 1.level. Run begins ahead of RV Aranda (79°55´N, 00°35.6´E). Variable ice conditions (open, ice, ridges). Always turbulent.
12.30.28-12.32.12	P19	2500-400	Turn / 90	100% ice. Clouds 0-1/8. Inversion base 1200'.
12.32.27-12.36.10	H11	400	90	
12.43.36-12.46.00	H12	800	270	Stack: 2.level. In PBL. Sunny,but hazy. 100% ice in western part of run. Several open areas in the east near RV Aranda. 12.35.30 Aranda on right side.
12.48.36-12.52.42	H13	1100	90	Stack: 3.level. In PBL with turbulence. Many open areas around Aranda. Ice is more closed in the west.
12.52.42-12.54.18		1100-100	Turn	Stack: 4.level. At top of PBL in/out with intermittent turbulence. At end of run passing over Aranda.
12.54.18-13.03.30	P20	200-15000	120	Return to RV Aranda. Low-level flight over the met station deployed on ice closely to the east of Aranda.
13.03.30-13.20.00?	Transit	15000	120	Profile towards Longyearbyen. Sunny, but very hazy. Mostly closed ice.
13.35.00				Transit to Longyearbyen. Ice edge at 79°31´N, 04°09´E. Beautiful cloud streets over the open West-Spitsbergen Current. Landing in Longyearbyen.

Summary/Commentary:

The mission took place under cloudless conditions over sea ice in a moderate (8-9 m/s) northerly air flow with temperatures around -27°C. Sea ice coverage varied from 100% (most of the area) to large open polynias. The boundary layer structure and the Arctic inversion were probed by 20 vertical profiles (P) and 13 horizontal runs (H). A vertical stack with 5 H runs (100, 200, 300, 400, 500') was flown across a lead and close to RV Polarstern. The PBL at this stack was about 600´ deep. A second vertical stack with 4 H runs (100, 400, 800, 1100') was flown close to RV Aranda with some open water areas around. The PBL at this stack was 1200' deep. During the connecting flight from Polarstern to Aranda a large open polynia was crossed. Here, the sea smoke which was generally present over all openings in the ice developed to shallow clouds which even obscured the sun. These clouds existed even for some distance over the ice downstream of the polynia. The leads at Polarstern and Aranda as well as the polynias between them are clearly visible in the NOAA satellite images.

Falcon Flight No. 2

Date: 5 April 2003 10.04-12.23UTC
Area: 80.3-81.6°N, 07-15°E
Mission: Horizontal distribution of the Arctic boundary layer and capping inversion in a 120 km x 120 km box over sea ice north of Spitsbergen within a weak cloud-free north-northwesterly air flow with temperatures below -25°C.

Time (UTC)	Pattern P = Profile H = Hor. Leg	Height (feet ('))	Heading (°)	Remarks
10.04.20		Long.-18000		Take-off at Longyearbyen. QNH=1022 hPa.
10.11-10.19	Transit	18000	0	Some Cirrus over N-Spitsbergen.
10.18.57-10.30.34	P01	18000-200	0	P01 begins at 79°37´N, 15°03´E. Cloudless over the ice, but hazy. Thin haze layers at 5000' and 2000'. Thin cloud/haze layer at 1500' and 900'. QNH=1013 hPa.
10.30.34-10.31.40	H01	200	0	High portion of open water. Run not lower than 200' because of sea smoke.
10.31.40-10.33.47	P02	200-4000	0	
10.33.52-10.36.20	P03	4000-100	0	P03 ends over 100% ice and good horizontal visibility.
10.36.20-10.38.22	H02	100	0	100% ice. Cloudless. At 10.37 UTC trail of sea smoke visible towards east.
10.38.22-10.40.30	P04	100-3800	0	100% ice. Cloudless. Large north-south lead in the east.
10.40.33-10.42.51	P05	3800-100	0	Several haze layers.
10.42.51-10.44.50	H03	100/50	0	10.43 flat-ice field. 10.44.30 rough-ice field.
10.44.50-10.47.38	P06	50-4500	0	Above haze/sea smoke.
10.47.38-10.51.40	P07	4500-100/70	0	Above 8/8 sea smoke which reaches over the closed ice and originates from an opening in the north. Later crossing the sea smoke trail: 8/8 St, top 1000'. Base 450'. Turbulence at 300'. Cloud base down to 0' over open water areas. Sea ice 80%, many small floes.
10.51.40-10-53.01	H04	100/70	0 ->270	90° turn to the left at the NE corner of the box flight pattern.
10.53.01-10.55.12	P08	100-4000	270	
10.55.15-10.58.17	P09	4000-100	270	Cloud top 1200', cloud base 600'. Many new cracks in ice deck.
10.58.17-11.00.07	H05	100/70	270	10.58.38 sea-smoke place.
11.00.07-11.01.17	P10	100-2000	270	100% ice. Cloudless.
11.01.17-11.02.55	P11	2000-100	270	100% ice. Cloudless.
11.02.55-11.04.12	H06	100	270	100% ice. Cloudless.
11.04.12-11.06.30	P12	100-4000	270	100% ice. Cloudless.
11.06.58-11.09.56	P13	4000-100	270	
11.09.56-11.11.35	H07	60	270	100% ice, rough. Turbulent. QNH=1028 hPa.
11.11.35-11.14.21	P14	60-5000	270	Cloud base 1000', cloud top 1300'. 90° left turn at top of P14.
11.14.47-11.18.25	P15	5000-50	180	Flat haze layer around 1200'.
11.18.25-11.19.44	P16	50-2000	180	100% ice. Cloudless.
11.19.44-11.21.46	P17	2000-50	180	Turbulence below 700'. But stratified in layers with more or less turbulence.
11.21.50-11.23.08	P18	50-2000	180	
11.23.08-11.25.15	P19	2000-50	180	Very strong ice ridges.
11.25.15-11.26.27	P20	50-2000	180	Sea smoke trail in the west. Approaching.

11.26.27-11.28.17	P21	2000-50	180	100% ice. Cloudless.
11.28.20-11.29.28	P22	50-2000	180	Sea smoke in the west: top 1000'.
11.29.28-11.31.38	P23	2000-50	180	Turbulence below 150'. P23 ends over open water area with some new ice spots.
11.31.38-11.32.57	P24	50-2000	180	Top of sea smoke and turbulence 500' (max. 900').
11.32.59-11.35.14	P25	2000-50	180	Cloud top 1300', cloud base 800-600'. 8/8 St/Sc (in streets) although there is 80% ice coverage, however, it is thin ice.
11.35.33-11-37.39	P26	50-4000	180	80% thin ice. 8/8 St. Cloud top 1300'. At top of P26 90° left turn.
11.37.43-11.40.21	P27	4000-50	90	P27 ends over 100% ice and without clouds. Thin ice below lowest heights of the profile. Turbulence below 150'.
11.40.48-11.42.01	P28	50-2000	90	100% ice. Cloudless.
11.42.01-11.43.52	P29	2000-50	90	100% ice. Cloudless.
11.43.56-11.45.10	P30	50-2000	90	P30 runs over an N-S oriented lead.
11.45.10-11.47.05	P31	2000-50	90	Turbulence below 120'.
11.47.05-11.48.17	P32	50-2000	90	Occasional cracks in sea ice with sea smoke looking like curtains.
11.48.17-11.50.04	P33	2000-120	90	Turbulence below 300'.
11.50.04-11.53.37	H08	120/80	90	11.50.50 crack. 11.51.11-11.51.50 over open water area. 11.53.00 crossing sea smoke.
11.53.37-12.00.54	P34	80-12000	90 ->170	Final profile. Afterwards transit to Longyearbyen.
12.23.00				Landing in Longyearbyen.

Summary/Commentary:

The mission took place slightly east of a high-pressure ridge with moderate to weak wind of 4-6 m/s from NNW. The low-level air temperature was -24 to-28°C. The inversion over the closed ice was very shallow (~ 100') or even surface-based. The inversion extended mostly up to 4000´. It was cloudless, except over openings in the ice. Depending on the horizontal size of the openings the sea smoke developed into clouds which had maximum tops at 1300'. Many cracks, leads and openings were found in the SE and SW part of the 120 km x 120 km experimental area. Turbulence was generally weak over ice and only slightly enhanced over openings. The mission gives a good representation of the horizontal variability of the Arctic inversion under variable sea ice conditions.

Falcon Flight No. 3

Date: 7 April 2003 09.08.51-11.24.00 UTC
Area: 80.0-82.3°N, 08-16°E
Mission: Probing the boundary layer and Arctic inversion ahead, within and behind a cold front over sea ice. RV Aranda and Polarstern are incorporated in the flight pattern. The ships are located well behind the cold front (Aranda) and just behind the cold front (Polarstern). The cold front is situated 30 km NE of Polarstern and belongs to a low at about 82.5°N, 16°E.

Time (UTC)	Pattern P = Profile H = Hor. Leg	Height (feet ('))	Heading (°)	Remarks
09.08.51-09.23.31	Startprofile	Long.-19000	330	Take-off at Longyearbyen. QNH=1003 hPa. Cs up to 19000'.
09.23.31-09.28.45	Transit	19000	325	All transit in Ci layer.
09.28.45-09.34.27	P01	19000-100	325	Ci base ~7000'. Cloud scraps around 2800'. 8/8 St: top 1500', base 400'. QNH=100 hPa. 70-90% ice (all small ice floes).
09.34.29-09.37.11	H01	100	325	Stack: 1.level. Wind: 4 kn, 240°. Temperature -17°C. 09.35.40 passing Aranda on west side. Ice in small pieces.
09.37.11-09.38.48	P02	100-3000	325	400' thin Cu scraps (0-1/8). Broken ice floes.
09.38.48-09.41.11	P03	3000-170	325/145	8/8 St in 1200'-2500'. Broken ice floes.
09.41.11-09.44.22	H02	170	145	Stack: 2.level. Below the thin Cu scraps layer. Passing Aranda on west side.
09.44.22-09.45.59	P04	170-3000	145	Through thin Cu scraps layer and 8/8 St layer (1200-2500').
09.45.59-09.47.50	P05	3000-260	325	As for P04.
09.47.51-09.51.07	H03	260	325	Stack: 3.level. Partly in thin Cu scraps layer. Layer is higher towards NW. Passing Aranda on its west side.
09.51.43-09.54.31	P06	100-5000	10	Top of Cu scraps layer 700'. Top of 8/8 Ci layer not reached. Heading towards Polarstern.
09.54.31.09.57.42	P07	5000-40	10	Only Cu scraps, otherwise no clouds within P07. 100% old ice with ridges.
09.57.42-10.00.20	P08	40-5000	10	At 500' haze layer: transparent (residual of Cu scraps layer around Aranda). Top of 8/8 Ci layer not reached.
10.00.20-10.03.22	P09	5000-50	10	10.00.41 photo towards 10° direction: cracks; 95% ice, large ice floe. P09 ends over 100% ice.
10.03.22-10.06.08	P10	50-5000	10	Good horizontal visibility. No clouds in profile. 8/8 Ci layer not reached. Temperature inversion 15K from 500' to 5000' (since profile P06).
10.06.08- 10.09.23	P11	5000-100	10	No clouds in profile. Turbulence below 500'. Wind at 1500': 10 kn, 200°; at 100': 3 kn, 280°. Backing wind: cold air advection behind cold front. Temp. at 100': -22 K.
10.09.23-10.11.56	P12	100-5000	10	It becomes hazier at lower levels. 8/8 Ci layer not reached.
10.11.56- 10.14.45	P13	5000-100	10	St layer 700-1200'.
10.14.45-10.18.46	H04	100	10	Passing Polarstern at 10.17.10 on its east side. T=-23°C. Wind 6-8 kn, 240°. Many ridges, very rough, but also cracks. Polarstern scientists just deploy station on ice for surface layer meteorology including turbulent and radiation fluxes. **QCI pressure inlet of the Five-hole probe is frozen!!**
10.18.56-10.23.50	P14	100-10000	10	QNH=1000 hPa. St layer: base 700', top 1400'. 8/8 Ci layer: base 8400', top not reached. At top of P14 turn towards east. Profile begins on the cold side of the cold front: -22°C, FF=8 kn, DD=230°.
0.23.53-10.29.30	P15	10000-100	90	Ci base 8400'. 8/8 St layer: top 3300', base 600'. 10.28.30 icing at aircraft. Profile ends on the warm side of the cold front: -16°C, FF=12 kn, DD=110°.
10.29.49-10.32.20	P16	100-5000	90	8/8 St layer: base? Top 2600'. Profile on warm side of cold front.
10.32.20-10.36.16	P17	5000-300	90	8/8 St layer: very sharp top 3000'. Base 500-300'. Icing at aircraft in St layer. Turbulence present only below 500'.
10.37.22-10.45.08	P18	300-18000	180	Final profile to transit level. 8/8 St top 2800'. 8/8 Ci: base 11000',top 19000'.

10.45.08-11.10.00 11.24.00	Transit	18000	180	On the warm side of the cold front: -14°C, FF=18 kn, DD=150°. Occasionally between Ci layers. Landing in Longyearbyen.

Summary/Commentary:

The whole mission took place under overcast sky.
During the last night a cyclone L1 (~996 hPa) moved northeastward through Fram Strait passing Aranda and Polarstern. At the beginning of the flight mission L1 was already NE of Polarstern. Ahead of L1 warm air was transported into the area. Residuals of the warm air were found in the NE part of the area with -14°C. On the rear side of L1 again cold air came into the experimental area between Aranda (-17°C) and Polarstern (-22°C) at lower levels. Warm air was still present at higher levels all over the area. A second cyclone L2 (forecast ~970 hPa) approached Fram Strait from SW.
RV Aranda is situated in the cold air, but with weak wind in the transition area between L1 and L2. There, a stack with 3 levels (100, 170, 260') was flown. The PBL was flat with Cu scraps around 400'. Further above, 8/8 stratus clouds occured in several layers. The inversion was 10 K strong.
On the way to RV Polarstern the low-level air became continuously colder, so that the inversion there was 15 K strong (-24 to -9°C) between 30 and 1500 m. NE of Polarstern, we reached the cold front of L1. P14 began on the cold side (-24°C) and P15 to P18 were on the warm side (-14°C). The inversion on the warm side was only 5-7 K strong. Behind the front at Polarstern the wind was from 240° with 3-4 m/s and the 8/8 Stratus layer was elevated (e.g. 700-1200' in P13). Ahead of the front the 8/8 Stratus layer was surface-based (0-3000') with strong aircraft icing.
During the mission it was striking that after the passage of L1 with its strong and turning field (from S to NW) the ice cover was locally very broken. This was especially obvious for the area around Aranda with about 70% ice cover consisting of small floes. Closed ice conditions began north of P07 and were also present at Polarstern. But fresh cracks were also observed there and further towards NE.

Falcon Flight No. 4

Date: 9 April 2003 10.53.45-14.05.00 UTC
Area: 80.0-82.1°N, 07-15°E
Mission: Probing the Arctic boundary layer and inversion over sea ice behind a strong cyclone (~970 hPa). The cyclone moved the night before from W to E over the experimental area. Winds during the mission were predominantly from W to NW with 7-11 m/s. Low-level air temperature was -20 to -24 °C. RV Aranda and Polarstern were incorporated in the flight pattern. At each ship a vertical stack with 6 horizontal runs in the boundary layer was flown.

Time (UTC)	Pattern P = Profile H = Hor. Leg	Height (feet ('))	Heading (°)	Remarks
10.53.45-11.00.00	Startprofile	Long.-18000	325	Take-off at Longyearbyen. QNH=1014 hPa. 6/8 St: base 2500', top 3700'. Cloudless above.
11.00.00-11.13.31	Transit	18000	325	No clouds over Spitsbergen. 8/8 cloud cover over West-Spitsbergen Current.
11.13.31-11.23.52	P01	18000-50	325	7-8/8 Sc/St: top 2100', base 500'. Broken sea ice 40%. Sea smoke over open water.
11.23.52-11.26.32	H01	70	280	Stack (parallel to wind) 1.level. Variable ice concentration. Aranda with its bow towards south is alongside and downwind of a large ice floe. Passing south of Aranda. 8/8 Sc. Very hazy.
11.26.32-11.28.10	P02	70-3000	280	8/8 Sc: base 600', top 2000'. Sc clouds in stripes.
11.28.20-11.30.52	P02a	3000-300	90	Large opening at the W end of the stack.
11.30.52-11.34.32	H02	300	90	Stack: 2.level. Very hazy. Rather turbulent. Snow-drift stripes over ice floes. Passing south of Aranda.
11.36.36-11.41.32	H03	650	280	Stack: 3.level. Below base of 3-5/8 Sc layer. The ice floe at Aranda is very rough. Passing south of Aranda.
11.45.32-11.48.48	H04	1000	90	Stack: 4.level. At cloud base. Cloud top 1700' at W side of the run. Passing south of Aranda.
11.51.36-11.55.19	H05	1500	280	Stack: 5.level. In cloud layer. Sometimes blue sky is visible. 11.54.04 clouds are deeper.
11.57.18-12.00.37	H06	1800	90	Stack: 6.level. At cloud top, mostly in cloud layer. Passing south of Aranda.
12.02.47-12.03.46	H07	50	330	Comparison with Aranda: near-by passage over Sonic mast. Aranda is in a sea smoke trail.
12.03.46-12.06.24	P03	50-5000	5	First of 6 saw-tooth profiles between Aranda and Polarstern. 3-5/8 Sc.
12.06.27-12.09.53	P04	5000-50	5	4/8 Sc: top 1900', base 1000'. P04 is through a cloud. 80-90% ice with large open area. P04 ends immediately behind the open area.
12.09.53-12.12.29	P05	50-5000	5	2-4/8 Sc: base 1200'. From 1600' to 1900' (cloud top) in clouds.
12.12.29-12.16.13	P06	5000-50	5	90% ice. Many new openings, only thin refrozen.
12.16.13-12.20.07	P07	50-7000	5	Very hazy caused by the openings. Two cloud layers. First layer very thin: base 1400', turbulence ends at 1800'. Second layer 8/8 St: base 5000', top 5700'.
12.20.07- 12.26.07	P08	7000-50	5	Also second (higher) cloud layer as in P07. First cloud layer not discernible. Very hazy. 12.24 short sunshine.
12.26.07-12.28.06	H08	100	25	Run begins 3nm ahead of Polarstern and ends at Polarstern. Afterwards 90° left turn.
12.29.26-12.32.22	H09	70/80	260	Stack: 1.level. Sunny, but hazy. Wind: 285°, 15 kn. T=-22°C. Very rough ice near Polarstern. Rough ice ends at 12.31.14. Passing north of Polarstern.
12.32.22-12.34.34	P09	70-4000	260	Cloudless. 180° turn after P09 top.
12.37.57-12.42.38	H10	300	90	Stack: 2.level. Sunny, but hazy. Passing north of Polarstern. Polarstern is in a lead in 95-100% ice surrounding.
12.44.42-12.48.58	H11	600	260	Stack: 3.level. Sunny. Variable ice coverage 100-90% (large cracks, leads, holes). 600' is in haze layer. Passing north of Polarstern.

12.52.00-12.54.50	H12	900	90	Stack: 4.level. 900' is still in turbulent layer. Hazier towards Polarstern. Passing north of Polarstern.
12.56.45-13.01.02	H13	1200	270	Stack: 5.level. 1200' is in inversion (no turbulence). 12.59.30 some turbulence. Passing north of Polarstern.
13.03.08-13.07.00	H14/P10	1500-50	90	Stack: 6.level. Diagonal flight through the stack. At 300' near Polarstern. Run ends over leads.
13.07.00- 13.08.14	H15	50	90	Cloudless. Mostly 100% ice.
13.08.14-13.10.58	P11	50-5000	90	Hazy. Cloudless. 100% ice. Clouds in the N (belonging to the disappearing low).
13.10.58-13.14.38	P12	5000-50	90	
13.14.38-13.20.57	P13	50-18000	360	2/8 Ci: top 9000'. At 10000' 180° turn towards Longyearbyen and further ascent to 18000'.
13.20.57-?	Transit	18000	170	
14.05				Landing in Longyearbyen.

Summary/Commentary:

The mission took place behind an eastward propagating low. The experimental area was between RV Aranda (80°36´N, 08°34´E) and RV Polarstern (81°52.9´N, 09°34´E). The wind direction was from W to NW and the low-level air temperature was between -20 and -24°C. The cloud coverage decreased from S to N; it was 8/8 Sc south of Aranda, 5-3/8 Sc around Aranda and cloudless around Polarstern. The visibility was hazy. The sea ice near Aranda was broken and the ice concentration varied between 30 and 100%. Here, the boundary layer was 450 to 540 m deep and topped by an 8 to 9 K strong inversion with its top at about 800 m. Sea smoke occurred over open water and was separated from the 3-5/8 Sc layer between 180 and 540 m. A vertical stack was flown passing Aranda at 6 levels (70, 300, 650, 1000, 1500, 1800'). The sea ice around Polarstern was 95-100%. Open leads occurred east of Polarstern. The ice west of Polarstern was mostly closed, but very rough. The boundary layer around Polarstern was cloudless. The inversion base was near 300 m and the top around 900 m. The inversion strength was about 8 K. A vertical stack was flown passing Polarstern at 6 levels (70, 300, 600, 900, 1200', and a slant diagonal descent). The vertical profiles P11-P13 northeast of Polarstern were flown with the intention to reach the warm air of the disappearing cyclone and to survey the boundary layer structure there, but it turned out soon that the cyclone was already too far east.

The data from the open wire Platinum resistance Pt-100 thermometer in the Rosemount 102 BM/BV housing showed intermittent spikes increasing with time. The open Pt-wire was broken!

Falcon Flight No. 5

Date: 10 April 2003 11.05-13.14 UTC
Area: 81.0-82.1°N, 09-14°E
Mission: Probing the Arctic boundary layer and inversion over sea ice in the area between buoy no.1096 and Polarstern under overcast As conditions in a weak (4-8 kn) flow from SE to S with temperatures around -20°C. A vertical stack with 5 horizontal runs in the boundary layer and inversion layer was flown north of buoy no.1096. A horizontal run at 50´ was flown over the surface-layer ice station on the ice floe at Polarstern.

Time (UTC)	Pattern P = Profile H = Hor. Leg	Height (feet ('))	Heading (°)	Remarks
11.05.12-11.11.4 0	Startprofile	Long.-18000	350	Take-off at Longyearbyen. Cloudless. Extremely good horizontal visibility.
11.11.40-11.30.43	Transit	18000	350	No clouds over Spitsbergen. Extended 8/8 As/Ac fields north of Spitsbergen.
11.30.52-11.41.49	P01	18000-50	350	Aiming point of P01 is buoy 1096. 8/8 Ac: top 10300', base 6000'. Strong icing of aircraft when in Ac layer. No clouds underneath. Inversion with 5 K between 3000' and 450'.
11.41.50-11.44.54	H01	100	350	Stack: 1.level. Start near buoy 1096. 97% ice, 3% cracks. No clouds in PBL. 8/8 Ac above. Hazy. T=-21 °C. FF=5-7 kn. DD=120-130°.
11.47.59-11.51.44	H02	300	170	Stack: 2.level. End near buoy 1096. 97% ice, 3% cracks. No clouds in PBL. 8/8 Ac above. Hazy. T=-21.5 °C. FF=5-7 kn. DD=100-130°.
11.54.49-11.58.02	H03	500	350	Stack: 3.level. Start near buoy 1096. 97% ice, 3% cracks. No clouds in PBL. 8/8 Ac above. Run is in inversion base. T=-19/-21 °C. FF=7-11 kn. DD=160-180°. Regular waves in time series of T, FF, DD (boundary layer rolls). Wavelength 450 m.
12.00.01-12.04.11	H04	700	170	Stack: 4.level. End near buoy 1096. 97% ice, 3% cracks. No clouds in PBL. 8/8 Ac above. Hazy. Run is in inversion. T=-18/-19 °C. FF=5-7 kn. DD=170-190°. At this level still weak signs of boundary layer rolls.
12.06.15-12.10.31	H05	900	350	Stack: 5.level. Start near buoy 1096. Run is in inversion. T=-17/-18 °C. FF=7-9 kn. DD= 170-190°. No clouds in PBL. 8/8 Ac above. Hazy.
12.10.30-12.12.15	P02	900-50	270	Below 8/8 Ac. Inversion base 120 m.
12.12.15-12.14.18	P03	50-3500	270	Below 8/8 Ac. Inversion: base 120 m, top 700 m, ΔT=5 K.
12.14.18-12.16.18	P04	3500-50	270	Below 8/8 Ac. Inversion: base 120 m, top 700 m, ΔT=5 K.
12.16.24-12.18.19	P05	50-3500	270	Below 8/8 Ac. Inversion: base 140 m, top 700 m, ΔT=4.5 K.
12.18.19-12.20.12	P06	3500-50	180	Below 8/8 Ac. Inversion: base 140 m, top 700 m, ΔT=4 K.
12.20.12-12.21.24	P07	50-2000	180	Below 8/8 Ac. Inversion: base 160 m, top = ?
12.21.24-12.22.34	P08	2000-50	200	Below 8/8 Ac. Heading towards Polarstern. Inversion: base 160 m.
12.22.35-12.25.15	H06	50	205	Comparison flight over the surface-layer ice station on the ice floe at Polarstern. Polarstern has maneuvered (bow is now towards W).
12.24.14-12.26.53	P09	50-3000	200	Below 8/8 Ac. Inversion: base 160 m, top 600 m, ΔT=6K.
12.26.53-12.28.36	P10	3000-50	150	Below 8/8 Ac. Inversion: base 190 m, top 550 m, ΔT=7K.
12.28.45-12.36.58	P11	50-18000	150	Inversion: base 190 m, top 550 m, ΔT=6.5K. 8/8 As: base 7000´, top 8800'.
12.36.58-12.57.00	Transit	18000	150	
12.57.00-13.13.31	Endprofile			Landing in Longyearbyen.

Summary/Commentary:

The mission took place north of a low-pressure zone over Fram Strait. The wind was weak with 4-8 kn from E to S with low-level temperatures of -21 to -20°C. The experimental area was about 70 km x 70 km wide and included the positions of buoy no.1096 and Polarstern. A vertical stack with 5 horizontal runs (100, 300, 500, 700, 900') was flown immediately north of buoy no.1096. A comparison flight at 50´ was flown over the ice station which has been deployed on the ice floe near Polarstern. The entire experimental area was covered by an 8/8 Ac/As cloud layer with its base at 6000' to 7000'. There were no further clouds below. The boundary layer was rather shallow. The inversion base was between 120 and 190 m. The inversion tops were between 550 and 700 m. The inversion strength amounted to 4 to 7 K. In the lowest 50 m of the inversion layer a sharp increase of wind direction by 30 to 60° was observed and a weak, but clear wind maximum occurred at the top of this sub-layer. The horizontal runs H03 and H04 were situated in this height range and showed clear regular variations of all meteorological quantities. This hints at organized circulations such as boundary layer rolls or Kelvin-Helmholtz waves. A boundary-layer situation like in this mission with no clouds in the boundary layer, but with a closed upper-level cloud deck was not observed in any of the other flight missions during the ABSIS 2003 experiment.

The data from the open wire Platinum resistance Pt-100 thermometer in the Rousemount 102 BM/BV housing showed very frequent spikes. The open Pt-wire was broken! Although this malfunction occurred already during the flight mission 4, it was only after this mission that the reason for it (broken Pt wire) was found.

Falcon Flight No. 6

Date: 13 April 2003 15.11-17.44 UTC
Area: 80.5-82.0°N, 08-15°E
Mission: Test of the new Pt-100 sensor and Rousemount probe.
A very shallow or even surface-based inversion over sea ice during warm on-ice air flow from southerly directions was probed. Low-level temperatures were between -5 and 0°C.

Time (UTC)	Pattern P = Profile H = Hor. Leg	Height (feet ('))	Heading (°)	Remarks
15.11.38-15.17.00	Startprofile	Long.-18000	340	Take-off in Longyearbyen. LYR weather: overcast, +3°C. Deep Ci layer.
15.17.00-15.31.28	Transit	18000	340	Entire transit in Ci layer.
15.31.28-15.41.11	P01	18000-100	340	8/8 Ci: top=? Base 6000'. Further 8/8 cloud layer: top 4000', base 2800'. P01 ends near Aranda. Lowest inversion: top 150 m, base 75 m, ΔT=3K.
15.41.12-15.43.45	H01	100	312	Stack: 1.level. 95-100% broken ice. In NW part 100% ice. Passing Aranda in the first third of the run. Wind: 7-9 m/s, 150-170°. T=-2/0°C at begin, T=+0.5°C at end.
15.43.44-15.45.30	P02a	100-3000	312	8/8 St. At top of P02a still in St layer. No inversion below 100´.
15.45.30-15.47.24	P02b	3000-300	132	No inversion below 300'.
15.47.24-15.53.46	H02	300	132	Stack: 2.level. First part: turbulence. Last part ahead of Aranda: no turbulence. Tsfc (Tair) decreases from -1.3 (+0.5) to -3.0 (-0.5)°C from NW to SE. Wind: 9-11 m/s, 150-170°.
15.55.41-15.58.30	H03	500	290	Stack: 3.level. Aranda is in the area with small ice floes. No turbulence in SE part, but turbulence in NW part. Wind: 10-14 m/s, 170-180°. T=+1 - 0°C.
16.01.11-16.05.52	H04	700	122	Stack: 4.level. Still some turbulence in the middle part of run. Wind: 14-17 m/s, 170-180°. T=-0.2 - +0.3°C. Passing north of Aranda (16.04.22).
16.08.01-16.11.30	H05	900	290	Stack: 5.level. Occasional turbulence. Passing north of Aranda (16.08.50). Wind: 17-19 m/s, 180-190°. T~0°C.
16.12.24-16.14.54	P03	900-100	25	Towards Polarstern. No inversion.
16.14.54-16.17.35	P04	80-5000	25	8/8 St/Sc: base 1600', top 3100'. No inversion below clouds, but stable stratification: -0.5K/100m. Further cloud layer above 5000'.
16.17.35-16.21.47	P05	5000-100	25	8/8 Sc: top 3200', base 1500'. Good visibility below cloud layer. P05 is over 100% ice. Some leads in the East. Surface-based inversion: top 100m (+0.2°C), base 0m (-2.5°C).
16.21.47-16.22.58	H06	100	25	100% ice. Wind: 5 m/s, 160°. T= -2°C. Tsfc=-4°C.
16.22.57-16.23.48	P06a	100-1000	25	Surface inversion: top 130m (0°C), base 0m (-2.7°C).
16.23.55-16.25.22	P06b	1000-100	25	Surface inversion: top 220m (0°C), base 0m (-3.5°C).
16.15.22-16.26.39	P07a	100-1000	25	Passing east of Polarstern. Sfc inversion: top 220m (0°C), base 0m (-3.5°C).
16.26.39-16.28.12	P07b	1000-100	170	Heading back towards Polarstern. Sfc inversion: top 190m (0°C), base 0m (-3.5°C).
16.28.13-16.29.36	H07	100	170	Stack: 1.level. Passing Polarstern almost in the middle of the run. Wind: 7-8 m/s, 130-140°. T=-3°C. Tsfc=-3/-5°C.
16.32.13-16.34.48	H08	300	360	Stack: 2.level. Flying directly over the Polarstern ice station. Wind: 9 m/s, 180°. T=-1.5°C. Tsfc=-5.5°C, at some places -3°C.
16.36.55-16.39.25	H09	500	170	Stack: 3.level. Still some turbulence. Wind: 11-13 m/s, 180-190°. T=-0.5°C. Aircraft heading correction at 16.37.30.
16.41.24-16.43.19	H10	700	360	Stack: 4.level. Occasionally little turbulence. Wind: 15-16 m/s, 200°. T=+0.2°C.
16.45.21-16.48.23	P08	100-5300	135	Partly sun through clouds. 2/8 St: base 3300', top=? Further thin cloud layer in 4500´. Inversion: base <30m (-3.5°C), top 250m (+0.5°C) with strong wind shear: FF from 5 to 16 m/s, DD from 115 to 205°.

16.48.23-16.52.14	P09	5300-50	135	Thin cloud layer in 4500'. Surface always visible. Good horizontal visibility. Elevated inversion: base <25m (-4.2°C), top 70m (-0.2°C). Further weak inversion: base 180m, top 350m. Wind shear is structured following the two inversions.
16.52.14-1654.56	P10	50-5000	135	No clouds in profile. Elevated inversion: base 30m (-4.2°C), top 70m (-0.7°C), further top 270m (+0.6°C). Wind shear follows inversion structure.
16.54.56-1658.50	P11	5000-50	135	No clouds in profile. Elevated inversion: base 50m (-4.5°C), top 90m (+0.2°C), further inversion top at 370m (+0.2°C). Wind shear structured.
16.58.50-17.01.32	P12	50-5000	135	No clouds in profile. Occasionally sun stripes. Elevated inversion: base 50m (-4.8°C), top 110m (-0-3°C), further top 290m (+0.2°C). Wind shear structured.
17.01.32-17.15.14	P13	5000-50	175	Profile towards LYR. No clouds in profile. Ice 95% with many cracks. Inversion (elevated or surface is not discernible): base 20m? (-5°C), top 140m (+0.4°C), further top 310m (1°C). Complexly structured wind shear. Marked LLJ with 11 m/s at 50m.
17.05.15-17.06.31	H11	50	175	100% ice. In surface inversion. T=-4.5°C. Tsfc=-6.5°C. Wind: 6-3 m/s, 120-130°.
17.06.30-17.09.09	P14	50-5000	175	No clouds in profile. Sfc inversion: base <15m (-5°C), top 150m (-0.7°C), further top 380m (-0.5°C).
17.09.09-17.12.28	P15	5000-50	175	No clouds in profile. 95-100% ice. Many cracks and displacements. Elevated inversion: base 20m (-2.4°C), top 45m (+1°C).
17.12.28-17.13.45	H12	50	175	100% ice. Several very high ridges. In inversion layer. T=-2°C. Tsfc=-5°C. Wind: 6 m/s, 120°.
17.13.44-17.22.30	P16	50-18000	175	Up to 6000' no clouds, only haze, but surface visible. From 7500' on surface no longer visible. Inversion: base 20m (-2.4°C), top 85m (+1°C), further top 380m (+1°C). Marked LLJ with 11m/s at 50m.
17.22.30-17.36.00	Transit	18000	175	
17.36.00-17.43.19	Endprofile			Top of St layer 10.000'.

Summary/Commentary:

Warm air was transported into the experimental area with southerly wind between a high over the Barents Sea and a low which moved from S into the Fram Strait. The Ci deck of the approaching low covered the entire experimental area. The warm air advection caused an inversion which was either surface-based or with an elevated base below 50 m height. At Aranda the warm air was already down to the surface without an inversion. In the Aranda area an 8/8 St/Sc layer with its base at 2800' was observed. This cloud layer was also present in the Polarstern area, but with only 2/8 coverage. Further to the east this cloud layer was absent.
During this mission the lowest inversions of the ABSIS experiment were sampled. The wind showed partly very strong shears both in speed and direction in the inversion layer. Very marked low-level jets were observed. Due to the low height of the inversion, the stack at Polarstern (100, 300, 500, 700') was flown mostly in the inversion layer. Since the warm air at Aranda was already mixed down to the surface without an inversion, the stack there was in the turbulent boundary layer. However, there was some horizontal inhomogeneity in the stack with some inversion residuals in the eastern part.

Falcon Flight No. 7

Date: 14 April 2003 09.54-12.56 UTC
Area: 80.5-82.0°N, 08-16°E
Mission: A cyclone moved from SW to NE slightly north of the experimental area. The boundary layer and elevated inversion were probed on the cold side of the cyclone under conditions of cold-air advection from SW with 8-12 m/s in the surface layer and air temperatures between -3 and -9°C. Stacks are flown at RVs Aranda (80°45.2´N, 10°26.9´E) and Polarstern (81°51.9´N, 10°05.2´E). A second cyclone approaches from S into Fram Strait.

Time (UTC)	Pattern P = Profile H = Hor. Leg	Height (feet ('))	Heading (°)	Remarks
09.54.10-10.06.10	Transit	Long.-18000	345	Take-off at Longyearbyen. Start profile and transit in 18000'. 8/8 cloud cover. Many cloud layers.
10.06.11-10.15.40	P01	18000-500	345	4 cloud layers. 11.000-9800'. 5500-5200' (5/8). 4500-2300' (6/8 Cu). 1100'-? (2-3/8 Cu).
10.15.41-10.18.04	H01	500	345	Run for calibration of Johnson-Williams sensor. Ice edge (sharp, ice floes in small pieces) crossed at 80°24.5´N, 12°25´E.
10.18.55-10.21.05	P02	50-4000	345	2-3 cloud layers: 500'-1000' (3/8 Cu), ?-2200', 2900'->4000'.
10.21.05-10.23.29	P03	4000-50/30	345	Same clouds as in P02. Inversion: 270-420m, ΔT=1.5K, strong wind shear (ΔDD=-20°, ΔFF=5m/s). 95% ice, broken.
10.25.28-10.29.31	H02	50	270	Stack: 1.level. Passing Aranda. 100-95% ice. T=-4 - -6°C. Wind: 6-11 m/s, 240-250°.
10.29.31-10.30.51	P04	50-2000	270	3/8 Cu: 500'-1000'.
10.32.53-10.35.31	H03	400	90	Stack: 2.level. Passing Aranda. Below clouds. In the middle of mixed layer. T=-8→-6°C. Wind: 8-12 m/s, 250°.
10.38.09-10.41.40	H04	700	270	Stack: 3.level. Passing Aranda (there 95-98% small ice floes). At first below cloud base, from Aranda position onwards above cloud base. Clouds are Kelvin-Helmholtz shaped. T=-7 - -8.5°C. Wind: 8-12 m/s, 250°.
10.44.37-10.47.07	H05	1000	90	Stack: 4.level. Passing Aranda. Near (below/above) cloud top. Cloud top is higher in the W (~1200') than in the E. T=-8°C. Wind: 10-15 m/s, 250°.
10.47.57-10.51.57	P05/H	1500-50	270	Stack: diagonal flight. Turbulence begins below 1300'.
10.52.30-10.55.20	P06	50-5000	270	Cloud base 700', top 1000'. Second cloud layer not reached. Inversion: base 270m, top 500m, ΔT=2K, sharp FF increase and DD veering.
10.55.20-10.58.24	P07	5000-50	270	Clouds as P06. Inversion: base 270m, top 550m.
10.58.24-11.01.05	P08	50-5000	10/20	Inversion: base 300m, top 400m. Second inversion: base 600m, top 750m.
11.01.05-11.03.54	P09	5000-50	10/20	Inversion: base 270m, top 380m. Sec. inv.: base 550m,top 770m.100% ice.
11.03.55-11.05.06	H06	50	10/20	Very hazy. Overcast. Some cracks, otherwise 100% ice. T=-8°C. Tsfc~-8°C. Wind: 8-12 m/s, 240-250°.
11.05.05-11.07.46	P10	50-5000	10/20	From here on different cloud and inversion situation. 8/8 St: base 1000´, top 1800'. Only one inversion! Base 450m, top 800m.
11.07.46-11.10.34	P11	5000-50	10/20	8/8 St: base 600´, top 2000´.Inversion: base 500m, top 800m. ΔT=3.5K.
11.10.35-11.11.47	H07	50	10/20	Some places 95%, otherwise 100% ice. T=-8°C. Tice=-8°C. Wind: 7-10m/s, 230-240°. Good visibility.
11.11.46-11.14.26	P12	50-5000	10/20	8/8 St: base 600', top 2000'. Inversion: base 550m, top 700m. ΔT=3.5K.
11.14.26-11.17.17	P13	5000-50	10/20	8/8 St: base 500', top 1800'. Inversion: base 530m, top 600m. ΔT=4K.
11.17.18-11.18.37	H08	50	10	Mostly 100% ice. Some openings. T=-8°C. Wind: 7-10m/s, 230-240°.
11.18.37-11.20.10	P14	50-3000	10	8/8 St: base 500', top 2300'. Second cloud layer begins at 3000'.Inversion: base 600m, top 700m.
11.20.10-11.21.43	P15	3000-50	160	8/8 St: base 700', top 2200'. Inversion: base 620m, top 700m. ΔT=3.5K.

