

# AFLUX Flight #11–13 September 2020

**Mission PI: Christof Lüpkes**

## Objectives:

Study differences in the atmospheric structure over sea ice and open ocean

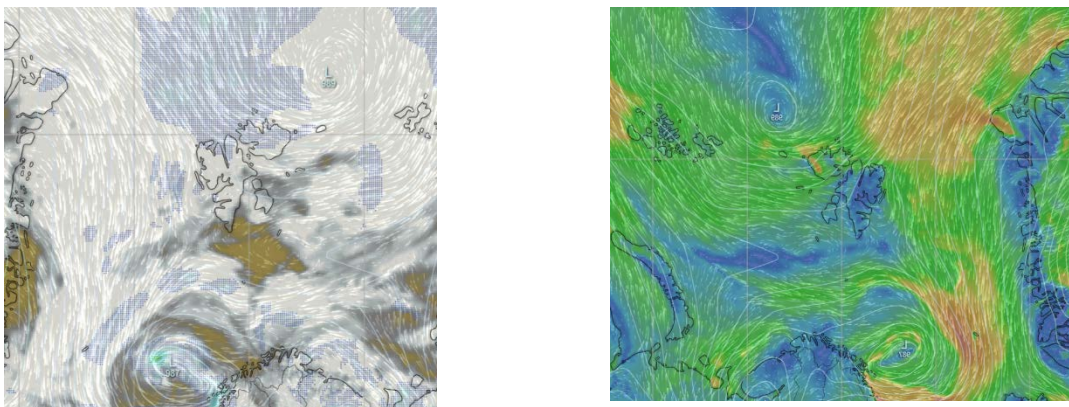
**Crew: Crew**

Polar 5	
<b>Pilot</b>	William Houghton (Kenn Borek Air)
<b>Co-Pilot</b>	Michelle Lacey (Kenn Borek Air)
<b>Mission-PI</b>	Christof Lüpkes
<b>Basis Data Acq.</b>	Hannes Probst
<b>SMART/Eagle Hawk</b>	Michael Schäfer
<b>Cloud Probes</b>	Manuel Moser
<b>MiRAC</b>	Friedhelm Jansen

## Overview:

During northerly flow over Fram Strait a transect was flown from LYR over Ny Alesund in westerly direction towards Greenland with two staircase patterns included, one over sea ice and one over the open ocean. The western staircase was characterized by inhomogeneous cloud conditions, parts of the legs were outside clouds. More clouds were present at the eastern staircase position and all legs were flown below and in the lowermost cloud layer. A sawtooth pattern was included on the way back from the western to the eastern staircase with some low-level horizontal legs included. Ny Alesund was on the flight track and was crossed two times.

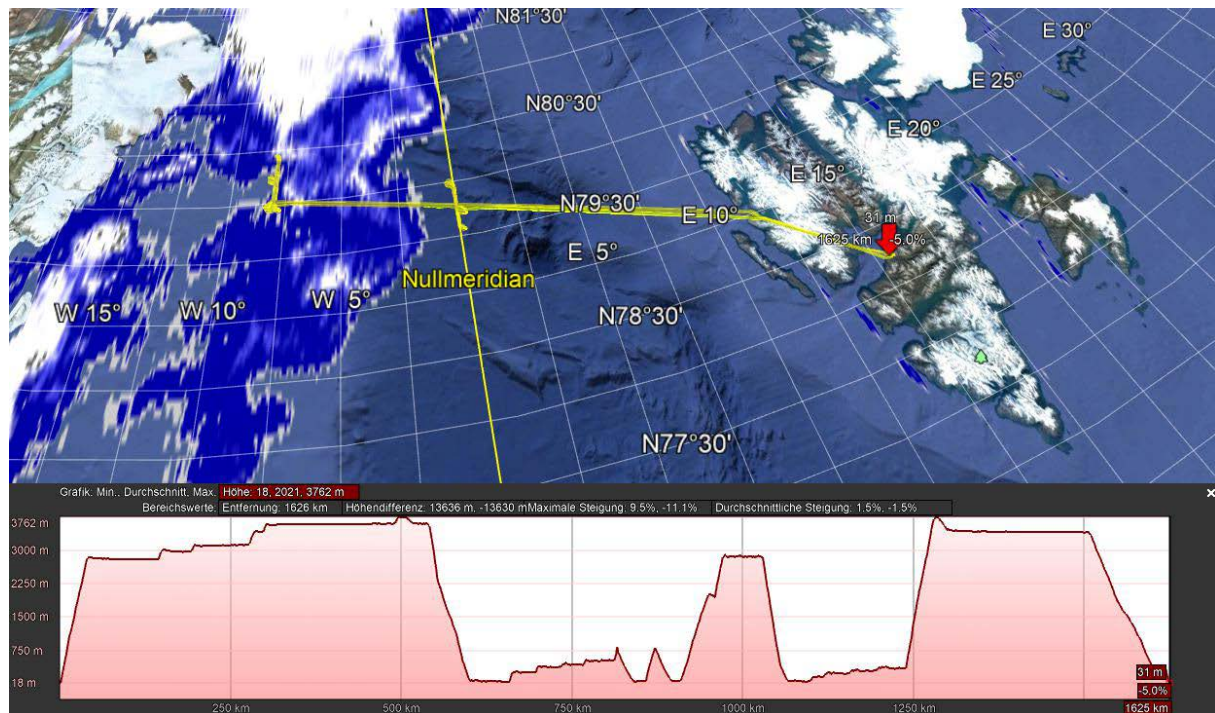
## Weather:



