ACLOUD Flight #20 – Polar 6 – 20170618

Mission PI P6:

Objectives: Difference between the over-ice and over-open-water clouds – influence of the underlying surface

Crew:

	Polar 6
PI	**Dmitry Chechin**
Basis Data Acq.	**Cristina Sans Coll**
PMS	**Guillaume Mioche**
Alabama	**Franzisca Kollner**
CVI	**Stephan Mertes**
A + TG	**Oliver Eppers**

Flight times:

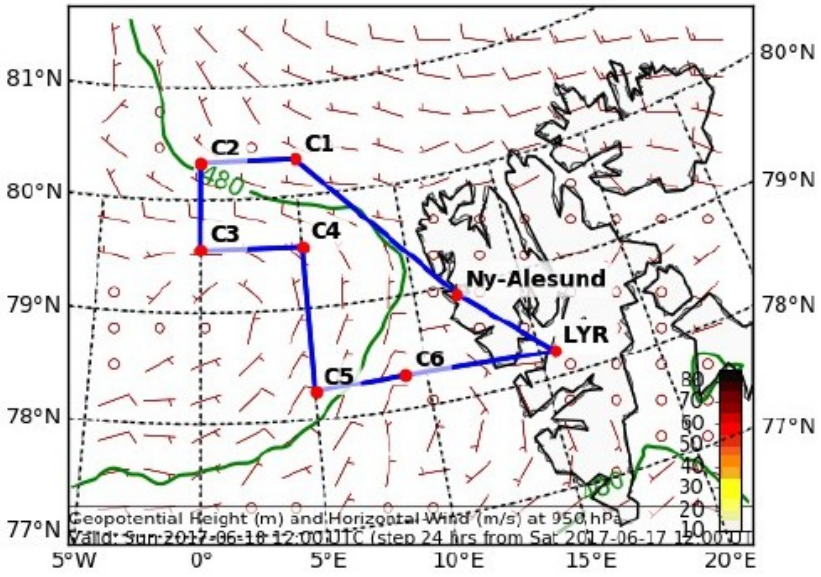
	Polar 6
Take off	**14:25 LT**
Touch down	**19:50 LT**

Weather situation as observed during the flight (compare to forecast):

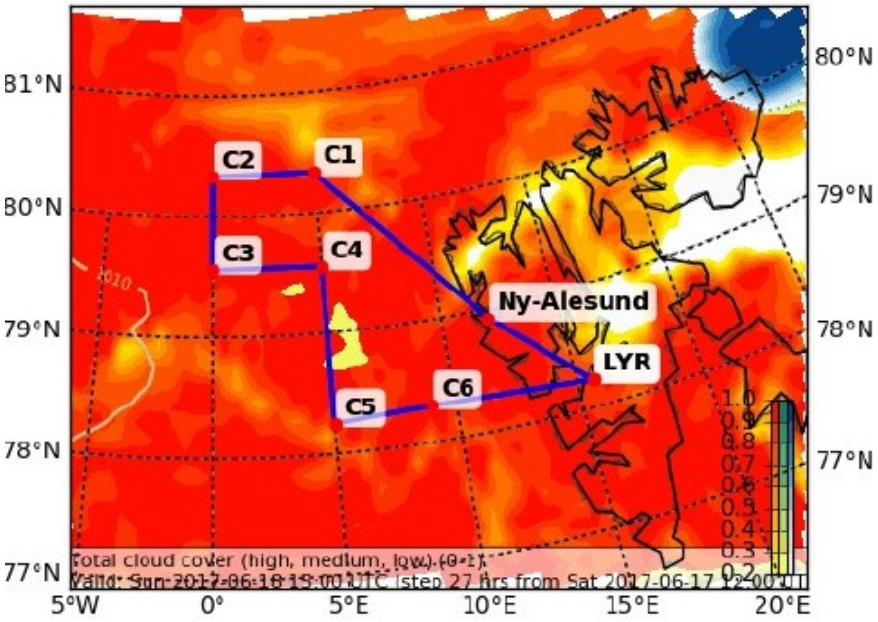
Low-level clouds were predicted all over the measurement area by ECMWF, with mid-level clouds dissipating during the day. Weak-gradient pressure field with low wind speed was predicted.