11.22.13-11.24.23	H09	100	160	Stack: 1.level. Passing Polarstern 11.22.45. T=-8°C. Tice=-8°C. Wind: 9-11m/s, 230-240°. Stack is normal to wind direction.
11.26.55-11.30.10	H10	400	340	Stack: 2.level. Passing Polarstern. Below cloud base. Hazy. 95-100% ice. T=-9°C. Wind: 10-12m/s, 240°.
11.33.01-11.36.04	H11	800	160	Stack: 3.level. Passing Polarstern 11.34.13. Slightly above base of 8/8 St. T=-9.5°C. Wind: 11m/s, 250°.
11.38.56-11.40.49	H12	1500	340	Stack: 4.level. Passing Polarstern. In 8/8 St layer. Icing at aircraft. T=-11°C. Wind: 12-14m/s, 250-260°.
11.41.40-11.42.16	H13	2000	340	Stack: Second part of 4.level. Change of altitude because of aircraft icing.
11.44.11-11.52.02	H14a,b	2500-1400	160	180° turn at NW end of stack. Ascent to 2500'. The leg is intended at cloud top, but 2500´ is here (at NW end) in a second cloud layer which is grown together with the lower cloud layer. Further SE both cloud layers are separated and the top of the lower layer decreases from 2200' to 1400'.
11.54.51-11.55.51	H15	100	90	100% ice. Bad visibility. Turbulence. T=-8.5°C. Tice=-8.5°C. Wind: 9-12 m/s, 240-250°.
11.55.49-11.58.36	P16	100-5000	90	8/8 St: base ? top 1300'. Inversion: base 400m, top 550m. ΔT=5K.
11.58.36-12.01.43	P17	5000-100	90	8/8 St: base 800', top 1300'. Inversion: base 380m, top 480m. ΔT=3K. Profile ends in area free of 8/8 St.
12.01.44-12.03.48	H16	50	90	2/8 St. Very good visibility. Sometimes sunny. Mostly 100% ice with some higher ridges. Weather conditions as at Aranda. T=-6 - -4°C. Tice= -6 - -5°C. Wind: 8-10m/s, 250°.
12.03.48-12.05.58	P18	50-4000	180	2/8 Sc stripes.
12.05.58-12.08.24	P19	4000-50	180	Thin St: 2800-3000'. 2/8 Sc stripes below: Kelvin-Helmholtz-like cloud tops. 95% ice. Inversion: base 370m, top 410m. ΔT=1.5K.
12.08.25-12.10.42	H17	50	180	Some leads and ridges. Mostly 100% ice, occasionally 93%. T=-4°C. Tice=-4-5°C. Wind: 7-10m/s, 240°.
12.10.41-12.19.02	P20	50-18000	180	1/8 Sc: 1000-1400'. 8/8 St: 2900-4000'. Altostratus stripes: 6200-9000'. Inversion: 400-600m. ΔT=1.5K.
12.19.02- 12.56.00	Transit			Transit and landing in Longyearbyen.

Summary/Commentary:

The mission took place in the SW wind area south of a north-eastward propagating low. Since the day before when low-level air temperatures close to 0°C were observed, colder air was again advected into the experimental area with temperatures between -4 and -9°C. The inversion in the southern part of the experimental area was lower (~300m) and weaker (~3K) than in the northern part (~550m and ~4-5K, respectively). The cloud conditions were also inhomogeneous. At Aranda 4/8 Cu and at Polarstern 8/8 St clouds occurred in the boundary layer. Two stacks were flown at Aranda (50, 400, 700' (cloud base), 1000' (cloud top), and a diagonal run from 1500' to 50') and at Polarstern (50, 400, 800' (cloud base), 1500' (in cloud layer), 2000/2500' (inversion)). The wind profile showed a clear backing of 10 to 20° and a clear increase of 5 to 10 m/s with height across the lowest inversion according to the cold-air advection behind the cyclone. Such conditions were not observed in any of the other flight missions during ABSIS 2003. The boundary-layer clouds in the southern part of the experimental area showed Kelvin-Helmholtz-like shapes.

Falcon Flight No. 8

Date: 15 April 2003 10.00-13.05 UTC
Area: 80.5-82.5°N, 09-15°E
Mission: The experimental area was situated in a cold westerly air flow at lower levels with temperatures between -12 to -18°C. The warm air of the preceding days was still present above 1000 m height with air temperatures around -8°C. Stacks were flown at RVs Aranda and Polarstern.

Time (UTC)	Pattern P = Profile H = Hor. Leg	Height (feet ('))	Heading (°)	Remarks
10.00.15-10.19.00	Transit	Long.-18000	330	Take-off at Longyearbyen. Cloudless area directly north of Spitsbergen. Further north extended field of 8/8 St.
10.19.00-10.29.47	P01	18000-50	330	8/8 St: 1000'-2500'. 95% broken ice.
10.29.24-10.30.19	H01	50/100	330	Towards Aranda.
10.30.46-10.32.50	H02	50/100	360	Stack: 1.level. Passing Aranda. Ice with several cracks. -13.5°C. 5m/s. 260°.
10.32.45-10.34.30	P02	50-300	360	8/8 St: 300'-800' (the cloud layer is tilted downwards from S to N). Second 8/8 St: 2200'-2700'.
10.38.0010.42.40	H03	200	180	Stack: 2.level. N: near cloud base, S: clearly below cloud base. N: 100% ice, since 10.39.50 broken ice 90-95%. -13.5°C. 7→4m/s. 250-260°.
10.44.44-10.49-15	H04	350	360	Stack: 3.level. Aranda 10.45.50. S: below cloud base, since 10.48.40 in cloud base. Base decreases till N. -13.5°C. 6-9m/s. 250°.
10.51.36-10.56.14	H05	500	180	Stack: 4.level. N: in 8/8 St. Since 10.52.30 below base. -13°C. 10-7m/s. 260°.
10.58.31-11.02.46	H06	800	360	Stack: 5.level. S: below 8/8 St. Later in 8/8 St. -12°C (waves). 12m/s. 240°. Aranda 10.59.02.
11.02.45-11.05.03	P02a	800-50	360	8/8 St: 400'-650'. All profile is stably stratified.
11.05.04-11.06.05	H07	50	350	Old ice with some leads. 2/8 Sc. Partly sunny. -15°C. 4m/s. 235°.
11.06.04.11.08.41	P03	50-5000	350	Turbulent up to 300/400'. Thin St: 2300-2500'. Since 11.07.40 no clouds.
11.08.41-11.11.34	P04	5000-50	350	In sunny area. Thin St stripe 2000-2100' ahead, but not intersected.
11.11.34-11.12.50	H08	70	350	No clouds. Mostly 100% ice. 11.12.36 re-frozen lead. -17°C. 4m/s. 225°.
11.12.50-11.15.30	P05	50-5000	350	No clouds. 95-100% ice.
11.15.30-11.18.30	P06	5000-50	350	As in P05. End is south of Polarstern. Inversion base 150m.
11.18.30-11.22.00	H09	50	350	Stack: 1.level. Over ice station west of Polarstern during first third of run. Many cracks/leads with turbulence above. High ridges north of Polarstern. -18°C. 4m/s. 230°.
11.24.26-11.28.31	H10	200	180	Stack: 2.level. Sunny. Turbulence over leads. From 11.26.35 many high ridges. 11.27.58 Polarstern and ice station. -18.2°C. 4m/s. 230°.
11.30.50-11.34.20	H11	300	360	Stack: 3.level. Sunny. Turbulence over lead near Polarstern. Polarstern at 11.31.50. Since 11.33.20 no turbulence. -18.2°C. 4-6m/s. 230°.
11.36.30-11.40.30	H12	400	180	Stack: 4.level. 11.38.25 turbulence over rough ridged ice. 11.39.37 Polarstern. Turbulence over lead. -18.0°C. 4-6m/s. 235°.
11.43.00-11.46.48	H13	500	360	Stack: 5.level. Sunny. 11.43.50 Polarstern. 11.45.03-1145.33 turbulence over rough ridged ice field. -18.0°C. 6-8m/s. 240°.
11.49.00-11.53.00	H14	600	180	Stack: 6.level. Turbulence over rough ridged ice field. Clouds approach from S, but not yet in stack. -17.8°C. 6m/s. 245°.
11.55.30-11.57.14	P07	1000-50	360	P07-P11 saw-tooth profiles across stack. No clouds. P07 ends over Polarstern ice station.
11.57.14-11.57.57	P08	50-1000	360	See P07.
11.57.57-11.58.49	P09	1000-50	360	See P07.

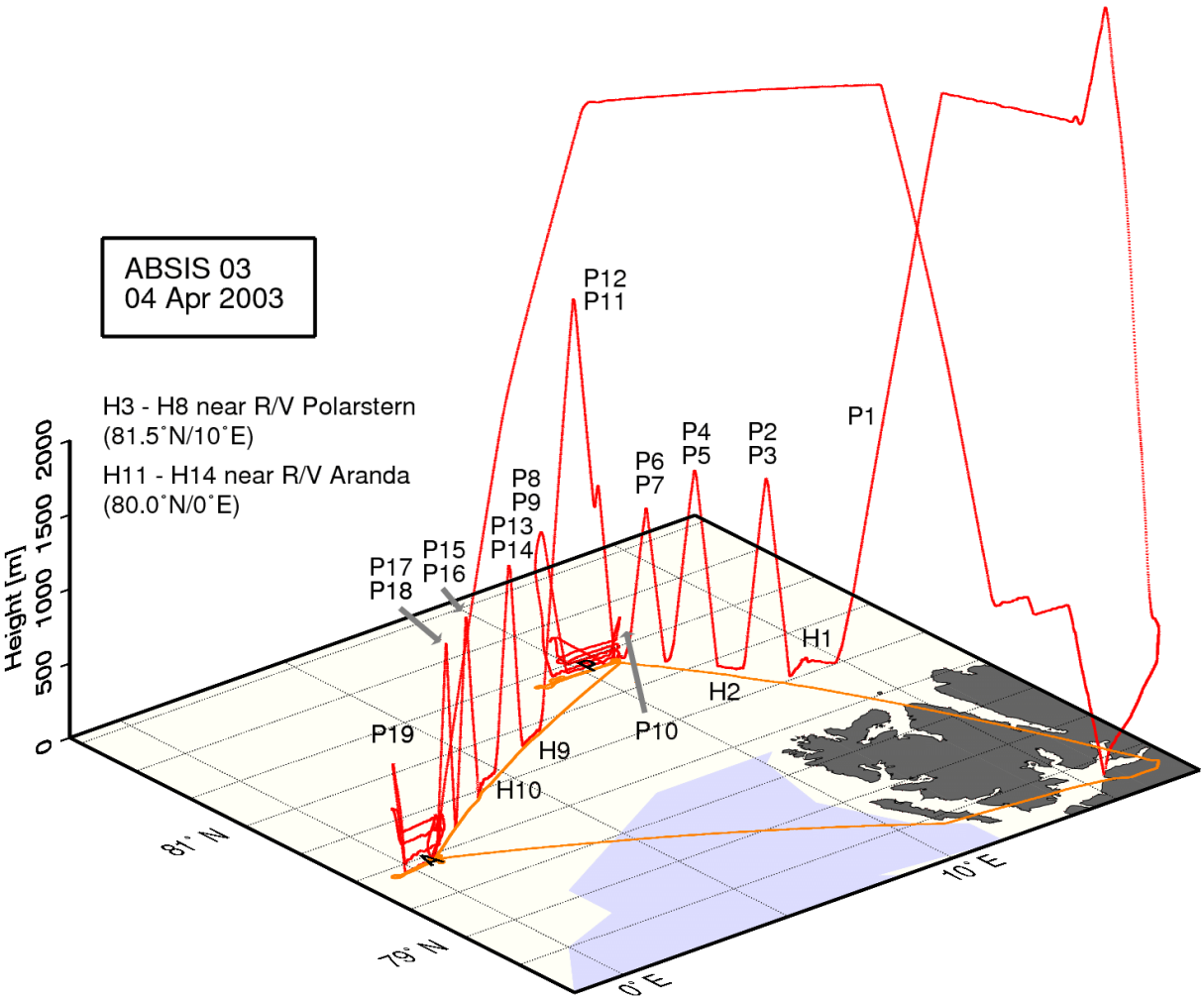
11.58.49-11.59.25	P10	50-1000	360	See P07.
11.59.25-12.00.37	P11	1000-50	360	See P07.
12.00.37.12.03.10	P12	50-5000	360	8/8 St: 2900-3200´. Inversion: base 120m, top 400m. ΔT=3K.
12.03.10-12.06.15	P13	5000-50	360	8/8 St: 2900-3300´. Turbulence below 400´.
12.06.15-12.08.58	P14	50-5000	360	8/8 St: 2900-3300´. Inversion: base 120m, top 350m. ΔT=3K.
12.08.58-12.12.02	P15	5000-50	90	8/8 St: 2800'-?. Turbulence below 300'. Very hazy at low levels.
12.12.02-12.18.00	P16	50-18000	90→160	8/8 St: around 3400', thin layer. Inversion base 120m with ΔT=3K. Second strong inversion: 900m-1050m with ΔT=8K.
12.18-13.04	Transit			Transit and landing in Longyearbyen.

Summary/Commentary:

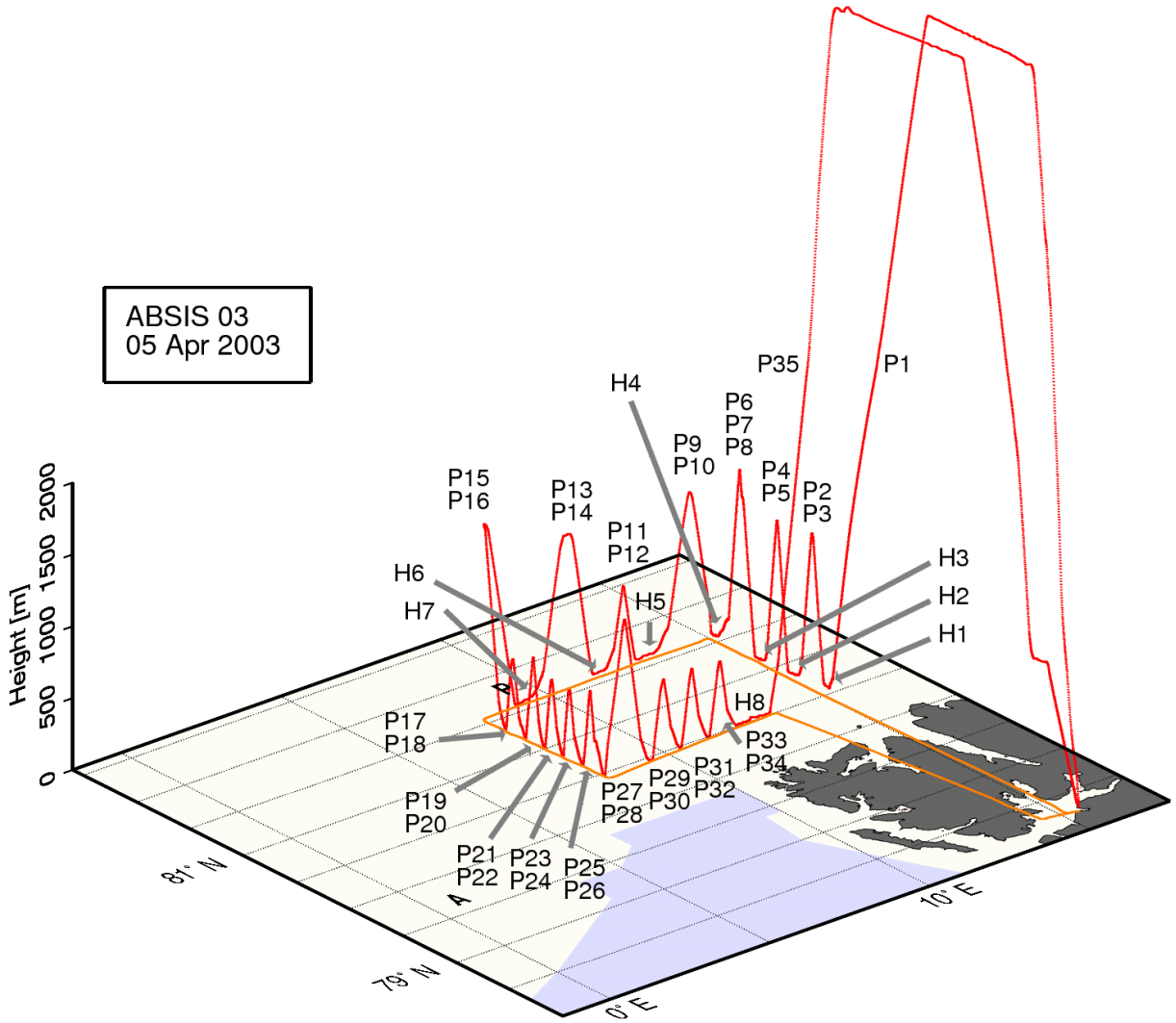
During the previous night a weak Fram Strait cyclone moved northeastwards. It has transported cold air into the experimental area. A weak high pressure ridge followed from W, so that the cold air was under weak high pressure influence. Temperatures in the surface layer were between -12 and -18°C. At levels above 900 m the warm air was still present. The low-level wind in the experimental area was from SW with about 5 m/s. Two inversions were present in the lowest kilometer. The first inversion was surface-based or had its base mostly around 120 m. Tops were around 600/700 m. The strength was between 2 and 3 K. It was accompanied by a marked shear of wind direction (+20°) and speed (3 to 5 m/s). The second inversion separated the lower cold air from the upper cyclone-related warmer air. This inversion was between 900 m and 1100 m and was up to 8 K strong. The cloud situation was inhomogeneous. It was overcast around Aranda with a cloud deck which decreased from S to N. Around Polarstern it was cloudless. Two stacks were flown at Aranda and Polarstern. The levels were placed in the boundary layer and inversion layer. Aranda stack: 50/100, 200, 350, 500, 800'. Polarstern stack: 50/100, 200, 300, 400, 500, 600', plus 5 saw-tooth profiles across the stack. It was found that the very roughly ridged ice field north of Polarstern caused turbulence even up to the 600' level.

3. Three-dimensional Falcon flight patterns

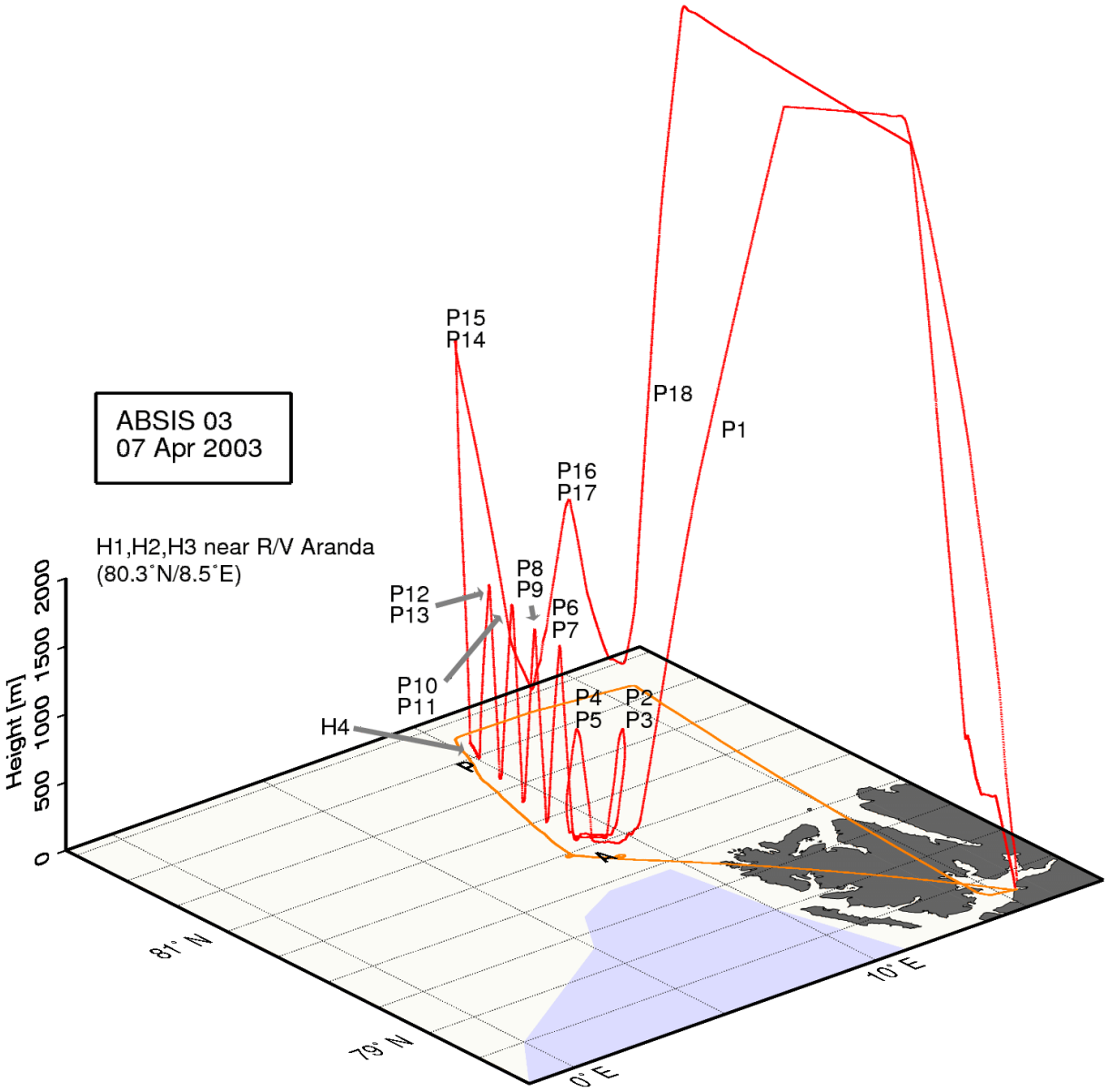
Falcon Flight No. 1 Date: 4 April 2003 10.09-13.35 UTC



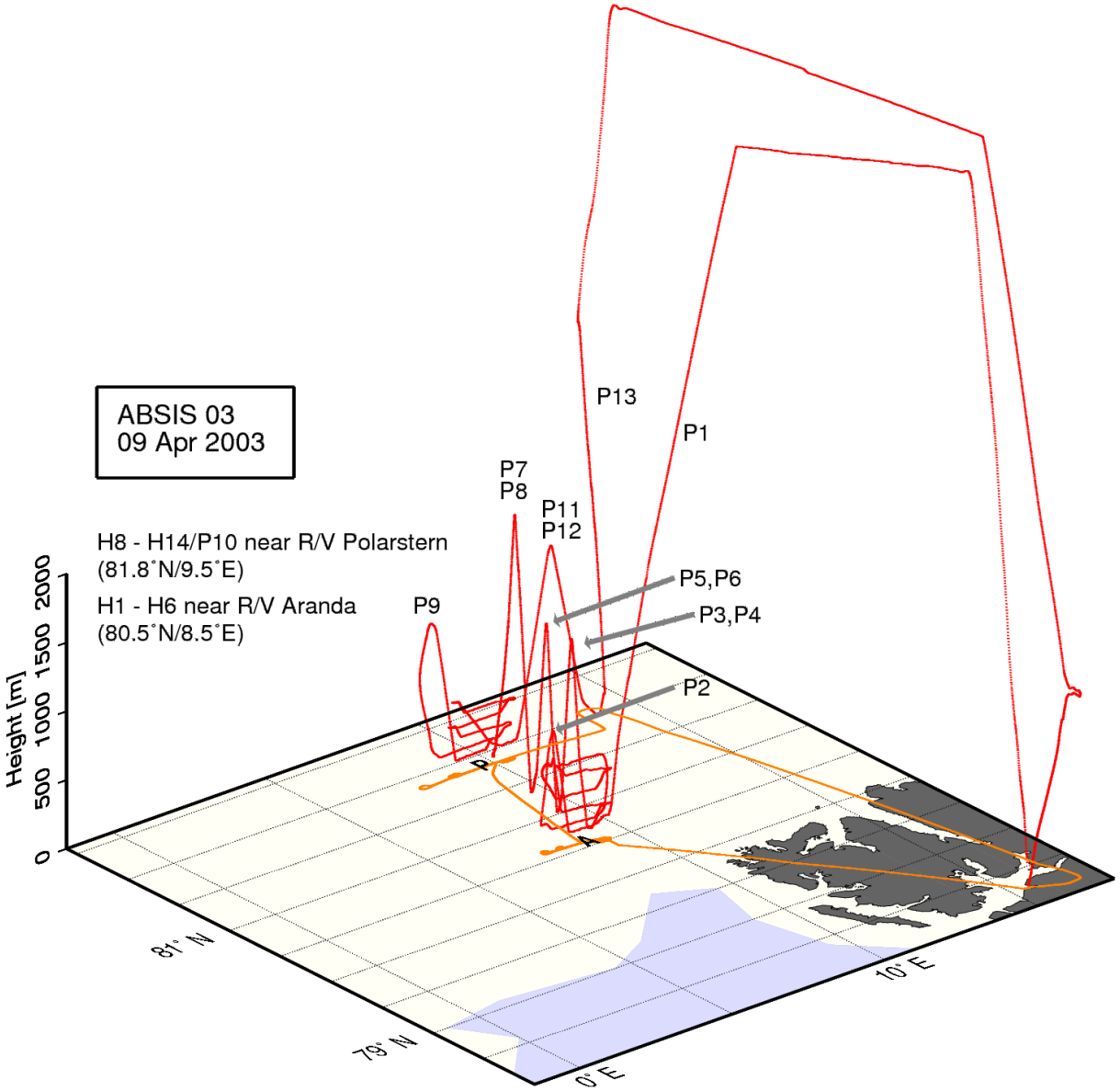
Falcon Flight No. 2 Date: 5 April 2003 10.04-12.23UTC



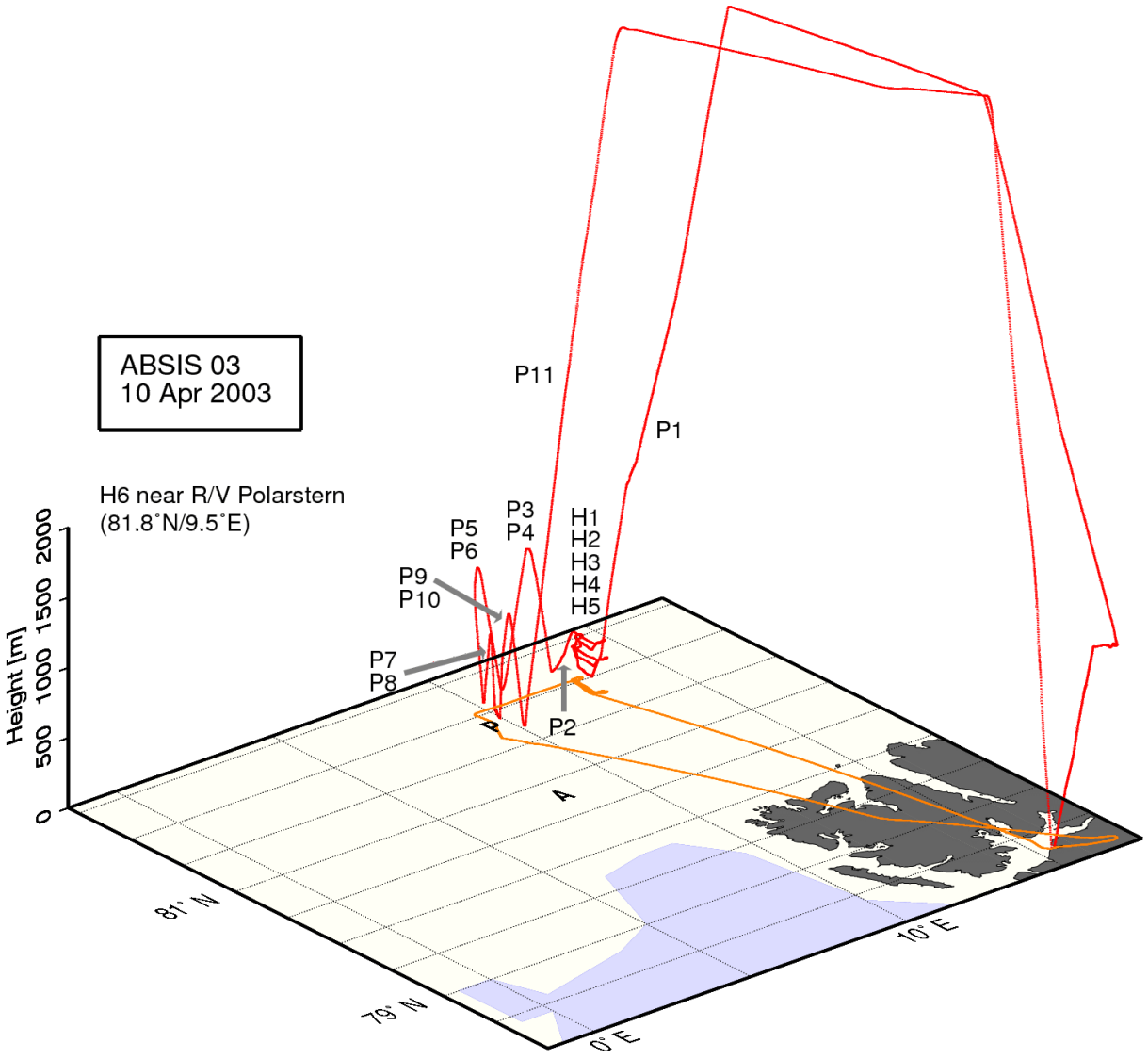
Falcon Flight No. 3 Date: 7 April 2003 09.09-11.24 UTC



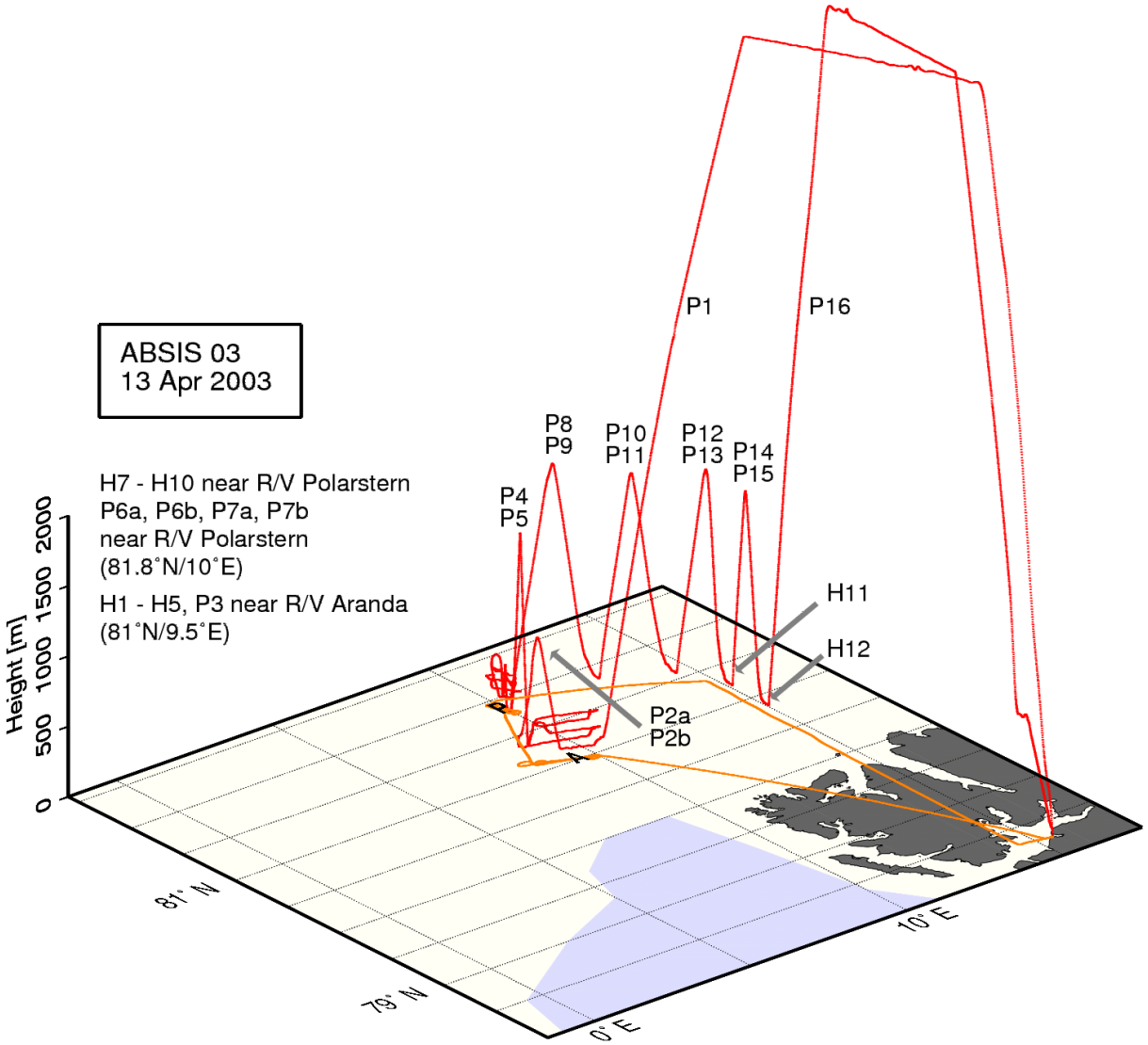
Falcon Flight No. 4 Date: 9 April 2003 10.54-14.05 UTC



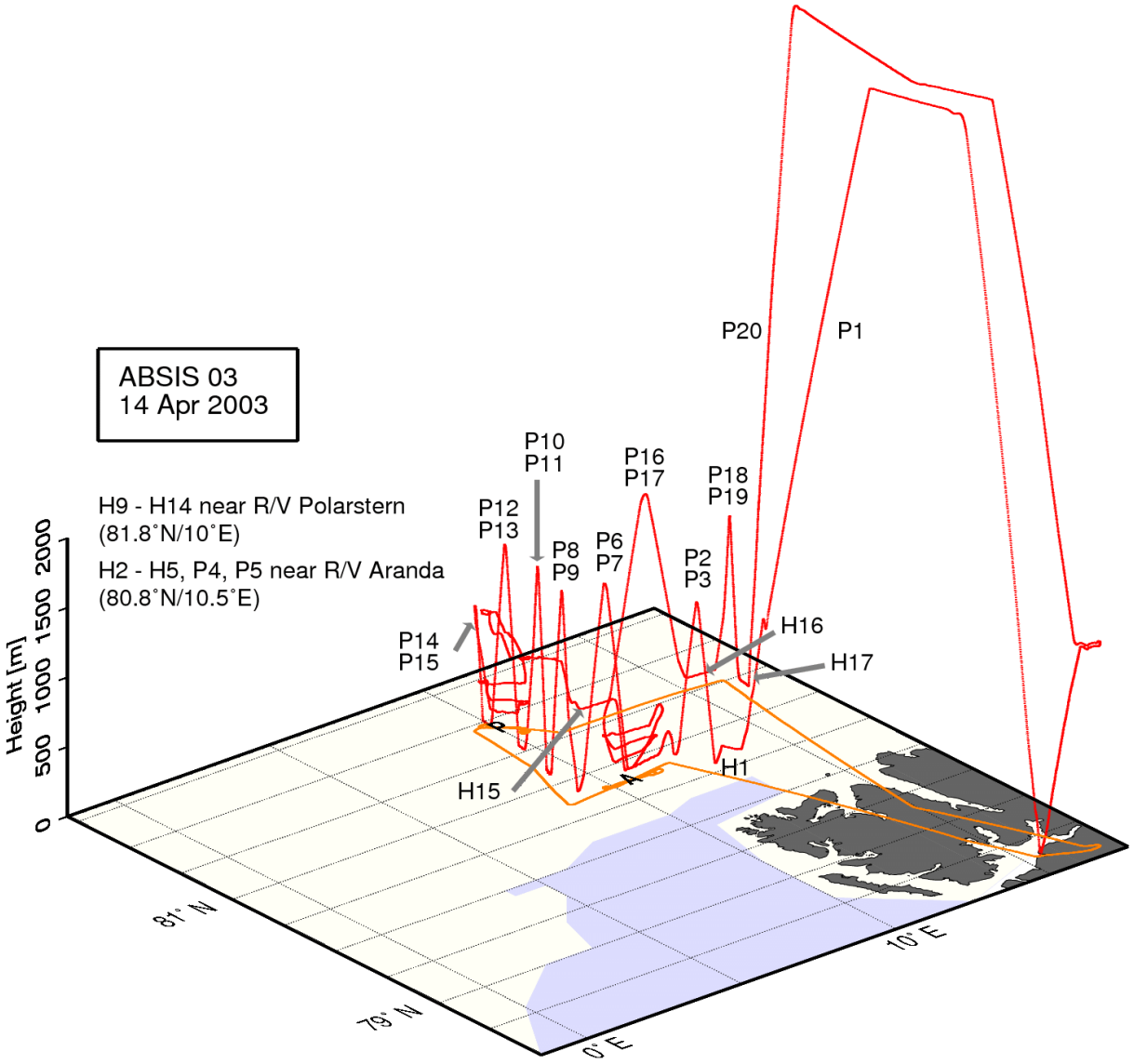
Falcon Flight No. 5 Date: 10 April 2003 11.05-13.14 UTC



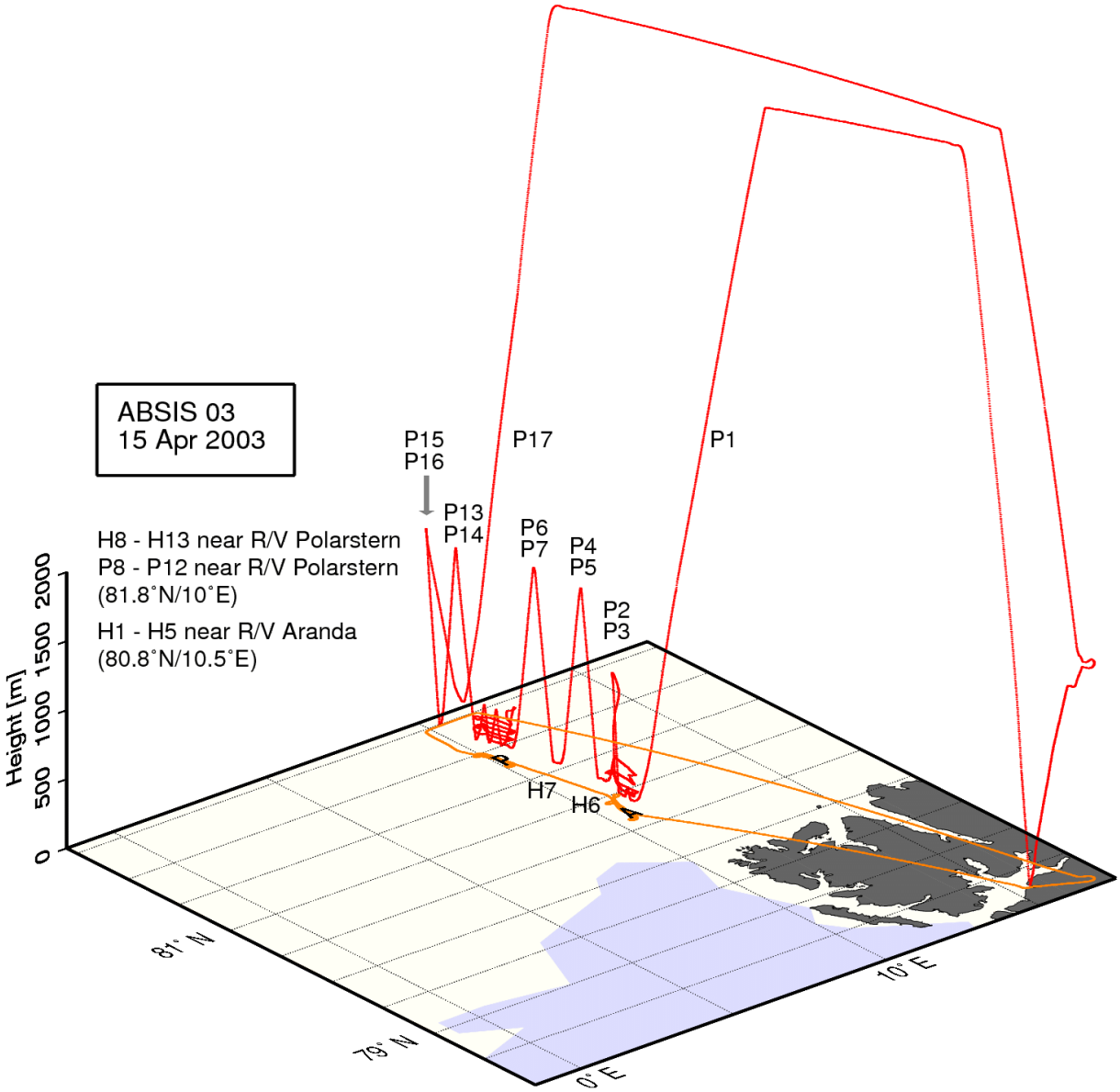
Falcon Flight No. 6 Date: 13 April 2003 15.11-17.44 UTC