*The Figure shows the 12 hr ECMWF forecast for 13.00 local for cloud cover and precipitation (left) and wind (right).*

The synoptic situation was governed by two low-pressure systems, one west of Norway and one northeast of Svalbard causing a thick cloud layer with precipitation north of Svalbard (see Figure above).

## Flight track, pattern and clouds



During the flight from LZR towards west we had to increase the flight altitudes several times to stay well above the clouds. The highest altitude of about 13000 ft was necessary between the positions of both staircase flights.

### Western staircase

We had to skip the first planned leg at 10.000 ft because of icing so that the first step was to descend to 200 ft. This altitude was reached at the northern end of the staircase. Then, horizontal legs followed in 200 ft, 850 ft (cloud base), 1300 ft, 1500 ft, 1700 ft (cloud top).

### Transect from western staircase to eastern staircase

A sawtooth pattern was flown towards the eastern staircase position with tops at 2500 ft in the first two sawteeth. Then, low-level legs at 200 ft followed to measure the change of surface fluxes towards the open ocean. The first one of these legs was still over the MIZ but a large lead was also passed. The second leg crossed the ice edge (strong decrease of sea ice concentration, but still some drifting floes) at longitude 3.5 W. The following ascend was carried out until 9400 ft to reach the top of the mid-level cloud layer at that position. But during the further horizontal flight, we crossed once more clouds and started then the descend to 200 ft at the eastern staircase position.

### Eastern staircase

After the descend, our position was several miles away from the planned starting point of the legs. We approached to this position in 200 ft. This was below cloud base, but we saw also clouds reaching to the surface (in agreement with the signals from the cloud radar, which had shown surface based clouds). After arrival at the originally planned starting point of the staircase we ascended to 500 ft (mostly already in the cloud or slightly below cloud base). The next legs followed at 1200 ft, 1400 ft, 1700 ft.

## **Transect to LYR**

After the staircase patterns we ascended to about 11.000 ft, which was for some distance still in clouds but the radar lost surface contact at higher altitudes so that we did not go higher. We were outside of clouds over Ny Alesund.

### **Turbulence:**

Turbulence during all low legs was weak or moderate, this time with more turbulence during the legs over sea ice than over open water.

### **Sea ice**

The western staircase was over drifting sea ice floes of about 90 % concentration. The sea ice was visible already from 10.000 ft (see foto below) while we approached the planned staircase position.



Sea ice conditions at western staircase position



During the transect from the western to the eastern staircase, we crossed some thick floes.



Further to the East, the sea ice cover reduced strongly (photo below) until we reached the ice edge at about 3.5 W with only few drifting floes.



No sea ice occurred at the position of the eastern staircase.

