

## **ACLOUD Flight #19 - Polar 6 - 170617**

### **Mission PI P6:**

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

### **Crew:**

#### **Polar 6**

<b>PI</b>	<b>Dmitry Chechin</b>
<b>Basis Data Acq.</b>	<b>Cristina Sans Coll</b>
<b>PMS</b>	<b>Guillaume Mioche</b>
<b>Alabama</b>	<b>Franziska Kollner</b>
<b>CVI</b>	<b>Stephan Mertes</b>
<b>A + TG</b>	<b>Oliver Eppers</b>

### **Flight times:**

#### **Polar 6**

<b>Take off</b>	<b>12:10 LT</b>
<b>Touch down</b>	<b>17:55 LT</b>

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

Good agreement with the ECMWF forecast with respect to the location and timing of the cloudy areas. Clouds were in the northern part of the domain (S1-S2) as well as in the southern (S5-S6), with thicker clouds to the east (S2 and S6). Over the MIZ there were only thin clouds. Clouds were spatially strongly inhomogeneous, often with several layers. The thickest clouds were found over the open water in the eastern part of the track S5-S6 and on the way back to Svalbard (S6-LYR), as also predicted by the ECMWF (see Fig.1).

Over the ice at S1-S2 we observed showers with presence of ice crystals. They looked like foggy areas reaching the ice surface. Above these showers there was a stratocumulus layer with sometimes another stratus layer right above the first one.