Falcon Flight No. 7 Date: 14 April 2003 09.54-12.56 UTC

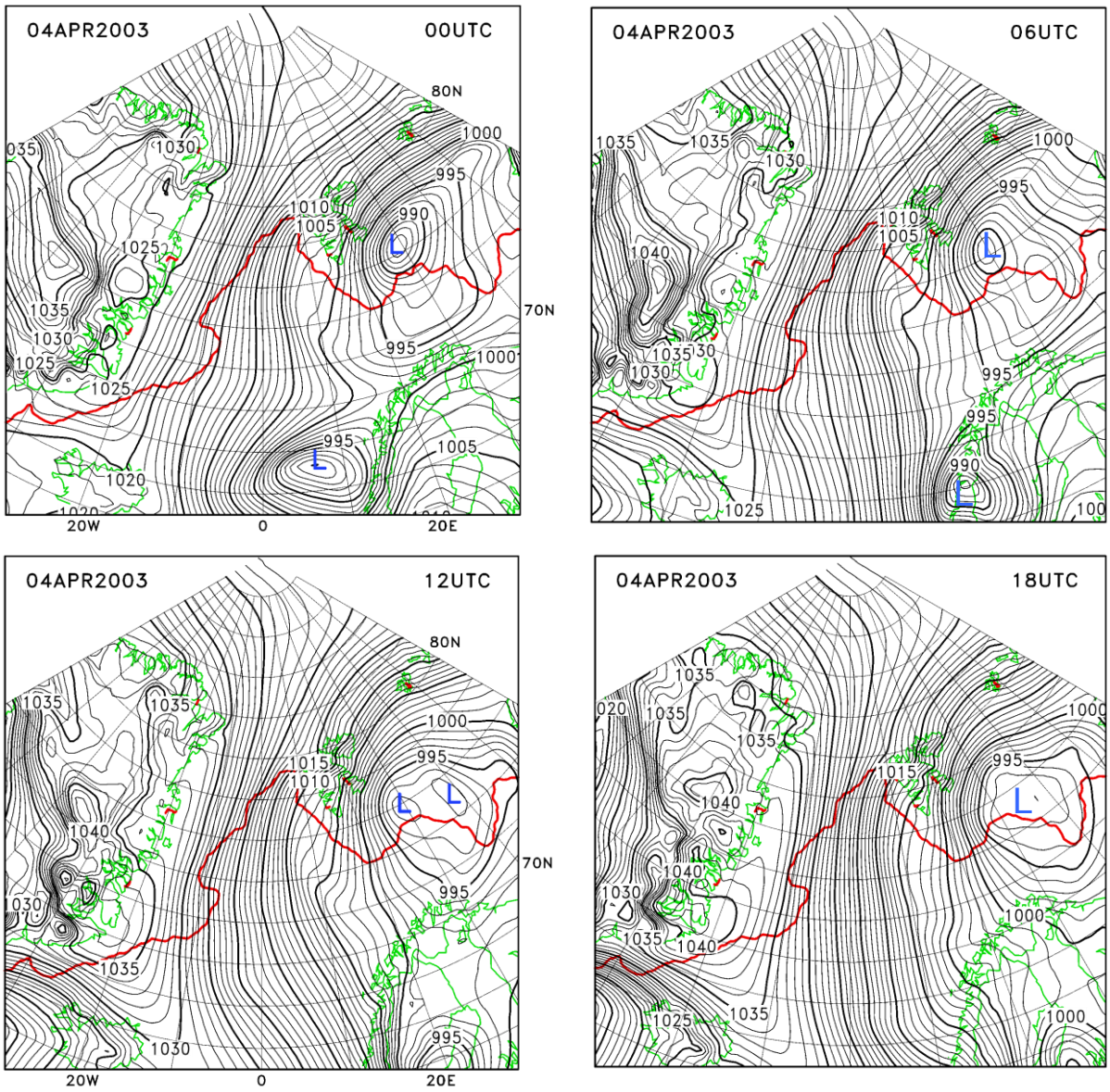


Falcon Flight No. 8 Date: 15 April 2003 10.00-13.05 UTC

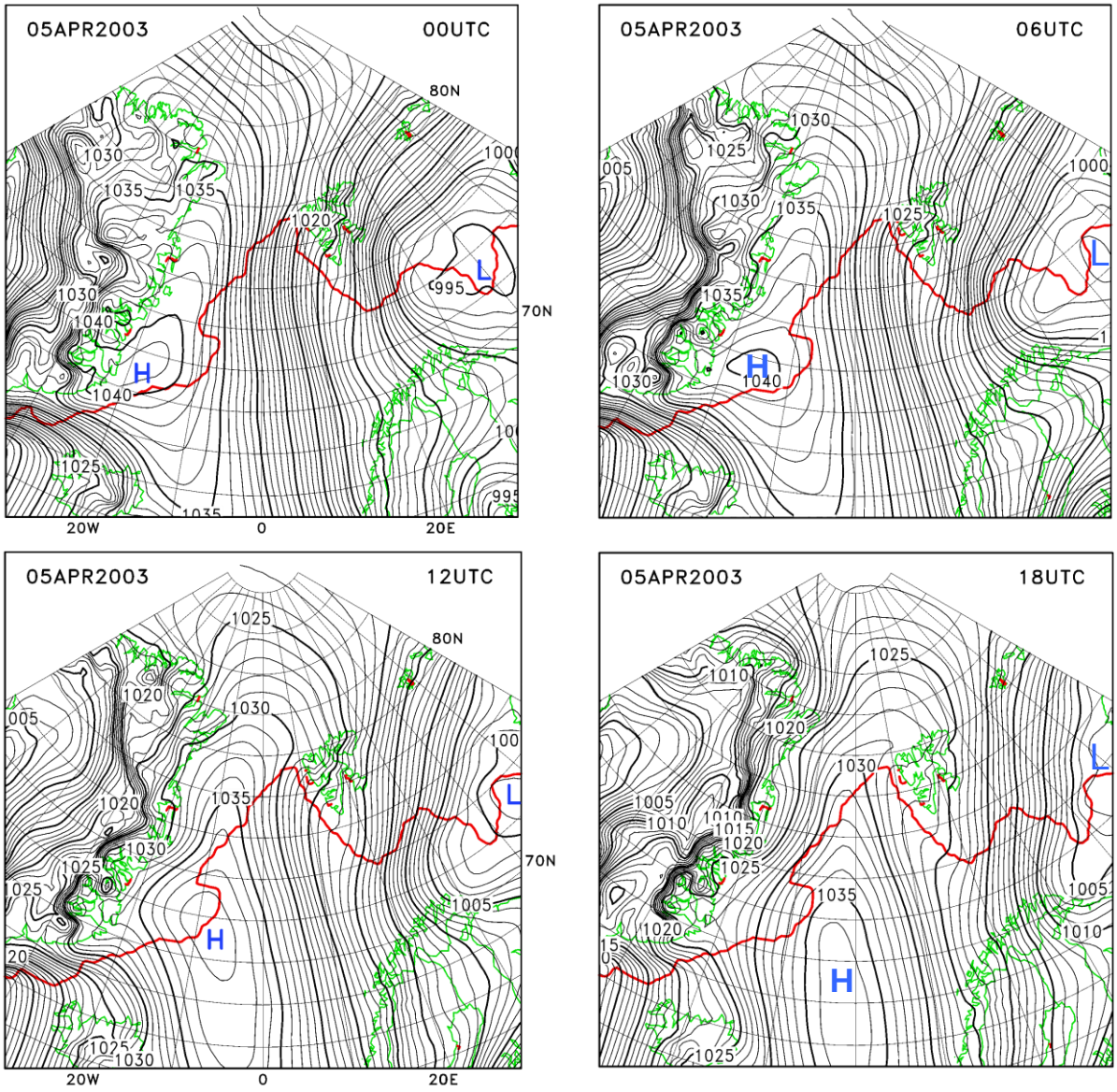


4. Six-hourly ECMWF sea-level pressure analyses for each Falcon flight mission

Falcon Flight No. 1 Date: 4 April 2003 10.09-13.35 UTC



Falcon Flight No. 2 Date: 5 April 2003 10.04-12.23UTC



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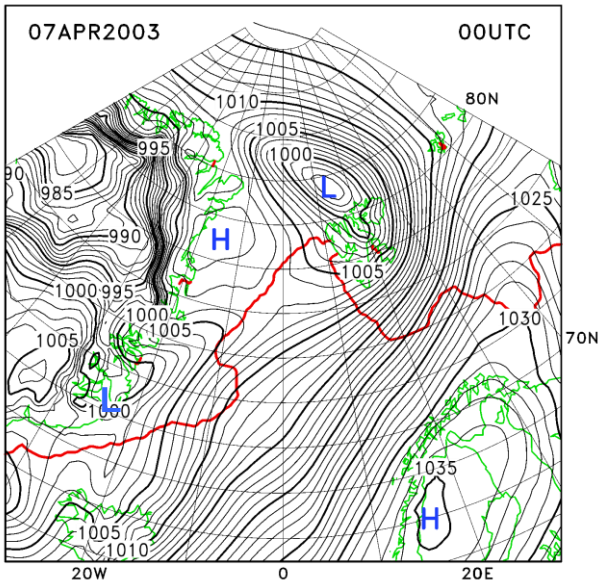
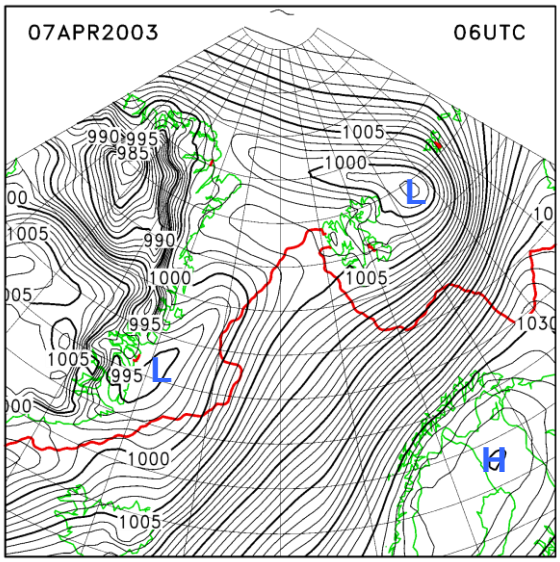
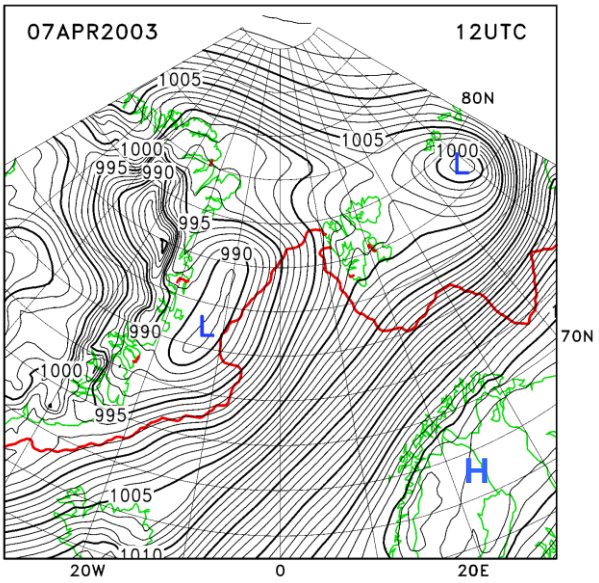
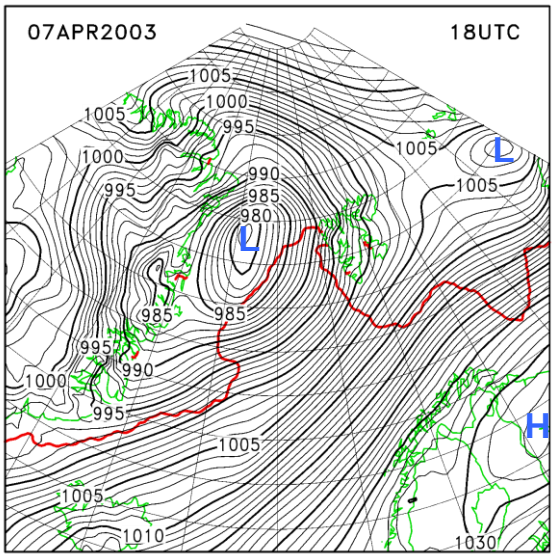
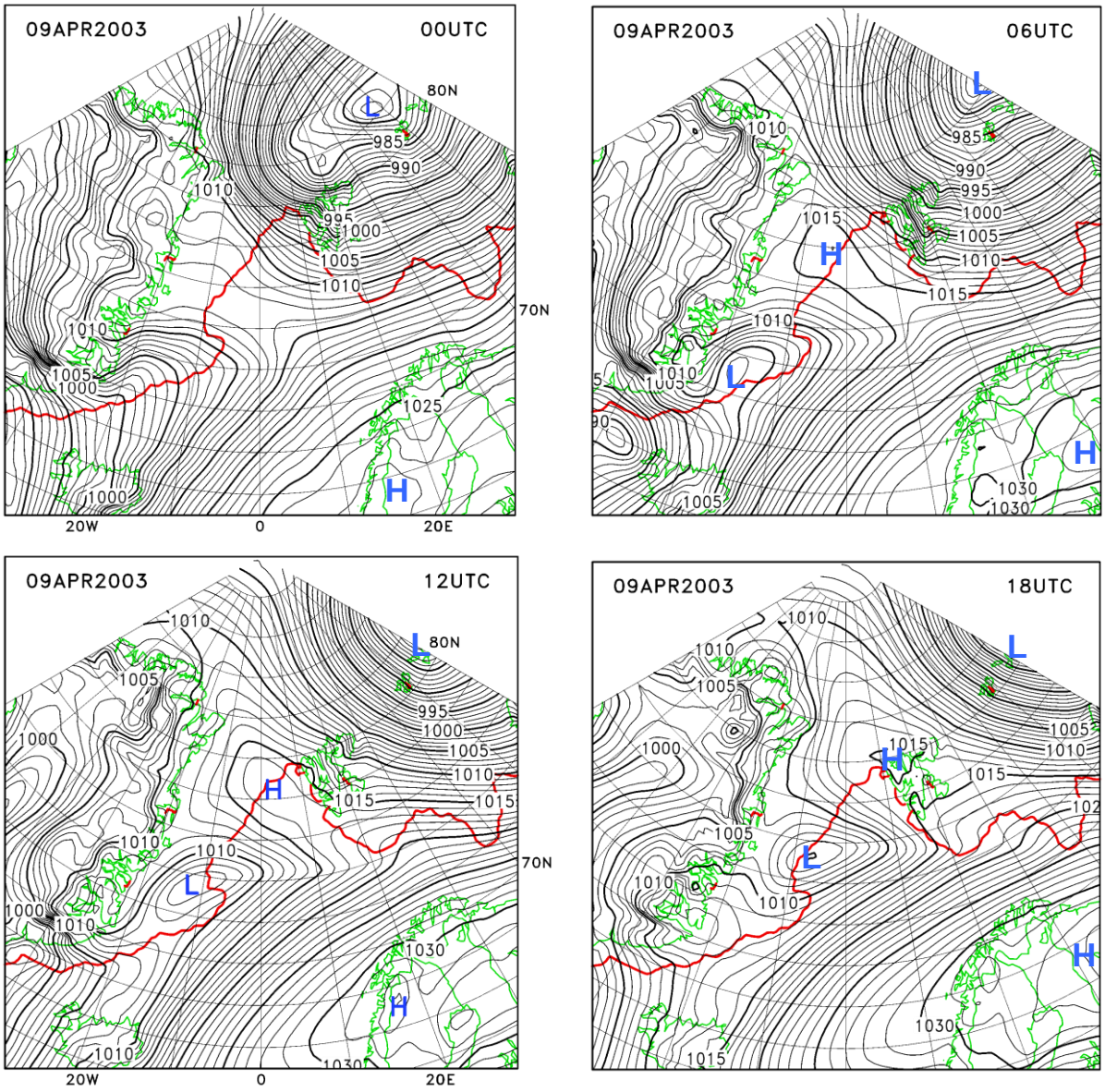




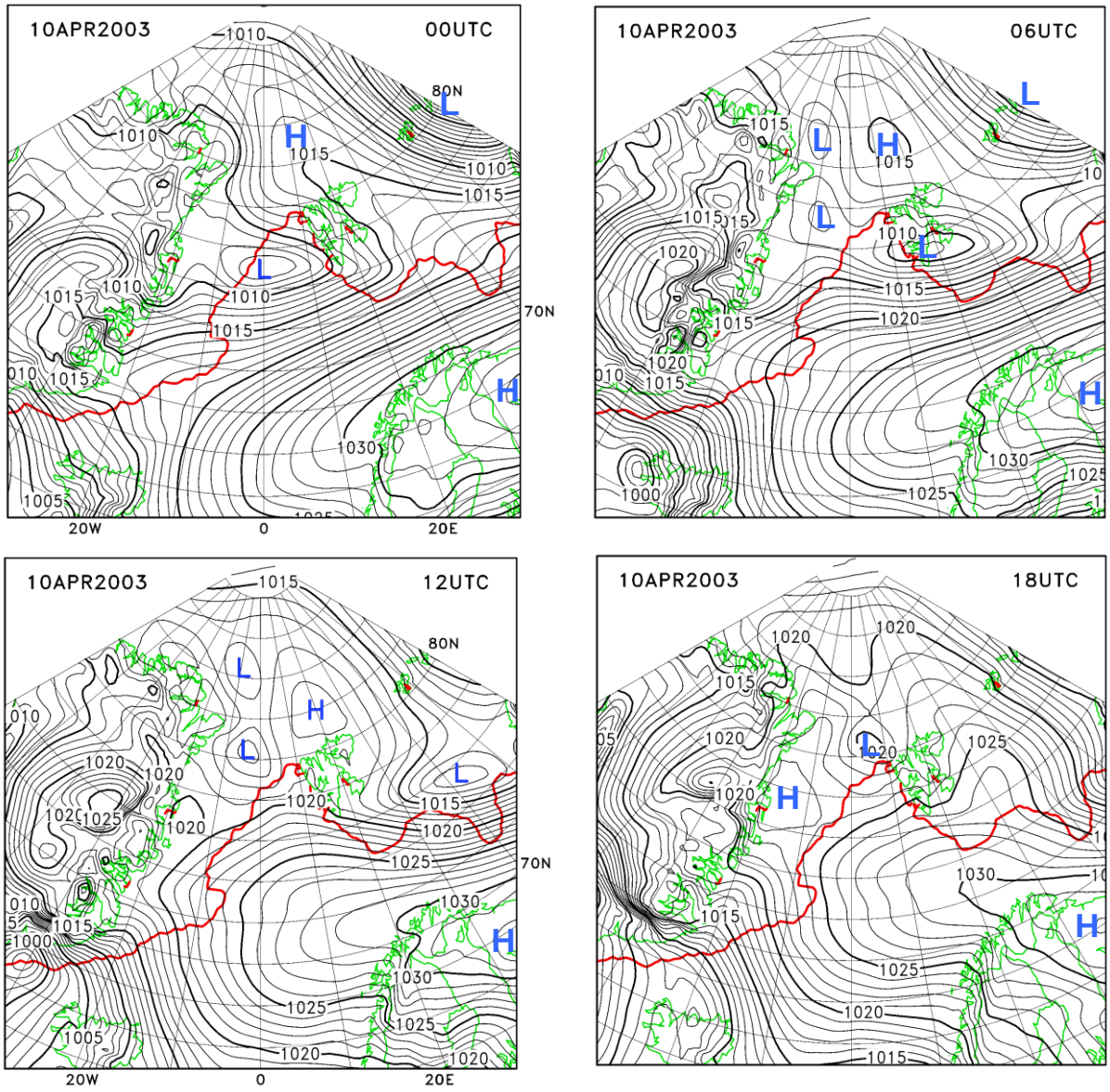




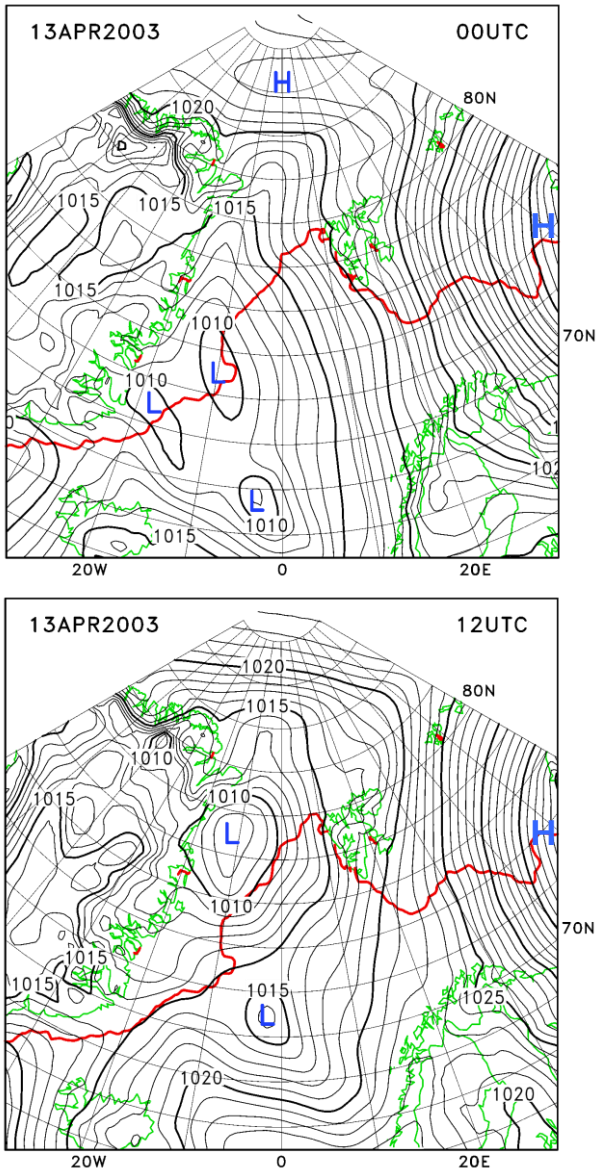
Falcon Flight No. 4 Date: 9 April 2003 10.54-14.05 UTC

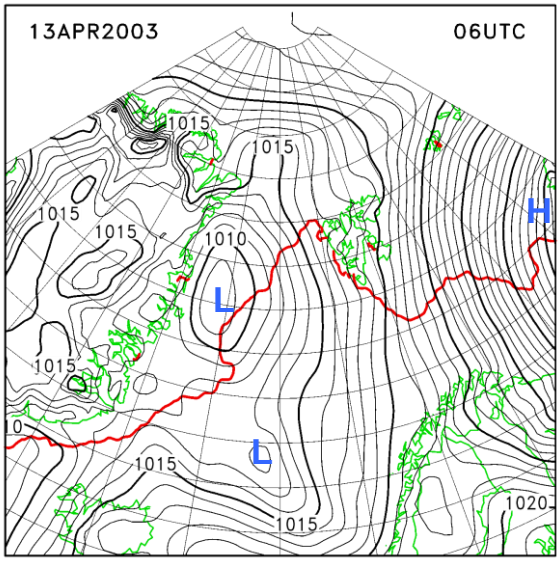


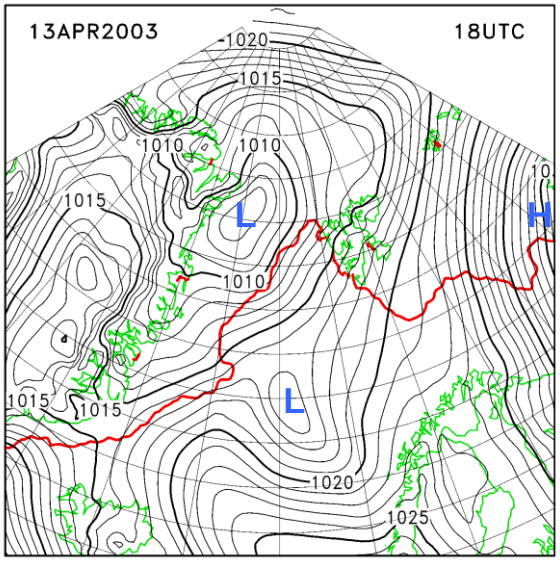
Falcon Flight No. 5 Date: 10 April 2003 11.05-13.14 UTC



Falcon Flight No. 6 Date: 13 April 2003 15.11-17.44 UTC







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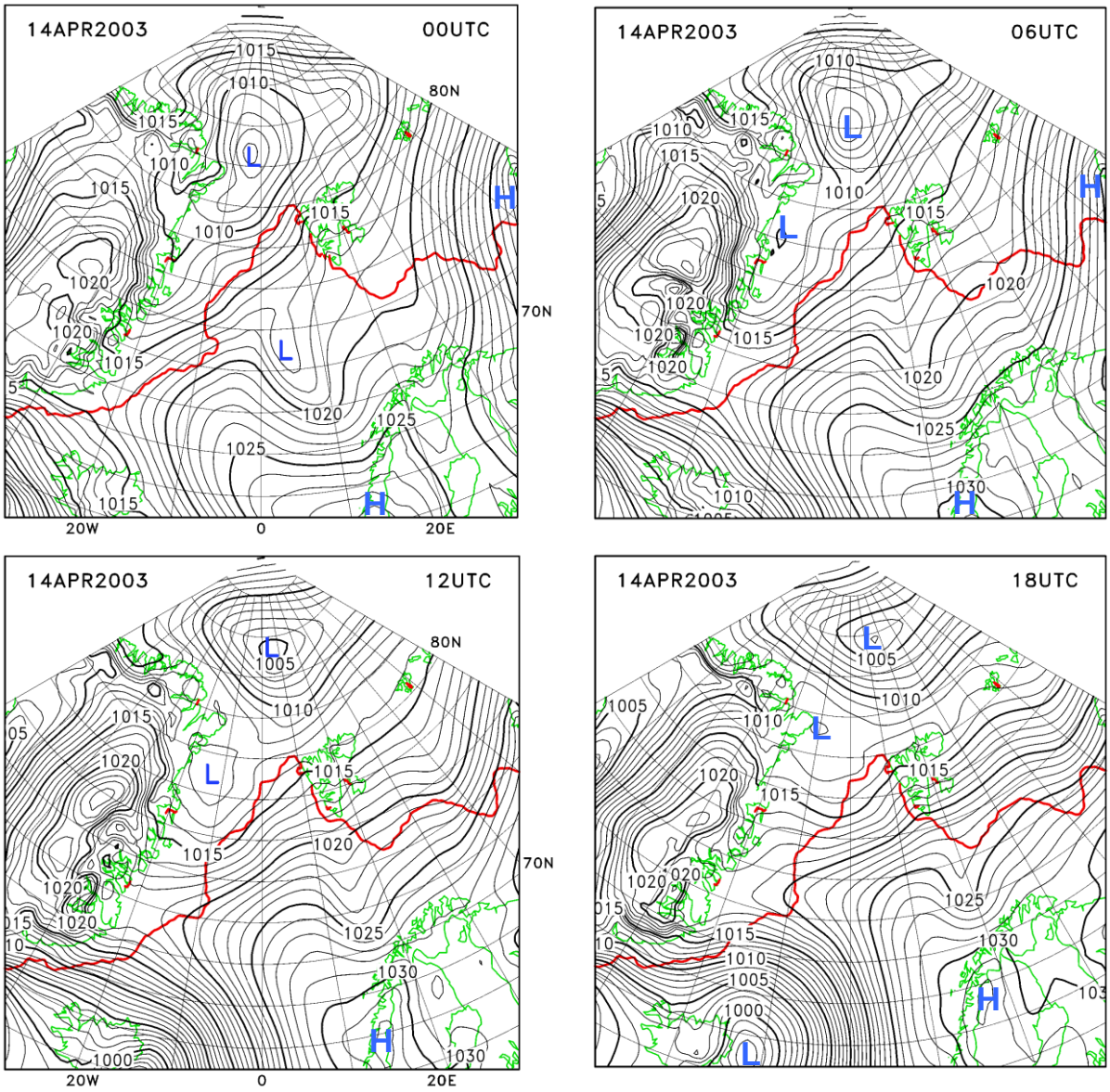
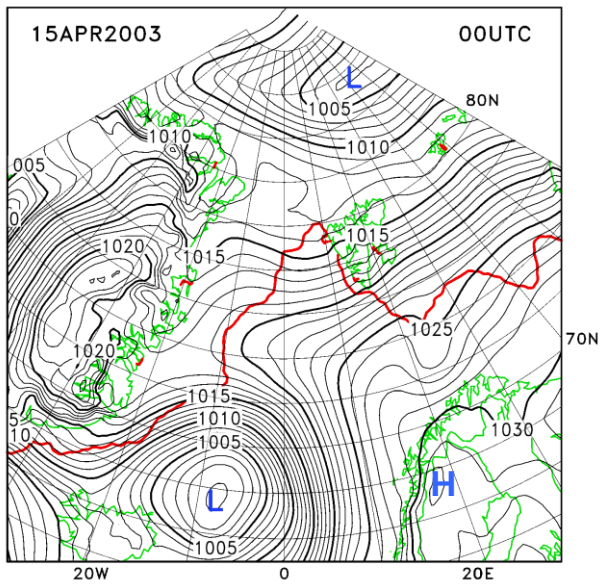
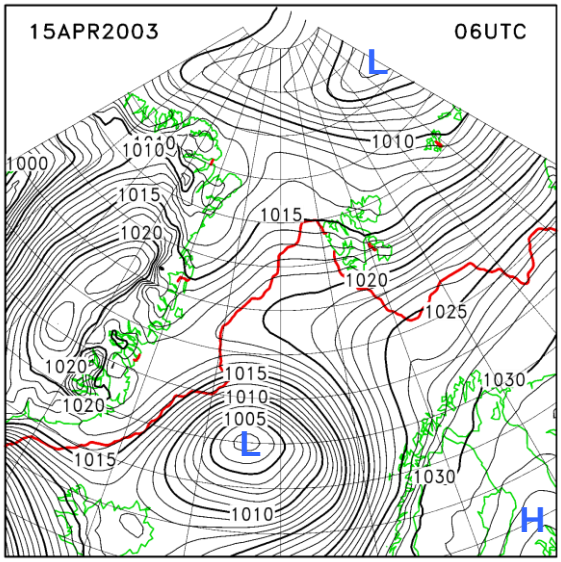
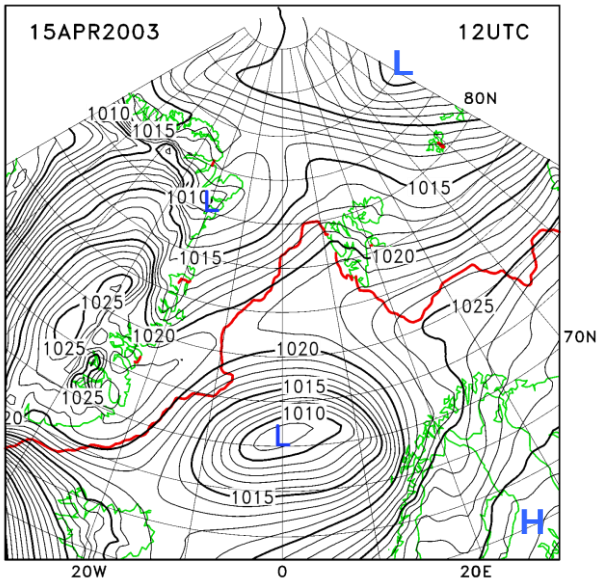
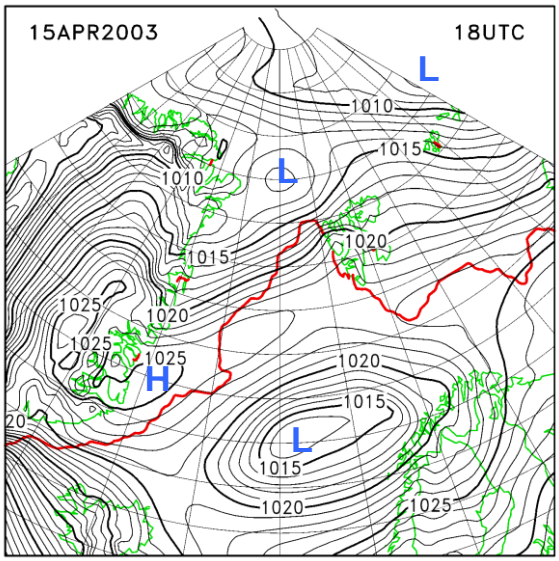


Falcon Flight No. 8 Date: 15 April 2003 10.00-13.05 UTC



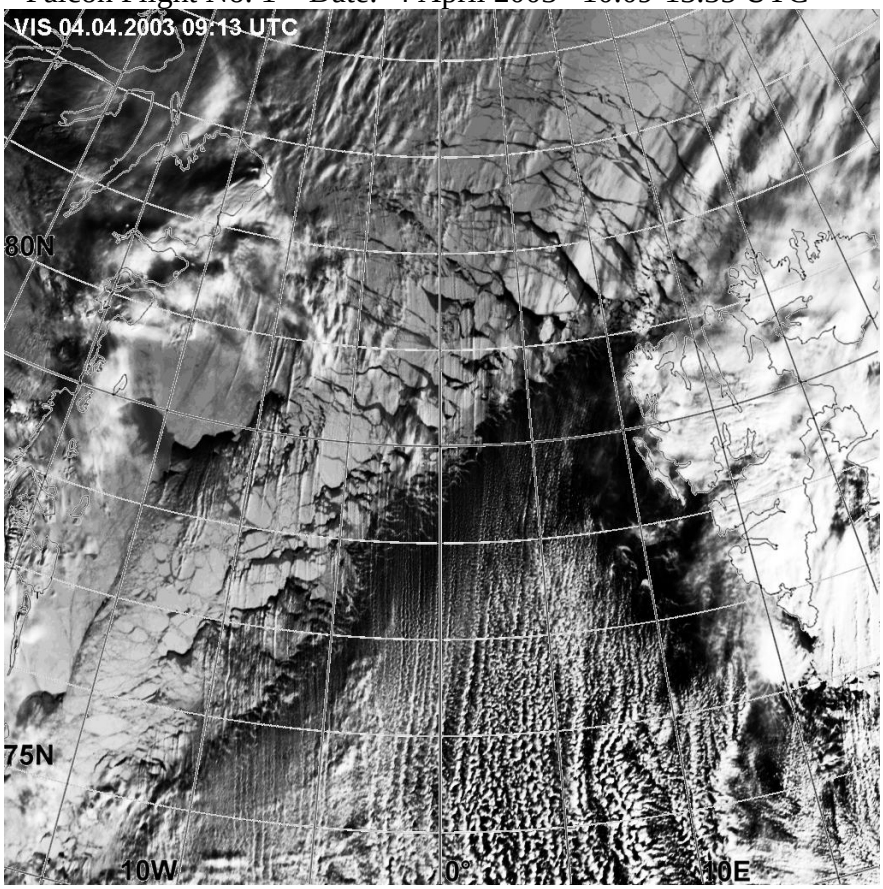


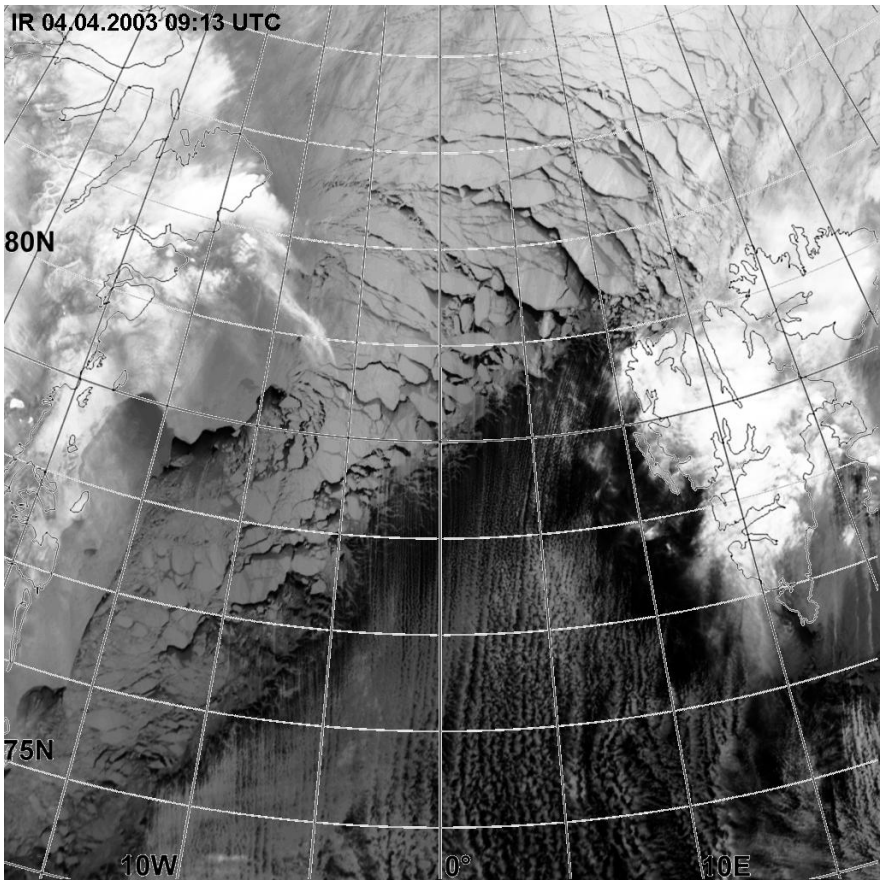




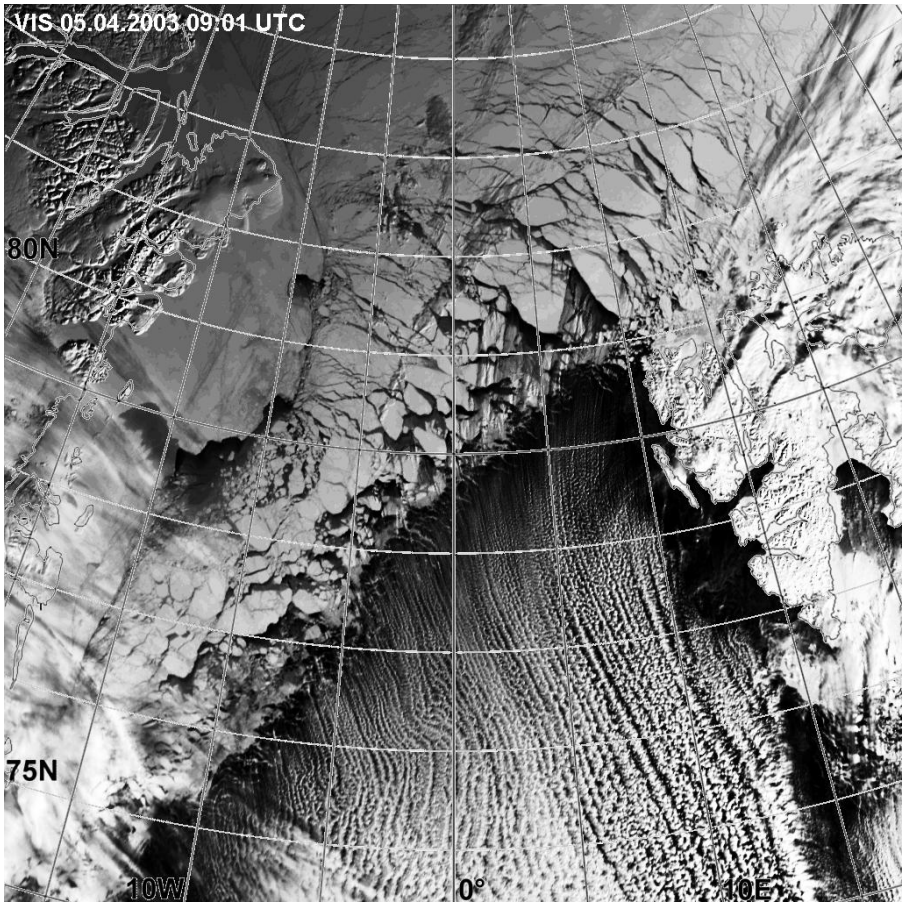
5. NOAA visible and infrared satellite images for each Falcon flight mission

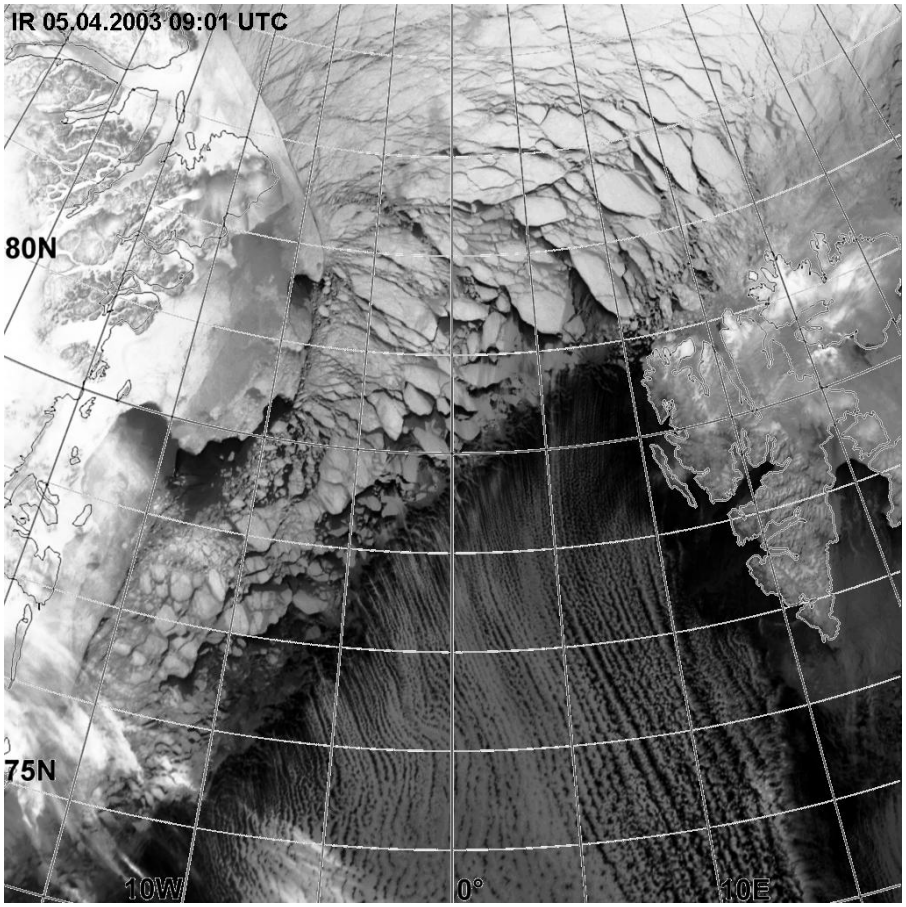
Falcon Flight No. 1 Date: 4 April 2003 10.09-13.35 UTC



