

Fig 2: Planed flight pattern with ECMWF horizontal wind (left) and LES total water content (right) forecast.

Weather situation as observed during the flight

The 28th of March 2022 was strongly impacted by a large quasi-stationary high-pressure system stretched along the east coast of Greenland. Combined with a low-pressure system located in the southeastern Barents Sea, this created a weak northeasterly flow at the surface of Fram Strait. With increasing altitude, this shifted more towards an easterly flow regime. Accordingly, a rather weak cold air outbreak developed west and south of Svalbard and shallow convective clouds developed in the Lee of Svalbard (written by Benjamin Kirbus). The 36h model forecast turned out to be very accurate and clouds were present everywhere west of WP2. Different to the LES forecast, organized cloud streets were not observed. Cloud tops were between 1000 and 1800 m. Clouds were mostly sampled cross-wind. No clouds were noticed above the aircraft. All cloud observations were above open ocean without sea ice.

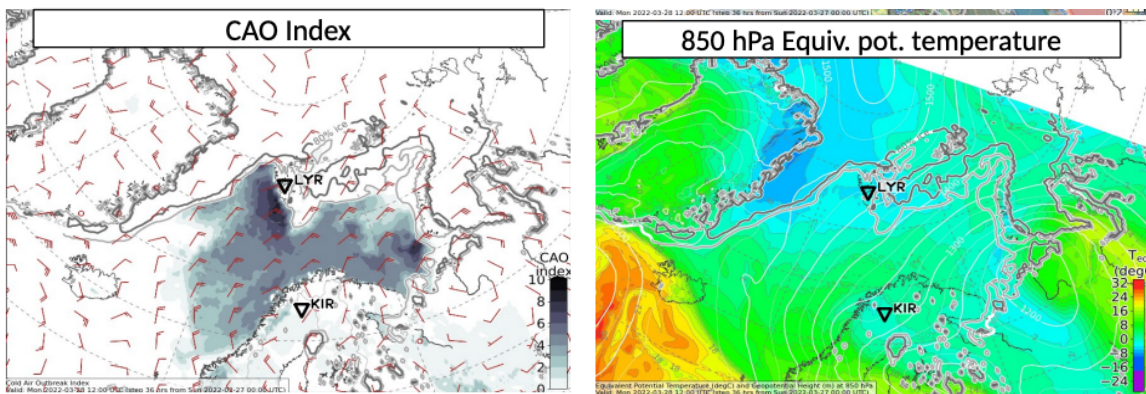


Fig. 3: Cold air outbreak index and 850 hPa equiv. potential temperature for Mon, 2022-03-28 12 UTC (ECMWF +36h)

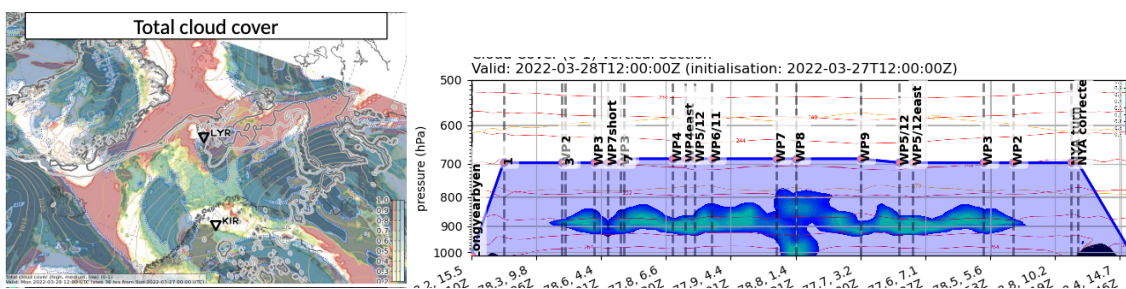


Fig. 4: ECMWF+36h cloud cover as a top view (left) and along the planed flight track (right).