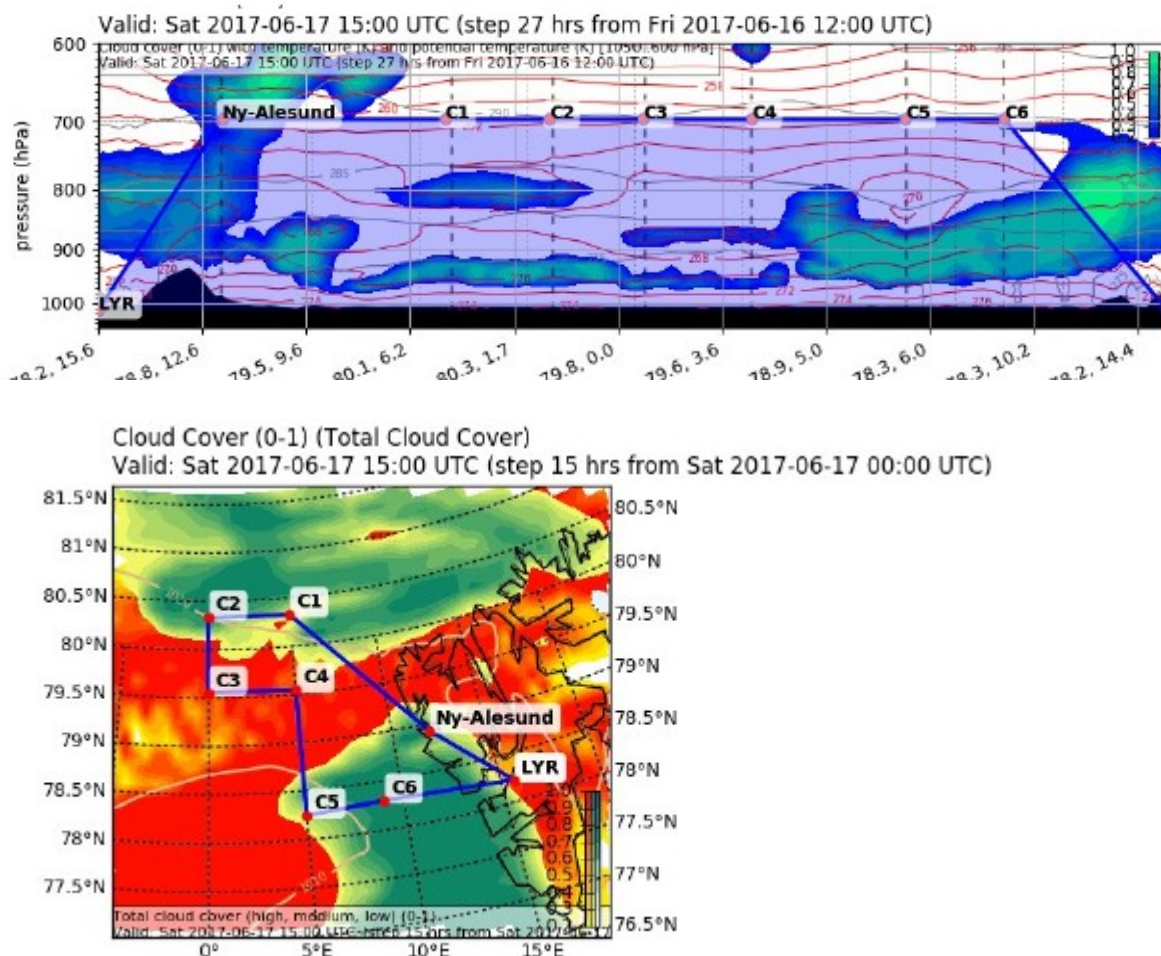


Fig. 1. ECMWF forecast valid for 2017-06-17 15:00 UTC.

## Overview:

Aerosol profile on the way to S1. 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 had to be adjusted according to the current cloud base and cloud top heights. Lowest level was always at 200 f. However,

Cloud base and top heights were spatially inhomogeneous and varied strongly even across the 15NM legs. Clouds were multilevel, with stratus layers above the more mixed lower layer. Thus, it was not easy to define the cloud top and plan the flight levels.

We still had the earlier encountered problem with the heating of the CVI inlet. The CVI inlet functioned well on the way to S1, but after some time in the clouds at S1-S2 it stopped working due to icing. On the way between S4 and S5 over warmer open ocean the ice on the CVI inlet melted away. This allowed us to continue the CVI-related measurements outside of the clouds, but not in clouds. All other instruments worked well.

## Flight track and pattern:

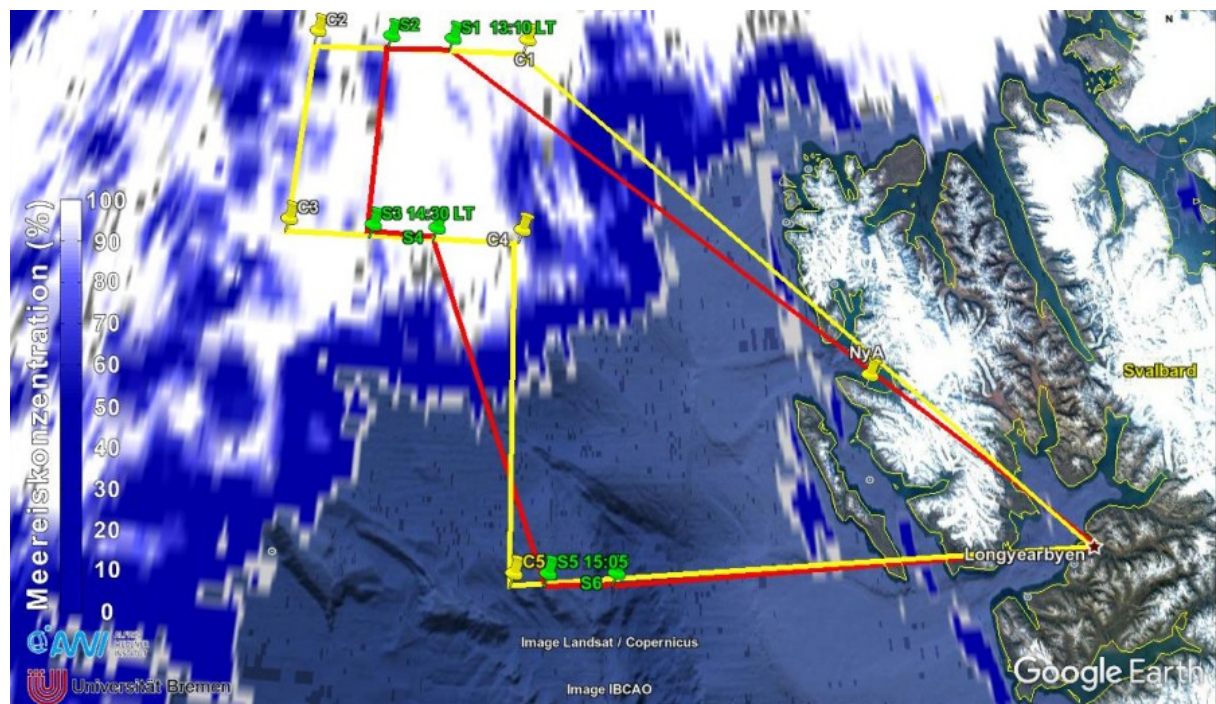


Fig.2. Polar 5 (yellow) and Polar 6 (red) planned flight tracks.