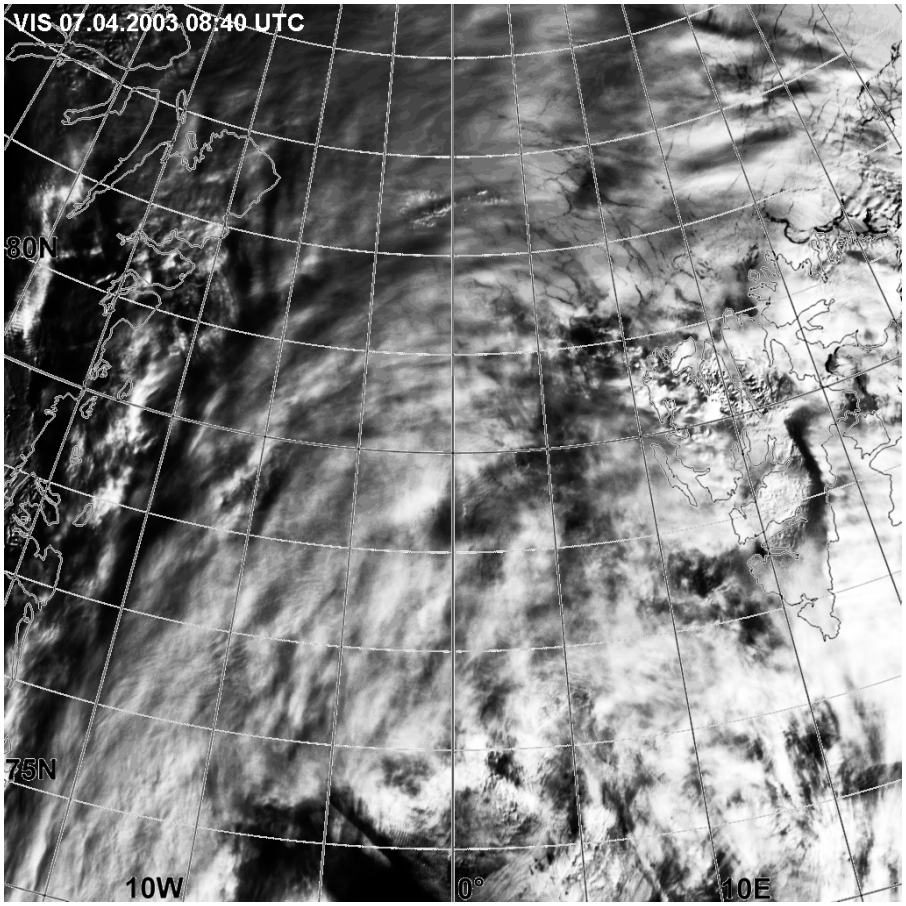


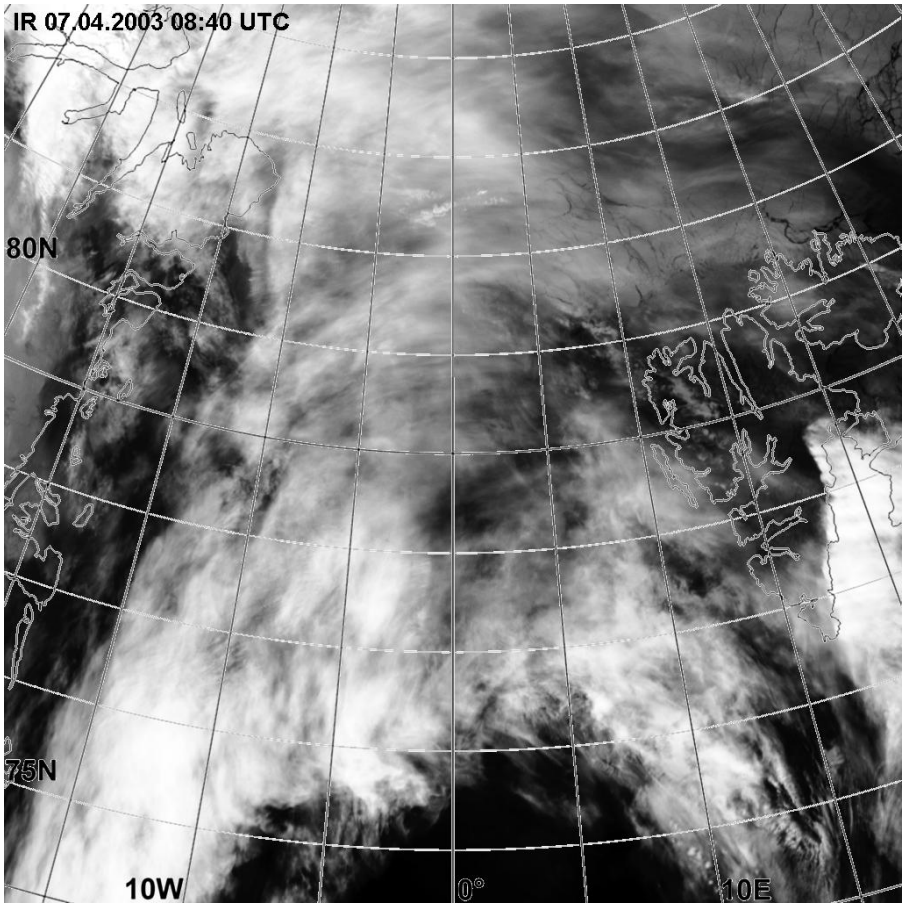
Falcon Flight No. 2 Date: 5 April 2003 10.04-12.23UTC



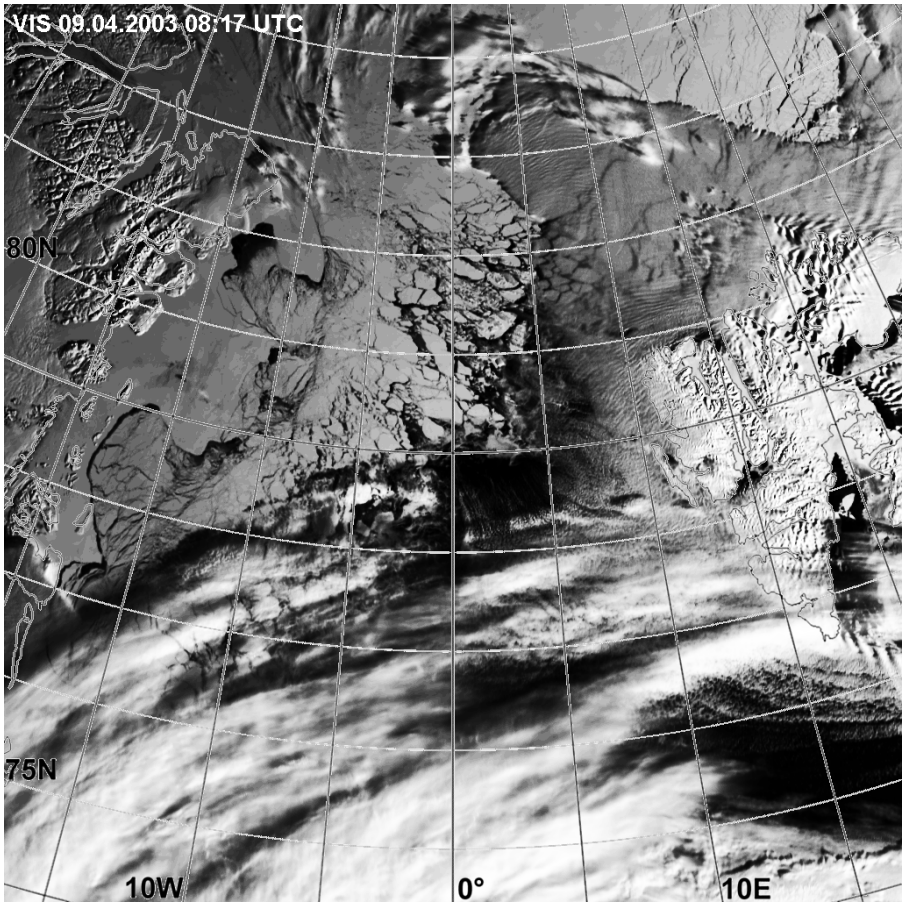


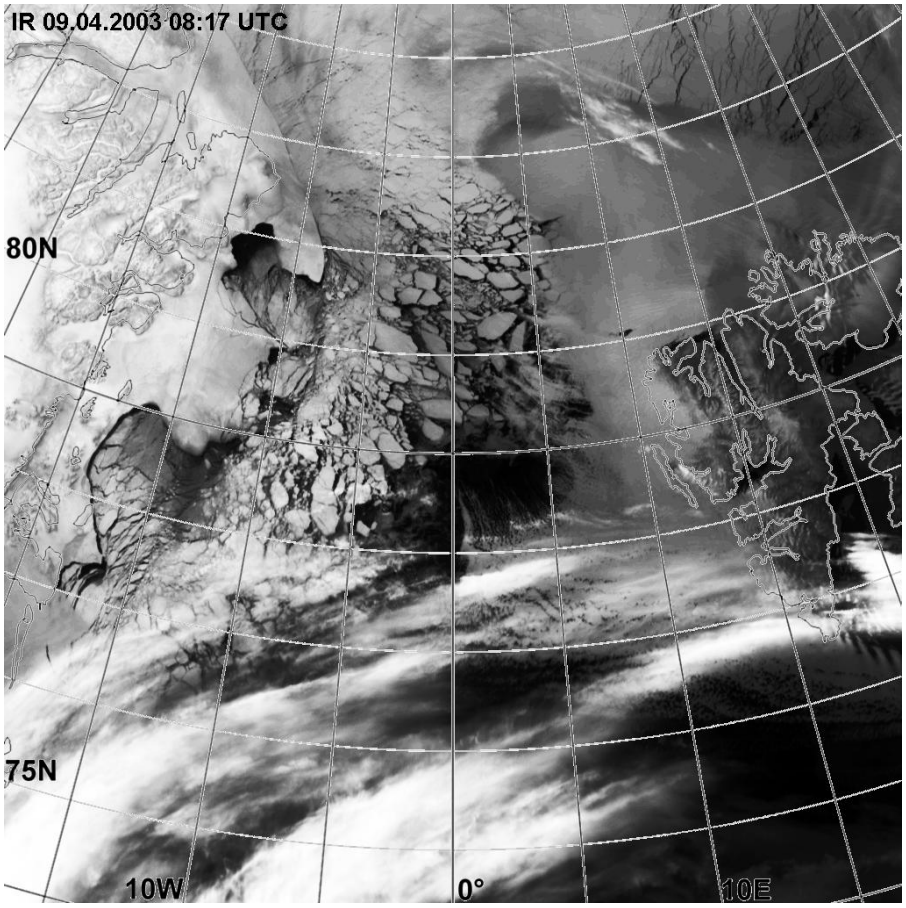
Falcon Flight No. 3 Date: 7 April 2003 09.09-11.24 UTC



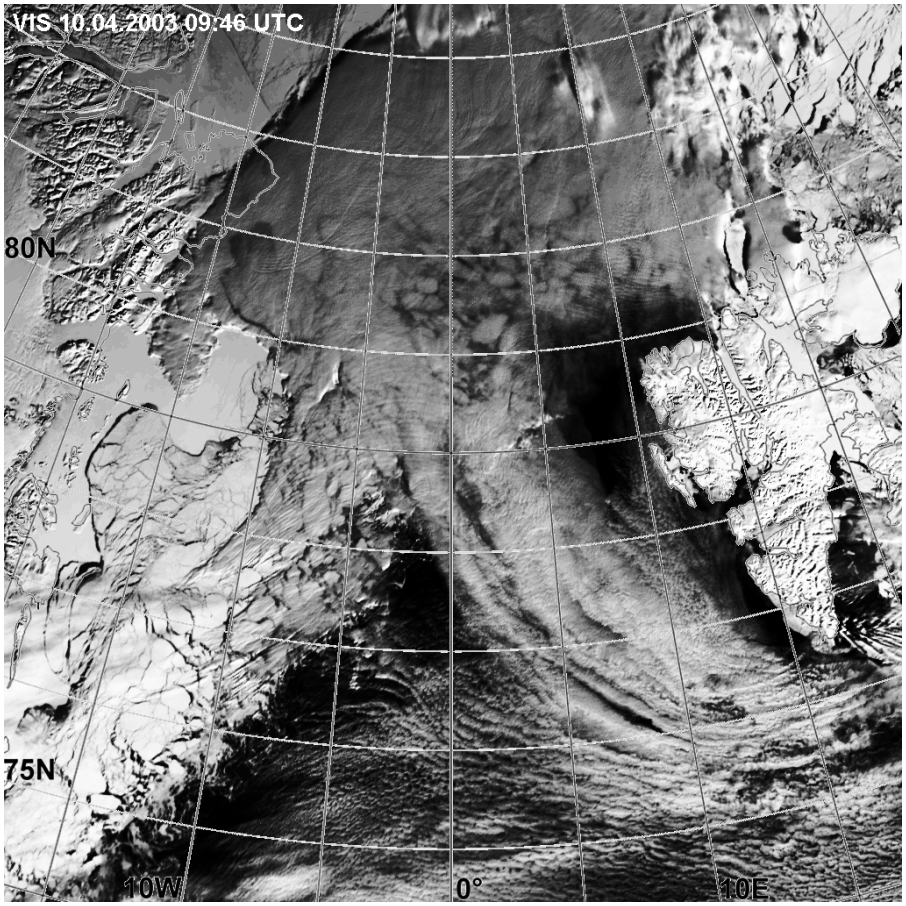


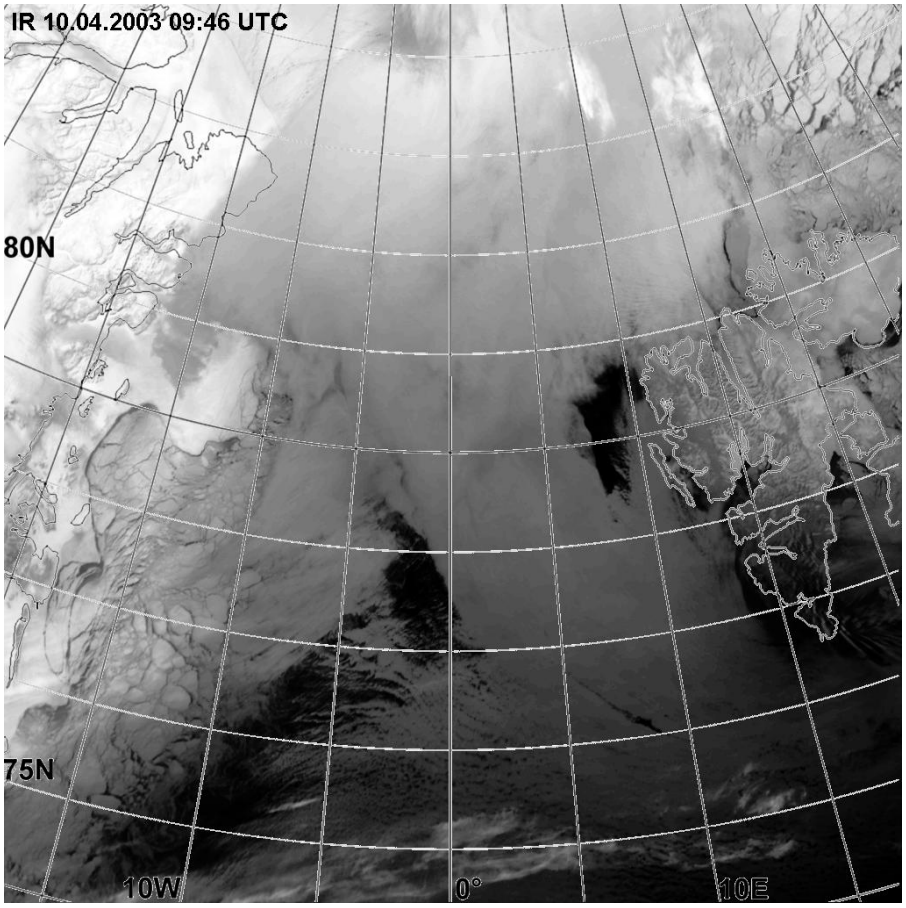
Falcon Flight No. 4 Date: 9 April 2003 10.54-14.05 UTC



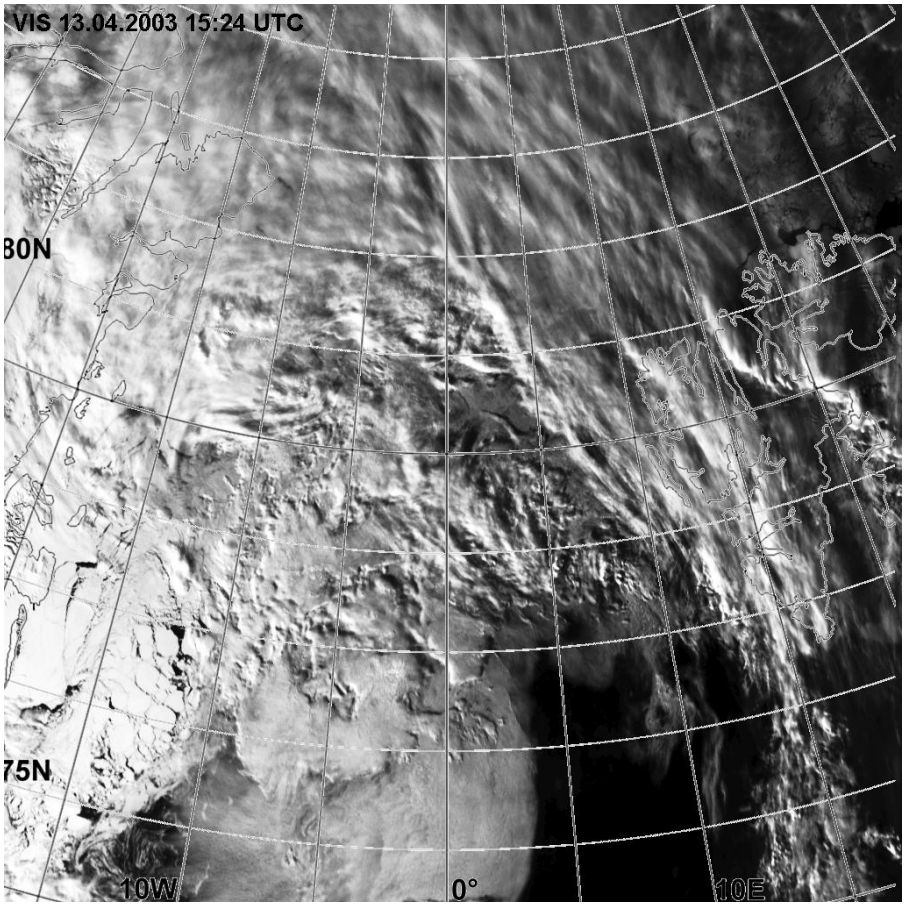


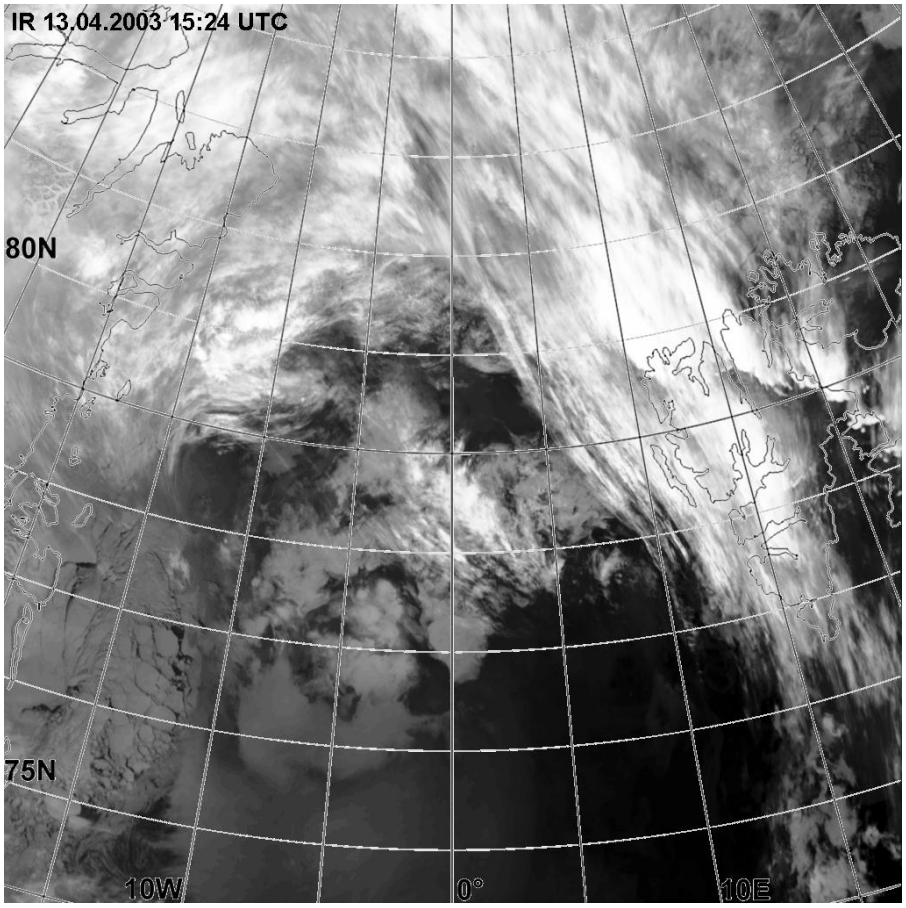
Falcon Flight No. 5 Date: 10 April 2003 11.05-13.14 UTC



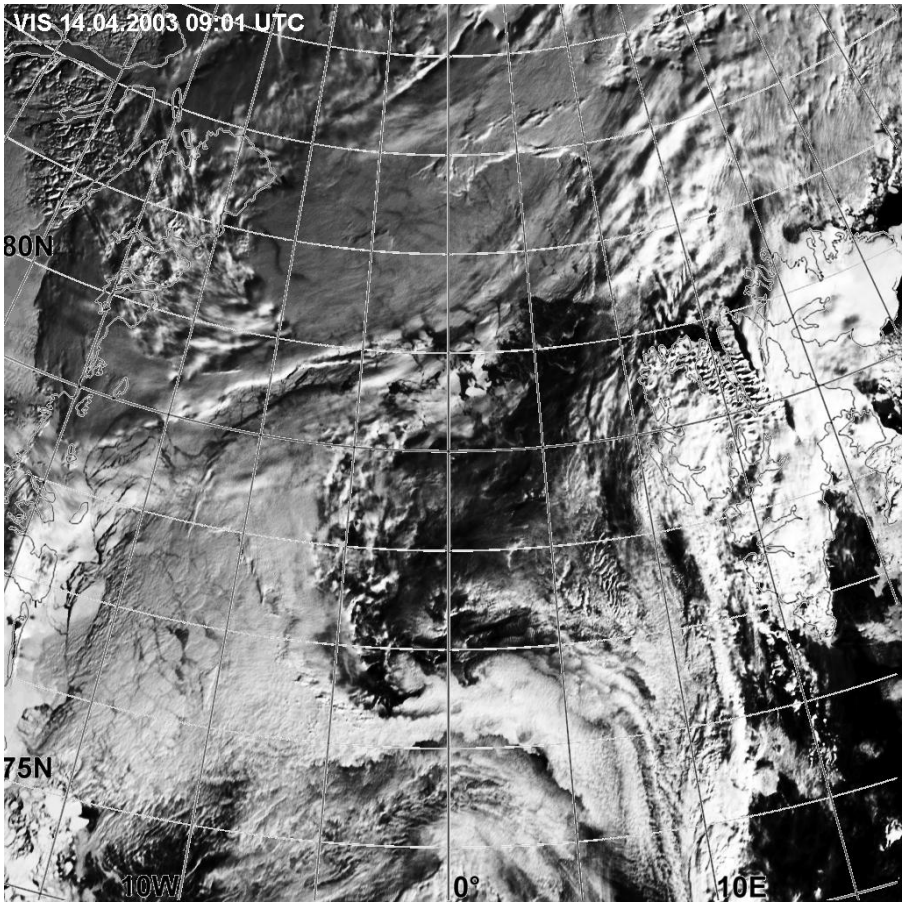


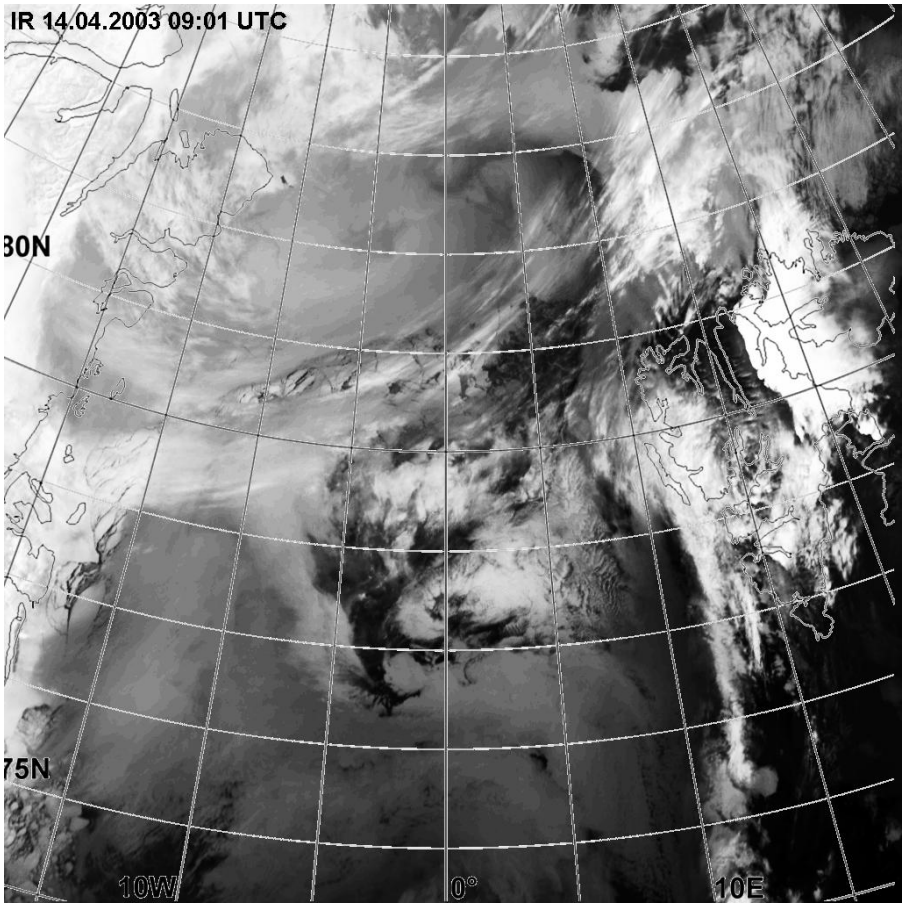
Falcon Flight No. 6 Date: 13 April 2003 15.11-17.44 UTC



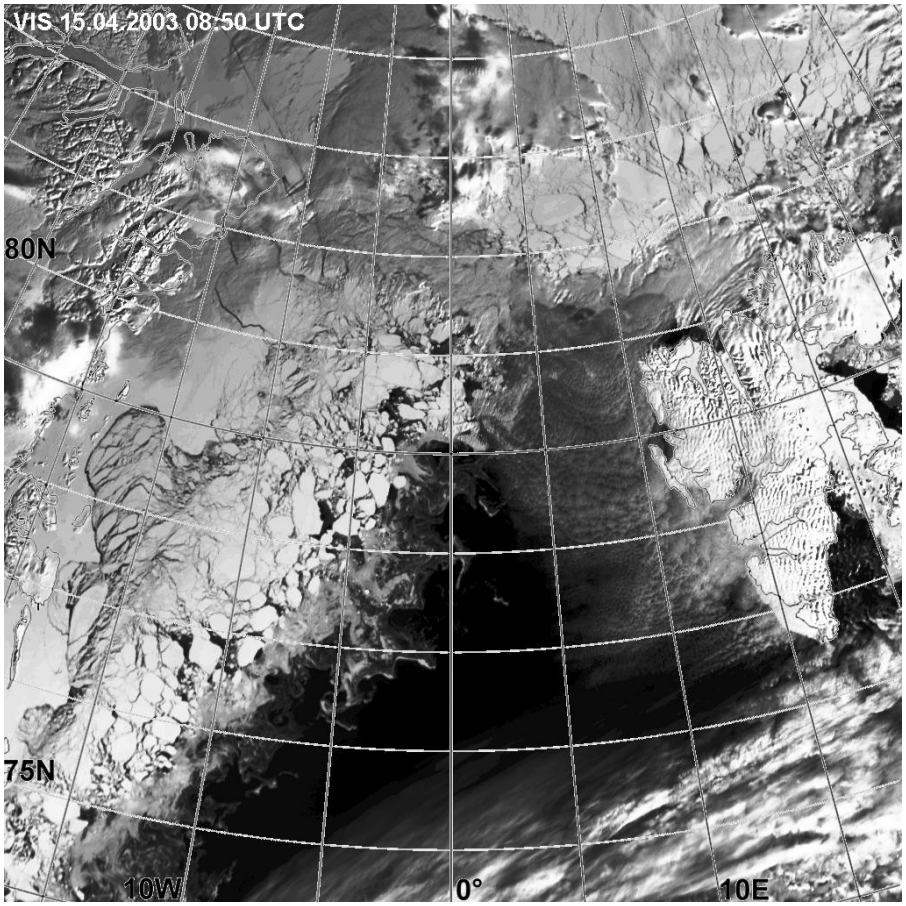


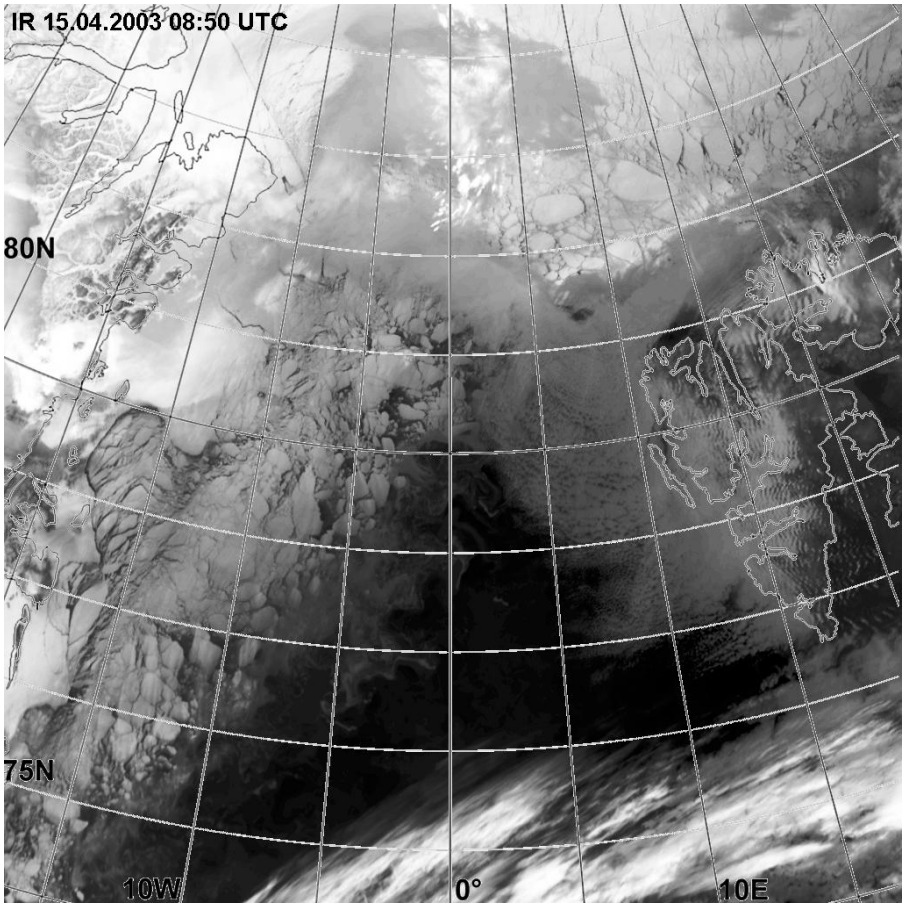
Falcon Flight No. 7 Date: 14 April 2003 09.54-12.56 UTC





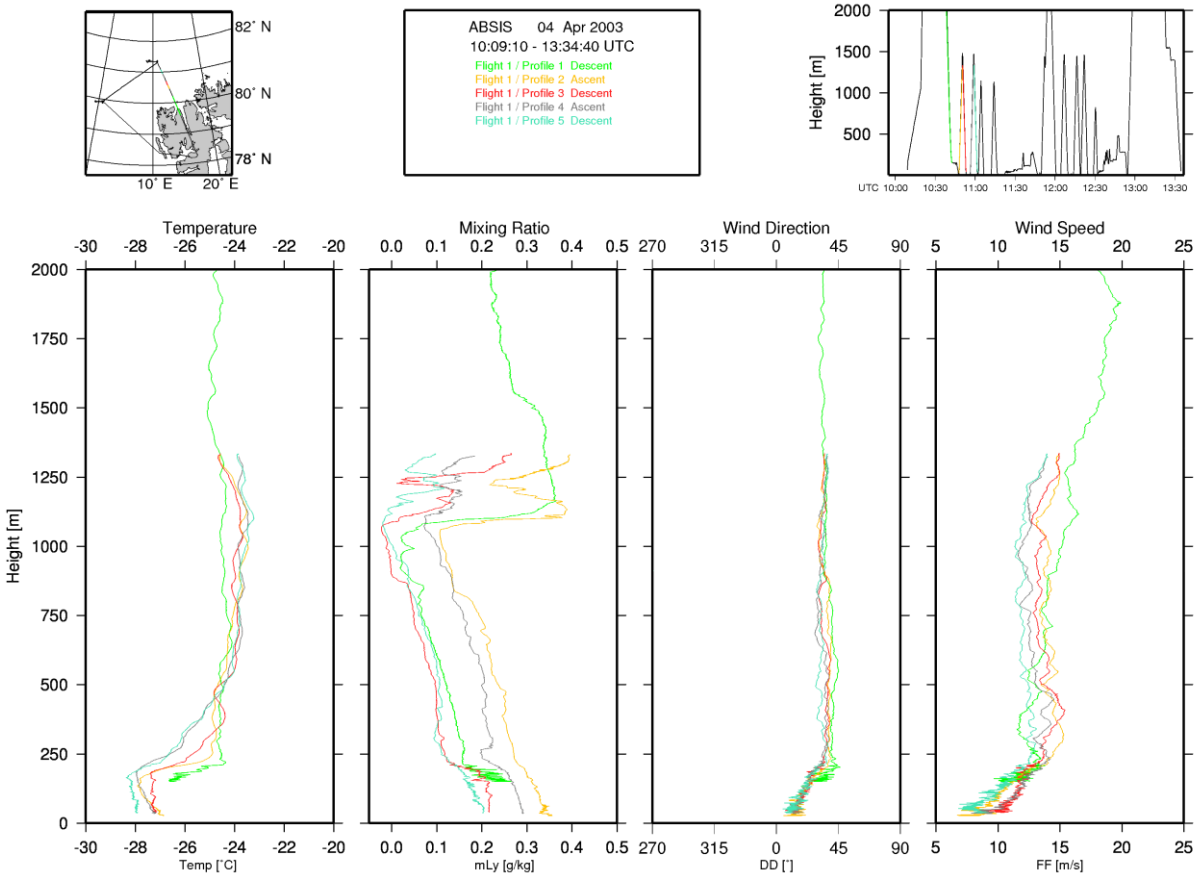
Falcon Flight No. 8 Date: 15 April 2003 10.00-13.05 UTC