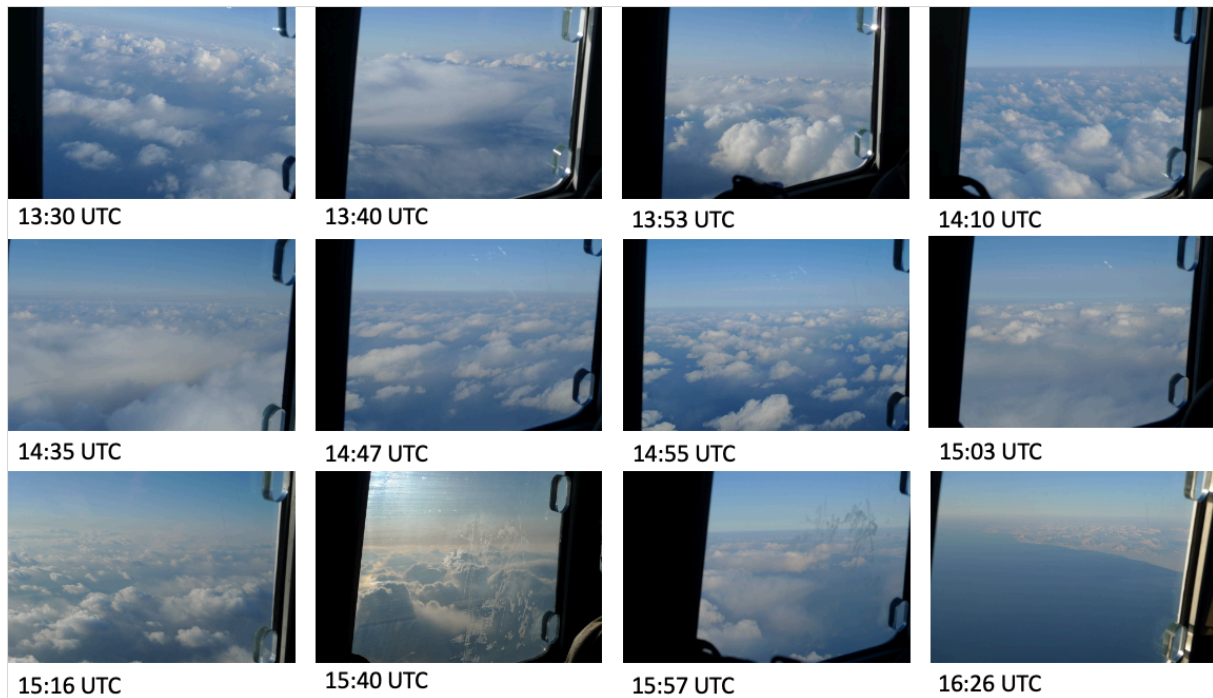


Fig. 5: Left cockpit window images taken during the flight

Overview:

The major objective of RF05 was a collocated flight with P6 to sample shallow convective clouds forming in the Lee of Svalbard. Due to technical problems with the fire detection system, take-off time was delayed from 9:10 to 12:26 UTC. Also, P6 take-off was delayed to approx. 11:35 UTC so that a collocated flight was still possible, but the initial flight plan for P5 had to be changed to catch up with P6. Therefore, the nose boom calibration leg (WP3 to WP7) was moved towards the end of the flight and a shortcut from WP2 to WP6/11 was flown where P6 was met. Other than expected, P5 was able to fly slowly enough to keep a constant distance to P6 for about 1:10 h. The flight track was shifted when necessary to follow the P6 flight track to the extent possible. Most of the time, P5 flew 1 to 2 miles behind P6 so that dropsondes could be safely launched. After leaving P6, the nose boom calibration was flown done from WP3 to WP7. Due to the delay, HALO was already measuring south of P5/P6 and coordinated measurements with HALO were conducted. However, P5 dropped several dropsondes at HALO locations on the meridional legs.

