

HALO-(AC)³ – 2022/04/10 – POLAR 5 research flight 13

Objectives:

- Sample cirrus clouds together with HALO
- Sample low-level clouds together with POLAR 6
- Sample low and high-level clouds over the ice edge and the open ocean

Mission PI POLAR 5:

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POLAR 5 Crew	
Mission PI	Marcus Klingebiel
AWI	Cristina Sans Coll
SMART	Tim Sperzel
EAGLE/HAWK	Hanno Müller
MiRAC/AMALi	Imke Schirmacher
Drosondes	Daria Paul
Pilots	Gary Andrist Noah Hladiak
Ground PI	Nina Maherndl

Flight times:

POLAR 5	
Take off	09:15 UTC
Touch down	14:11 UTC

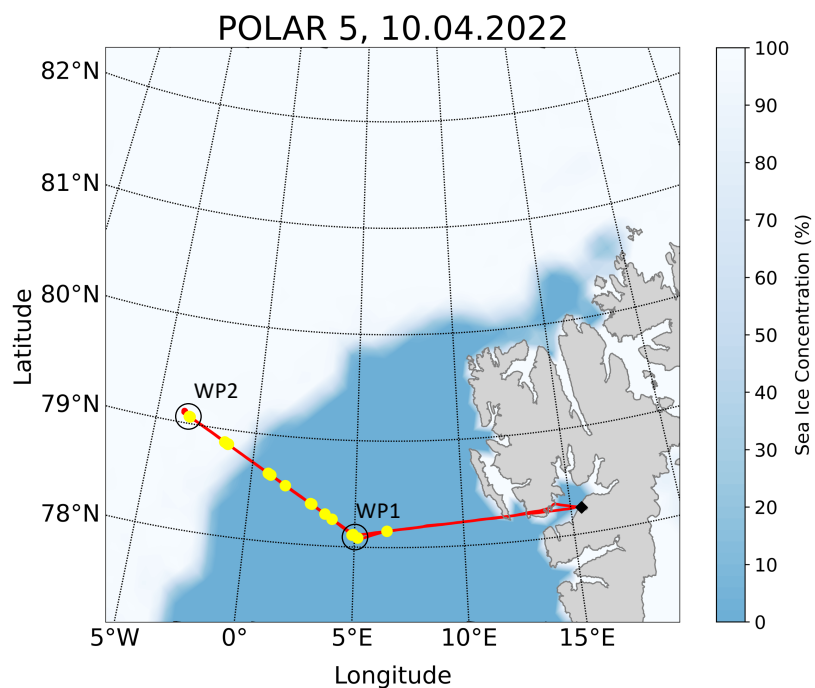


Fig. 1: Flight track with AMSR sea ice concentration and location of the launched drosondes and waypoints (WP).