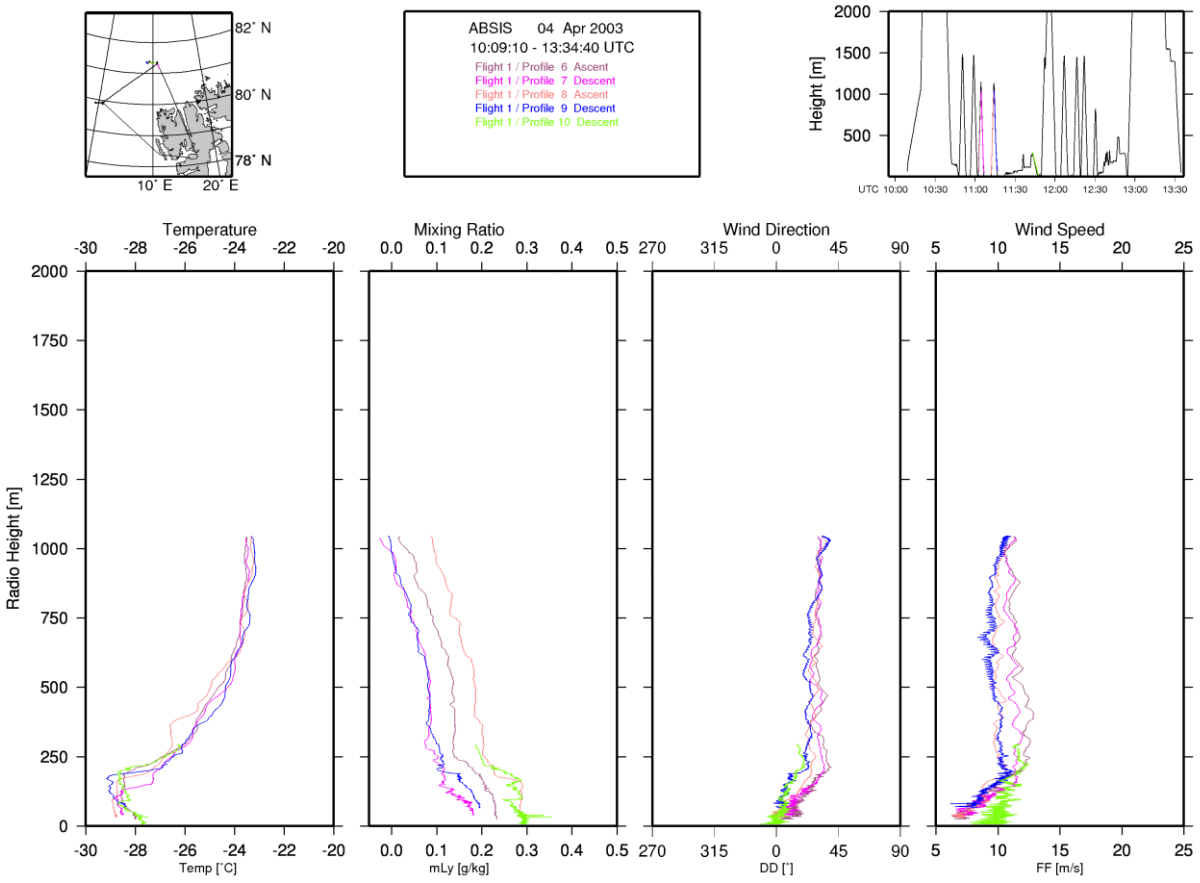


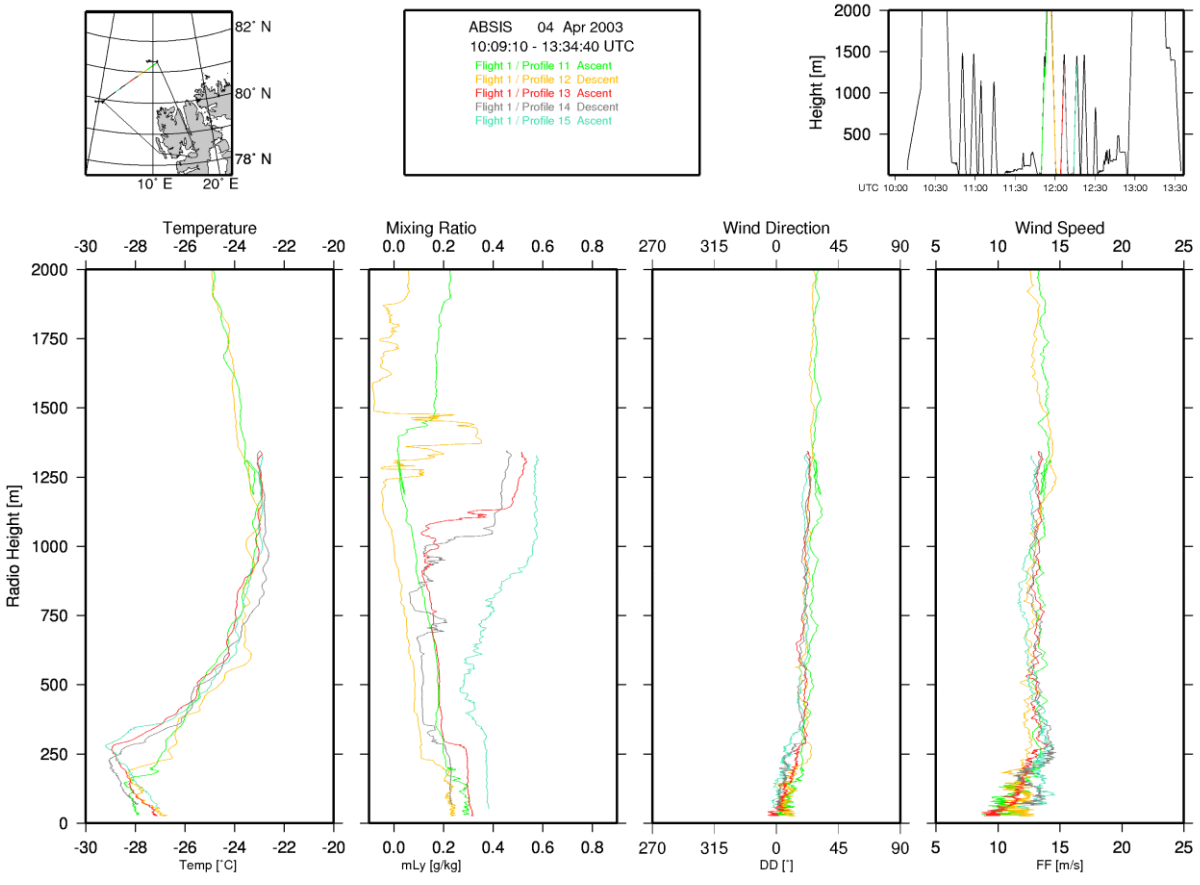


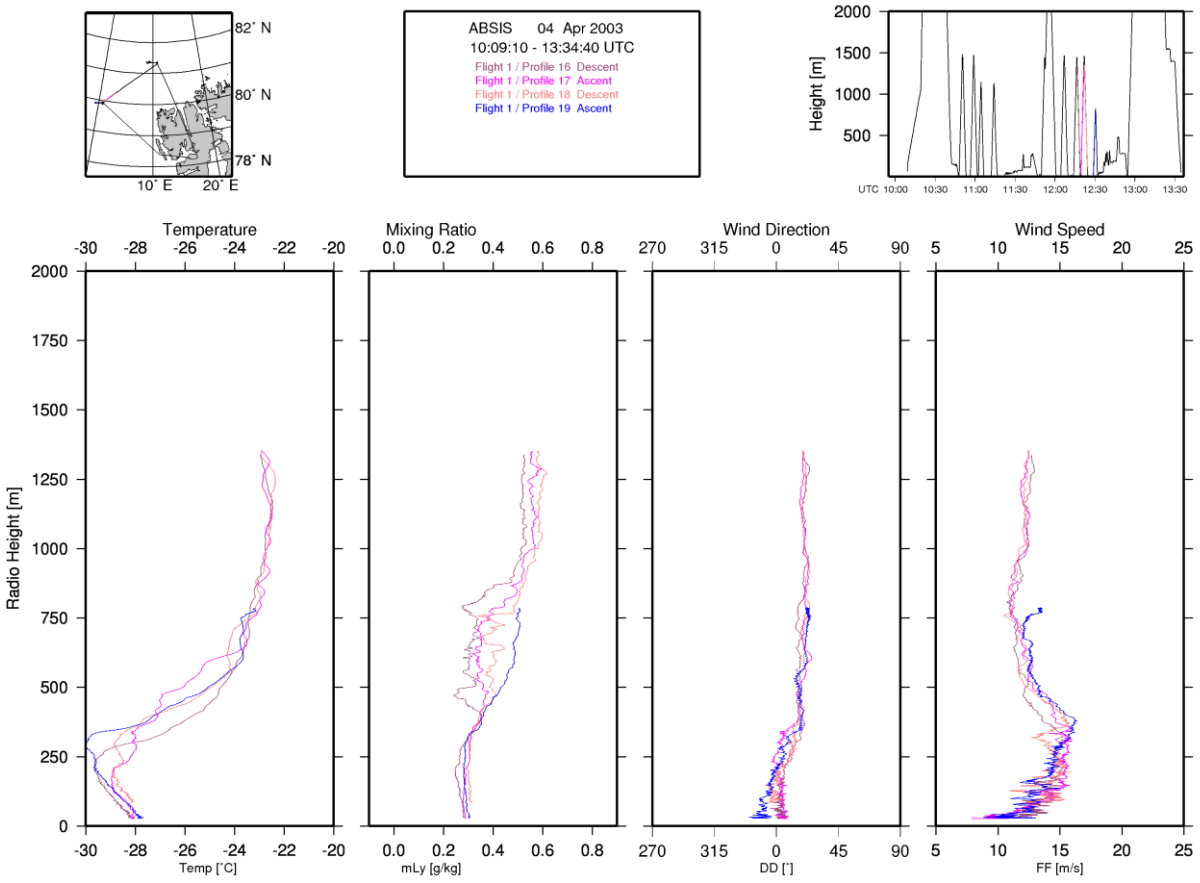
6. Vertical profiles of temperature, specific humidity, wind speed and wind direction for each flight mission

Falcon Flight No. 1 Date: 04 April 2003 10.09-13.35 UTC

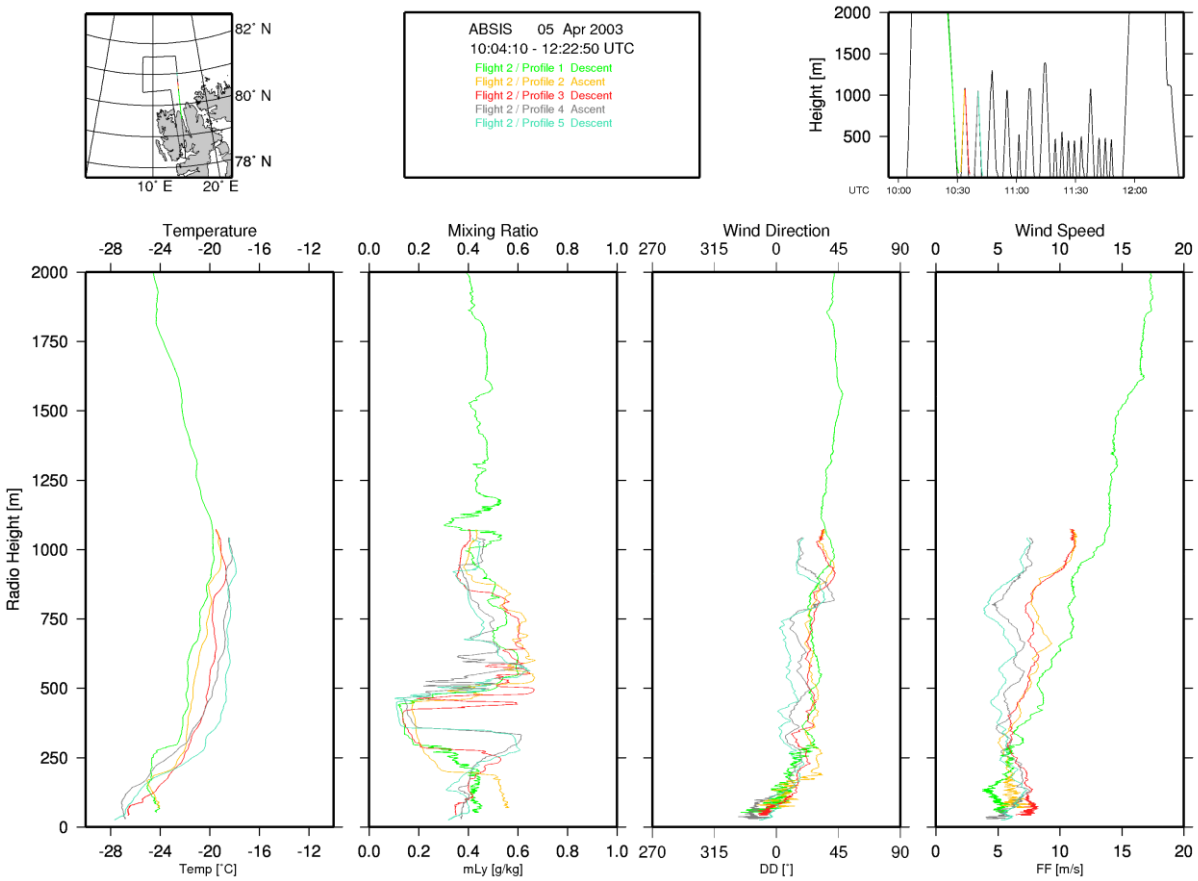


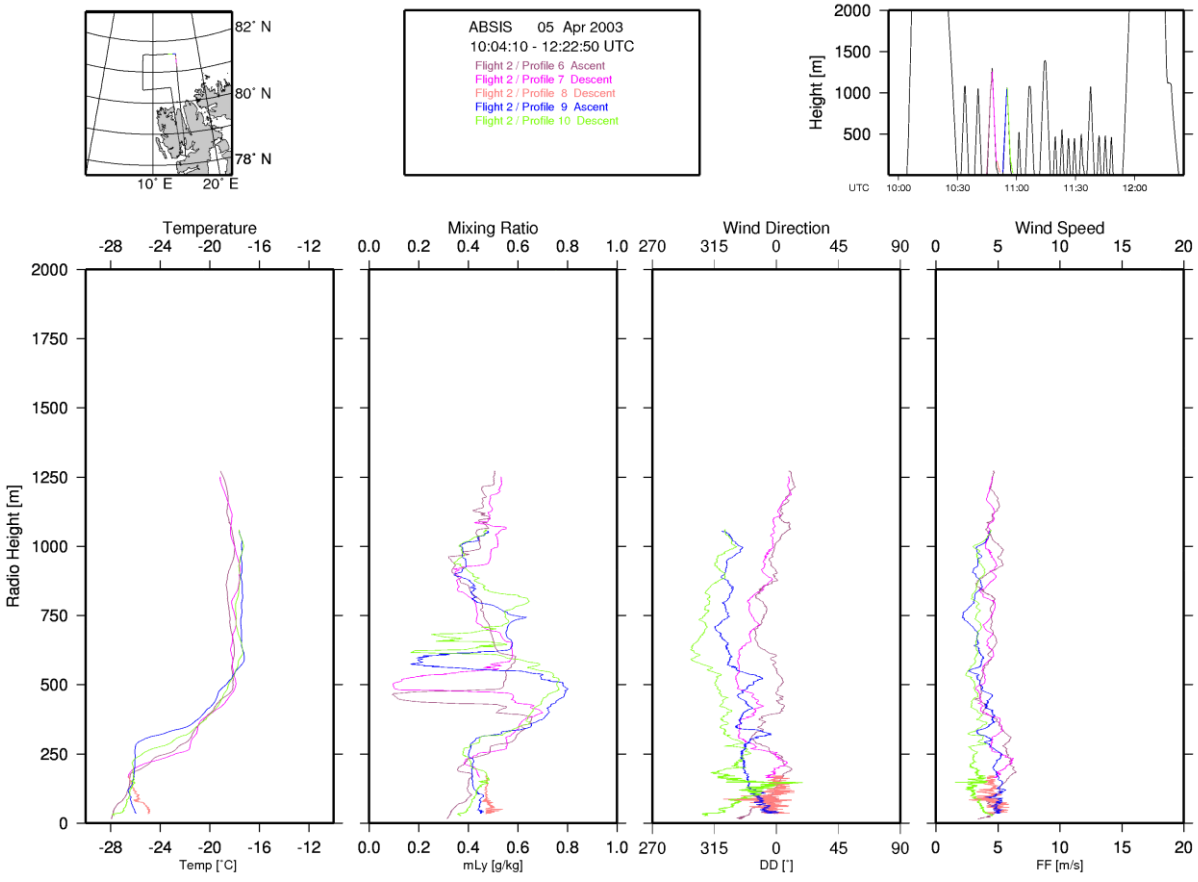

82° N
80° N
78° N
10° E
20° E
ABSIS 04 Apr 2003
10:09:10 - 13:34:40 UTC
Flight 1 / Profile 6 Ascent
Flight 1 / Profile 7 Descent
Flight 1 / Profile 8 Ascent
Flight 1 / Profile 9 Descent
Flight 1 / Profile 10 Descent
Height [m]
UTC 10:00 10:30 11:00 11:30 12:00 12:30 13:00 13:30
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

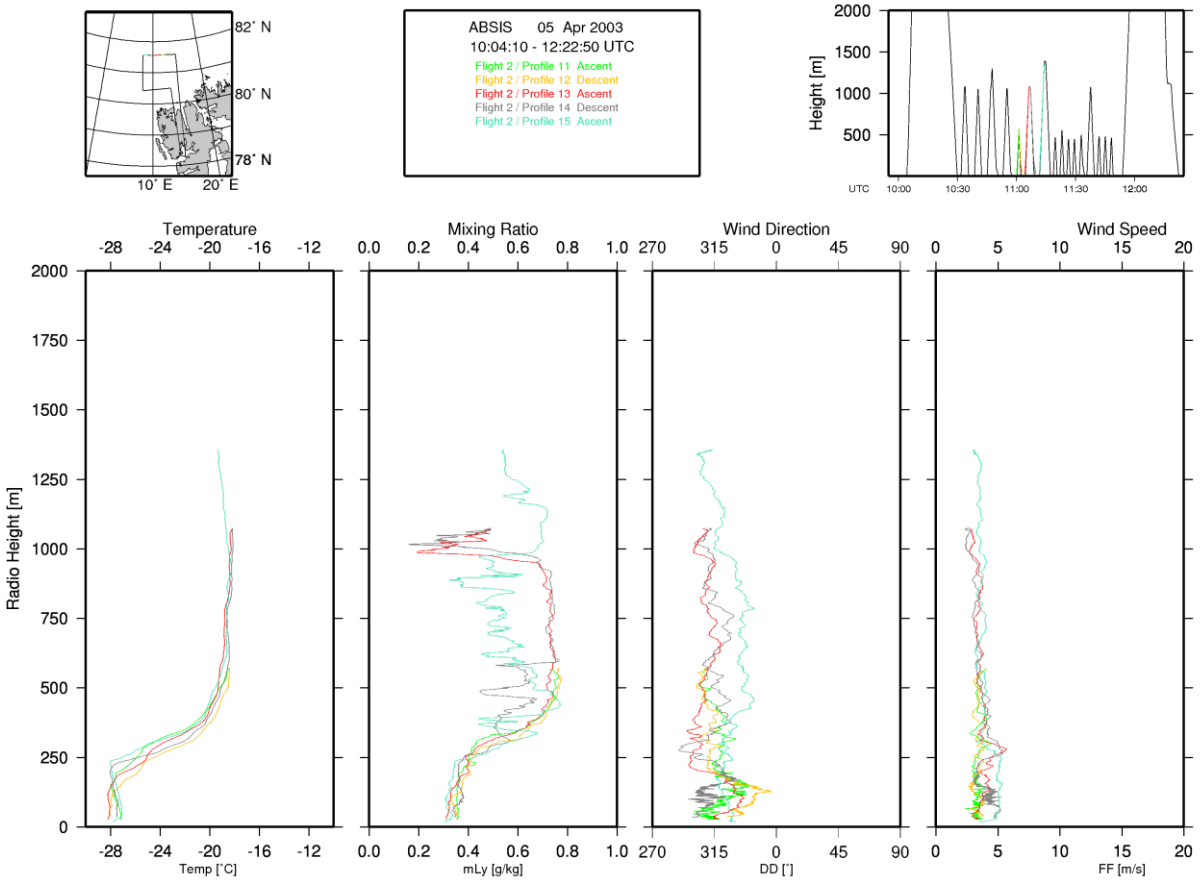

82° N
80° N
78° N
10° E
20° E
ABSIS 04 Apr 2003
10:09:10 - 13:34:40 UTC
Flight 1 / Profile 11 Ascent
Flight 1 / Profile 12 Descent
Flight 1 / Profile 13 Ascent
Flight 1 / Profile 14 Descent
Flight 1 / Profile 15 Ascent
Height [m]
UTC 10:00 10:30 11:00 11:30 12:00 12:30 13:00 13:30
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

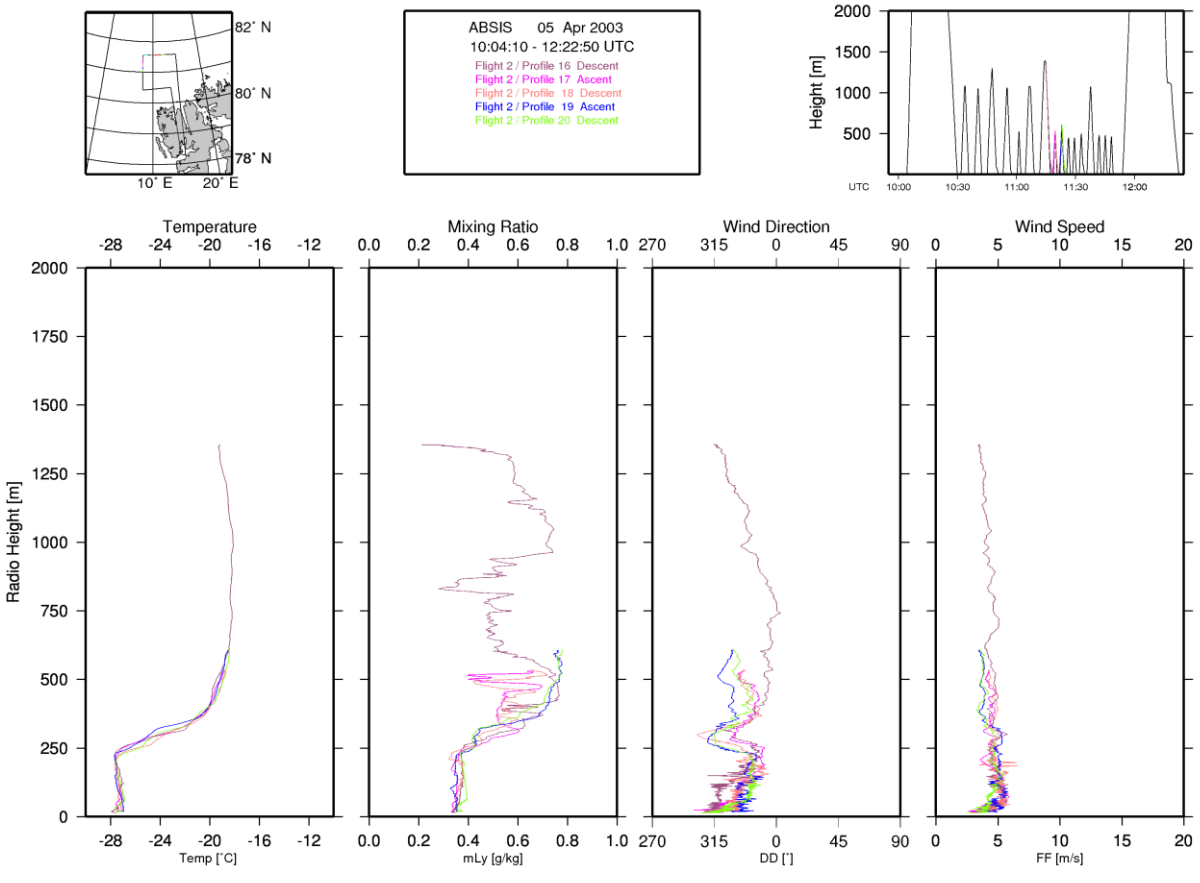

82° N
80° N
78° N
10° E
20° E
ABSIS 04 Apr 2003
10:09:10 - 13:34:40 UTC
Flight 1 / Profile 16 Descent
Flight 1 / Profile 17 Ascent
Flight 1 / Profile 18 Descent
Flight 1 / Profile 19 Ascent
Height [m]
2000
1500
1000
500
UTC 10:00 10:30 11:00 11:30 12:00 12:30 13:00 13:30
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

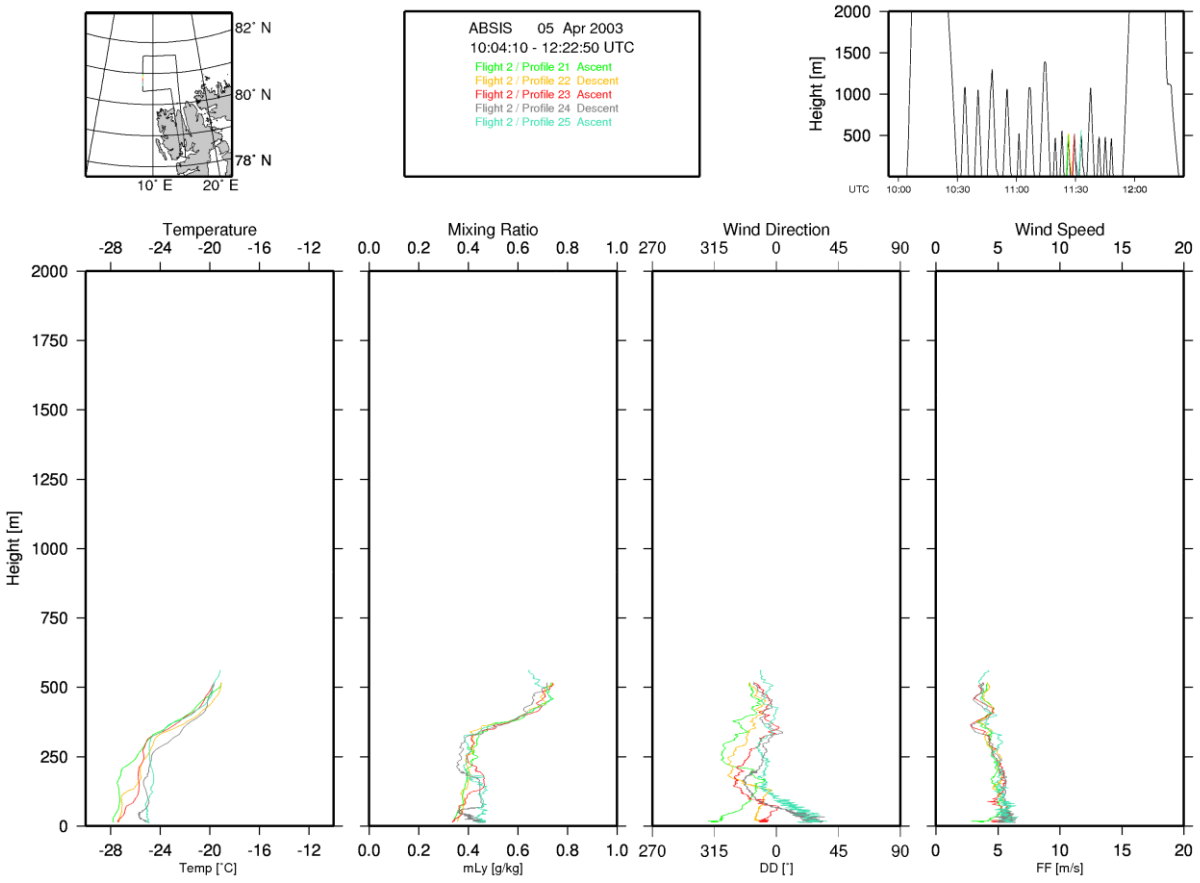
Falcon Flight No. 2 Date: 05 April 2003 10.04-12.23UTC

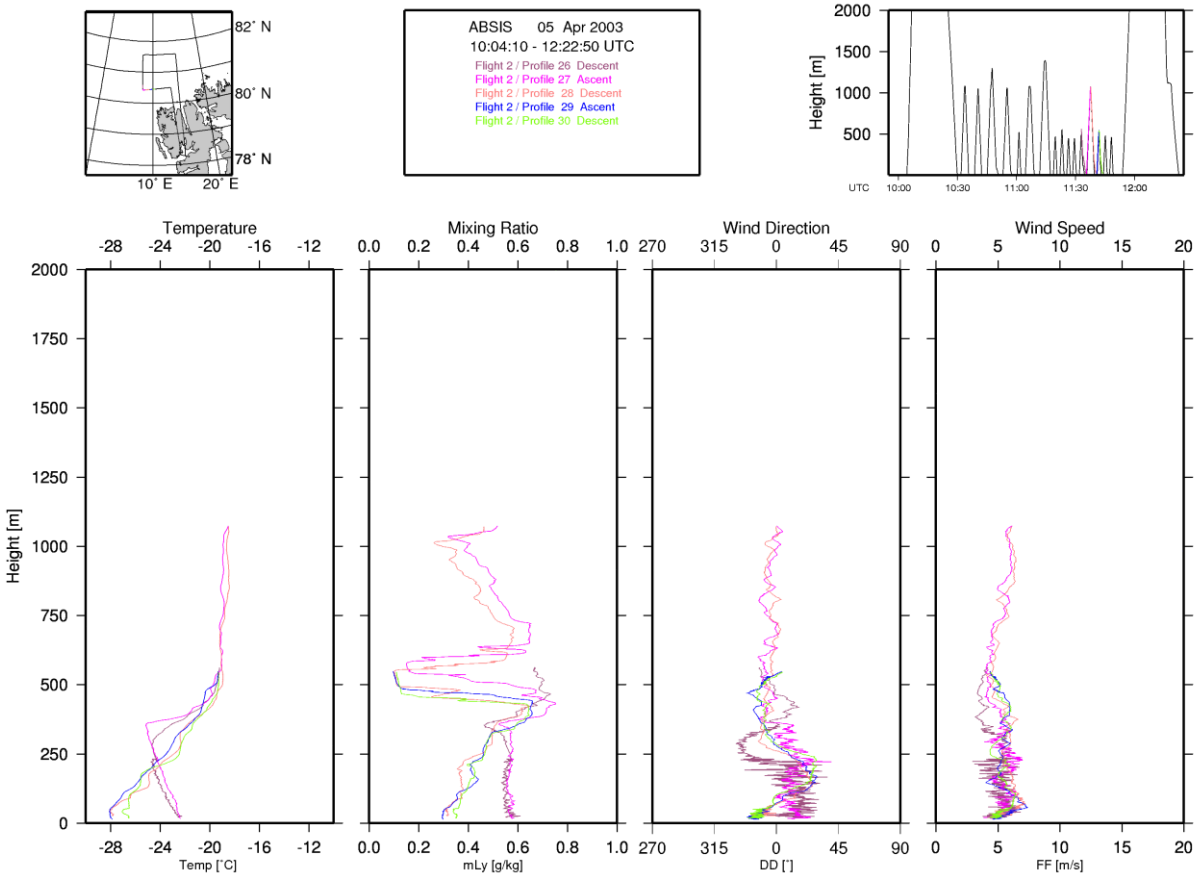


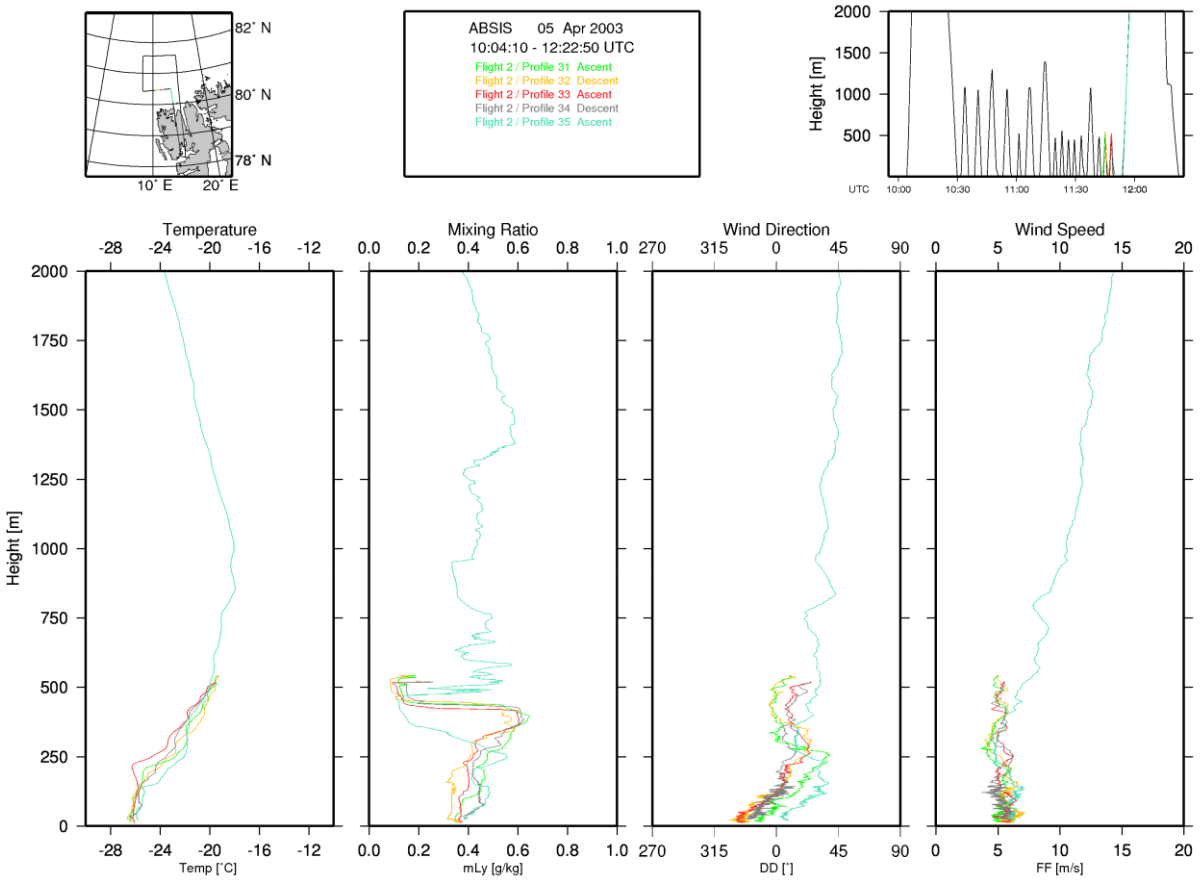



82° N
80° N
78° N
10° E
20° E
ABSIS 05 Apr 2003
10:04:10 - 12:22:50 UTC
Flight 2 / Profile 11 Ascent
Flight 2 / Profile 12 Descent
Flight 2 / Profile 13 Ascent
Flight 2 / Profile 14 Descent
Flight 2 / Profile 15 Ascent
Height [m]
UTC
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

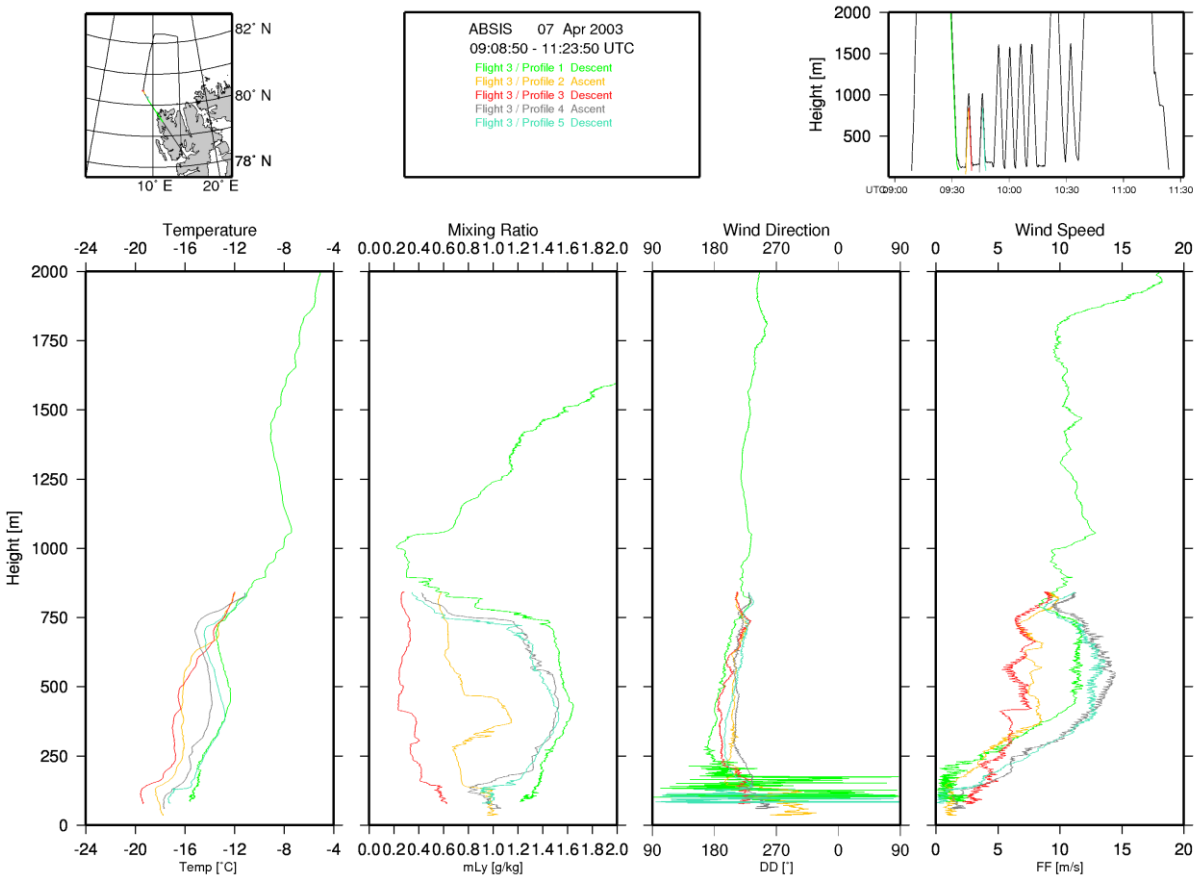

82° N
80° N
78° N
10° E
20° E
ABSIS 05 Apr 2003
10:04:10 - 12:22:50 UTC
Flight 2 / Profile 16 Descent
Flight 2 / Profile 17 Ascent
Flight 2 / Profile 18 Descent
Flight 2 / Profile 19 Ascent
Flight 2 / Profile 20 Descent
Height [m]
UTC
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

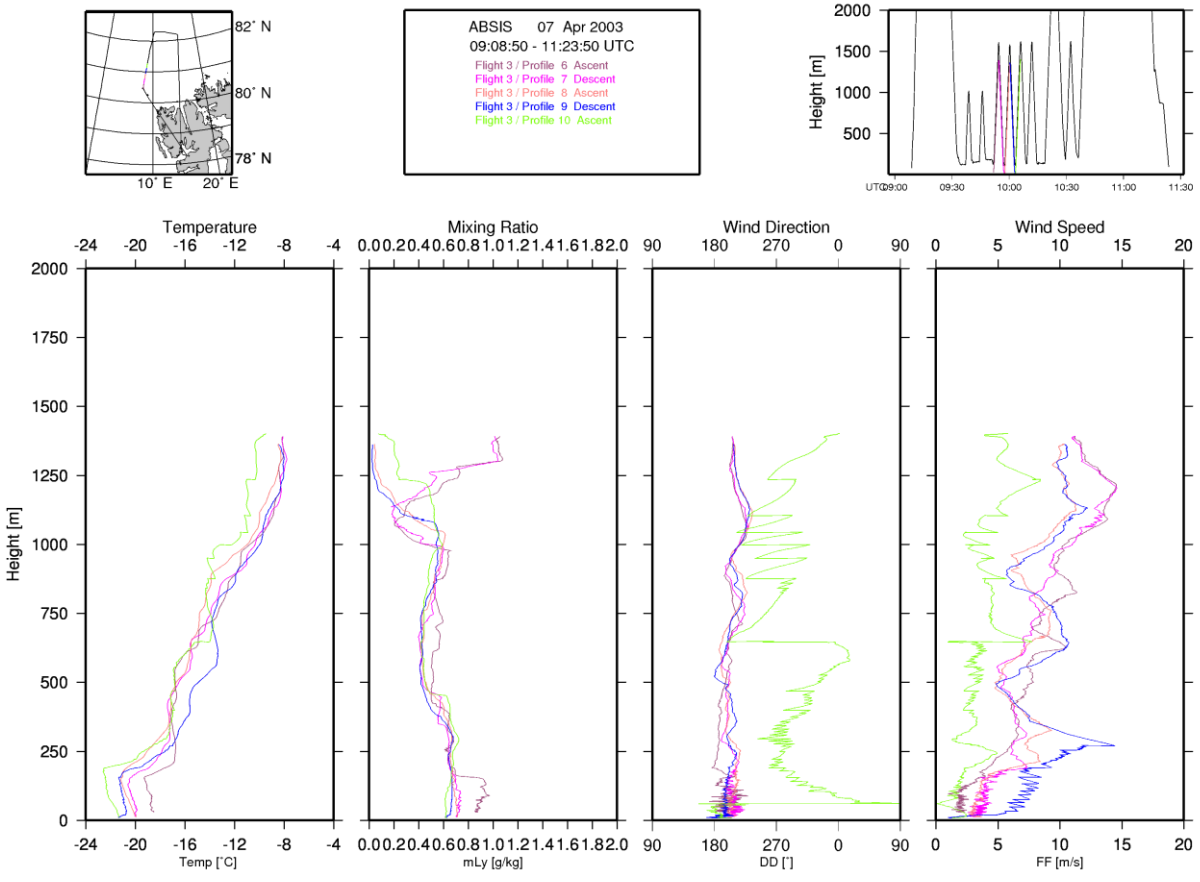

82° N
80° N
78° N
10° E
20° E
ABSIS 05 Apr 2003
10:04:10 - 12:22:50 UTC
Flight 2 / Profile 21 Ascent
Flight 2 / Profile 22 Descent
Flight 2 / Profile 23 Ascent
Flight 2 / Profile 24 Descent
Flight 2 / Profile 25 Ascent
Height [m]
UTC
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

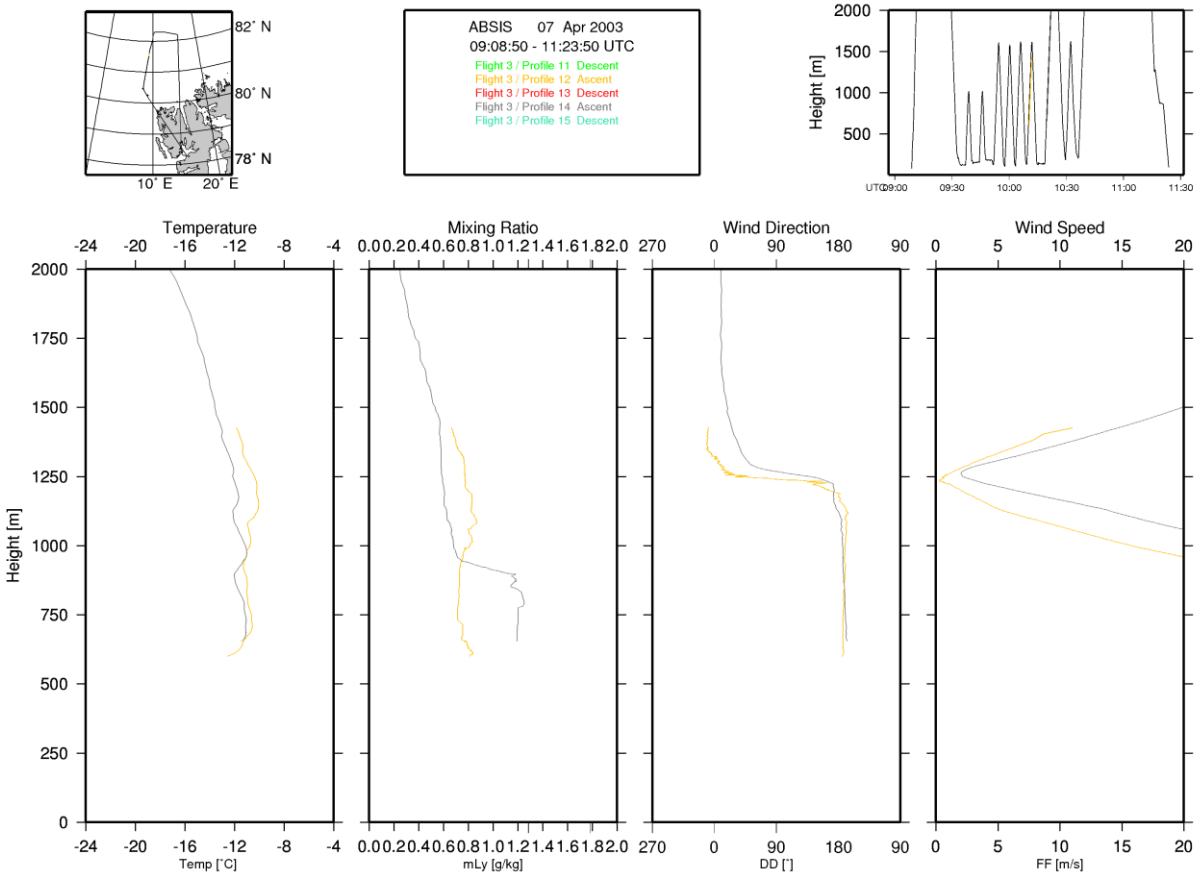

82° N
80° N
78° N
10° E
20° E
ABSIS 05 Apr 2003
10:04:10 - 12:22:50 UTC
Flight 2 / Profile 26 Descent
Flight 2 / Profile 27 Ascent
Flight 2 / Profile 28 Descent
Flight 2 / Profile 29 Ascent
Flight 2 / Profile 30 Descent
Height [m]
UTC
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