Indeed, there was a mid-level cloud in the first half of the flight, with low-level clouds below. The upper cloud was at 6500-7000f. Low-level clouds over the ice were in the layer 100-650 feet during the northernmost track (S1-S2). Over the open water there was a thin layer of stratocumulus with strong convective clusters penetrating through it from below. Convective clusters were separated from each other by large distances of order of 10km. There was a distinctive difference between cloud cover over the ice and water.

Geopotential Height (m) and Horizontal Wind (m/s) (Wind Speed 10-85 m/s) at 950 (h
Valid: Sun 2017-06-18 12:00 UTC (step 24 hrs from Sat 2017-06-17 12:00 UTC)



Cloud Cover (0-1) (Total Cloud Cover)
Valid: Sun 2017-06-18 15:00 UTC (step 27 hrs from Sat 2017-06-17 12:00 UTC)



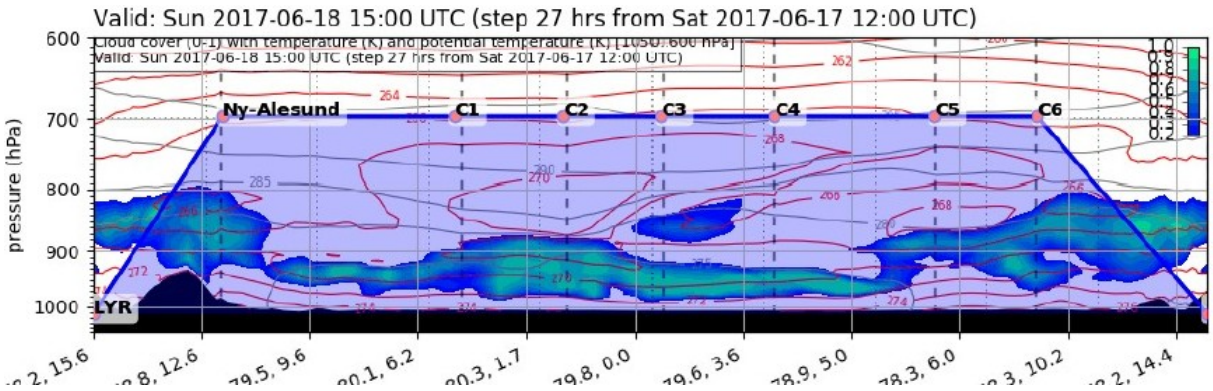


Fig.1. ECMWF forecast valid for 12:00 (upper plot for wind) and 15:00 UTC (lower plots for cloud cover).

Overview:

The main goal of the flight was to sample low-level clouds over the ice and open water to study the difference.

Aerosol profile was made on the way to S1 with legs at 12000f and 8000f. Two racetrack patterns over the ice: S1-S2, S3-S4 with 5 legs 15NM each at different heights. The cloud saw-tooth pattern on the way south to S5 crossing the marginal sea ice zone. Third racetrack pattern S5-S6 over open water also consisting of 5 legs 15NM each at different heights.

Flight levels during each racetrack were adjusted according to the current cloud base and cloud top heights. Lowest level was always at 200 f and highest – above the cloud top.

The northernmost racetrack pattern over the ice was shifted 5 miles to the west in a way that eastern 10 miles are in the low-level homogeneous stratocumulus with no upper cloud above and western couple of miles are below the upper cloud in less homogeneous and thinning stratocumulus cloud.

Over the open water we sampled a large convective cluster (see Fig.3 below with the MODIS image). It was snowing below it and we were flying several times through the precipitating snow and through the cloud.

CVI inlet got frozen during the patterns over the ice but deiced over warmer water in the southern part of the flight.