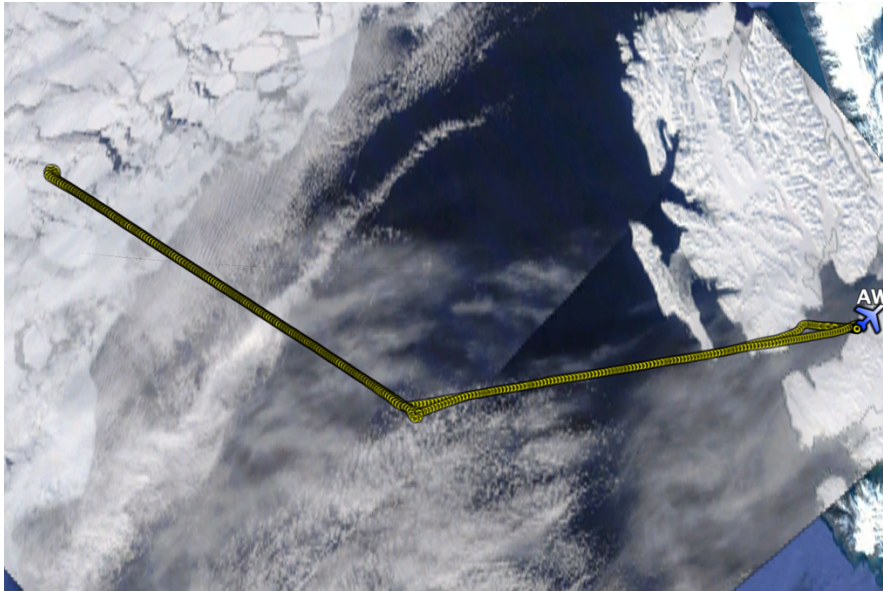


Fig. 2: Flight track with MODIS satellite image (from 10.04.2022).

Weather situation as observed during the flight:

The observed conditions during the research flight partly matched the forecast. In the following, the forecasted and the observed weather are shown in detail and the differences are explained.

Weather forecast:

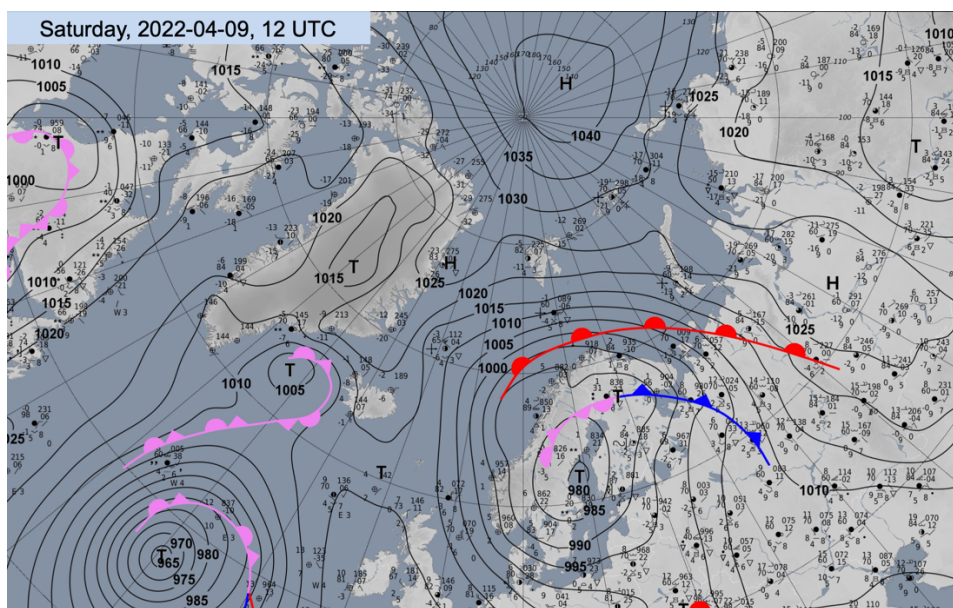


Fig. 3: Weather situation on Saturday, 09.04.2022 at 12 UTC, one day before the research flight.