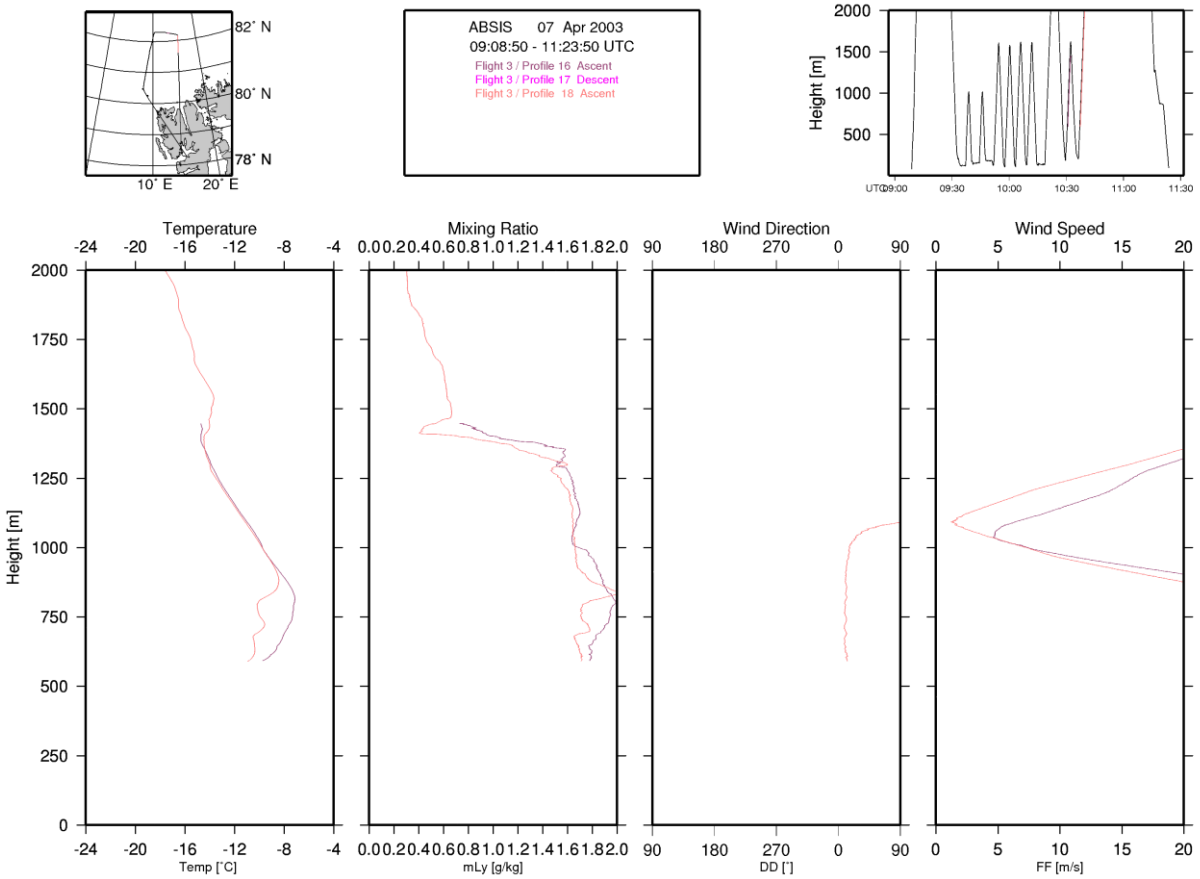

82° N
80° N
78° N
10° E
20° E
ABSIS 05 Apr 2003
10:04:10 - 12:22:50 UTC
Flight 2 / Profile 31 Ascent
Flight 2 / Profile 32 Descent
Flight 2 / Profile 33 Ascent
Flight 2 / Profile 34 Descent
Flight 2 / Profile 35 Ascent
Height [m]
2000
1500
1000
500
UTC
10:00
10:30
11:00
11:30
12:00
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

Falcon Flight No. 3 Date: 07 April 2003 09.09-11.24 UTC

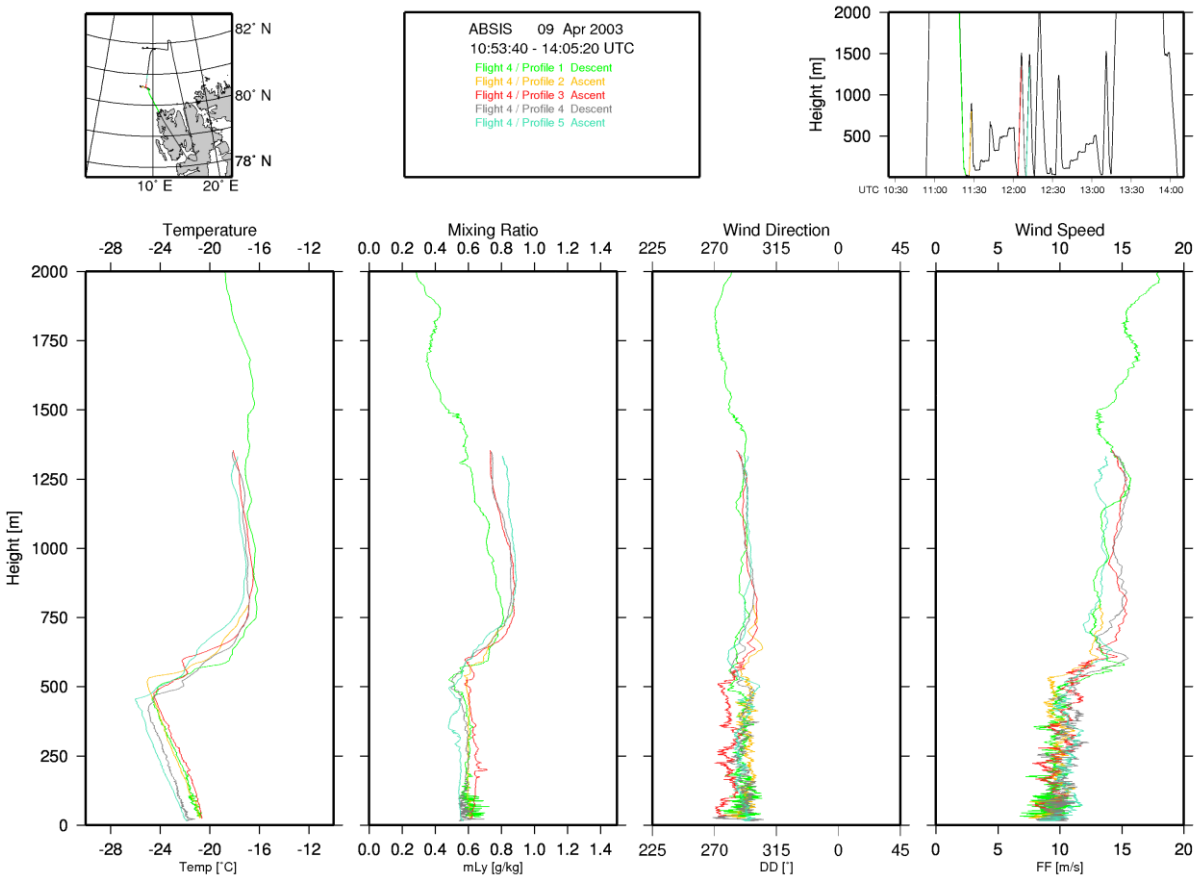


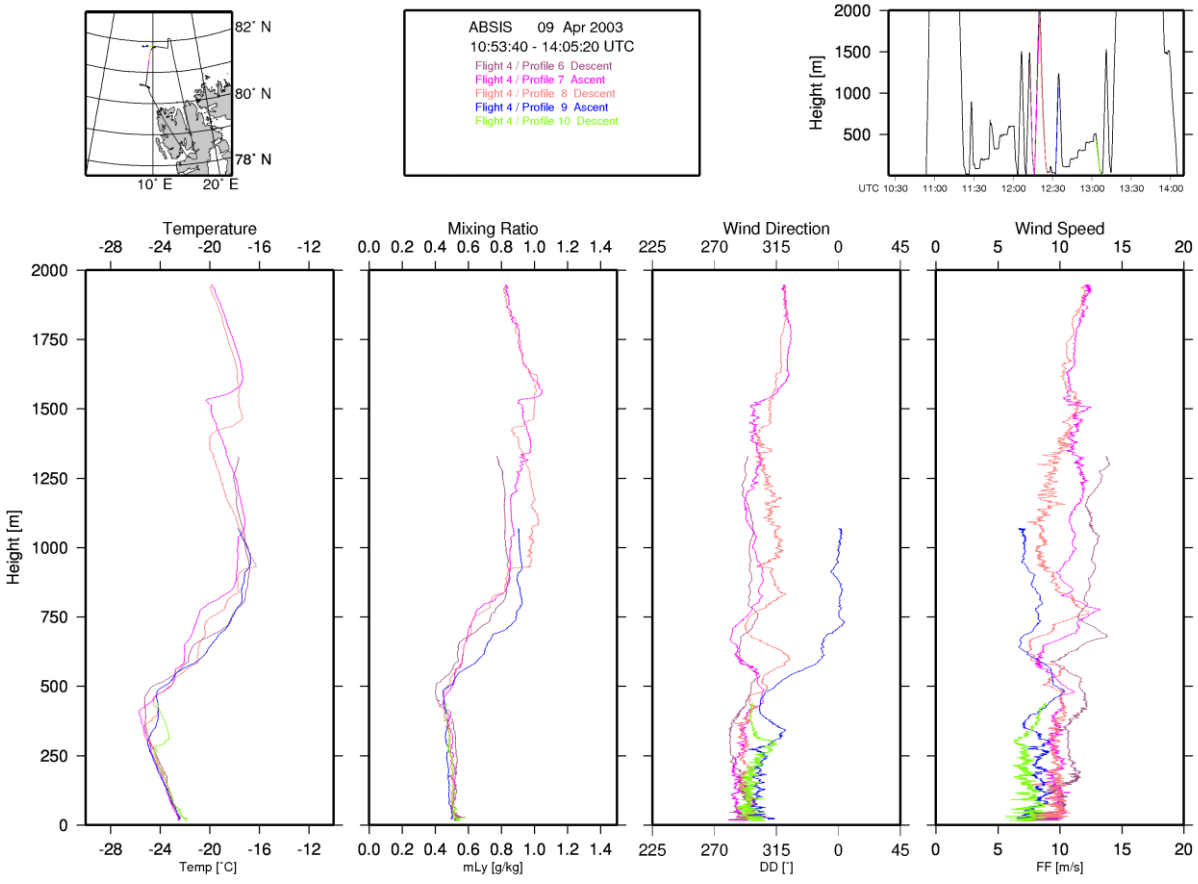


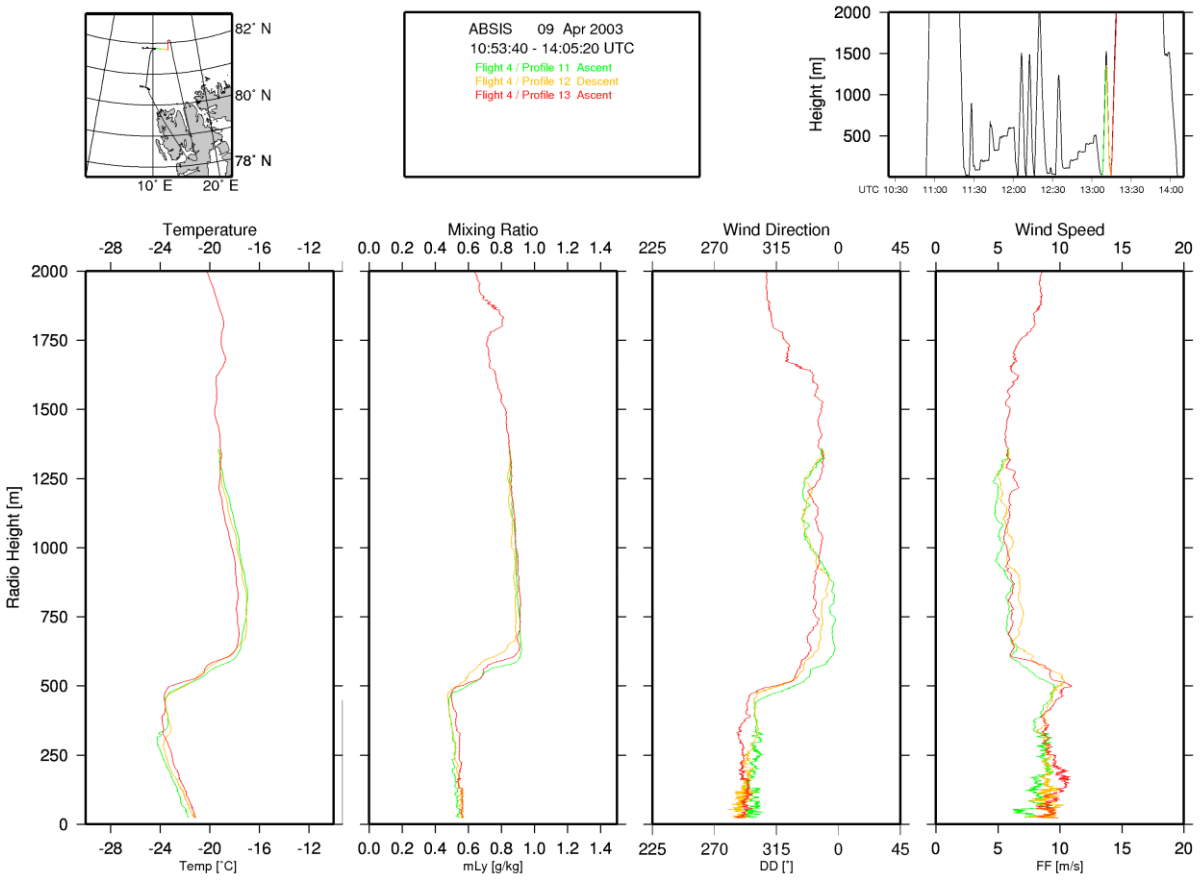

82° N
80° N
78° N
10° E
20° E
ABSIS 07 Apr 2003
09:08:50 - 11:23:50 UTC
Flight 3 / Profile 11 Descent
Flight 3 / Profile 12 Ascent
Flight 3 / Profile 13 Descent
Flight 3 / Profile 14 Ascent
Flight 3 / Profile 15 Descent
Height [m]
2000
1500
1000
500
UTC09:00
09:30
10:00
10:30
11:00
11:30
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]


82° N
80° N
78° N
10° E
20° E
ABSIS 07 Apr 2003
09:08:50 - 11:23:50 UTC
Flight 3 / Profile 16 Ascent
Flight 3 / Profile 17 Descent
Flight 3 / Profile 18 Ascent
Height [m]
2000
1500
1000
500
UTC09:00
09:30
10:00
10:30
11:00
11:30
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

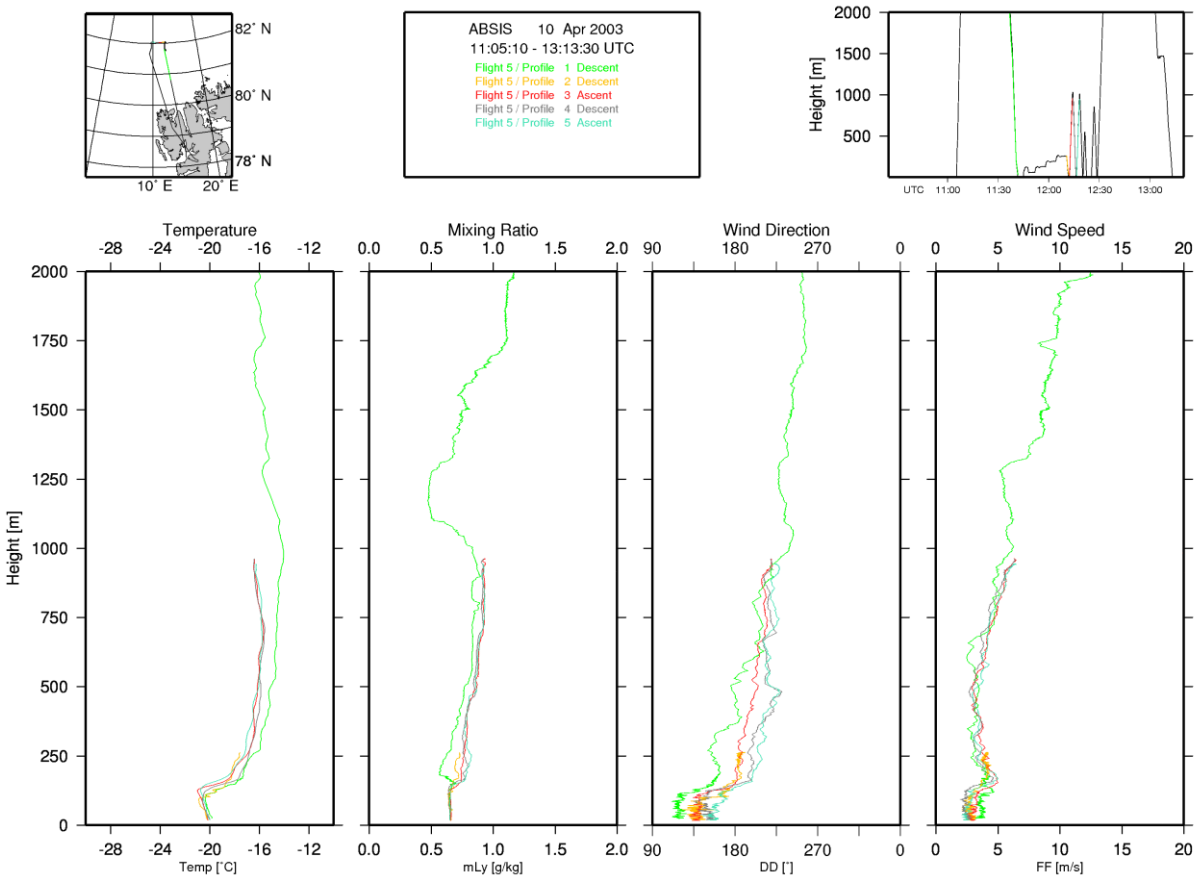
Falcon Flight No. 4 Date: 09 April 2003 10.54-14.05 UTC

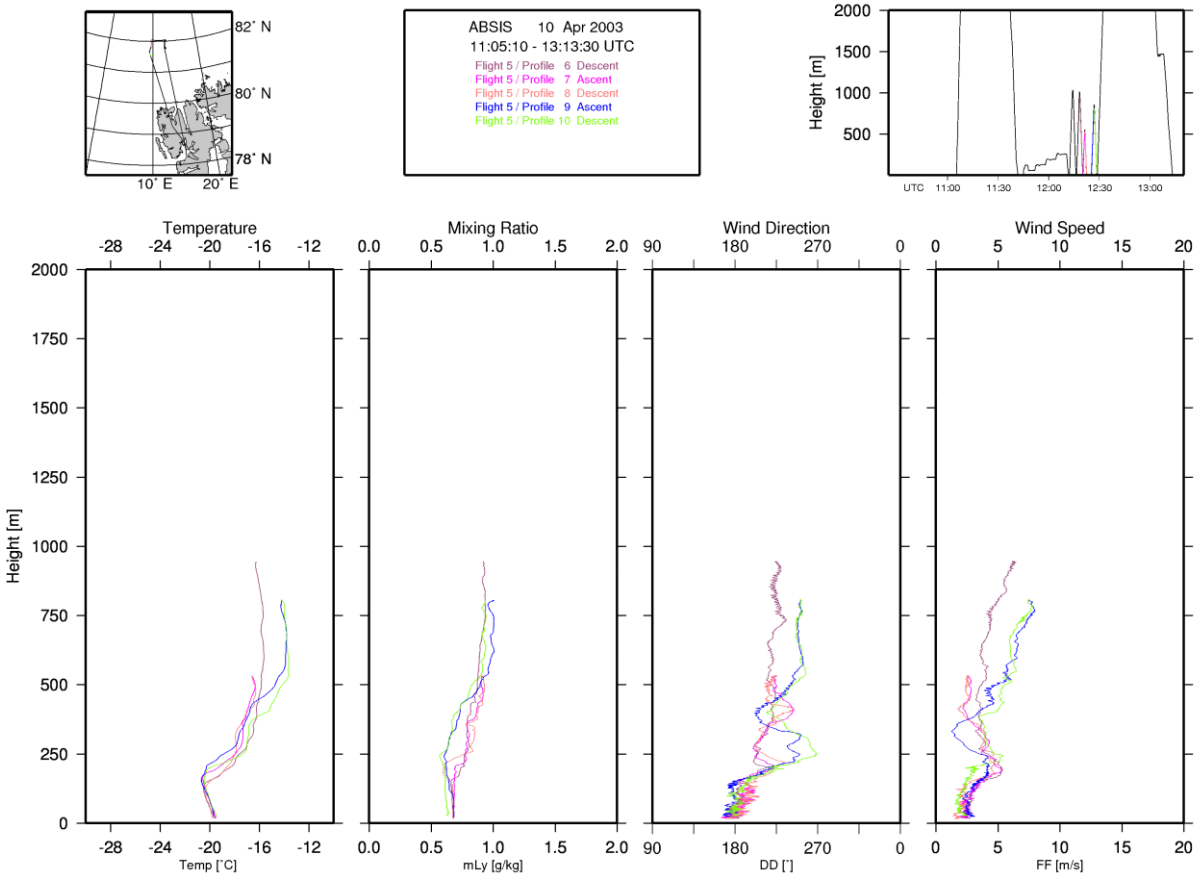


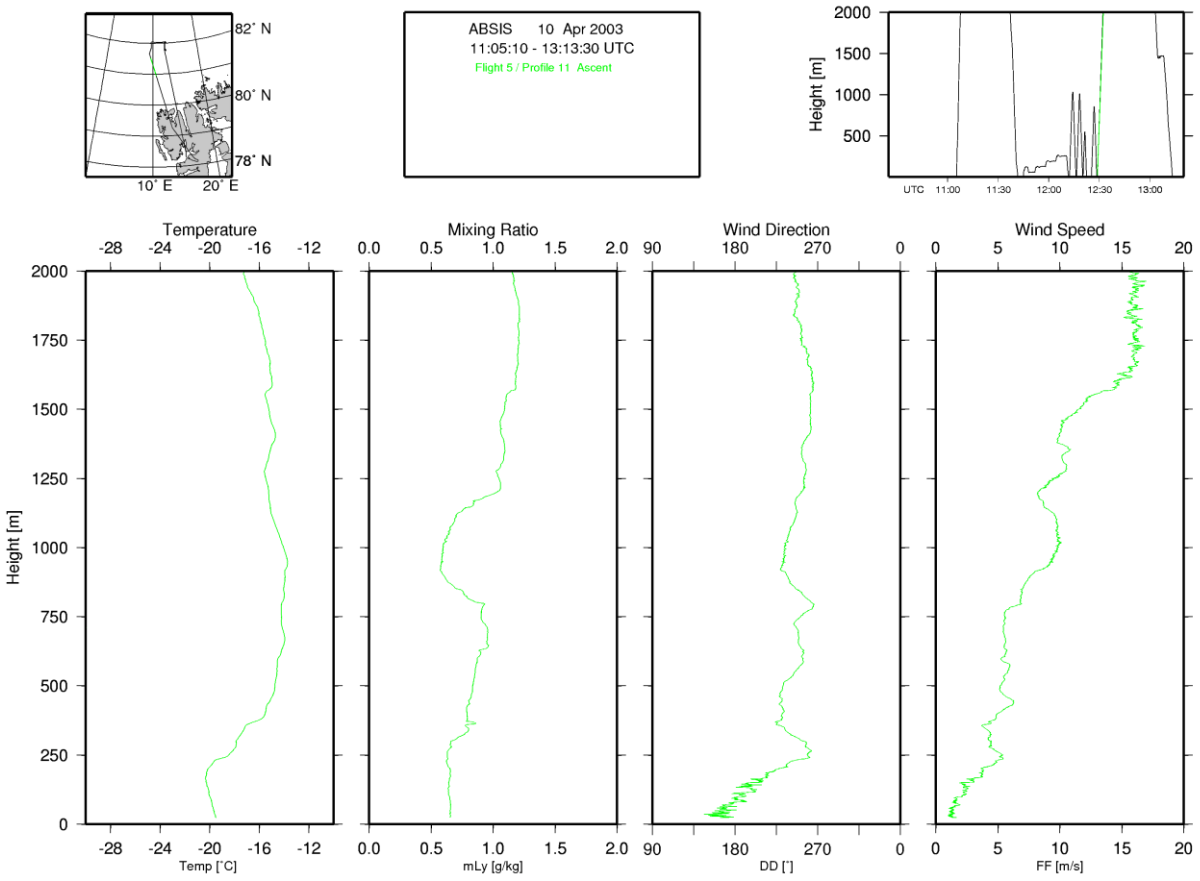



82° N
80° N
78° N
10° E
20° E
ABSIS 09 Apr 2003
10:53:40 - 14:05:20 UTC
Flight 4 / Profile 11 Ascent
Flight 4 / Profile 12 Descent
Flight 4 / Profile 13 Ascent
Height [m]
2000
1500
1000
500
UTC 10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

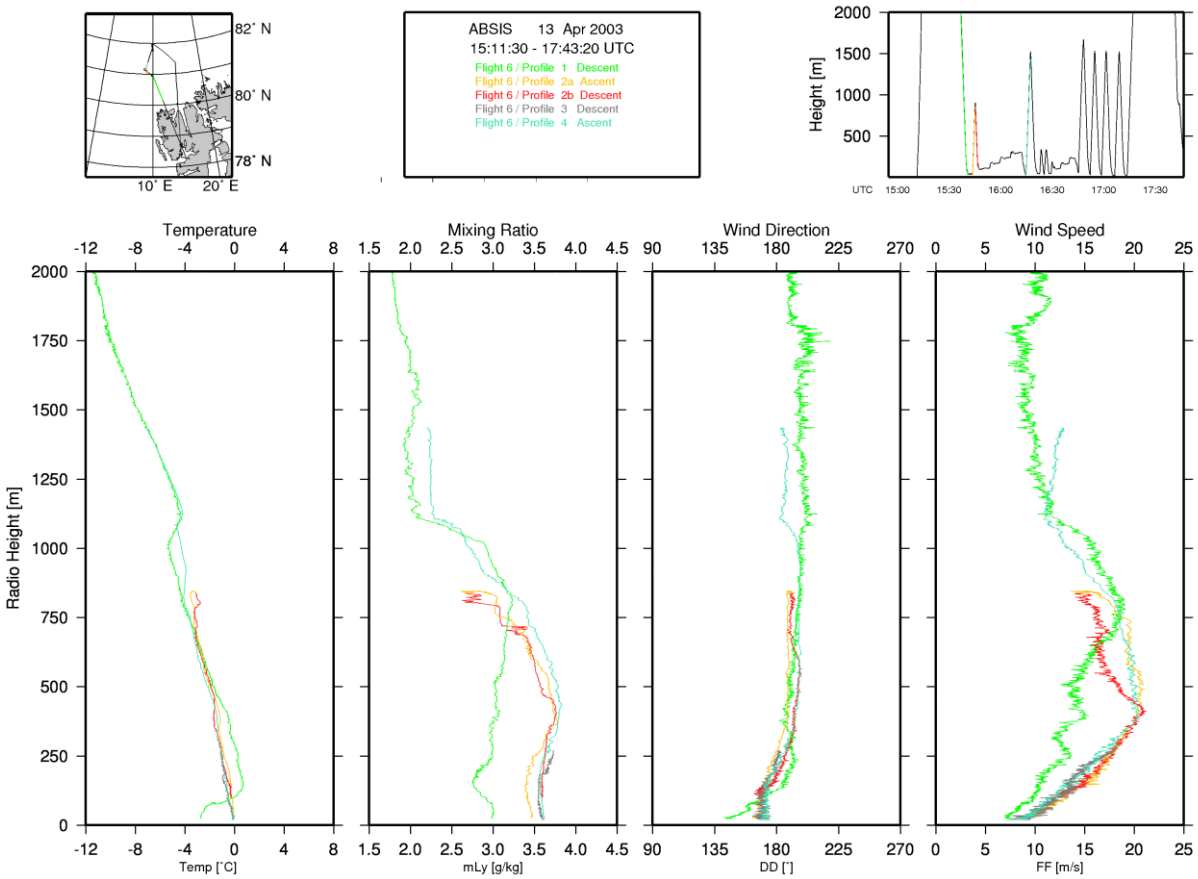
Falcon Flight No. 5 Date: 10 April 2003 11.05-13.14 UTC

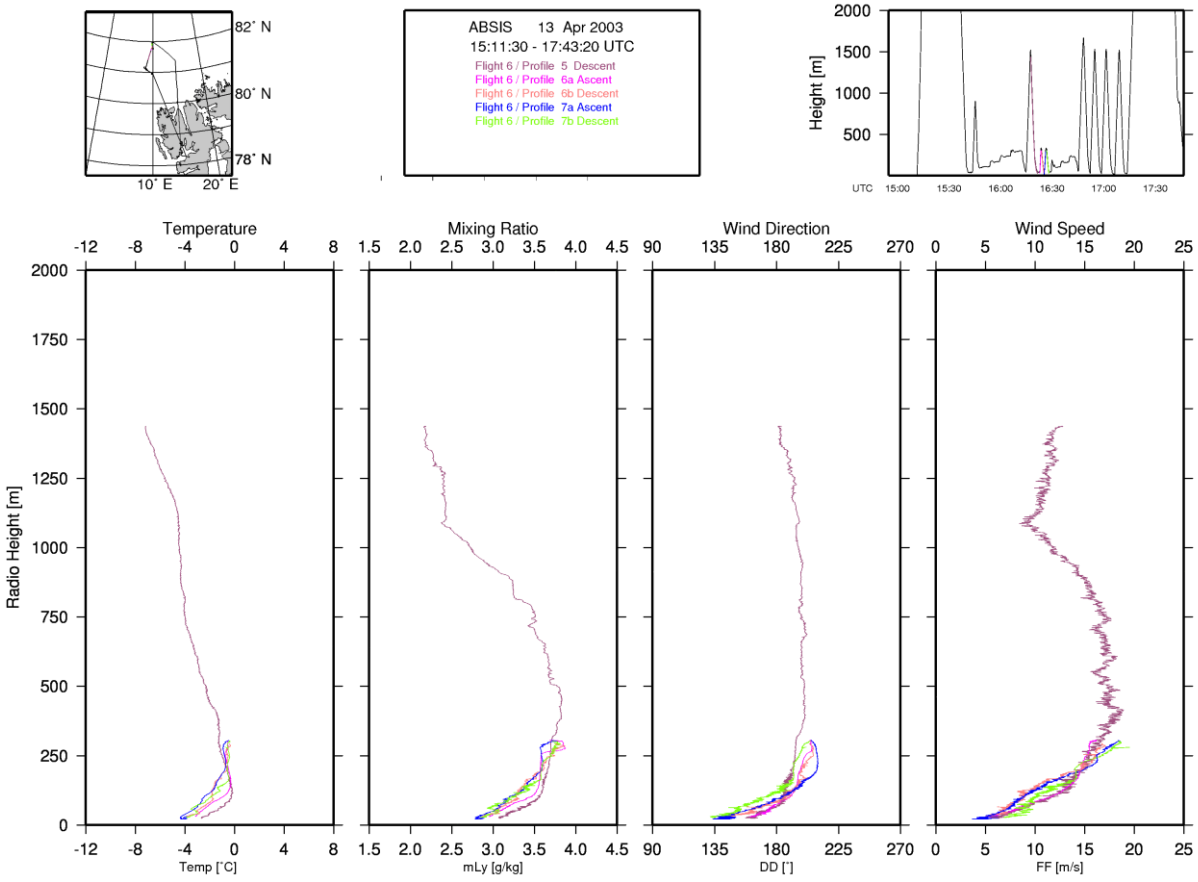


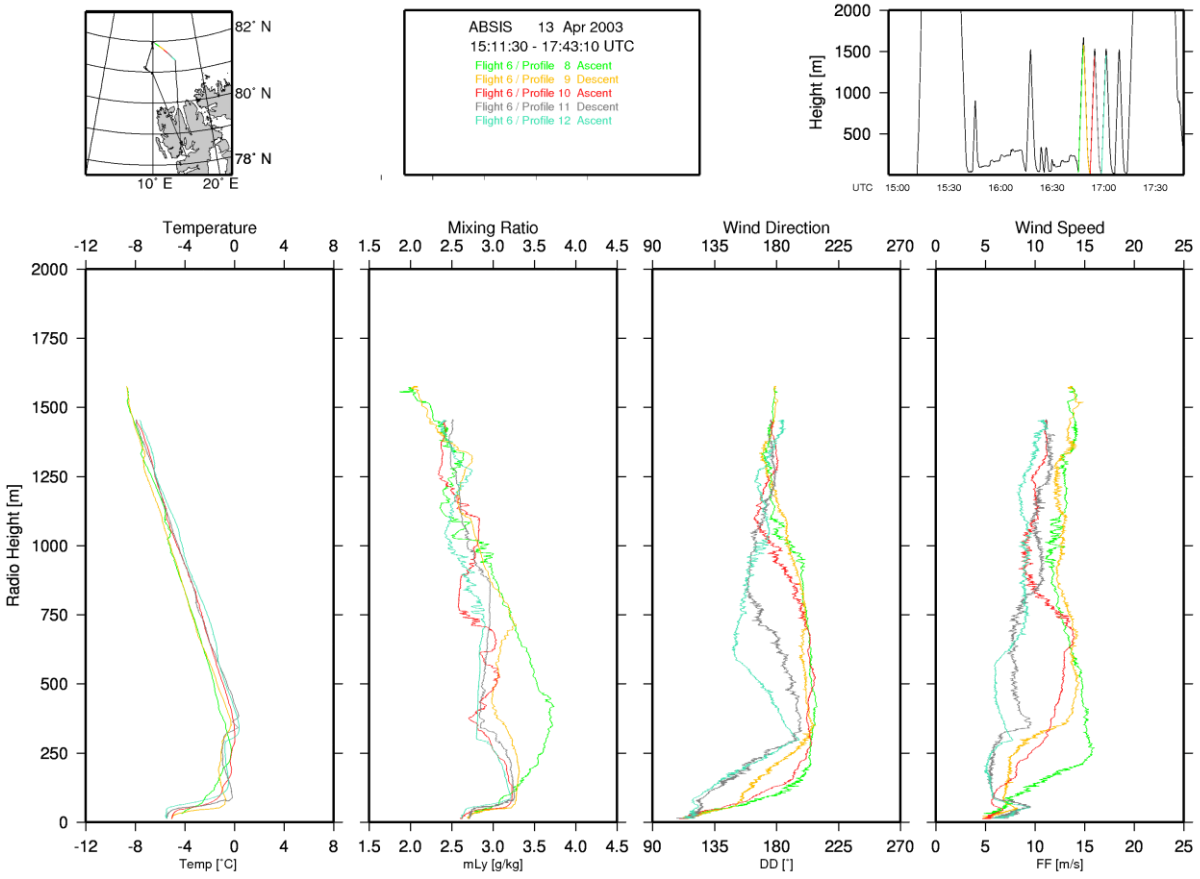


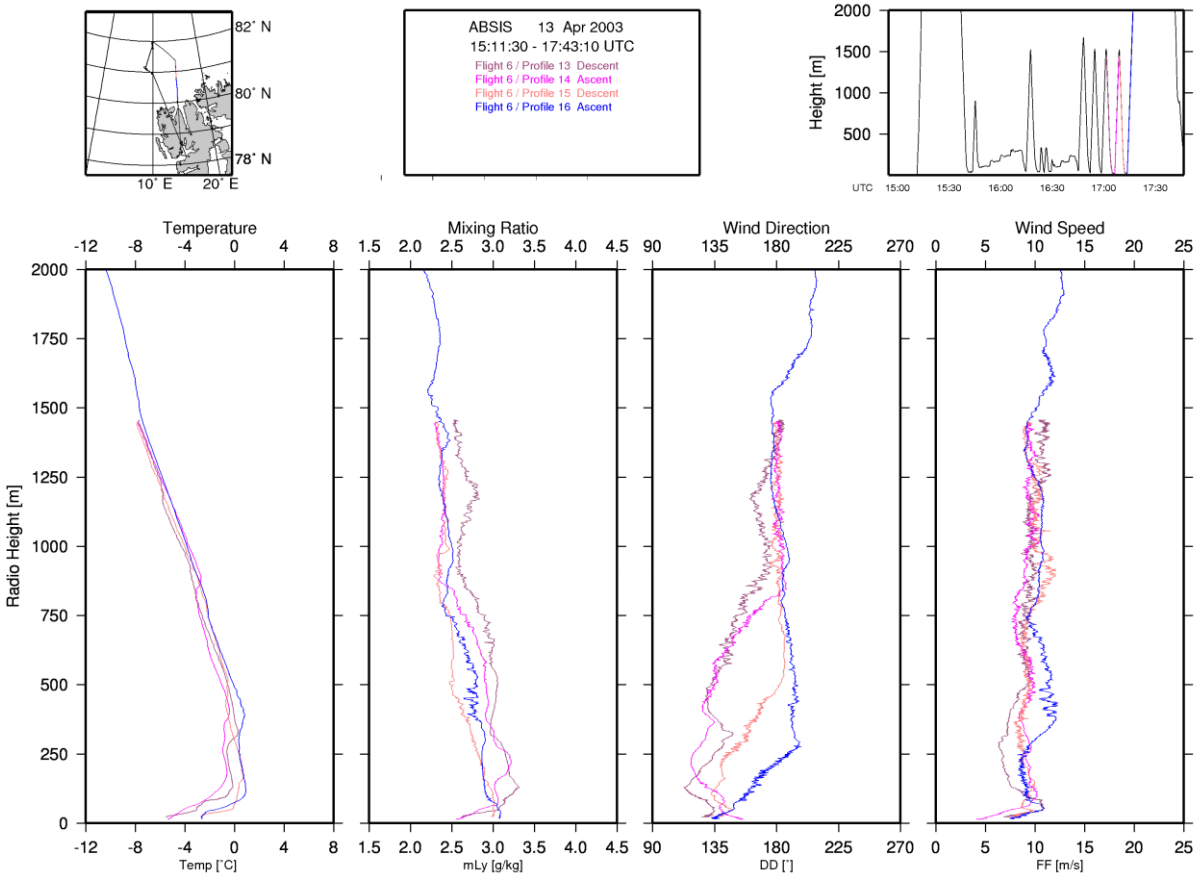

82° N
80° N
78° N
10° E
20° E
ABSIS 10 Apr 2003
11:05:10 - 13:13:30 UTC
Flight 5 / Profile 11 Ascent
Height [m]
2000
1500
1000
500
UTC 11:00 11:30 12:00 12:30 13:00
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