Instrument Status:

Polar 5	
Basis data acquisition	
Nose Boom	
MiRAC-A	
HATPRO	
AMALi	
SMART	
Eagle/Hawk	
Sun Photometer	
Drop Sondes	15

Table S5.1: Instrument status as reported after the flight for all instruments on Polar 5.

Comments: All instruments were operational.

Detailed Flight Logs:

12:26 Take-off

12:43 WP2: 140 knts indicated, clouds start to form

12:50: increased speed to 160knts

13:03 WP3: due to delay, we went directly to WP6/11 to assure that arrival time at WP6/11 fits to P6, speed was only 100 knts indicated

13:32 WP6/11: catching up to P6, increased speed to 160 knts because P6 was earlier than anticipated

13:44: 6 miles behind P6, clouds get denser

13:50: perfect coordination with P6, less than one mile behind P5, speed around 100 to 105 knts

13:56: cloud fraction declines

14:09 WP8: more stratiform clouds, still closely behind P6

14:40 WP9: still closely behind P6

15:00 WP12/5: end of collocated flight with P6, back to 160 knts indicated

15:05 WP 5/12 east: mote compact clouds, flying 130 knts indicated

15:34 WP3: cumulus clouds get smaller, starting nose boom calibration leg

15:42 WP7: start of procedure turn after WP

15:46 WP7: continuing calibration

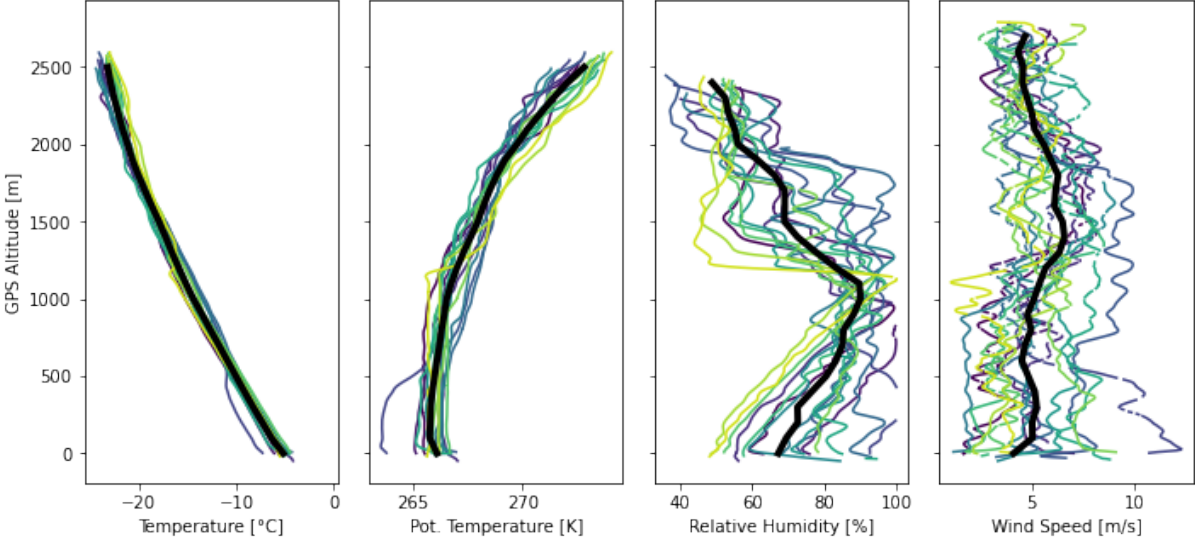
16:08 WP2: no more clouds, continuing at cruising speed 160 knts

