

HALO-(AC)³ – 2022/03/28 – Polar5 research flight 05

Objectives:

Sampling low level clouds in the lee of Svalbard with P5 and P6.

Mission PI P5:

Polar 5 Crew	
Mission PI	Maximilian Maahn Maximilian.Maahn@uni-leipzig.de
Basis Data Acq.	Cristina Sans Coll
Eagle/Hawk	Hanno Müller
SMART	Sebastian Becker
MiRAC / AMALi	Nina Maherndl
Dropsondes	Pavel Krobot

Flight times:

Polar 5	
Take off	12:26 UTC
Touch down	17:00 UTC
Flight time	4:34 h

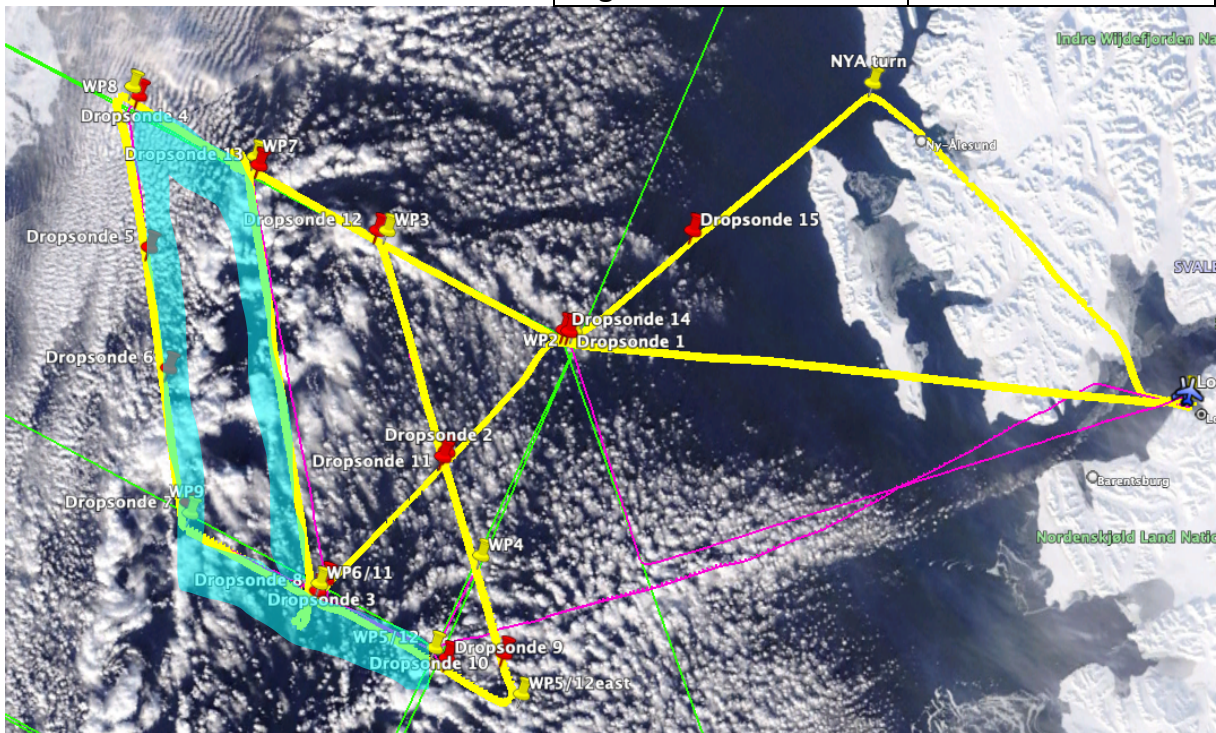


Fig. 1: MODIS Terra RGB composite satellite image at 12:31 UTC with P6 track (yellow) with waypoints (yellow pins) and dropsondes (red pins). Also shown are the P6 track (pink) and planned HALO track (green). Blue shaded region indicates collocation with P6.