Falcon Flight No. 6 Date: 13 April 2003 15.11-17.44 UTC

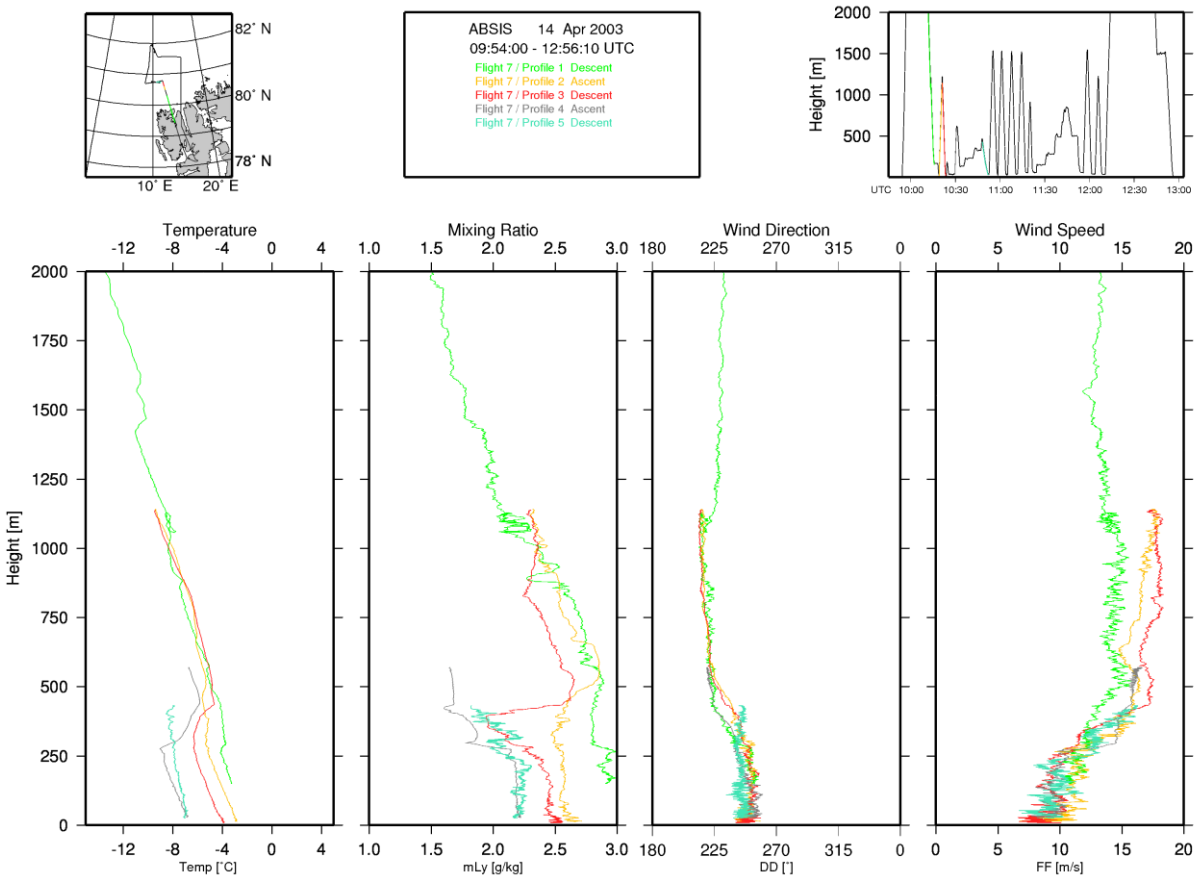


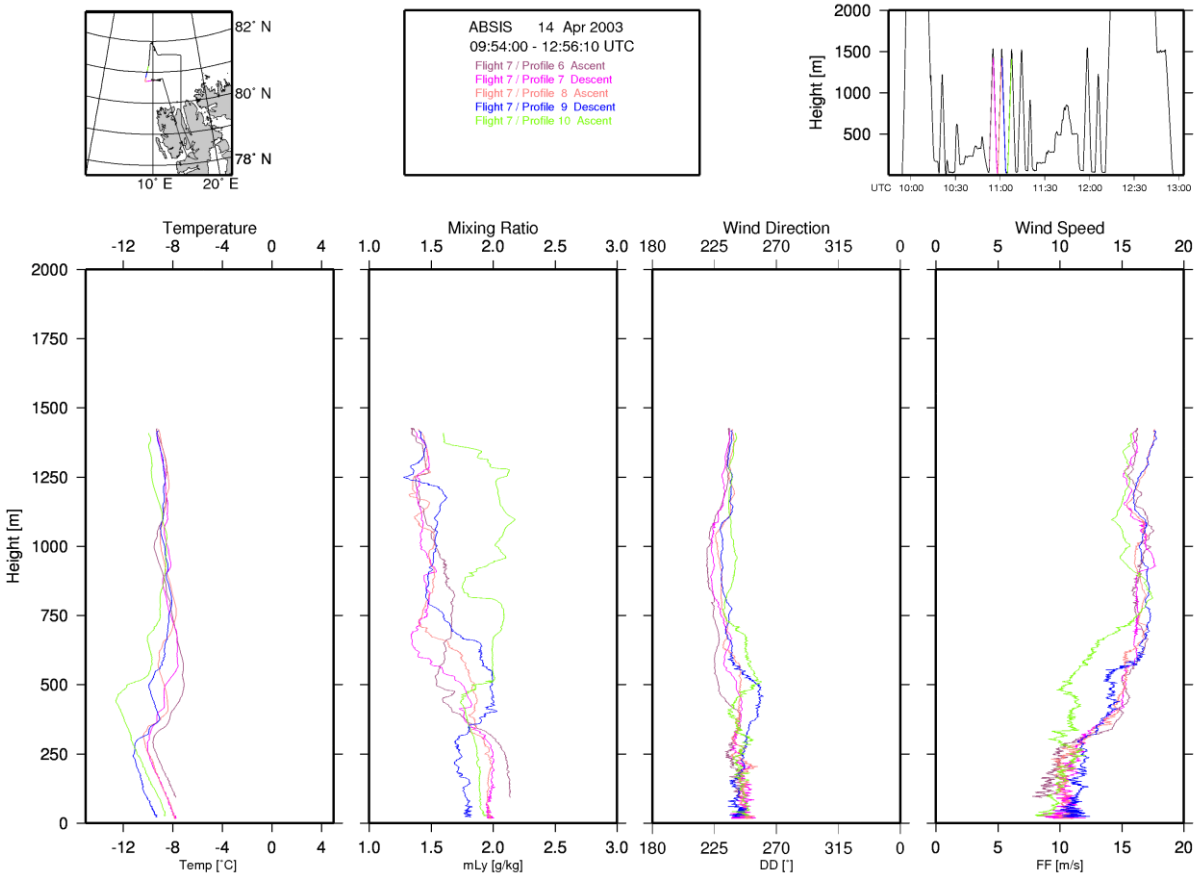


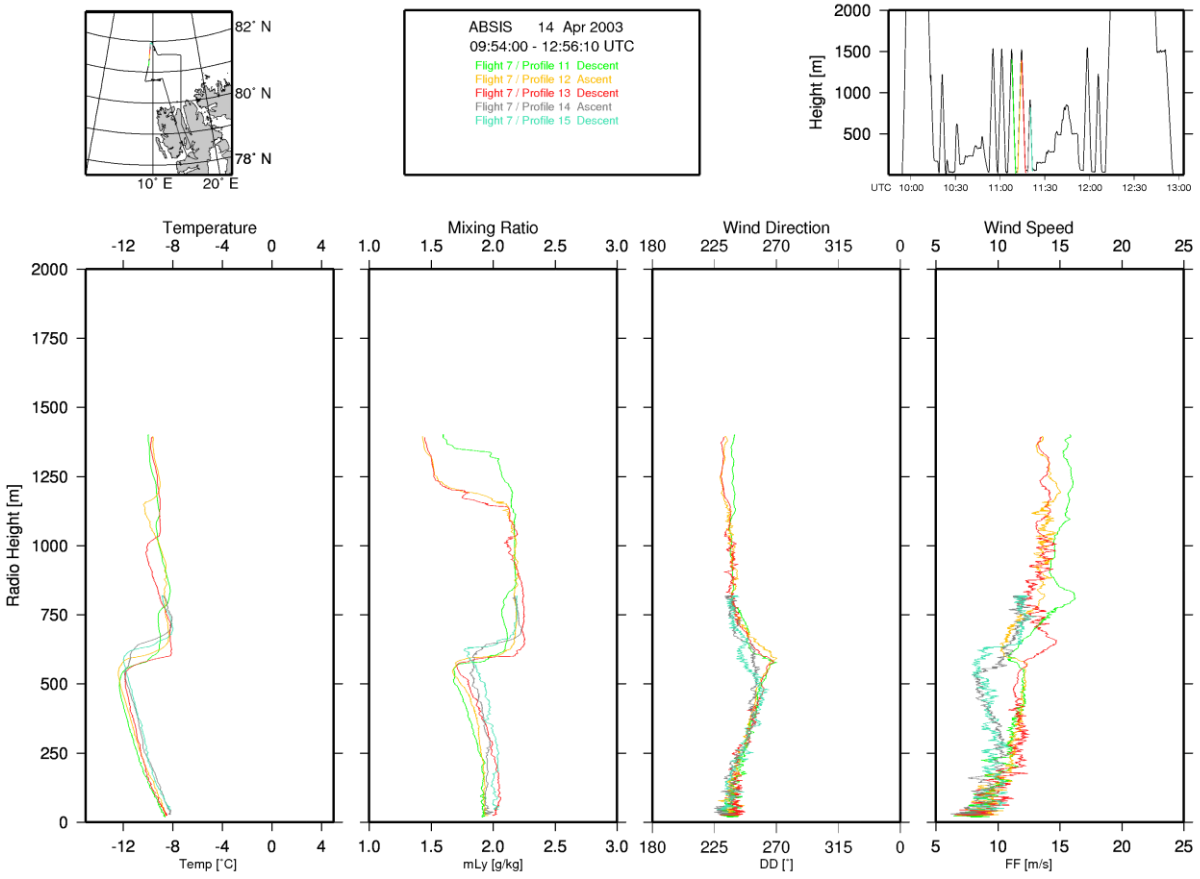

82° N
80° N
78° N
10° E
20° E
ABSIS 13 Apr 2003
15:11:30 - 17:43:10 UTC
Flight 6 / Profile 8 Ascent
Flight 6 / Profile 9 Descent
Flight 6 / Profile 10 Ascent
Flight 6 / Profile 11 Descent
Flight 6 / Profile 12 Ascent
Height [m]
UTC
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

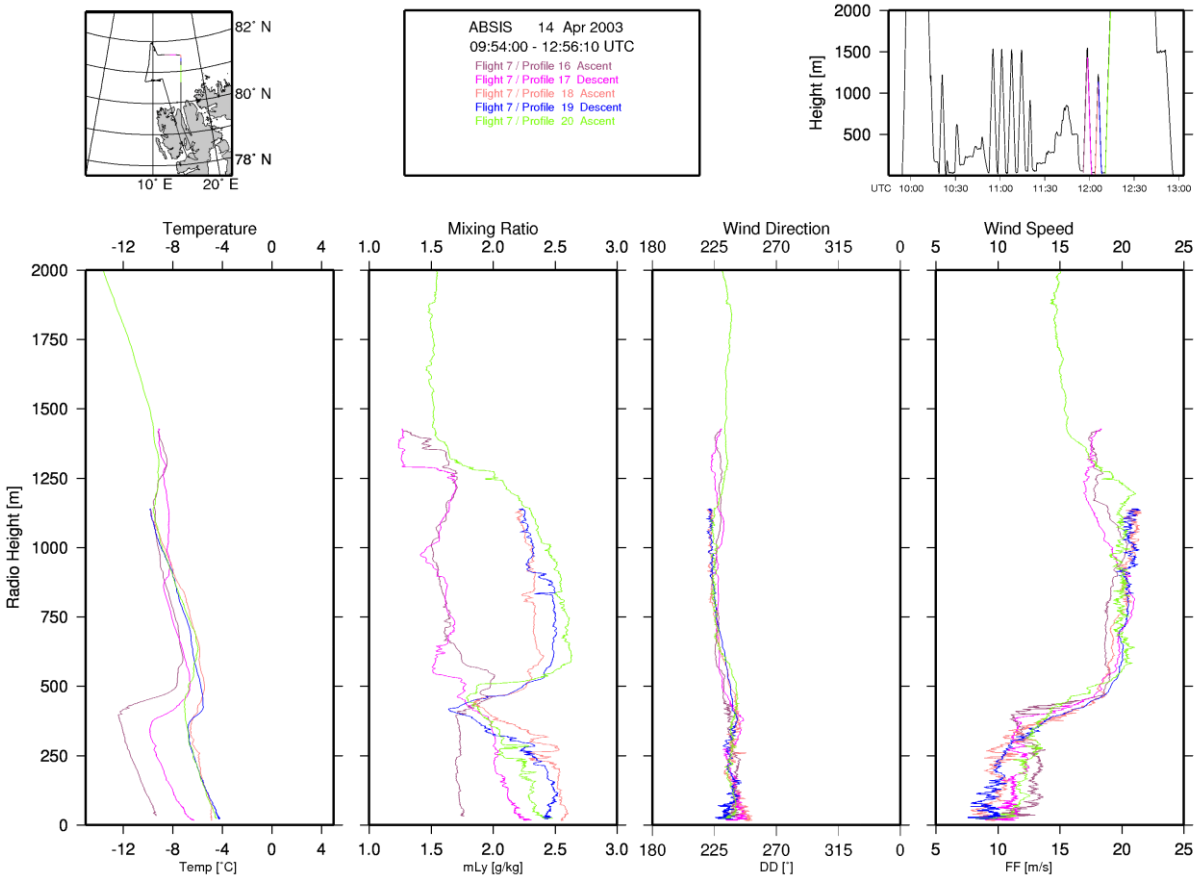

82° N
80° N
78° N
10° E
20° E
ABSIS 13 Apr 2003
15:11:30 - 17:43:10 UTC
Flight 6 / Profile 13 Descent
Flight 6 / Profile 14 Ascent
Flight 6 / Profile 15 Descent
Flight 6 / Profile 16 Ascent
Height [m]
UTC
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

Falcon Flight No. 7 Date: 14 April 2003 09.54-12.56 UTC

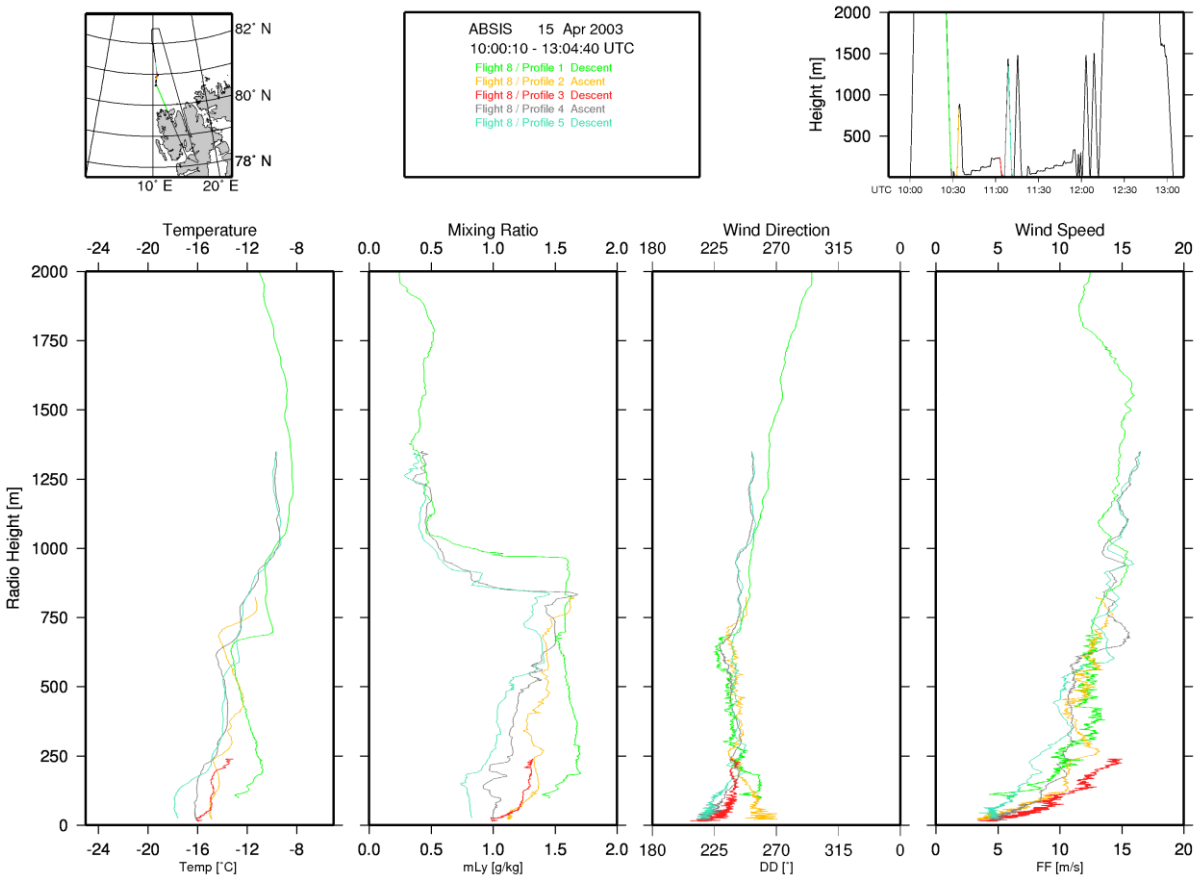


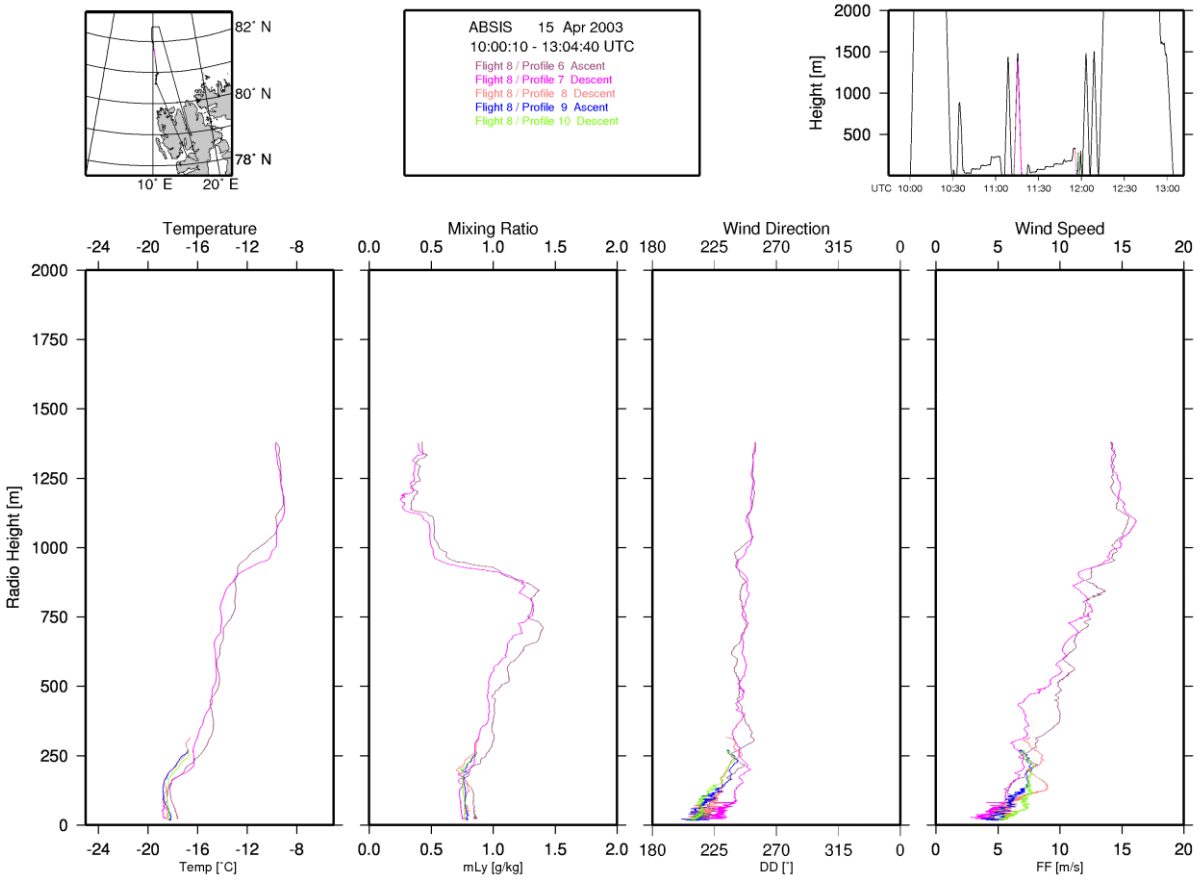


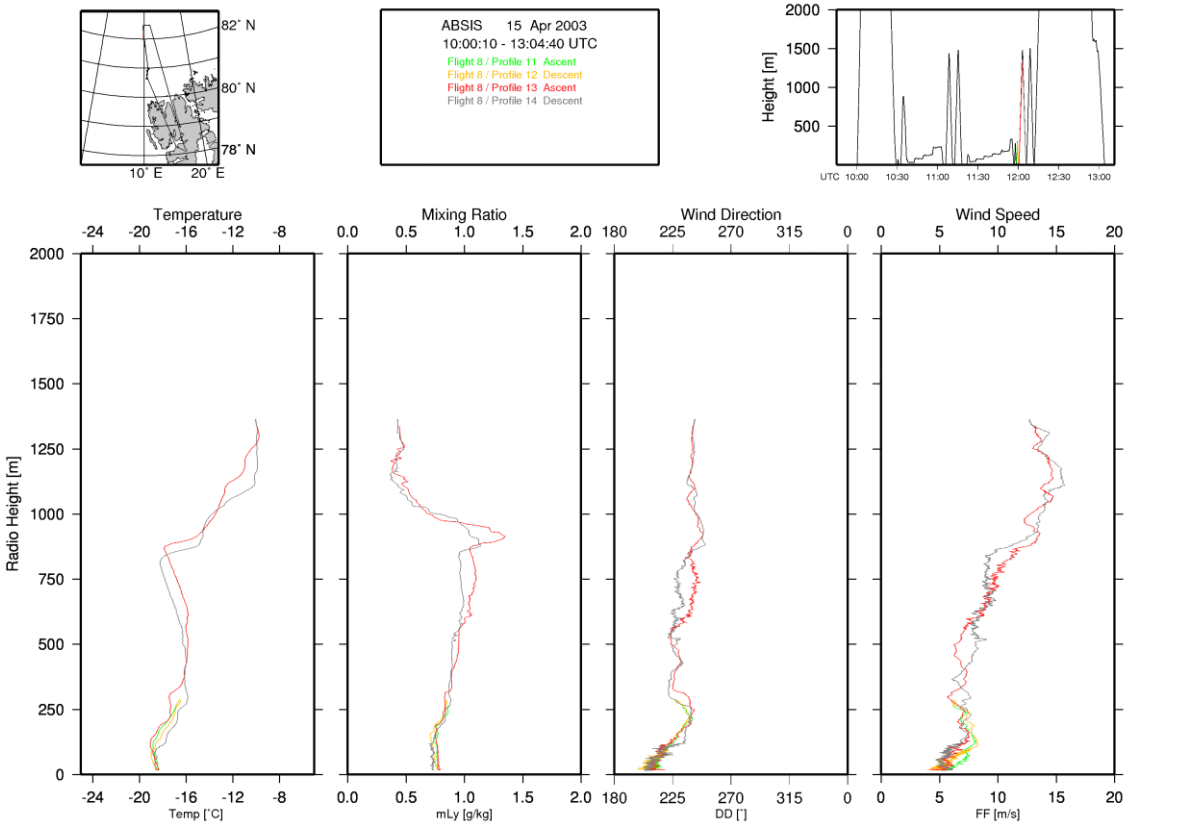

82° N
80° N
78° N
10° E
20° E
ABSIS 14 Apr 2003
09:54:00 - 12:56:10 UTC
Flight 7 / Profile 11 Descent
Flight 7 / Profile 12 Ascent
Flight 7 / Profile 13 Descent
Flight 7 / Profile 14 Ascent
Flight 7 / Profile 15 Descent
Height [m]
UTC 10:00 10:30 11:00 11:30 12:00 12:30 13:00
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

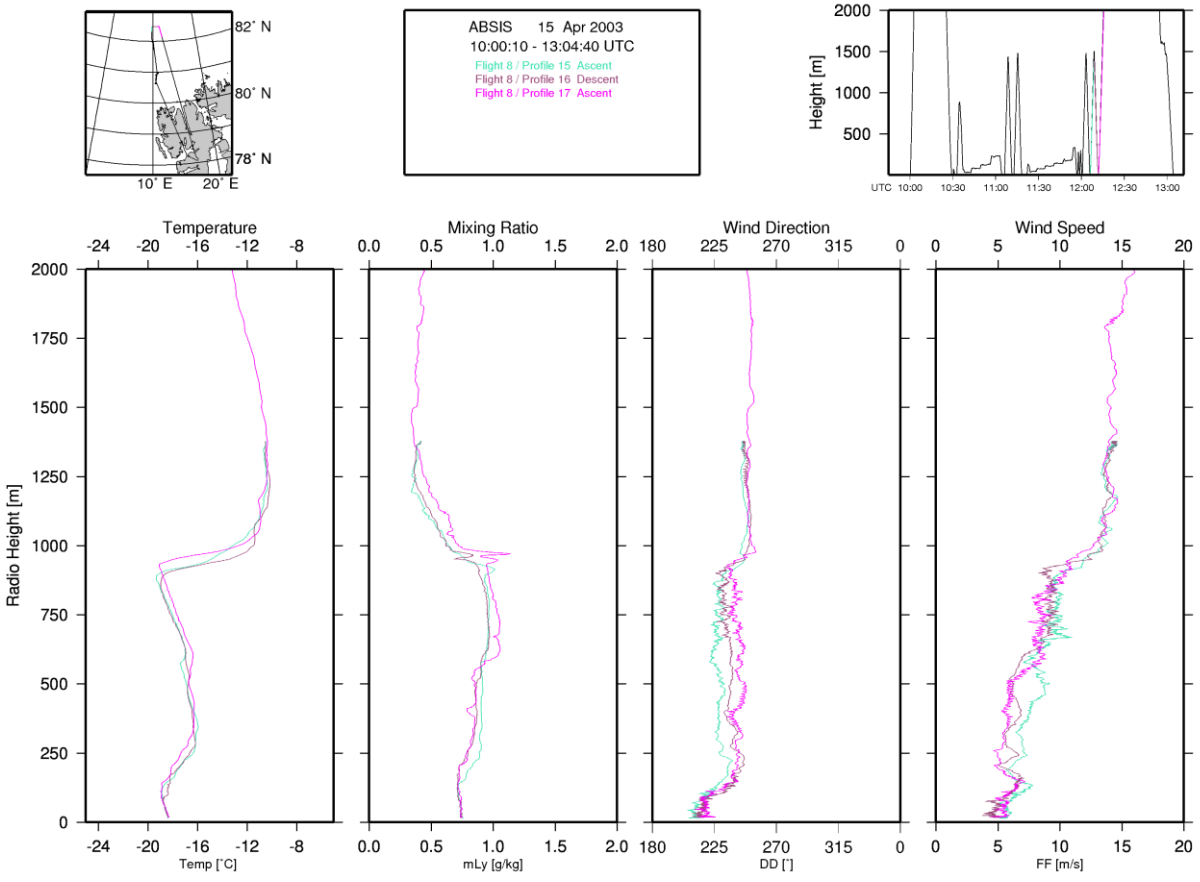

82° N
80° N
78° N
10° E
20° E
ABSIS 14 Apr 2003
09:54:00 - 12:56:10 UTC
Flight 7 / Profile 16 Ascent
Flight 7 / Profile 17 Descent
Flight 7 / Profile 18 Ascent
Flight 7 / Profile 19 Descent
Flight 7 / Profile 20 Ascent
Height [m]
UTC 10:00 10:30 11:00 11:30 12:00 12:30 13:00
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

Falcon Flight No. 8 Date: 15 April 2003 10.00-13.05 UTC






82° N
80° N
78° N
10° E
20° E
ABSIS 15 Apr 2003
10:00:10 - 13:04:40 UTC
Flight 8 / Profile 11 Ascent
Flight 8 / Profile 12 Descent
Flight 8 / Profile 13 Ascent
Flight 8 / Profile 14 Descent
Height [m]
UTC 10:00 10:30 11:00 11:30 12:00 12:30 13:00
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]


82° N
80° N
78° N
10° E
20° E
ABSIS 15 Apr 2003
10:00:10 - 13:04:40 UTC
Flight 8 / Profile 15 Ascent
Flight 8 / Profile 16 Descent
Flight 8 / Profile 17 Ascent
Height [m]
UTC 10:00 10:30 11:00 11:30 12:00 12:30 13:00
Temperature
Mixing Ratio
Wind Direction
Wind Speed
Radio Height [m]
Temp [°C]
mLy [g/kg]
DD [°]
FF [m/s]

7. Selected photos for each Falcon flight mission

Falcon Flight No. 1 Date: 04 April 2003 10.09-13.35 UTC

04. 04. 2003 Ice fields SE of Polarstern

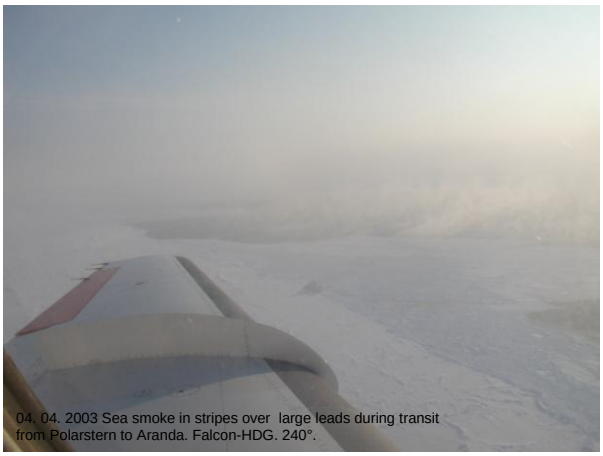
04. 04. 2003 Polarstern during run H02 at 100´

04. 04. 2003 Polarstern during run H04. Falcon-Hdg 270°

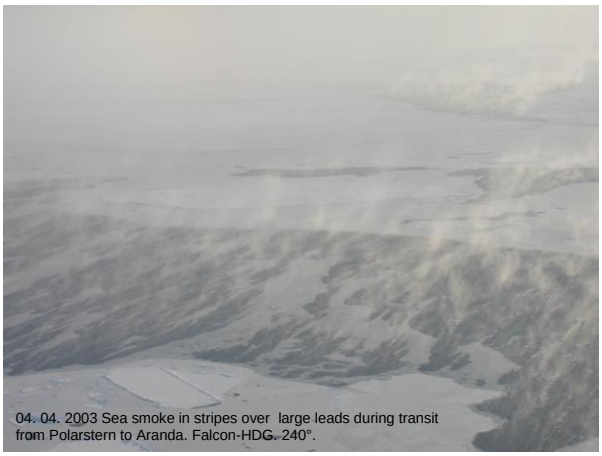
04. 04. 2003 Polarstern stems N during slant descent run H07.
Falcon-HDG. 90°. Sea smoke over lead.

04. 04. 2003 Polarstern stems N during slant descent run H07.
Falcon-HDG. 90°. Sea smoke from lead extends over the pack ice.

04. 04. 2003 Polarstern stems N during slant descent run H07.
Falcon-HDG. 90°. Sea smoke from lead extends over the pack ice.



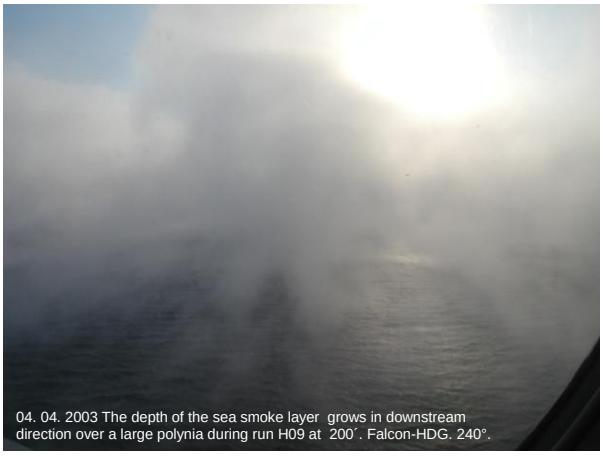
04. 04. 2003 Sea smoke in stripes over large leads during transit from Polarstern to Aranda. Falcon-HDG. 240°.



04. 04. 2003 Sea smoke in stripes over large leads during transit from Polarstern to Aranda. Falcon-HDG. 240°.

04. 04. 2003 Above sea smoke at the upwind end of a large polynia during run H09 at 200´. Falcon-HDG. 240°.

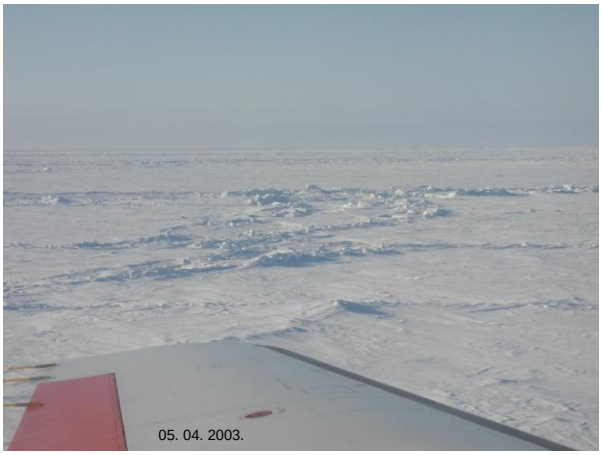
04. 04. 2003 In the sea smoke layer over a large polynia during run H09 at 200´. Falcon-HDG. 240°.



04. 04. 2003 The depth of the sea smoke layer grows in downstream direction over a large polynia during run H09 at 200´. Falcon-HDG. 240°.

04. 04. 2003 Falcon over lead near Polarstern.

Falcon Flight No. 2 Date: 05 April 2003 10.04-12.23UTC

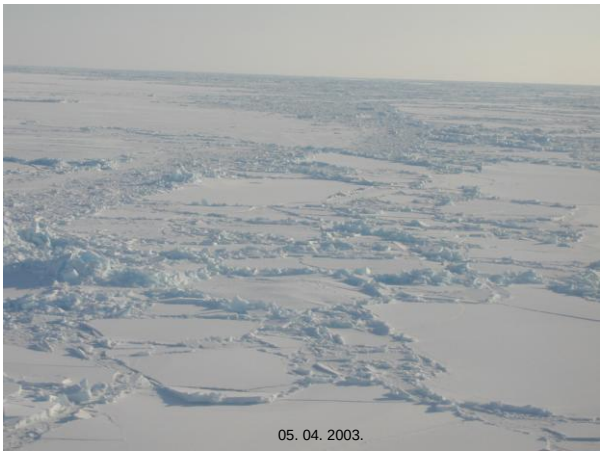



05. 04. 2003. Below a sea smoke cloud which extends over the closed ice.


05. 04. 2003. A large sea smoke cloud.

05. 04. 2003. A large sea smoke cloud.

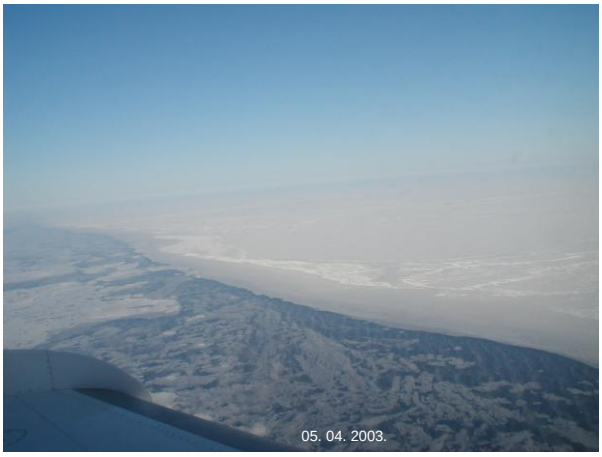
05. 04. 2003. In a sea smoke cloud.



05. 04. 2003.

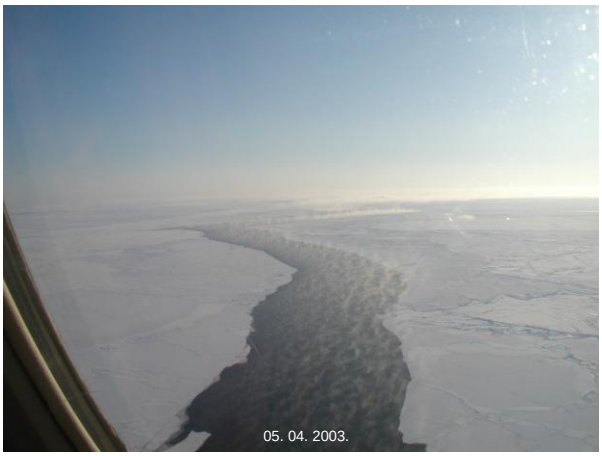
05. 04. 2003.

05. 04. 2003.



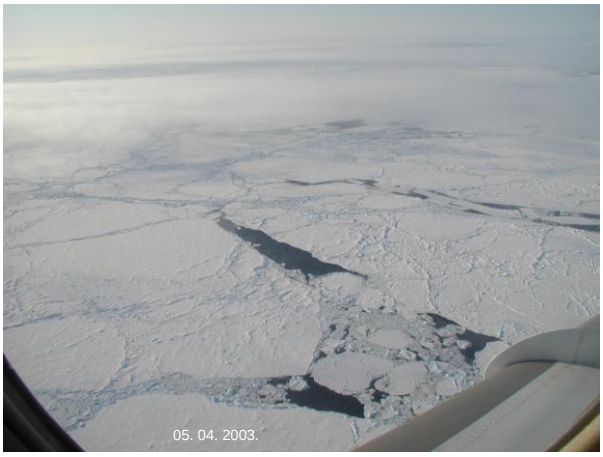
05. 04. 2003.

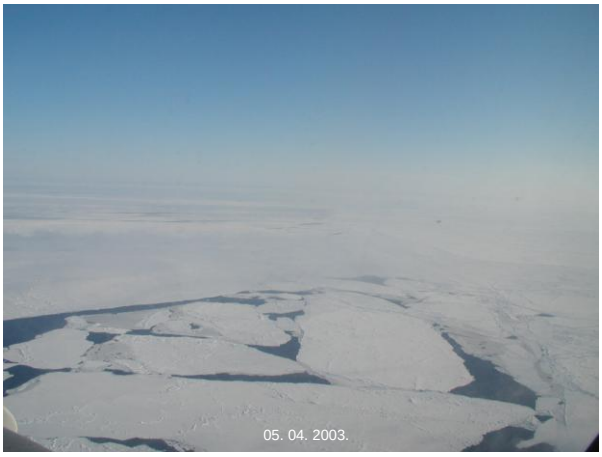

05. 04. 2003.


05. 04. 2003.


05. 04. 2003.


05. 04. 2003.


05. 04. 2003.

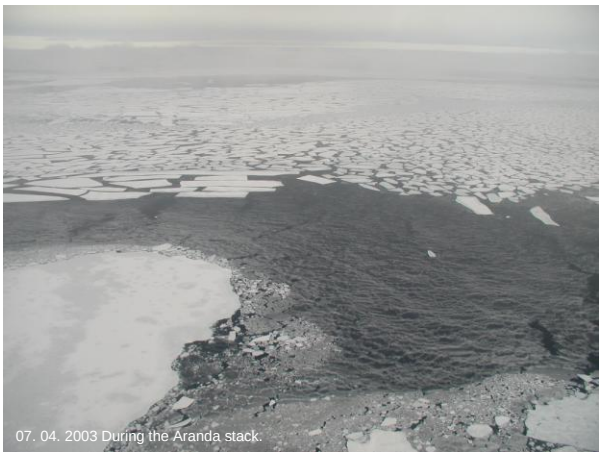

05. 04. 2003.

Falcon Flight No. 3 Date: 07 April 2003 09.09-11.24 UTC

07. 04. 2003 Ice situation around Aranda during H01 at 100˚. HDG. 325°

07. 04. 2003 Ice situation around Aranda during H01 at 100˚. HDG. 325°

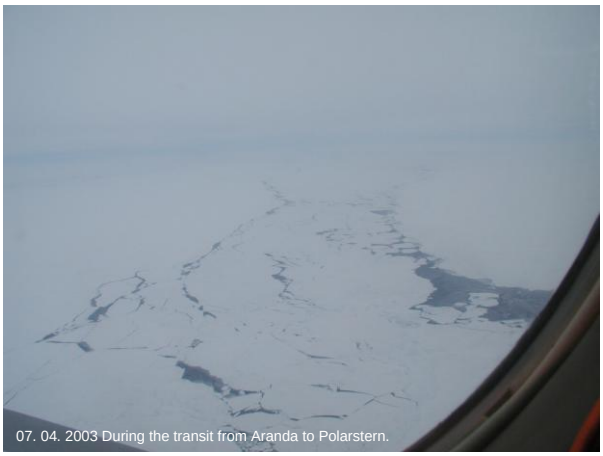
07. 04. 2003 Profile during the Aranda stack.



07. 04. 2003 During the Aranda stack.

07. 04. 2003 During the transit from Aranda to Polarstern.

07. 04. 2003 During the transit from Aranda to Polarstern.



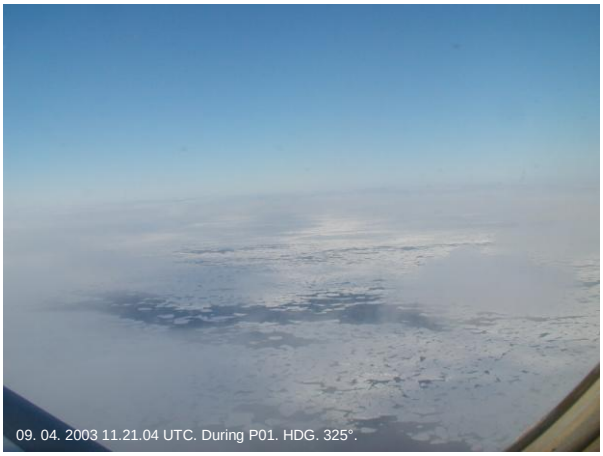
07. 04. 2003 During the transit from Aranda to Polarstern.

07. 04. 2003 around 10.17 UTC. Passing Polarstern during H04 at 100´. HDG. 10°.