16:33: overflight at Ny-Ålesund, no clouds

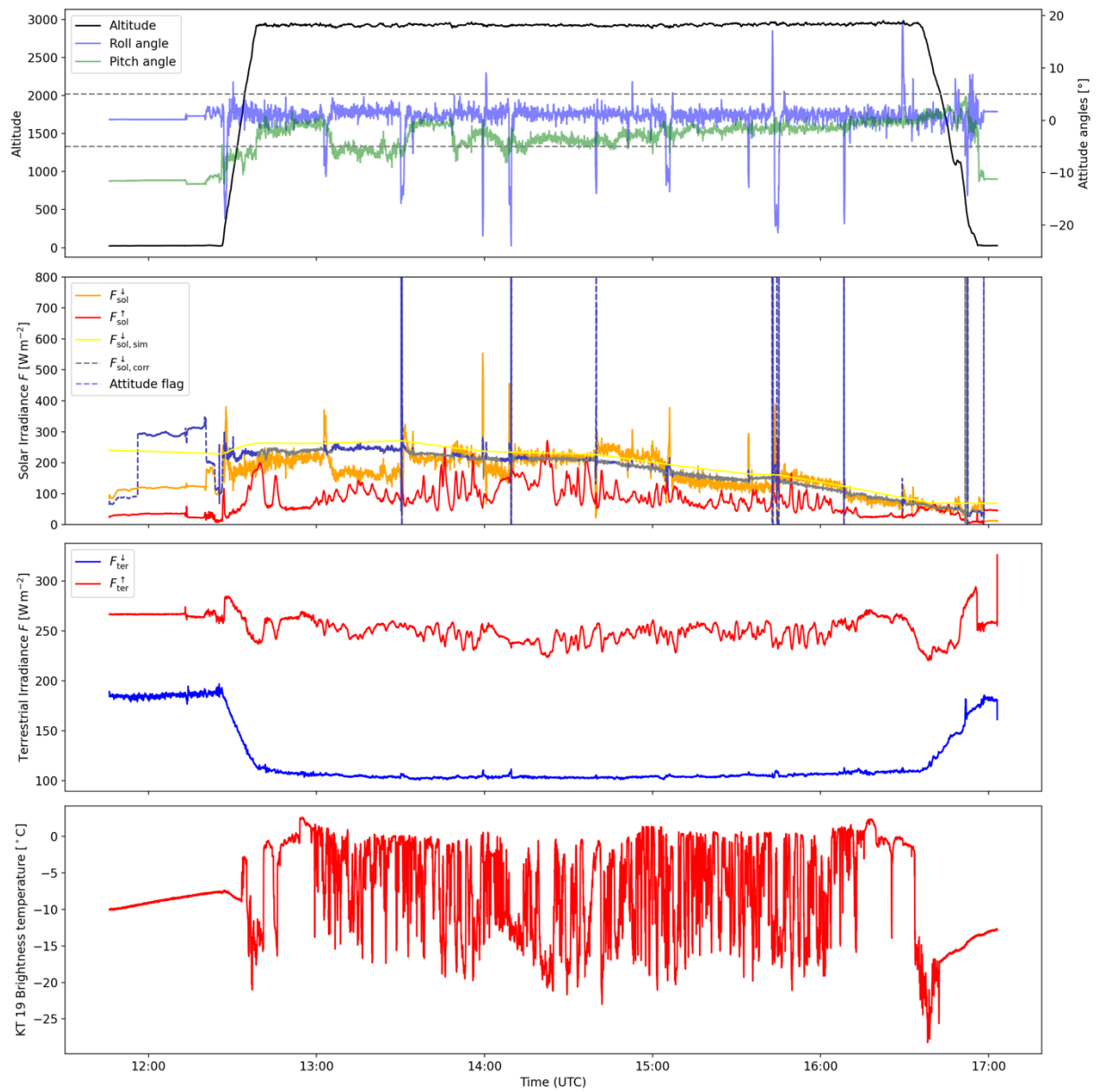
17:00: touch down at Longyearbyen

Quicklooks:

Drosondes Polar 5 28.03.22 RF05



Broadband radiometers



SMART