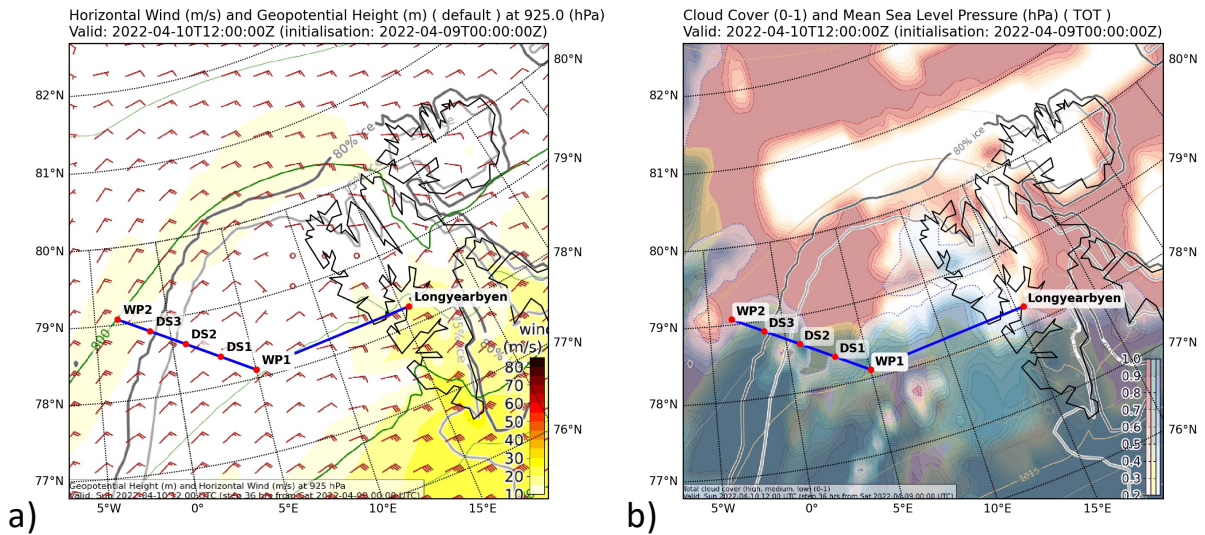


Fig. 4: a) ECMWF forecast of the horizontal wind and the geopotential height for 10.04.2022, 12 UTC (from 09.04.2022, 00:00 UTC). b) ECMWF cloud cover for the same times. Both maps include the planned flight track from the POLAR 5.

As displayed in Fig. 3, the weather in the target area, west of Svalbard, was controlled by a high pressure system on the east coast of Greenland and a low pressure system over Sweden. The combination of both systems led to a weak cold air outbreak in the Fram Strait, with winds parallel to the ice edge at 925 hPa (see Fig. 4a). Because of the lee effect of Svalbard, no clouds were expected west of Svalbard. Between WP1 and WP2 low-level clouds and high-level clouds were expected (see Fig. 4b), which were supposed to get thicker throughout the day (see Fig. 5a and 5b).