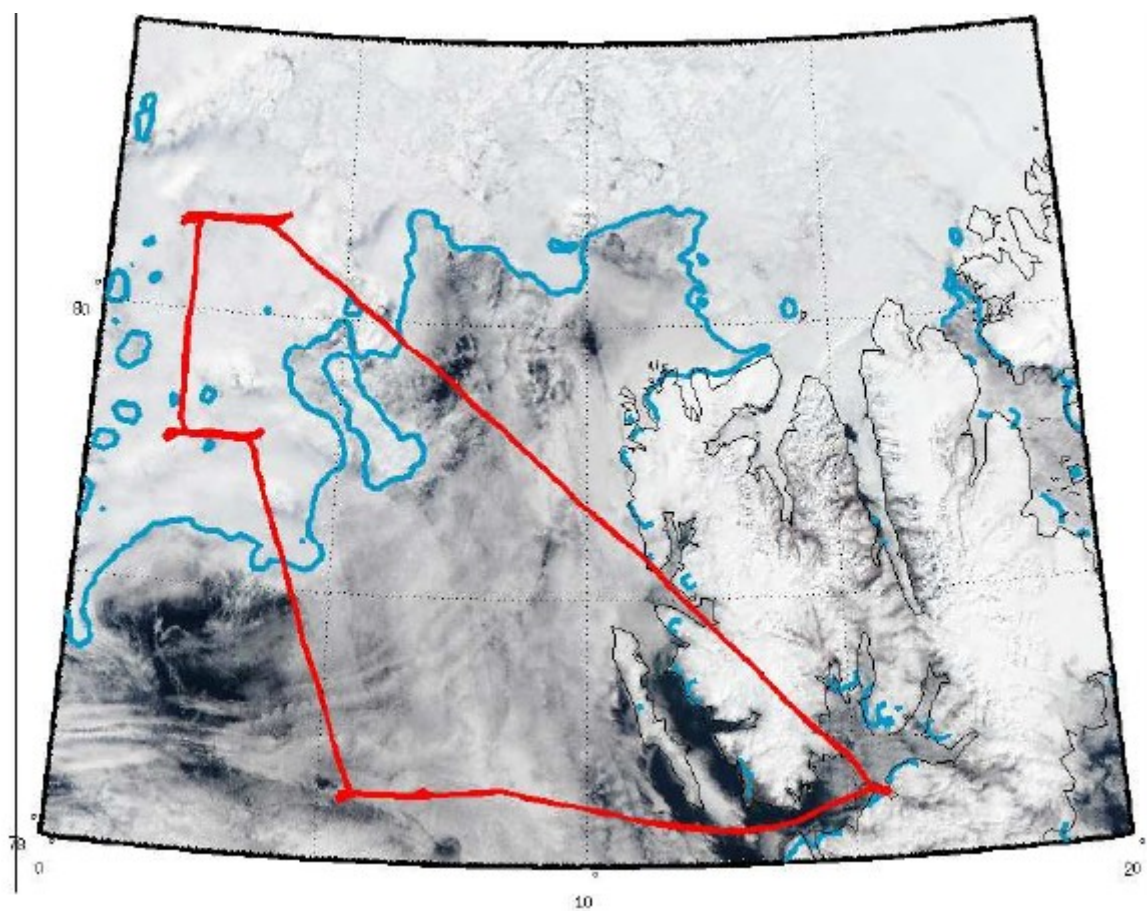
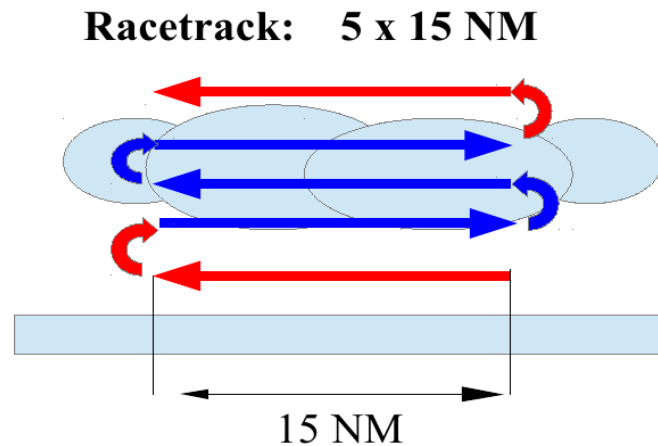




Fig.3. Actual Polar 6 flight track. Blue line - 70% sea ice concentration (AMSR2 3.15km resolution from Bremen University). Clouds: visible image from MODIS at 09:00 UTC.