## Clouds

After leaving the western coast of Svalbard we crossed a mid level cloud layer with tops around 13.000 ft so that we had to ascend to 13.500 ft. However, although their vertical extent was high these clouds were most often thin, typically as shown in the photo below.



After crossing the sea ice edge high clouds disappeared but occurred again when we reached the western staircase position. The photo below shows also that roll-type clouds occurred over the sea ice covered region.





During the horizontal low level legs cloud conditions were strongly inhomogeneous. Some clouds reached the surface as shown below (probably due to a lead).



Some other parts of the legs were clearly outside clouds (especially the lowest leg as shown below).



Despite some surface based clouds the main cloud base was near 850 ft where one of the legs has been flown. The tops were near 1700 ft, but due to the roll structure (see also to Figure below), parts of all cloud legs have also been outside of the clouds.



### Drop sondes

Four drop sondes have been thrown on the way towards West and 3 ones on the way back (see positions in the Figures for quicklooks).

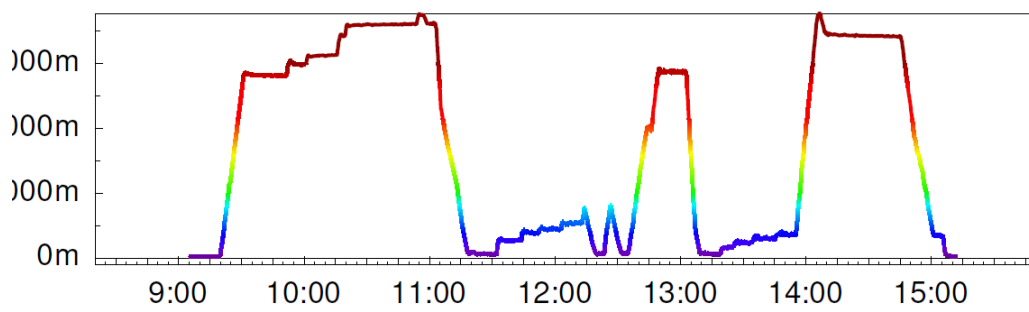
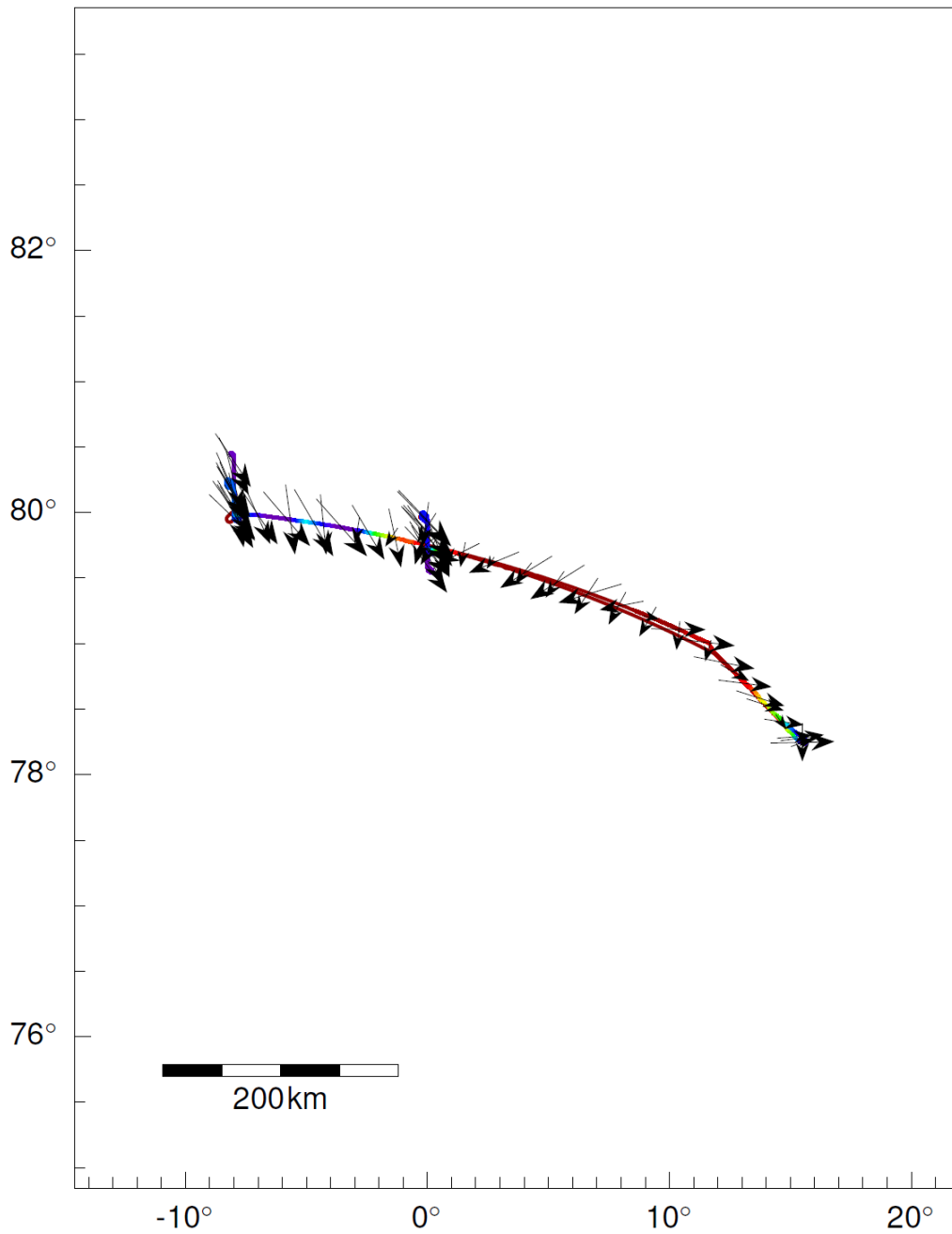
### Instrument Status:

<b>Polar 5</b>	
Basis data acquisition	
Nose Boom	
MiRAC	
AMALi	
SMART	
Eagle/Hawk	
Cloud Particle Probes	

### Quicklooks:

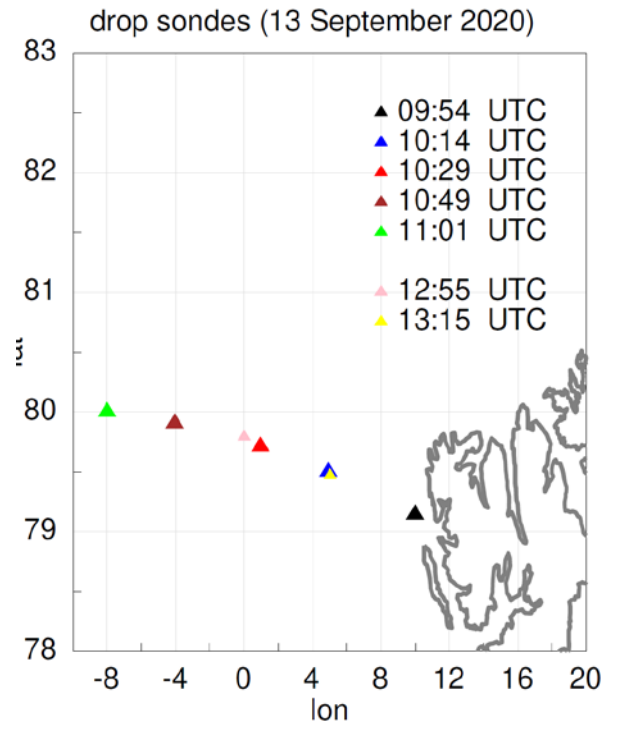
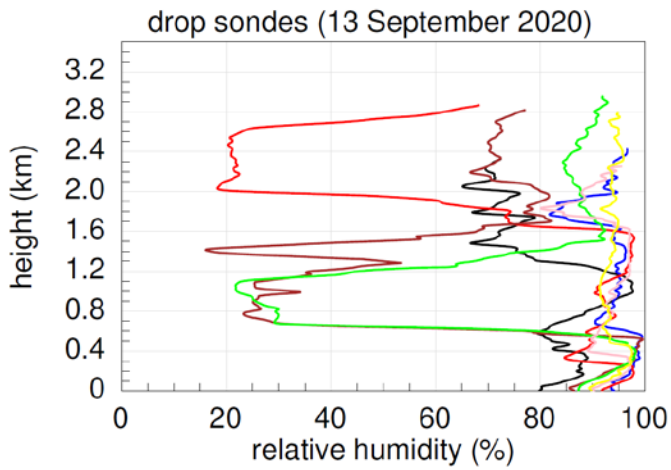