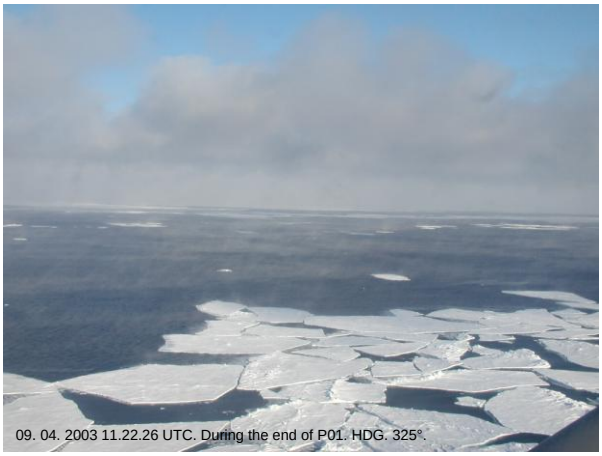
07. 04. 2003 around 10.17 UTC. Passing Polarstern during H04 at 100´. HDG. 10°.

07. 04. 2003 around 10.17 UTC. Passing Polarstern during H04 at 100´. HDG. 10°.

Falcon Flight No. 4 Date: 09 April 2003 10.54-14.05 UTC



09. 04. 2003 11.21.04 UTC. During P01. HDG. 325°.

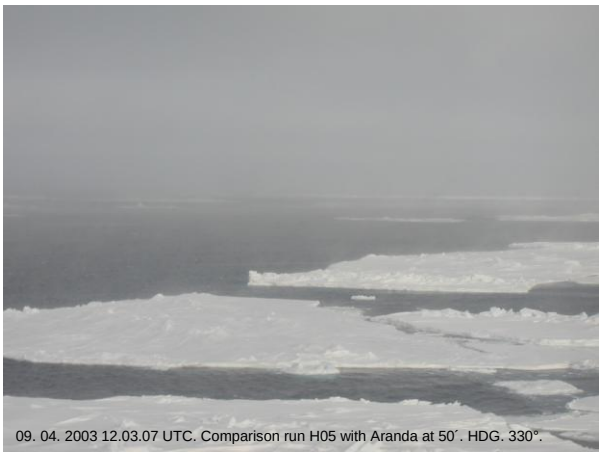


09. 04. 2003 11.22.26 UTC. During the end of P01. HDG. 325°.

09. 04. 2003 11.23.54 UTC. During H01 at 70´. HDG. 280°.

09. 04. 2003 11.23.54 UTC. Passing S of Aranda during H01 at 70´. HDG. 280°.

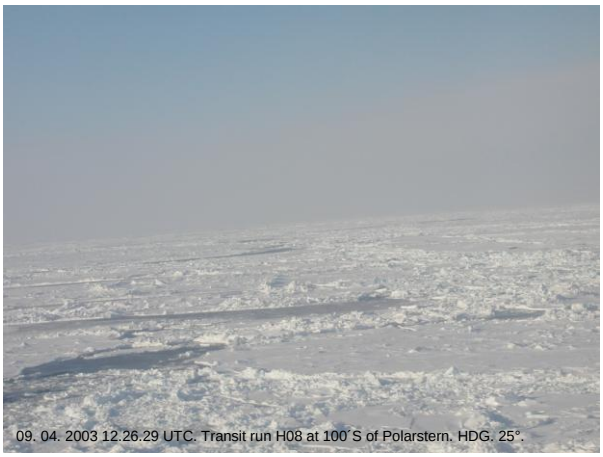
09. 04. 2003 11.36.21 UTC. Stack at Aranda. During the beginning of H03 at 650´. HDG. 280°.



09. 04. 2003 12.03.07 UTC. Comparison run H05 with Aranda at 50´. HDG. 330°.

09. 04. 2003 12.07.16 UTC. Transit profile P04 from Aranda to Polarstern. HDG. 5°.

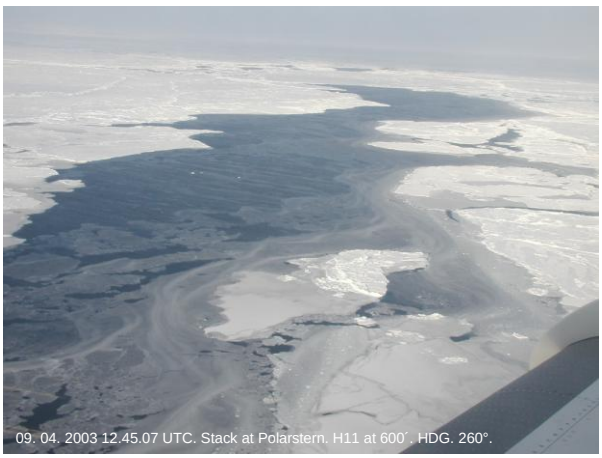
09. 04. 2003 12.13.50 UTC. Transit profile P06 from Aranda to Polarstern. HDG. 5°.



09. 04. 2003 12.26.29 UTC. Transit run H08 at 100´S of Polarstern. HDG. 25°.

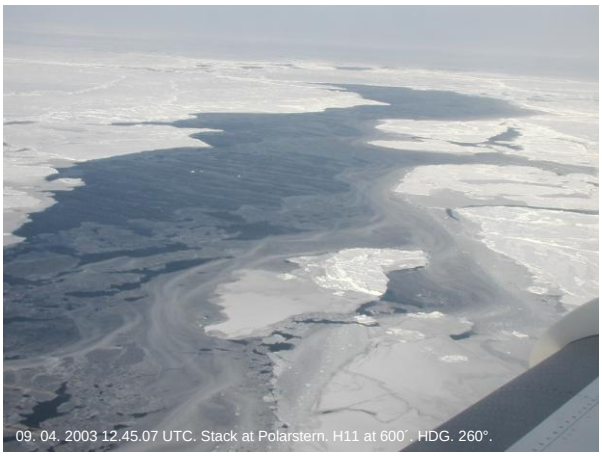
09. 04. 2003 12.29.17 UTC. Stack at Polarstern. H09 at 80´. HDG. 260°.

09. 04. 2003 12.41.26 UTC. Stack at Polarstern. H10 at 300´. HDG. 90°.



09. 04. 2003 12.45.07 UTC. Stack at Polarstern. H11 at 600´. HDG. 260°.

09. 04. 2003 12.41.26 UTC. Stack at Polarstern. H10 at 300´. HDG. 90°.



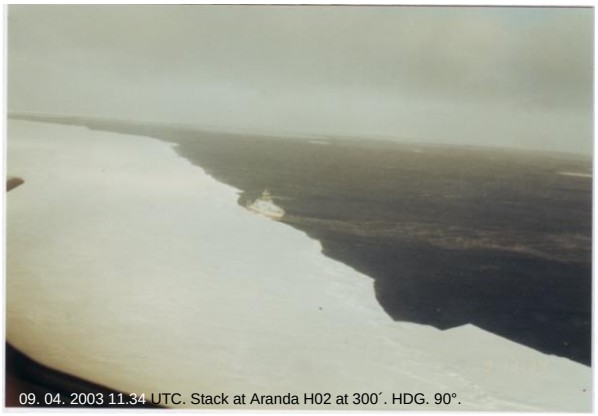
09. 04. 2003 12.45.07 UTC. Stack at Polarstern. H11 at 600´. HDG. 260°.

09. 04. 2003 13.06.44 UTC. Stack at Polarstern. Diagonal run H14 at 1500 - 50´. HDG. 90°.

09. 04. 2003 11.34 UTC. Stack at Aranda H02 at 300´. HDG. 90°.

09. 04. 2003 11.34 UTC. Stack at Aranda H02 at 300´. HDG. 90°.

09. 04. 2003 11.34 UTC. Stack at Aranda H02 at 300´. HDG. 90°.



09. 04. 2003 11.34 UTC. Stack at Aranda H02 at 300´. HDG. 90°.

09. 04. 2003 12.29 UTC. Stack at Polarstern H09 at 70/80´. HDG. 260°.

09. 04. 2003 12.29 UTC. Stack at Polarstern H09 at 70/80´. HDG. 260°.

09. 04. 2003 12.46 UTC. Stack at Polarstern H11 at 600´. HDG. 260°.

09. 04. 2003 13.05 UTC. Stack at Polarstern H14/P10. HDG. 90°.

Falcon Flight No. 5 Date: 10 April 2003 11.05-13.14 UTC

10. 04. 2003 11.46.17 UTC. Stack N of buoy 1096. H01 at 100´. Hdg. 350°.

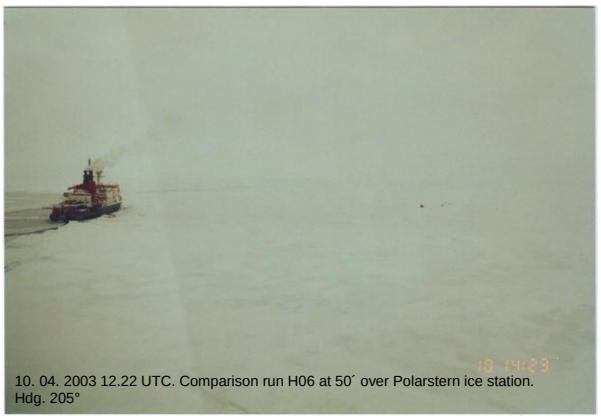
10. 04. 2003 11.54.56UTC. Stack N of buoy 1096. H03 at 500´. Hdg. 350°.

10. 04. 2003 12.22.58UTC. Comparison run H06 at 50´. Hdg.

10. 04. 2003 12.22 UTC. During profile P08 Hdg. 200° towards Polarstern.

10. 04. 2003 12.22 UTC. During profile P08 Hdg. 200° towards Polarstern.

10. 04. 2003 12.22 UTC. Comparison run H06 at 50´ over Polarstern ice station. Hdg. 205°

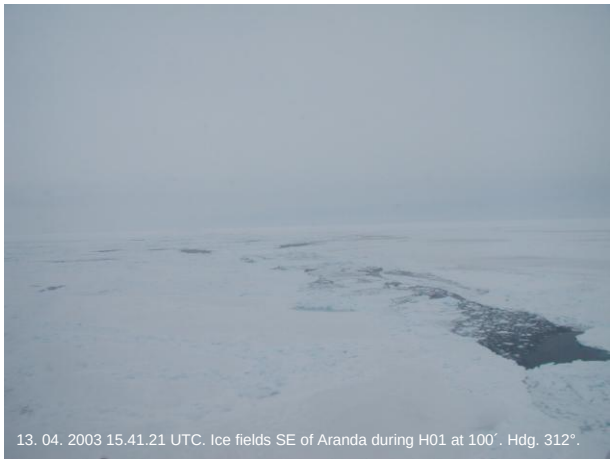


10. 04. 2003 12.22 UTC. Comparison run H06 at 50´ over Polarstern ice station. Hdg. 205°

10. 04. 2003 12.22 UTC. Comparison run H06 at 50´ over Polarstern ice station. Hdg. 205°

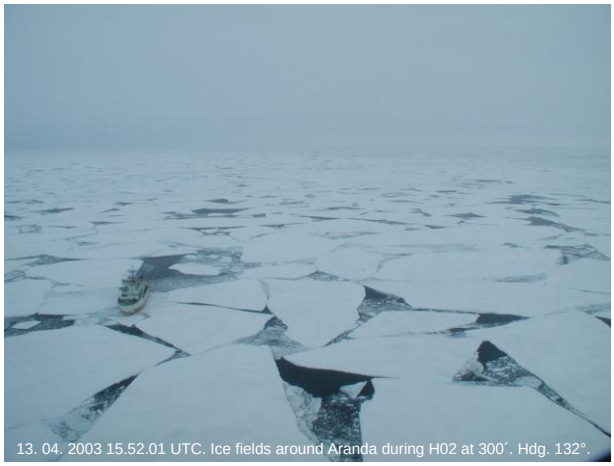
10. 04. 2003 12.22 UTC. Comparison run H06 at 50´ over Polarstern ice station. Hdg. 205°

Falcon Flight No. 6 Date: 13 April 2003 15.11-17.44 UTC



13. 04. 2003 15.41.21 UTC. Ice fields SE of Aranda during H01 at 100´. Hdg. 312°.

13. 04. 2003 15.51.54 UTC. Ice fields around Aranda during H02 at 300´. Hdg. 132°.

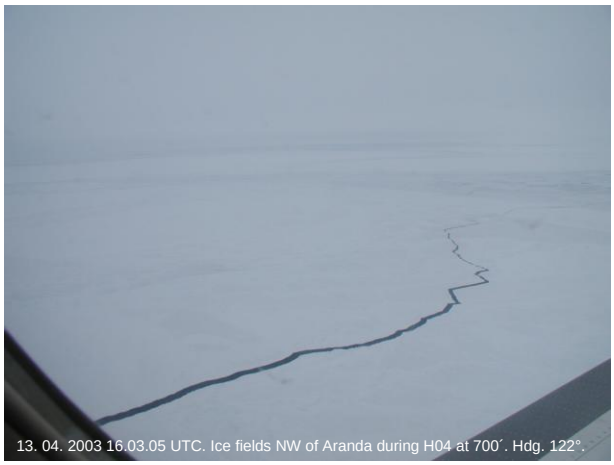


13. 04. 2003 15.52.01 UTC. Ice fields around Aranda during H02 at 300´. Hdg. 132°.

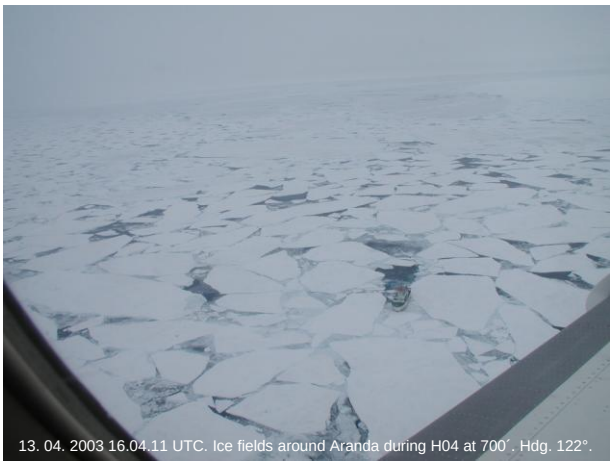
13. 04. 2003 15.52.04 UTC. Ice fields around Aranda during H02 at 300´. Hdg. 132°.

13. 04. 2003 15.56.36 UTC. Ice fields around Aranda during H03 at 500´. Hdg. 290°.

13. 04. 2003 15.56.39 UTC. Ice fields around Aranda during H03 at 500´. Hdg. 290°.



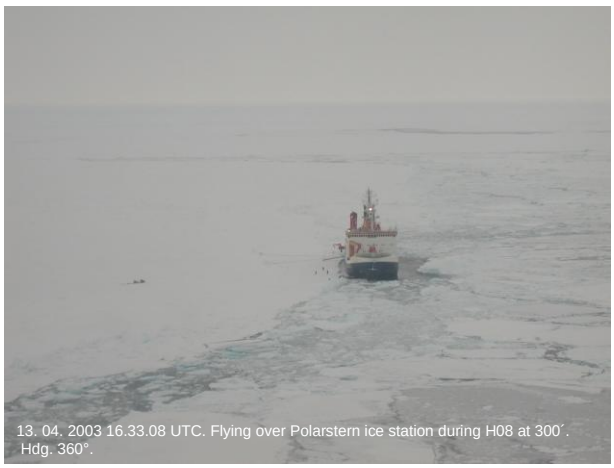
13. 04. 2003 16.03.05 UTC. Ice fields NW of Aranda during H04 at 700´. Hdg. 122°.



13. 04. 2003 16.04.11 UTC. Ice fields around Aranda during H04 at 700´. Hdg. 122°.

13. 04. 2003 16.24.22 UTC. During transit P06b between Aranda and Polarstern. Hdg. 25°.

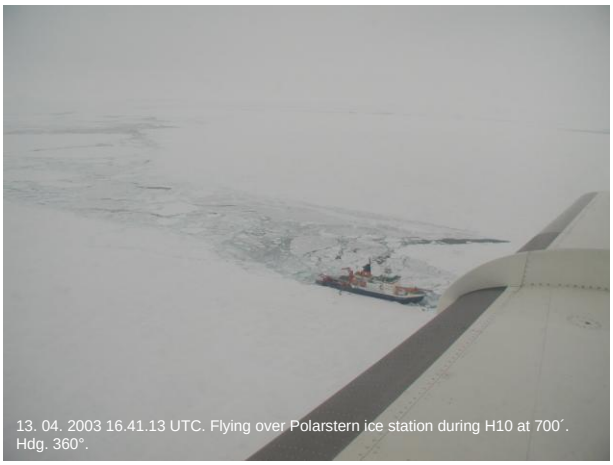
13. 04. 2003 16.24.40 UTC. Passing E of Polarstern during P06b at 100´. Hdg. 25°.



13. 04. 2003 16.33.08 UTC. Flying over Polarstern ice station during H08 at 300´. Hdg. 360°.

13. 04. 2003 16.33.11 UTC. Flying over Polarstern ice station during H08 at 300´. Hdg. 360°.

13. 04. 2003 16.37.41 UTC. Flying over Polarstern during H09 at 500´. Hdg. 170°.



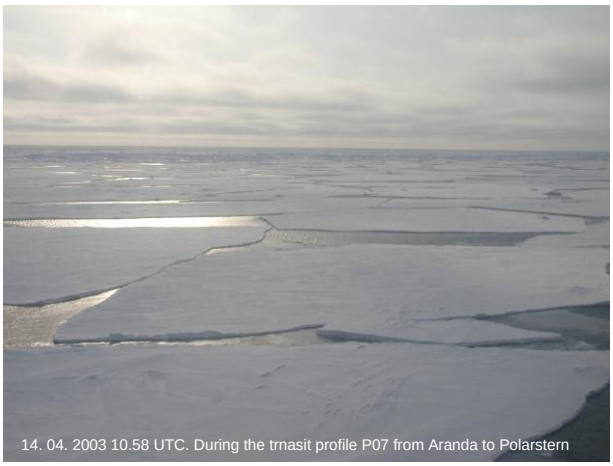
13. 04. 2003 16.41.13 UTC. Flying over Polarstern ice station during H10 at 700´. Hdg. 360°.

Falcon Flight No. 7 Date: 14 April 2003 09.54-12.56 UTC

14. 04. 2003 10.17 UTC.The sharp ice edge during run H01 at 500´.

14. 04. 2003 10.41 UTC. Broken sea ice and Kelvin-Helmholtz shaped clouds near Aranda during H04 at 700´.

14. 04. 2003 10.46UTC. Near cloud top during H05 at 1000´ near Aranda

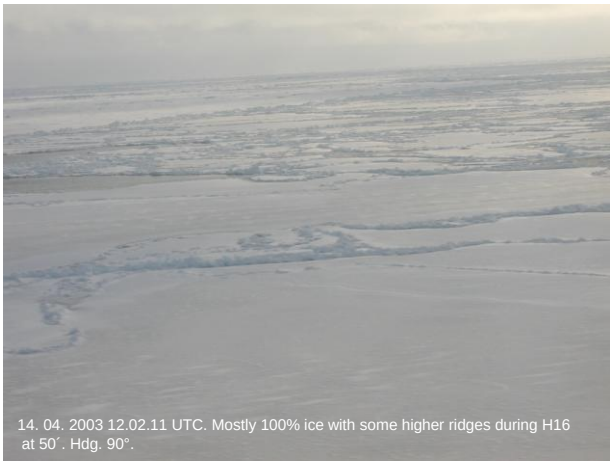


14. 04. 2003 10.58 UTC. During the trnasit profile P07 from Aranda to Polarstern

14. 04. 2003 11.22.24 UTC. 8/8 Stratus. Passing Polarstern during H09 at 100´. Hdg. 160°

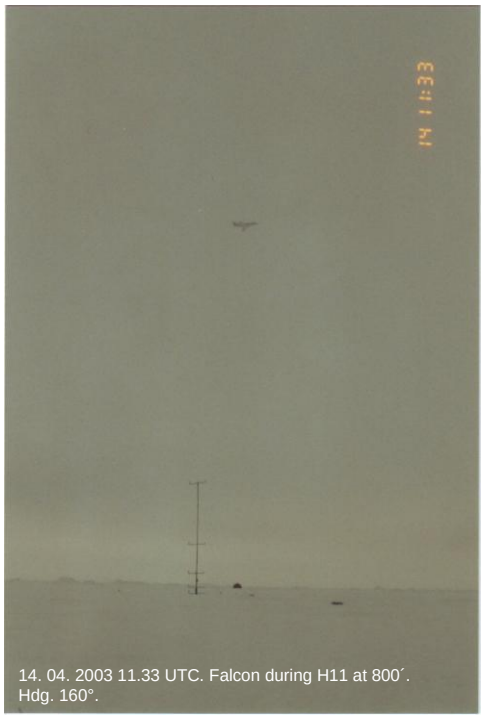
14. 04. 2003 11.22.29 UTC. 8/8 Stratus. Passing Polarstern during H09 at 100´. Hdg. 160°

14. 04. 2003 12.01.29 UTC. Ice ccnditions and 2/8 Sc stripes during H16 at 50´. Hdg. 90°.

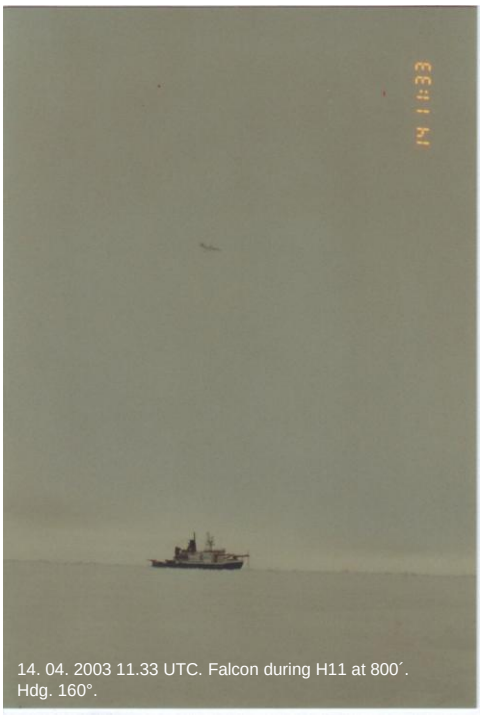


14. 04. 2003 12.02.11 UTC. Mostly 100% ice with some higher ridges during H16 at 50´. Hdg. 90°.

14. 04. 2003 11.28 UTC. Falcon during H10 at 400´. Hdg. 340°.

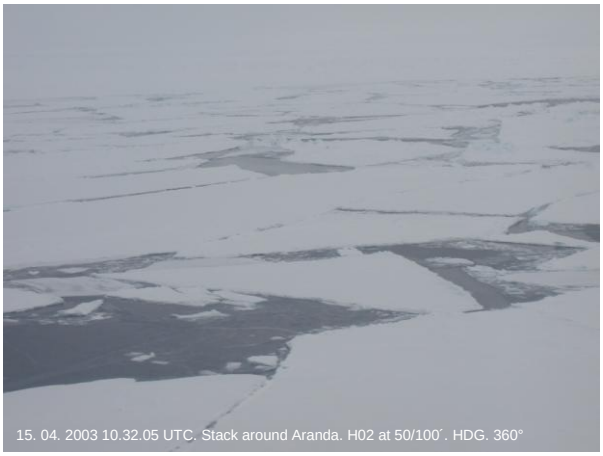


14. 04. 2003 11.33 UTC. Falcon during H11 at 800´. Hdg. 160°.



14. 04. 2003 11.33 UTC. Falcon during H11 at 800´. Hdg. 160°.

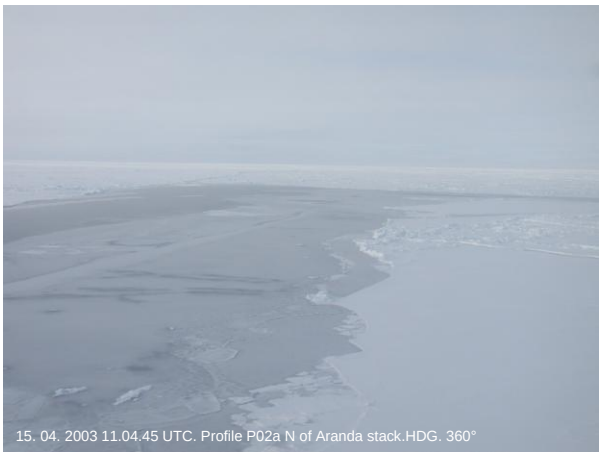
Falcon Flight No. 8 Date: 15 April 2003 10.00-13.05 UTC



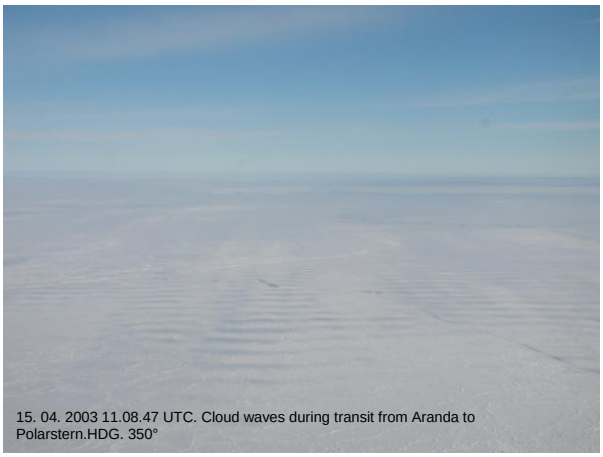
15. 04. 2003 10.32.05 UTC. Stack around Aranda. H02 at 50/100´. HDG. 360°

15. 04. 2003 10.41.47 UTC. Stack around Aranda. H03 at 200´. HDG. 180°

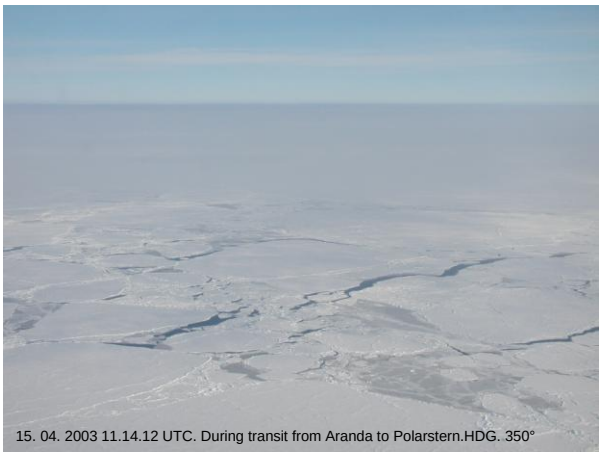
15. 04. 2003 10.55.28 UTC. Stack around Aranda. H05 at 500´. HDG. 180°



15. 04. 2003 11.04.45 UTC. Profile P02a N of Aranda stack.HDG. 360°



15. 04. 2003 11.08.47 UTC. Cloud waves during transit from Aranda to Polarstern.HDG. 350°



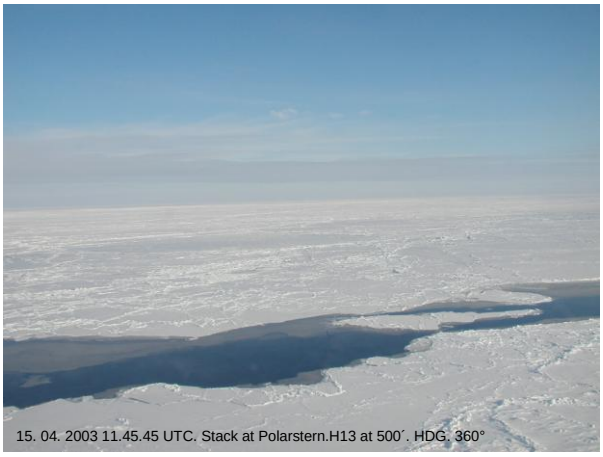
15. 04. 2003 11.14.12 UTC. During transit from Aranda to Polarstern.HDG. 350°

15. 04. 2003 11.19.12 UTC. Stack at Polarstern.H09 at 50´. HDG. 350°

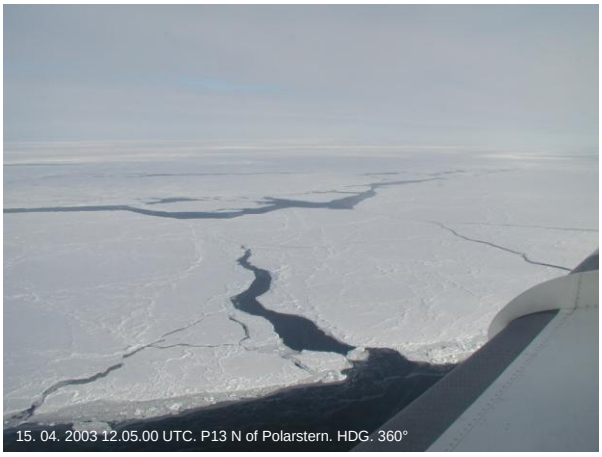
15. 04. 2003 11.19.16 UTC. Stack at Polarstern.H09 at 50´. HDG. 350°

15. 04. 2003 11.37.19 UTC. Stack at Polarstern.H12 at 400´. HDG. 180°

15. 04. 2003 11.43.49 UTC. Stack at Polarstern.H13 at 500´. HDG. 360°



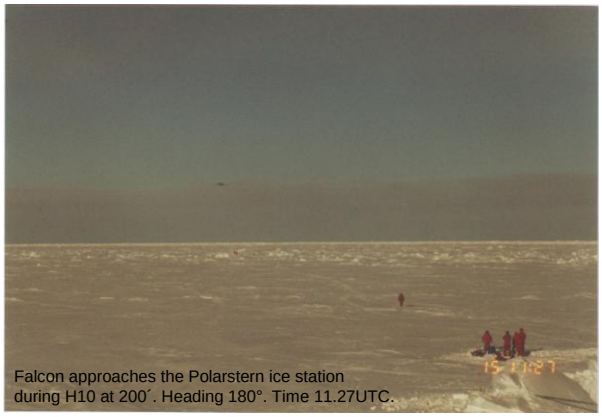
15. 04. 2003 11.45.45 UTC. Stack at Polarstern.H13 at 500´. HDG. 360°



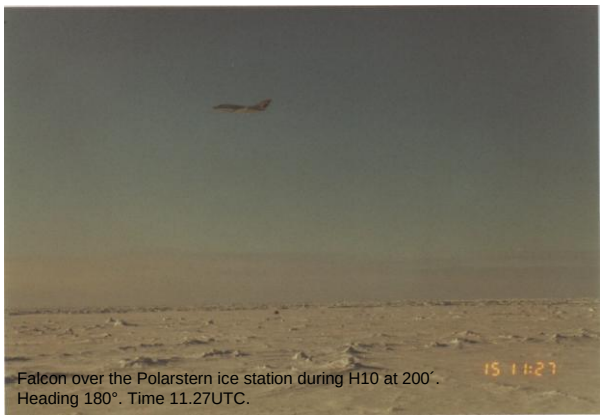
15. 04. 2003 12.05.00 UTC. P13 N of Polarstern. HDG. 360°

Over Polarstern ice station during H10 at 200´.
Heading 180°. Time 11.28 UTC.

Falcon during H09 at 50´ over Polarstern ice station.
Heading 360°. Time 11.19 UTC.



Falcon approaches the Polarstern ice station
during H10 at 200´. Heading 180°. Time 11.27UTC.

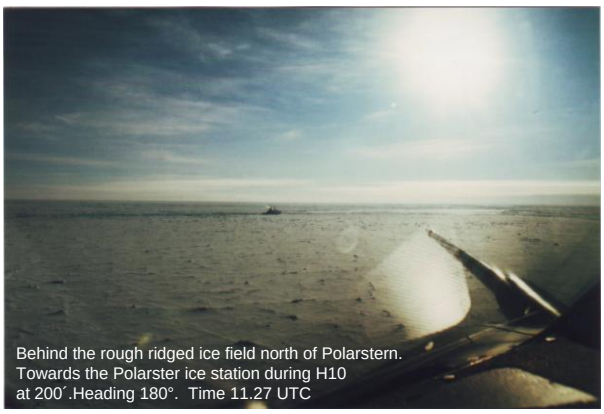


Falcon over the Polarstern ice station during H10 at 200´.
Heading 180°. Time 11.27UTC.

Aranda during run H01. Time 10.30 UTC.

Aranda during run H03 at 200´. Time 10.42 UTC.

Above the rough ridged ice field north of Polarstern during H10
at 200´.Heading 180°. Time 11.26 UTC



Behind the rough ridged ice field north of Polarstern.
Towards the Polarster ice station during H10
at 200´.Heading 180°. Time 11.27 UTC

8. Data availability

The dataset, on which this report is based, is published for use by the scientific community on the World Data Center for Climate's (WDC-C) CERA (http://www.dkrz.de/daten-en/cera) database. It can be downloaded after registration on the webpage and is free for non-commercial, scientific use.

This dataset contains measurements of the research aircraft DLR-Falcon. The data are subdivided into flight missions (different days) and flight sections (profiles, horizontal runs). Standard meteorological parameters (temperature, wind, radiation, etc.) and turbulent fluxes (momentum, sensible and latent heat) are stored in separate files. The file format is simple text (ascii). Extensive documentation is provided along with the dataset on the CERA database, filed under 'additional information'.

The dataset features an unique persistent identifier (DOI: digital object identifier) which ensures the unambiguous identification and long-term locatability. When using or mentioning the dataset it should be referenced as a formal citation:

Brümmer, B., J. Launiainen, G. Müller, A. Kirchgässner, C. Wetzel (2011): ACSYS 2003 - Arctic Atmospheric Boundary Layer and Sea Ice Interaction Study north of Spitsbergen: meteorological measurements of the research aircraft Falcon, 11 autonomous ice buoys and radiosoundings at the research vessels Aranda and Polarstern. World Data Center for Climate. DOI:10.1594/WDCC/UNI_HH_MI_ACSYS2003.

9. Related Publications and Datasets

Besides the Falcon aircraft measurements the ABSIS 2003 experiment featured observations at two research vessel (German Polarstern and Finnish Aranda), at a drifting ice station and two types of autonomous drifting ice buoys. Radiosoundings at Polarstern and Aranda (ACSYS2003_polarstern_rs, ACSYS2003_aranda_rs) as well as buoy data (ACSYS2003_ibeacon_buoy, ACSYS2003_calib_buoy) are incorparated in the CERA database. Ship and icestation datasets are available on request.

Measurements with the research aircraft DLR Falcon were conducted in some more experiments under arctic and sub-arctic conditions. Datasets and documentation are also available from the CERA database. See the section 'Related datasets' below.

Links to all ABSIS/ACSYS 2003 datasets on the CERA database:

http://cera-www.dkrz.de/WDCC/ui/Compact.jsp?acronym=ACSYS2003_falcon
http://cera-www.dkrz.de/WDCC/ui/Compact.jsp?acronym=ACSYS2003_ibeacon_buoy
http://cera-www.dkrz.de/WDCC/ui/Compact.jsp?acronym=ACSYS2003_calib_buoy
http://cera-www.dkrz.de/WDCC/ui/Compact.jsp?acronym=ACSYS2003_aranda_rs
http://cera-www.dkrz.de/WDCC/ui/Compact.jsp?acronym=ACSYS2003_polarstern_rs

Related Publications:

Launiainen, J. & Brümmer, B. (2003): ACSYS-ABSIS 2003, RV Aranda Cruise Plan, http://www.itameriportaali.fi/fi/aranda/aranda_matkat/matkat/fi_FI/acsys_absis_52/_files/12076504320074797/default/absis03.pdf

Launiainen, J. & Brümmer, B. (2003): ACSYS-ABSIS 2003, RV Aranda Cruise Report, http://www.itameriportaali.fi/fi/aranda/aranda_matkat/matkat/fi_FI/acsys_absis_52/_files/12076504320076571/default/CruiseRep03b.pdf

Schauer, U. & Kattner, G. (2004): The Expedition ARKTIS XIX/1 a, b and XIX/2 of the Research Vessel Polarstern in 2003. Reports on Polar and Marine Research, Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, 481, 194 pp, hdl:10013/epic.10486

Brümmer, B. (2003): The Arctic inversion over sea and its representation in operational weather models, ACSYS Final Science Conference 11-14 November 2003, St. Petersburg, Russia, http://acsys.npolar.no/meetings/final/abstracts/metadata_abstracts.php?id=117

Brümmer, B. & Launiainen, J. (2004): The Arctic Boundary Layer and Sea-Ice Study (ABSIS) 2003, Ice and Climate News the WCRP Climate and Cryosphere Newsletter, http://ipo.npolar.no/newsletters/archive/ice_climate_2004_03_no_05.pdf

Brümmer, B., J. Launiainen, G. Müller and D. Schröder, (2005): FRAMZY 2002: Second field experiment on Fram Strait cyclones and their impact on sea ice. Ber. a.d. ZMK, Reihe A, Meteorologie, 37, 154 pp.

Brümmer, B. (Ed.), (2000): Field experiment FRAMZY 1999: Cyclones over the Fram Strait and their impact on sea ice – Field report with examples of measurements. Ber. a.d. ZMK, Reihe A, Meteorologie, 33, 176 pp.

Brümmer, B. & Thiemann, S. (1999): Field Campaign ACSYS 1998 - Aircraft measurements in Arctic on-ice air flows, Berichte aus dem Zentrum für Meeres- und Klimaforschung, Universität Hamburg, Reihe A, 1999, 32, 35pp

Brümmer, B. (ed.) (1993): ARKTIS 1993: Report on the Field Phase with Examples of Measurements, Berichte aus dem Zentrum für Meeres- und Klimaforschung, Universität Hamburg, Reihe A, 1993, 11, 186pp

Related datasets and data sources:

König-Langlo, Gert (2005): Meteorological observations during POLARSTERN cruise ARK-XIX/1. Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, DOI:10.1594/PANGAEA.269619

AWI Polarstern Cruise ARK-XIX/1: Information, Reports and Data, in PANGAEA Publishing Network for Geoscientific & Environmental Data, http://www.pangaea.de/PHP/CruiseReports.php?b=Polarstern

Brümmer, B., G. Müller, A. Lammert-Stockschläder, A. Jahnke-Bornemann, C. Wetzel (2011): FRAMZY 2007 - Third Field Experiment on Fram Strait Cyclones and their Impact on Sea Ice: meteorological measurements of the research aircraft Falcon, 16 autonomous ice buoys and 13 autonomous water buoys. World Data Center for Climate. DOI:10.1594/WDCC/UNI_HH_MI_FRAMZY2007.

Brümmer, B., G. Müller, D. Schröder, C. Wetzel (2011): LOFZY 2005 - First Field Experiment on Cyclones over the Norwegion Sea: meteorological measurements of the research aircraft Falcon, 23 autonomous water buoys and radiosoundings at the research vessel Celtic Explorer. World Data Center for Climate. DOI:10.1594/WDCC/UNI_HH_MI_LOFZY2005.

Brümmer, B., J. Launiainen, G. Müller, A. Kirchgässner, C. Wetzel (2011): ACSYS 2003 - Arctic Atmospheric Boundary Layer and Sea Ice Interaction Study north of Spitsbergen: meteorological measurements of the research aircraft Falcon, 11 autonomous ice buoys and radiosoundings at the research vessels Aranda and Polarstern. World Data Center for Climate. DOI:10.1594/WDCC/UNI_HH_MI_ACSYS2003.

Brümmer, B., J. Launiainen, G. Müller, C. Wetzel (2011): FRAMZY 2002 - Second Field Experiment on Fram Strait Cyclones and their Impact on Sea Ice: meteorological measurements of the research aircraft Falcon, 15 autonomous ice buoys and radiosoundings at the research vessel Aranda. World Data Center for Climate. DOI:10.1594/WDCC/UNI_HH_MI_FRAMZY2002.

Brümmer, B., G. Müller, G. Kruspe, H. Hoeber, C. Wetzel (2011): FRAMZY 1999 - First Field Experiment in Cyclones over the Fram Strait and their Impact on Sea Ice: meteorological measurements of the research aircraft Falcon, 15 autonomous ice buoys and radiosoundings at the research vessel Valdivia. World Data Center for Climate. DOI:10.1594/WDCC/UNI_HH_MI_FRAMZY1999.

Brümmer, B., S. Thiemann, , C. Wetzel, (2011): ACSYS 1998 - Air mass modification in on-ice air flows north of Fram Strait: meteorological measurements of the research aircraft Falcon: meteorological measurements of the research aircraft Falcon. World Data Center for Climate. DOI:10.1594/WDCC/UNI_HH_MI_ACSYS1998.

Brümmer, B., G. Müller, S. Thiemann, C. Wetzel (2011): BASIS 1998 - Baltic Air Sea Ice Study 1998: meteorological measurements of the research aircraft Falcon and radiosoundings at the research vessel Aranda and 3 land stations. World Data Center for Climate. DOI:10.1594/WDCC/UNI_HH_MI_BASIS1998.

Jeske, H., G. Kruspe, A.P. Nagurny, B. Brümmer, G. Müller, C. Wetzel (2011): ARKTIS 1993 - Air mass modification in off-ice air flows: meteorological measurements of the research aircraft Falcon and radiosoundings at the research vessels Valdivia, Polarstern and Prof. Multanovsky and at 4 land stations. World Data Center for Climate. DOI:10.1594/WDCC/UNI_HH_MI_ARKTIS1993.

World Data Center – Climate (WDCC) and CERA database: http://www.dkrz.de/daten-en/wdcc

Integrated Climate Data Center (ICDC) at Klimacampus, Hamburg: http://icdc.zmaw.de