Flight track and pattern:

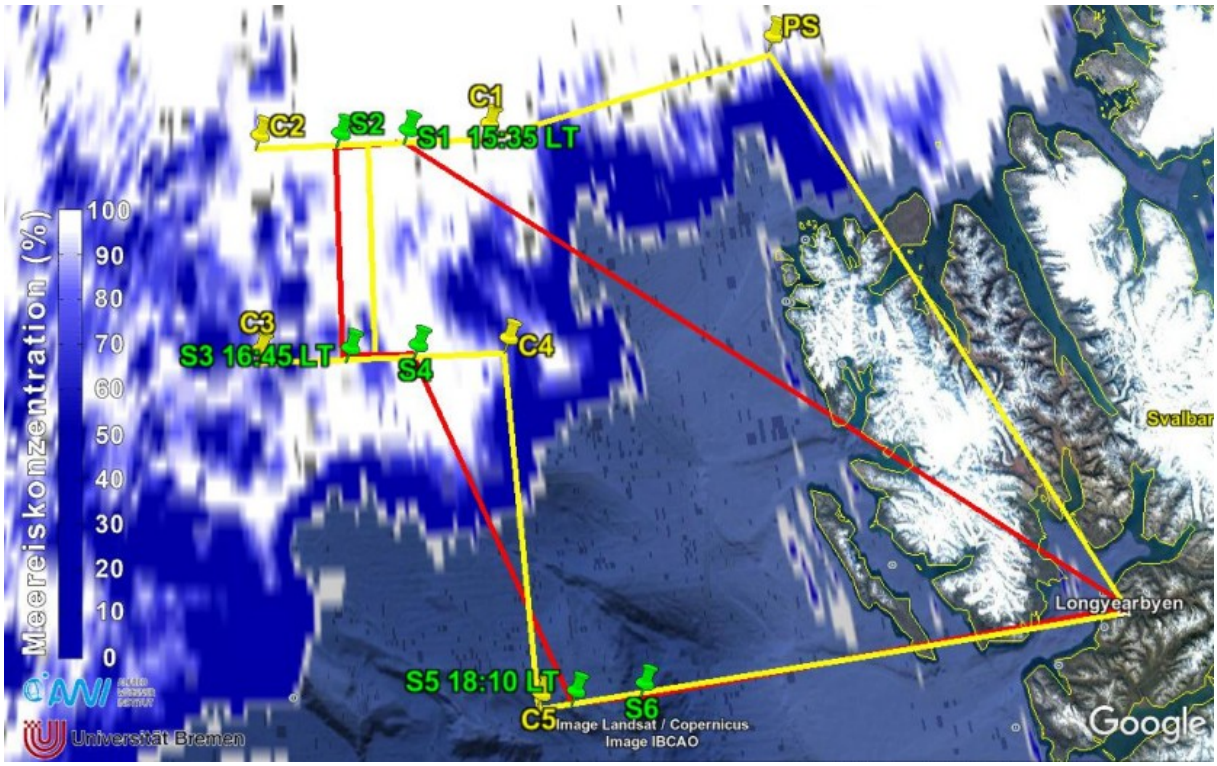


Fig.2. Polar 5 (yellow) and Polar 6 (red) flight tracks.