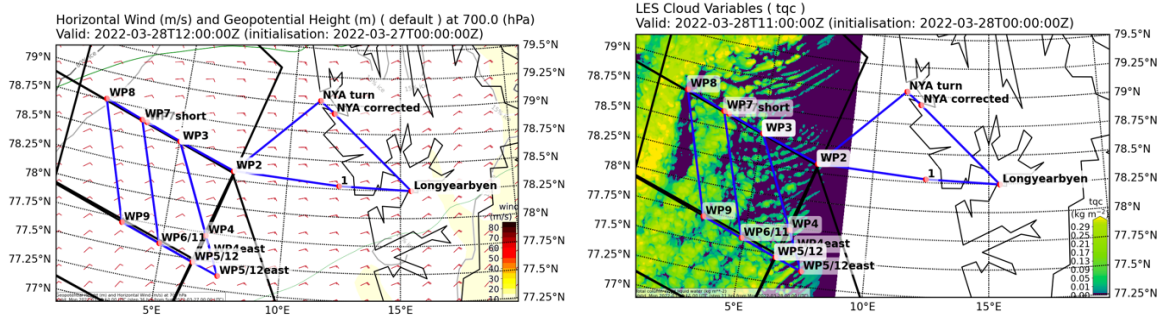


Fig 2: Planned flight pattern with ECMWF horizontal wind (left) and LES total water content (right) forecast.

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.

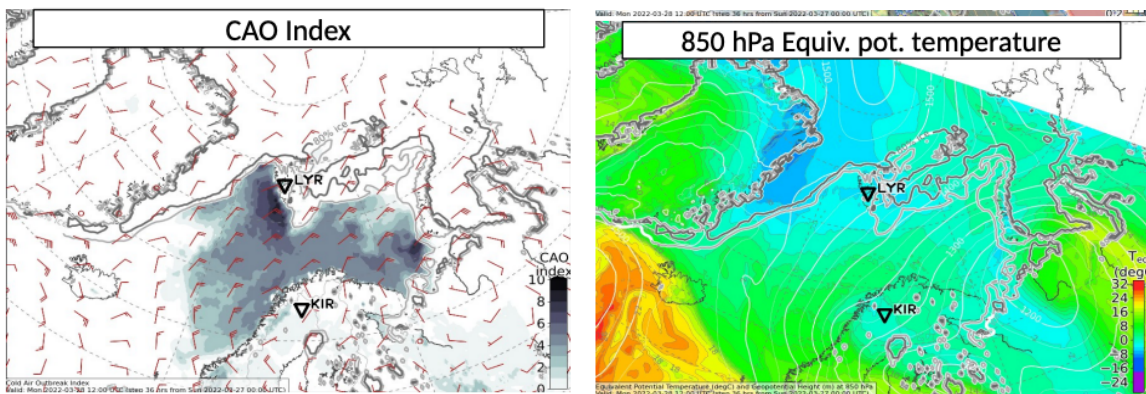


Fig. 3: Cold air outbreak index and 850 hPa equiv. potential temperature for Mon, 2022-03-28 12 UTC (ECMWF +36h)

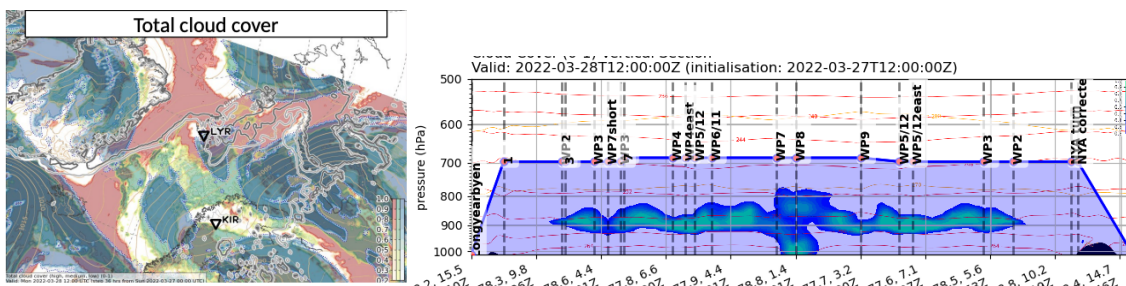


Fig. 4: ECMWF+36h cloud cover as a top view (left) and along the planned flight track (right).