Racetrack flight pattern at S1-S2, S3-S4 and S5-S6.



### Detailed Flight Logs:

#### Dmitry Chechin:

At height of about 10500-11500f there was a thin alto-cumulus/stratus layer almost during the whole flight. Rarely we had more sunny conditions when this layer was, perhaps, absent. We penetrated this layer twice during the aerosol profile up to 12000f on the way LYR-S1 (12:10 - 13:10 LT).

*Fig.1. Between the altocumulus and stratocumulus on the way to S1 flying at about 6000f (about 13:40 LT)*

Over the open water on the way to S1: looking from above we observed the stratocumulus deck, not very homogeneous.

Approaching to S1: descent to 200f. Cloud top is between 2500 and 1700f. At 2300f we were between the two layers of clouds. Cloud base is at 1000f. But below the cloud base we observe showers over the sea ice which touch the surface.

First racetrack pattern S1-S2 13:18-14:15 LT

Leg #1 @ 200f: flying in a shower for about 4 min. Inhomogeneous cloud conditions: shower(or fog,cloud) / no shower

Leg#2 @ 700f: patchy-foggy mixed-phase showers, but more abundant than on 200f; sampling ice crystals; below the main cloud deck; turbulence is variable

Leg#3 @ 1200f: in cloud all the time; sometimes we sample ice

Leg#4 @ 3500f" upper leg above the cloud top (to deice before the last cloud leg); cloud top is inhomogeneous; another stratus layer (sometimes 2 layers) right above the main low-level deck;

Leg#5 @ 1700f → 1200f: flying at the cloud top, sometimes sampling air from above the cloud; descend to 1200f following the cloud top.

Closer to the end of the first racetrack CVI inlet got frozen and stopped working.

From S2 to S3 flying at 2500f above low-level clouds; still altocumulus above us. Clouds below become thinner, more inhomogeneous, broken.

Descending to S3. Cloud top is at 1000f. Approaching S3 at 200f.

Second racetrack pattern S3-S4 14:32 – 15:30 LT

Leg #1 @ 200f: It looks calm, no wind over leads. Larger ice floes to the west, smaller to the east.

Leg#2 @ 500f: we are flying below very thin inhomogeneous, broken layer of clouds

Leg#3 @ 700f: we are flying through those thin, broken clouds, sampling them

Leg#4 @ 1500f: at S4 we encountered stratus layer; droplets 25 micron

Leg#5 @ 2000 → 3200f we started at 2000f but went higher after first half of the leg, trying to sample something that looked like a cloud; but it turned out that it was not really a cloud. It looked hazy through the window.

From S4 to S5 (15:30 -16:00 LT) saw-tooth pattern. We started almost in cloud-free conditions at low levels (but still Ac high above us). Then we reached the cloud with cloud top at 1500f. Second profiling: cloud top still at 1500f. As we went closer to S5, clouds started to thicken: second layer appeared at 2300f. In the lower levels it is more turbulent, looks like Langmuir circulations in the ocean. Cloud base got also lower as we approached S5. In warmer air CVI inlet deiced and started working.

Third racetrack pattern S5-S6 (16:00 – 17:00 LT)

Leg #1 @ 200f cloud base is higher in the eastern part of the leg

Leg #2 @ 1000f in the lower part of the cloud; 12 micron droplets;

Leg#3 @ 1300f in the cloud; quite homogeneous; some turbulence;

Leg#4 @ 1600f in the cloud;

Leg#5 @ 2500 → 3000f between two cloud layers, but then got into the top of the cloud in the western part and sampled it.

Ascent at S6 around 17:00 LT. Found cloud top at 4000f.

Halfway to LYR descended to the level below the clouds. More turbulent, waves.

**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 on the way to S5-S6 and operated with limited functionality (only outside of clouds measurements were possible)

**Quicklooks:**