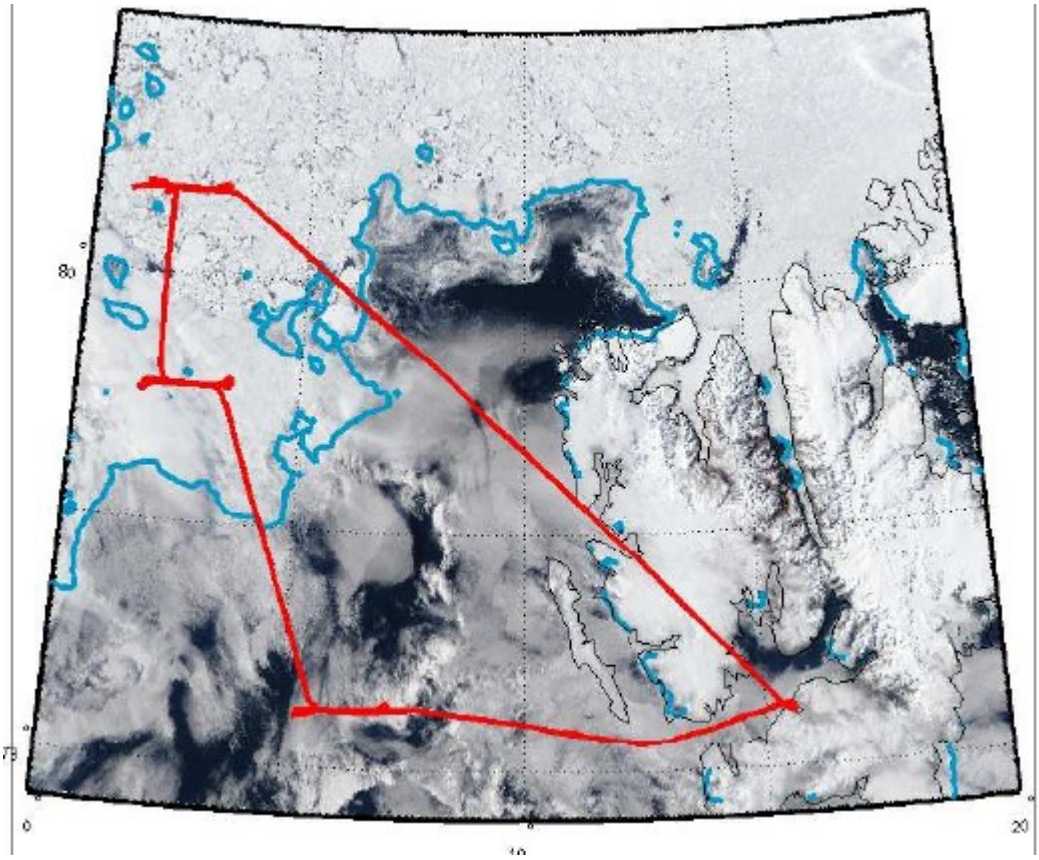
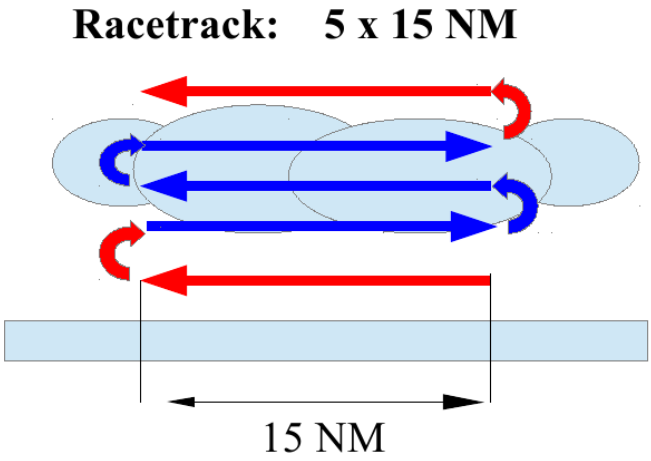


Fig.3. Actual Polar 6 flight track. Blue line – 70% sea ice concentration (AMSR2 3.15km resolution from Bremen Uni). Clouds: visible image from MODIS at 17:30 UTC.



Detailed Flight Logs:

Dmitry Chechin:

Soon after take-off ascending through the cloud layer over LYR (cloud top at 4000f).

We are making aerosol profile over Svalbard with legs at 12000 and 8000f.

14:58 Leg at 8000f, above the top of an altocumulus (or strato-) layer. Further we descent through it: cloud top 7200f and cloud bottom is at 6500m. But this cloud ends soon ahead of us.

15:17 We descent further and reach the ice edge. Over open water there were inversions at heights 1200 and 400m. We observe large leads.

15:22 We reach and enter low-level clouds flying at 200f. It's bottom is probably at 60-80f or touching the ground and its top is at 450f but might vary.

15:30 We approach S1. Above us there is blue sky and no mid-level cloud, below us – homogeneously turbulent stratocumulus.

First racetrack S1-S2 15:30-16:30 LT:

#1 @ 700f--> 800f (S1-S2): we fly above the low-level stratocumulus to check the situation along the racetrack. We have to change height to 800f to avoid rising cloud top. Approaching S2 we clearly observe the mid-level cloud ahead and, importantly, low-level stratocumulus below the mid-level cloud breaks and disappears. Thus, we decide to shift our lower-level legs 5 miles to the west, to capture this transition.