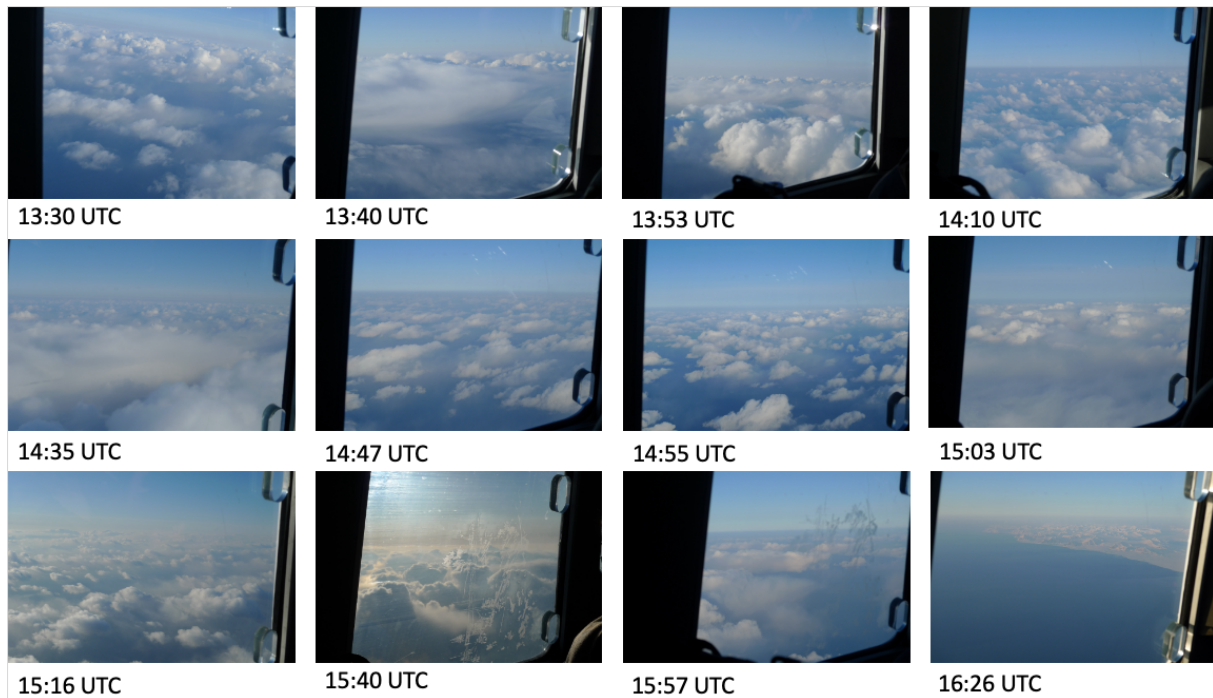


Fig. 5: Left cockpit window images taken during the flight

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. After flying to WP2, a shortcut was flown from WP2 to WP6/11 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 via WP7, WP8, WP9 to 5/12. 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, we flew alone to WP5/12east, then to WP3 where the nose boom calibration was done from WP3 to WP7 and back. From WP3, we returned to Longyearbyen via WP2 and Ny-Ålesund (clear sky). Due to the delay, HALO was already measuring south of P5/P6 and coordinated measurements with HALO were not 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