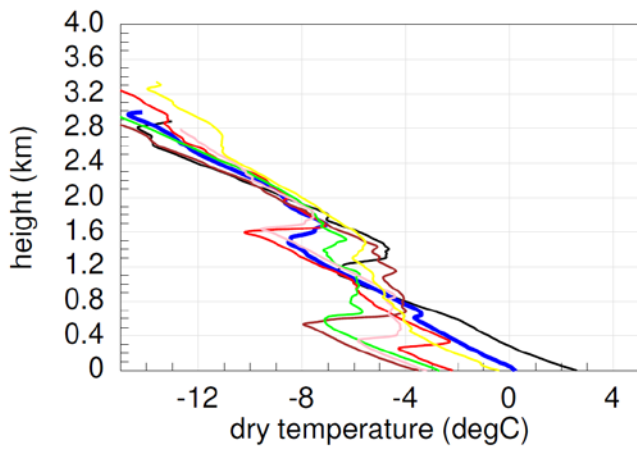
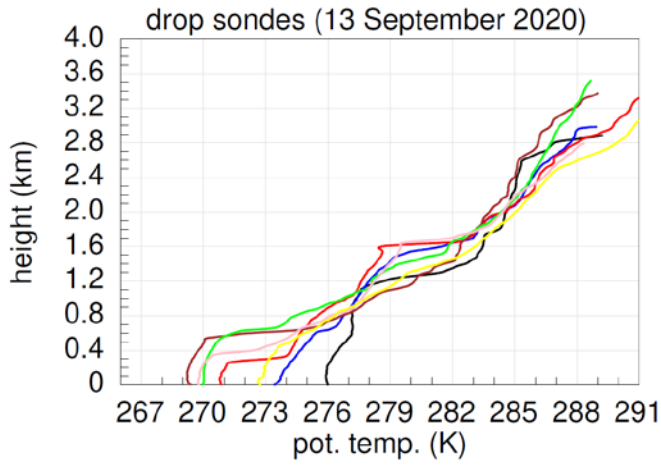
**Noseboom data**

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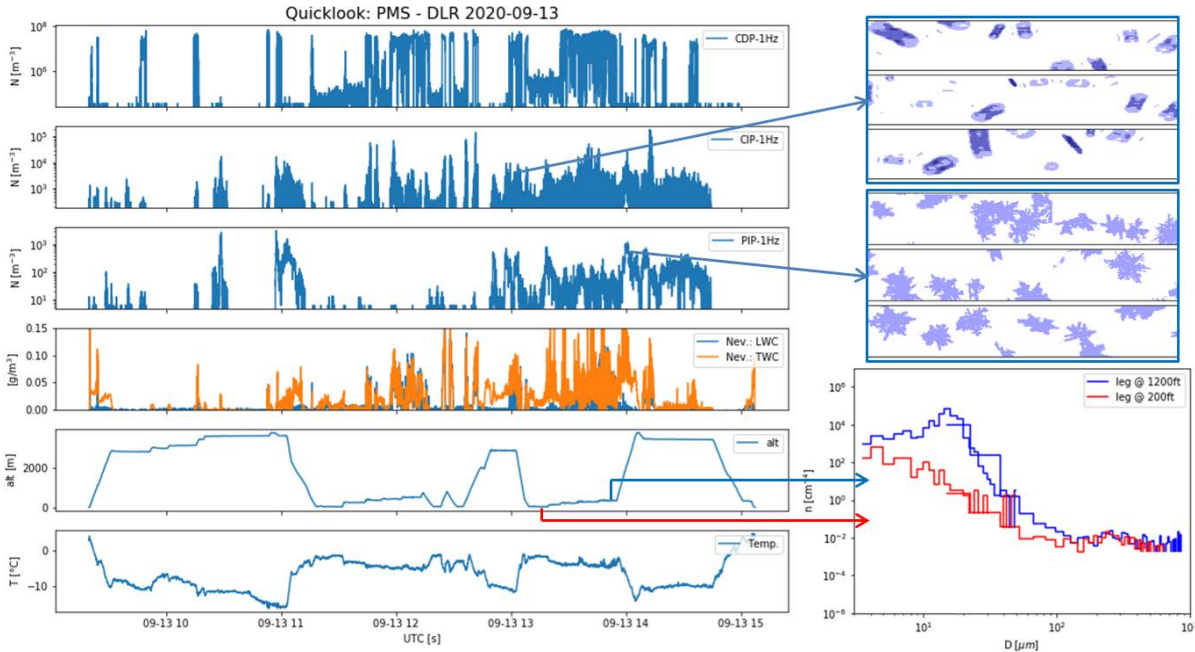