#2 @ 200f: at S2 low-level cloud is broken and thin, this is where we start our leg. We fly ¼ of our leg in clear air and then enter the stratocumulus deck.

#3 @ 400f: when we are above S2 stratocumuls deck starts to be brocken and patchy.

#4 @ 500f: the whole leg is in the upper part of the cloud. Only liquid, no ice.

#5 @ 300f: in the west the cloud is thinner, in the east – thicker,

The mid-level cloud above S2 started dissipating while we were flying our pattern. CVI inlet got frozen during the first racetracking.

16:26 We start from S2 to S3. We get again below the mid-level cloud. Low-level clouds become patchy.

16:35 we go through a stratus cloud with bottom at 1500f and top at 2000f.

16:44 we are at S3 starting second racetrack pattern.

Second racetrack S3 -->S4 16:44-17:40 LT

#1 @ 2500f: first leg is above the clouds. We observe a cloud-free spot to the east of S4. Large leads are observed.

#2 @ 200f: during this leg we observe that at S3 cloud base is much lower than at S4: almost at 200-300f

#3 @ 700f: this leg is aiming to catch low-level clouds which are observed over S3, flying through them. As we approach S4, cloud base rises. We see much more open water than the day before.

#4 @ 1200f: we enter the cloud at S4 and fly in the lowermost part of the cloud; but as we approach S3 we get into a proper cloud and fly there for about 2:30 min.

#5 @ 1600f: the whole leg was completely in the cloud. Only exited it at S4.

We start to go in the direction of S5, doing the saw-tooth pattern.

We descent through a hole in the clouds to deice. Cloud top is at about 1900f and cloud base is at about 1300-1500f.

17:53 we meet low-level clouds with cloud base at 200f; we are over the transition to open water – separate floes below us.

17:56 cloud base is at 300-400f, we are ascending.

17:58 we still see the surface being at 700f; at 900f we feel turbulence in the cloud.

18:00 we are at 1200f in the cloud, it becomes more turbulent; at 2000f it is even more turbulent.

At height 2200f we cross the cloud top. Around us we see holes in the cloud field. Perhaps, the latest ascent was through a convective structure. Those ones are found later over the open water.

Third racetrack pattern S5-S6

#1 @ 200f: we fly across the elongated cloud structures. Passing by a shower to the right of us. At S6 we get into precipitation, it is snowing, large crystals.

#2 @ 1500f: there small pieces of clouds below us. At 18:24 we get out of the cloud, as the cloud base rises closer to S5

#3 @ 3000f → 2700f: we are in the layer of mid-level clouds; it feels turbulent; and more turbulent around S6;

#4 @ 4000f: we see that convective cloud tops pop up from the stratocumulus deck here and there

#5 @ 900f: there are no clouds at this height close to S5; but we get into the shower as we approach S6.

We make ascent through this precipitating convective cluster at S6 (seen at the satellite image). There is ice in this cloud all the way through the ascent. Cloud top is at about 3500-4000f.

We ascent to 8000f doing aerosol profile and find a dirty polluted layer there.

On the way to Svalbard everywhere around we see convective cloud tops penetrating through the stratocumuls.

We descent to LYR. Cloud top is at 4300f, cloud base at 3600f.

19:50 landing

Instrument Status:

Polar 6

Basis data acquisition	
Nose Boom	
PHIPS	
SID-3	
CIP	

PIP

CDP

ALABAMA

CVI

CVI UHSAS

CVI ???