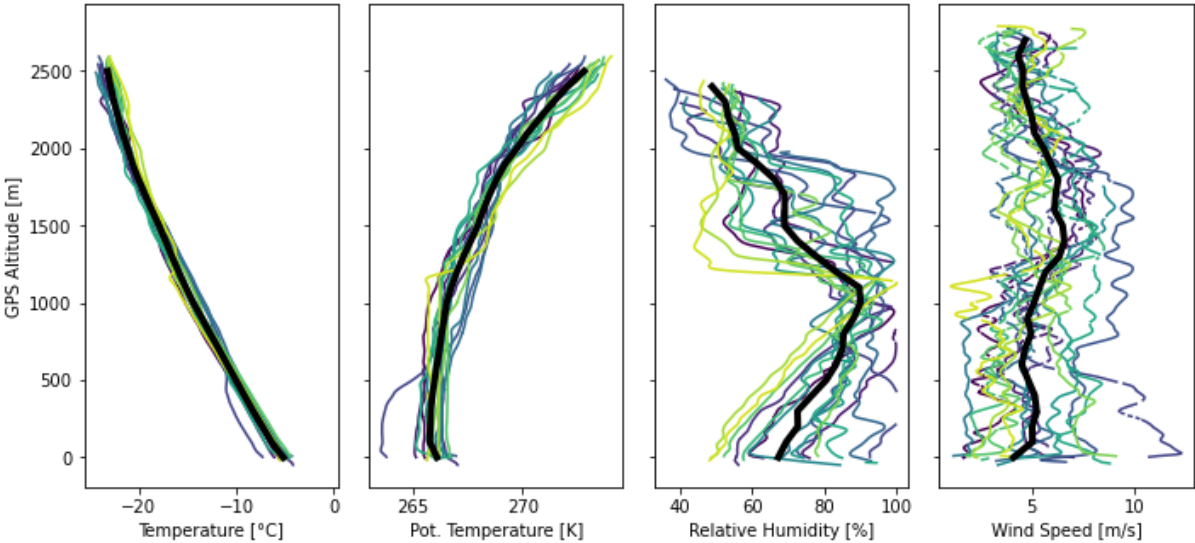
16:08 WP2: no more clouds, continuing at cruising speed 160 knts