**Dropsondes**



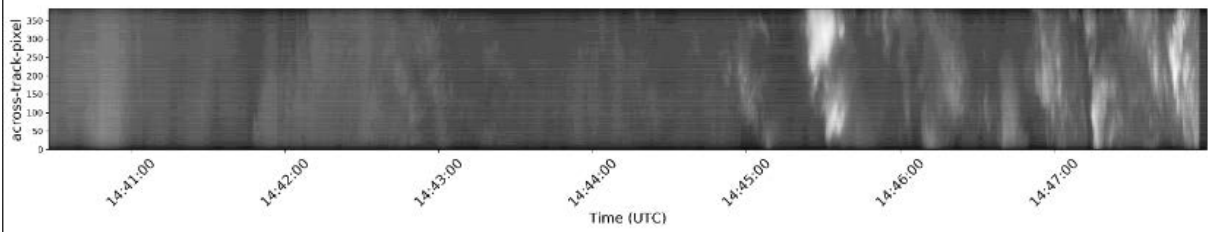
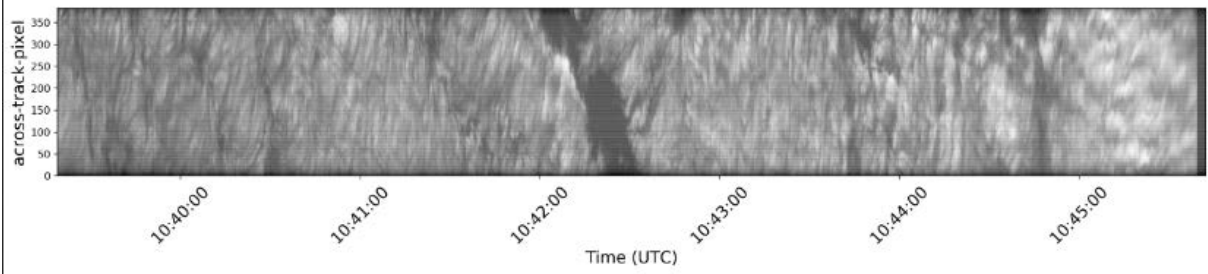
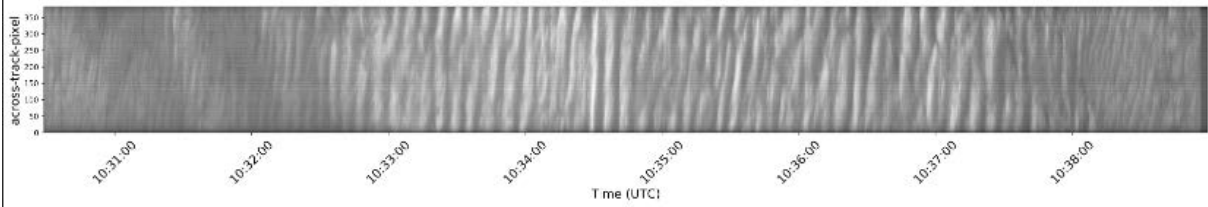


# PMS Probes



# Quicklook Flight 11, 13.09.2020

## HAWK (Spectral imager)





HAWK

# Quicklook Flight 11, 13.09.2020