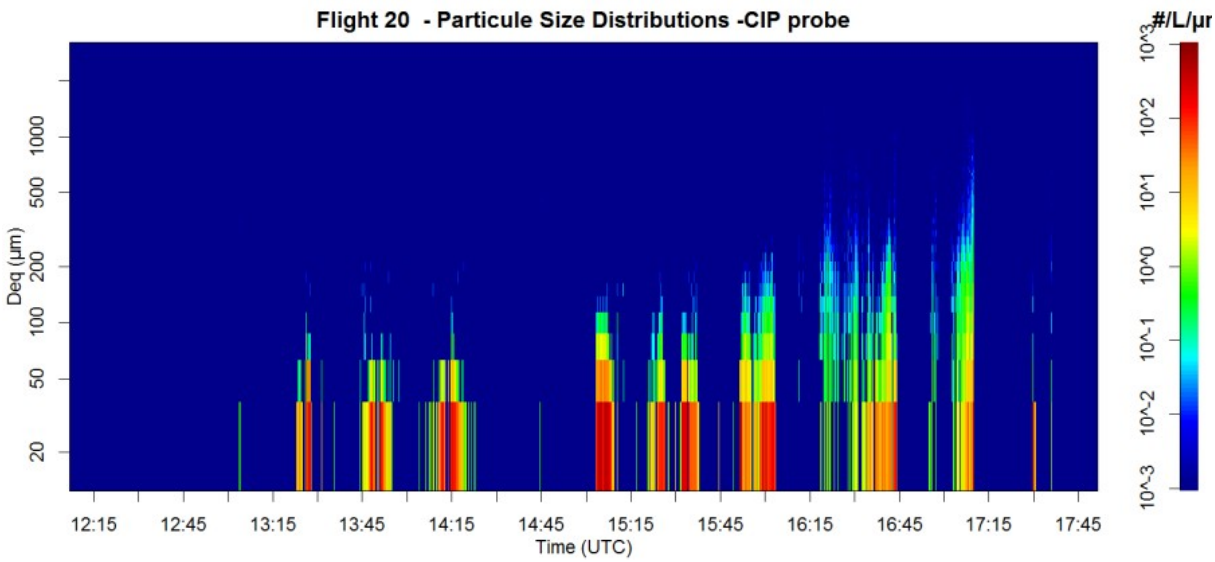
AWI SP2

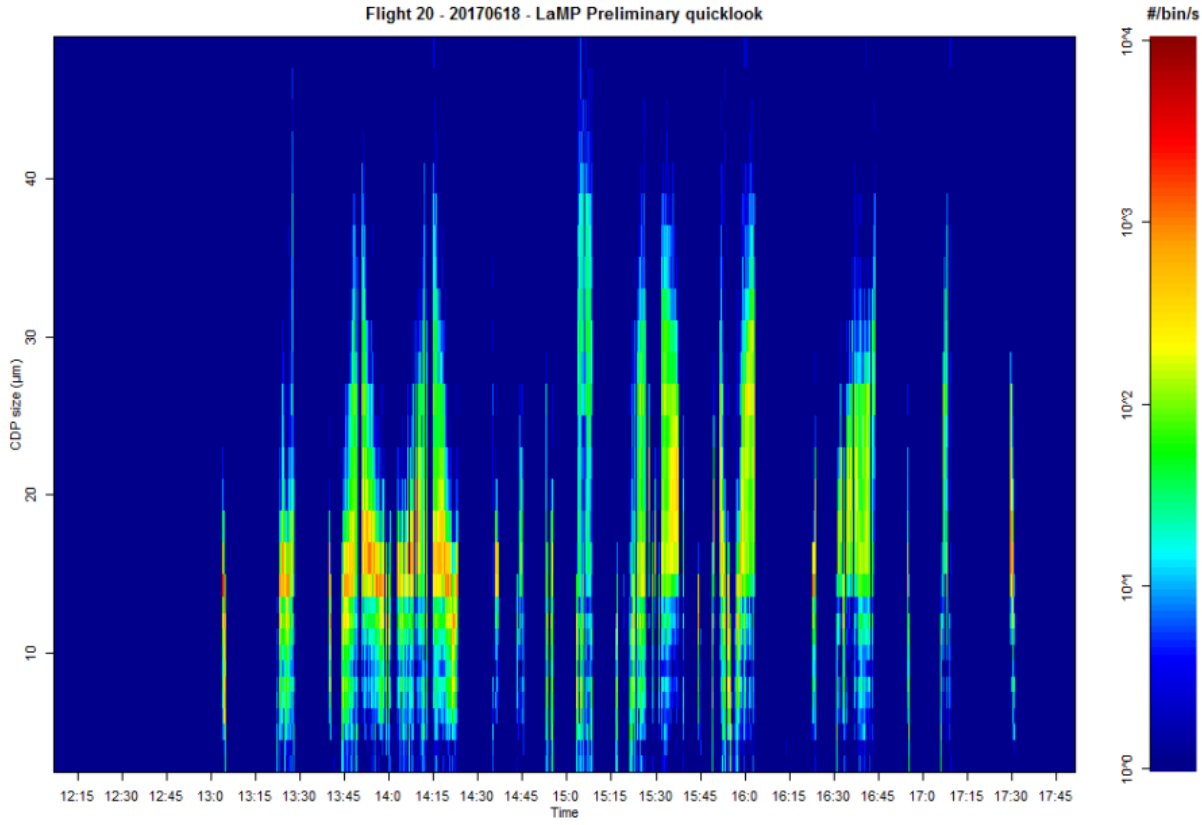
AWI UHSAS

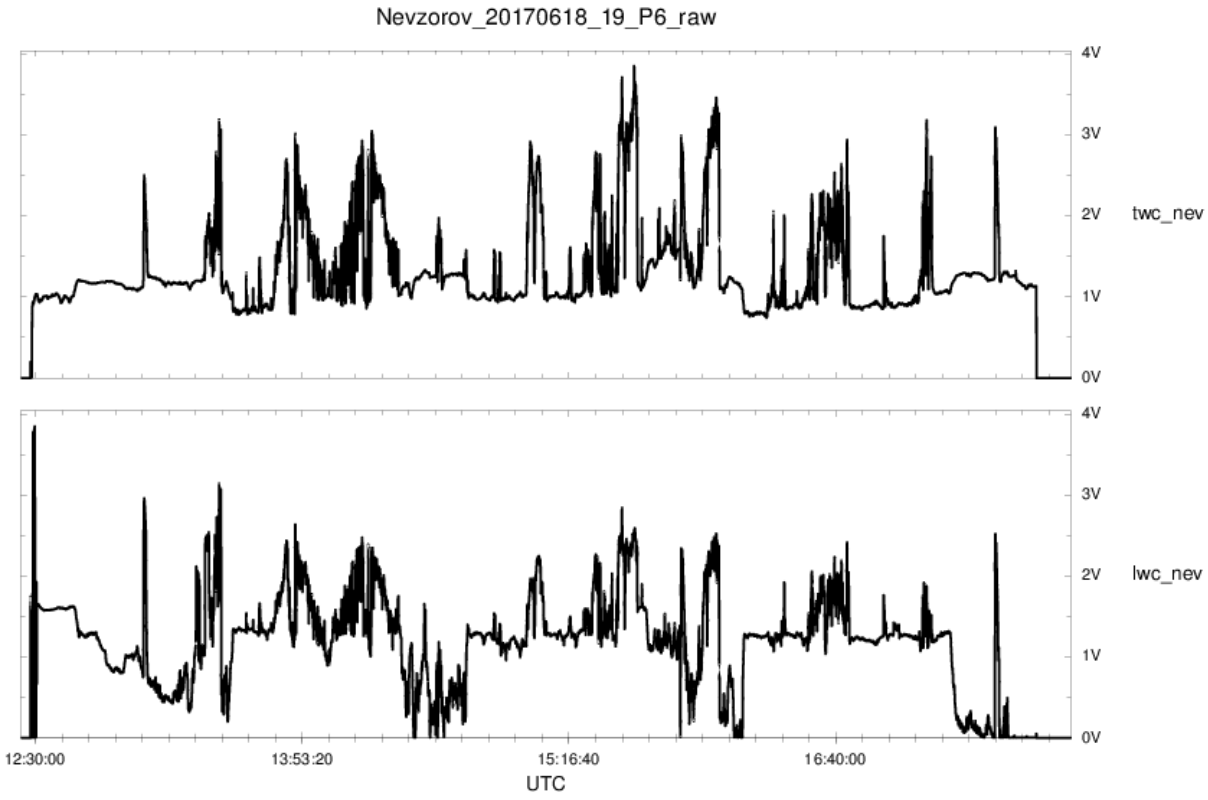
CO/CO2/O3

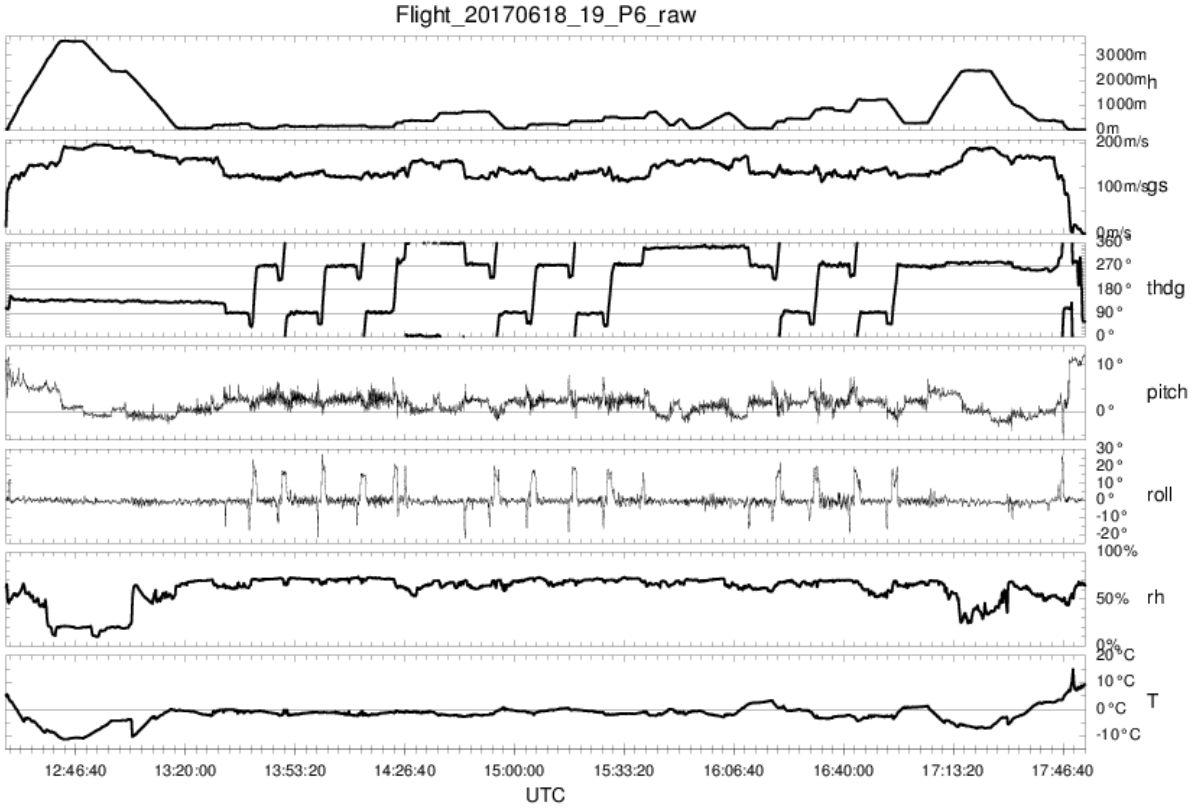
Problem with CVI inlet: CVI inlet heating is not working. When the inlet freezes it does not operate at its full functionality. It got frozen during the first racetrack (S1-S2) but got unfrozen later over the open water and during the S5-S6 racetrack observations were made also in clouds.

Quicklooks:




Flight 20 - 20170618 - LaMP Preliminary quicklook
#/bin/s
CDP size (µm)
Time


Nevzorov_20170618_19_P6_raw
twc_nev
lwc_nev
UTC


Flight_20170618_19_P6_raw
3000m
2000m
1000m
0m
h
200m/s
100m/s
0m/s
gs
360°
270°
180°
90°
0°
thdg
10°
0°
pitch
30°
20°
10°
0°
-10°
-20°
roll
100%
50%
0%
rh
20°C
10°C
0°C
-10°C
T
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13:20:00
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16:40:00
17:13:20
17:46:40
UTC