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

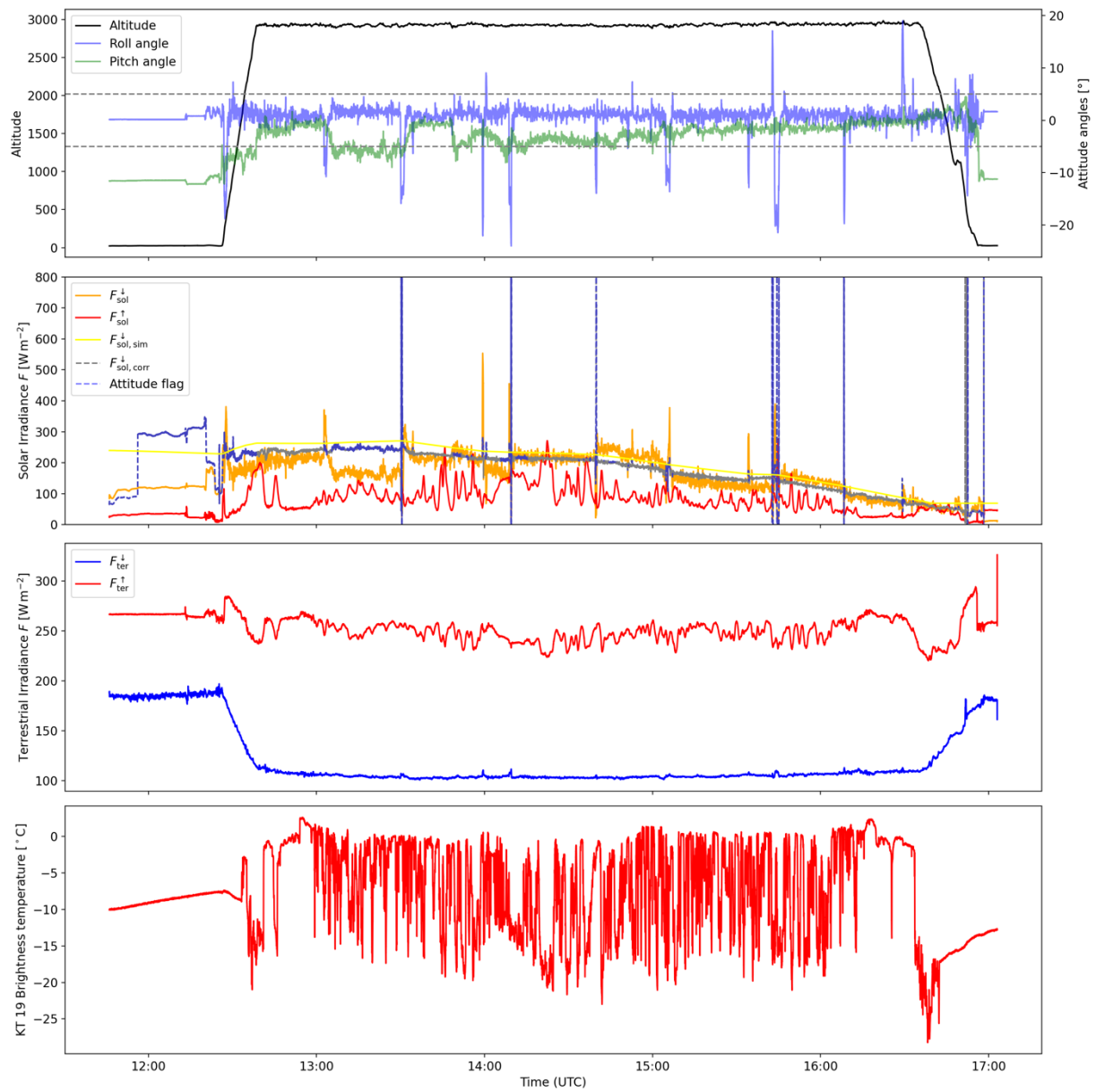
17:00: touch down at Longyearbyen

Quicklooks:

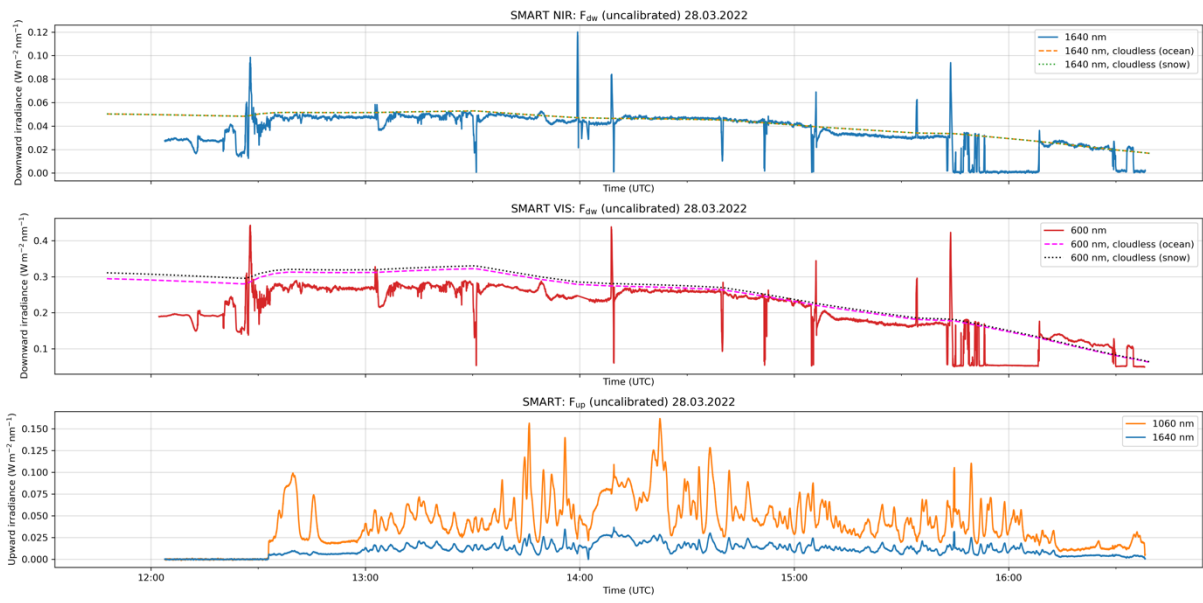
Drosondes Polar 5 28.03.22 RF05



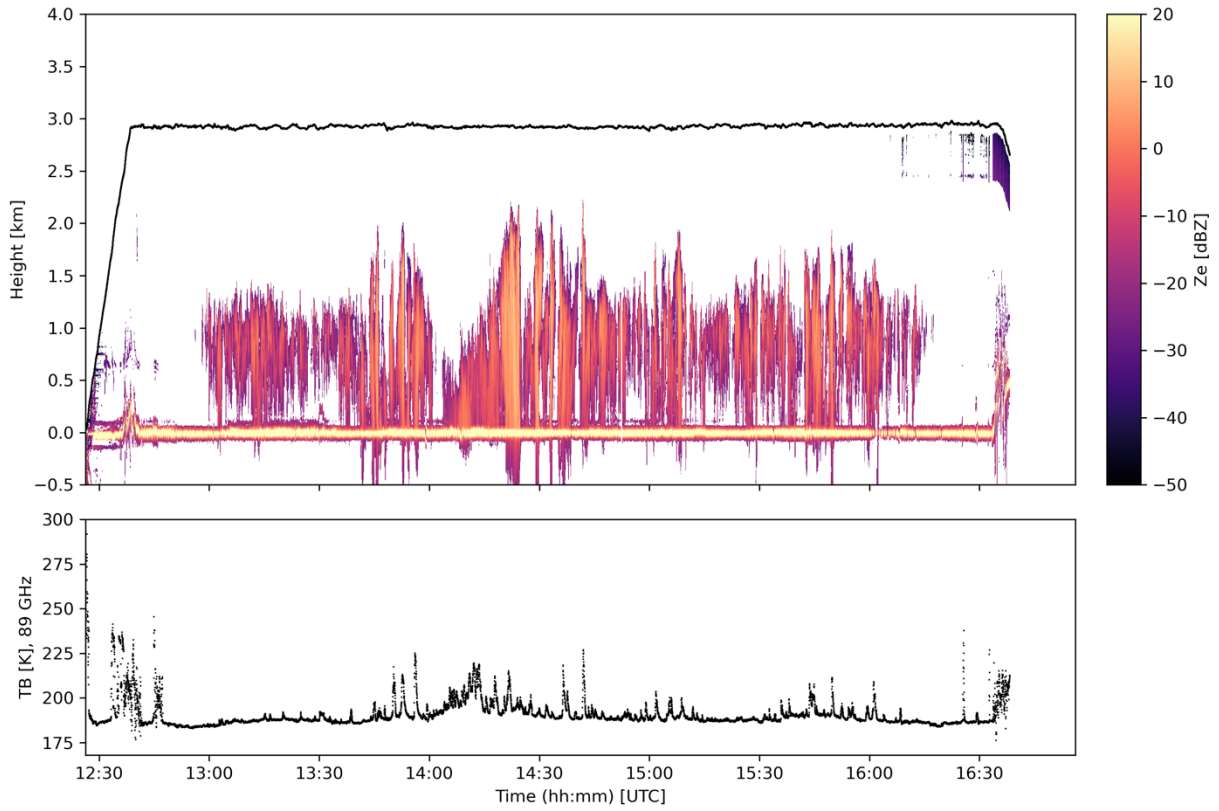
Broadband radiometers



SMART



MIRAC-A, 2022-03-28, 12:26-16:56 UTC



HATPRO, 2022-03-28, 12:26-16:56 UTC