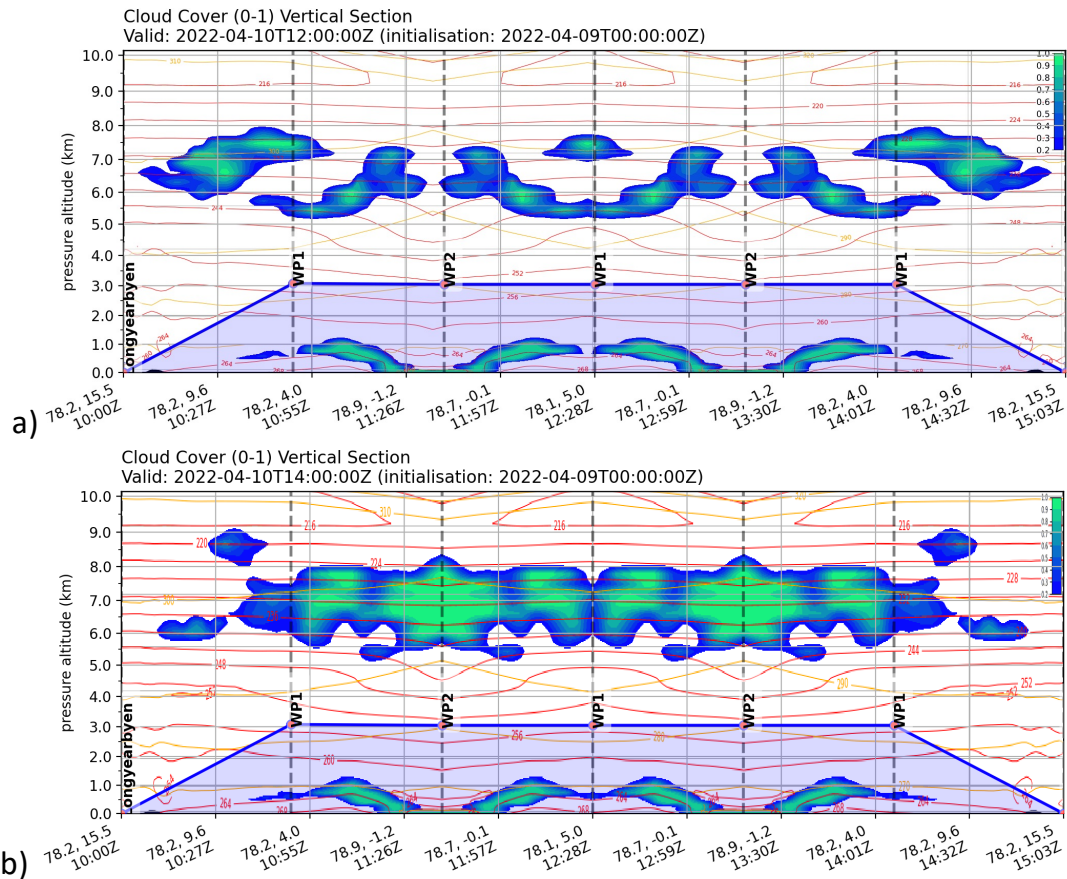


Fig. 5: a) Side view of the ECMWF forecasted cloud cover valid for 10.04.2022, 12:UTC and b) 14:00 UTC. Both panels include the planned flight track.

Observed Weather:

On the way to WP1 we had clear sky conditions because we flew through the lee of the island. On the first leg from WP1 to WP2, stratocumulus clouds were present (see Fig. 6a and 6b), and we sampled them by a collocated flight with the POLAR 6. Towards the ice, the low-level clouds got thinner with a lower cloud top (see Fig. 6c), as it was forecasted by ECMWF (see Fig. 5a and 5b). Over the ice, low-level clouds were not present, just a little sea smoke (see Fig. 6c and 6d). The situation didn't change much while flying the same leg three more times, except for the high-level clouds. Through the whole flight, we saw cirrus clouds moving towards the target area from the south. During the time of the research flight, these cirrus clouds never reached the target area.

Differences between Forecast and Observations:

The main differences between the forecast and the observations were obvious in the predicted cirrus clouds. This cirrus seemed to appear later than forecasted because through the whole research flight we didn't have any cirrus clouds above us, but we could see it moving in from the south. Despite that, the low-level clouds matched the forecast well.

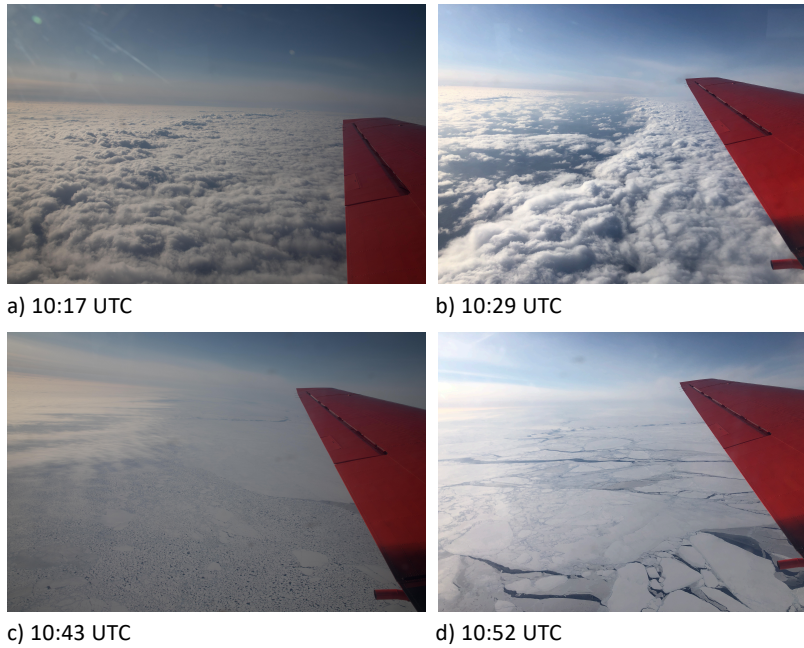


Fig. 6: Pictures from the cloud situation during different times of the flight (taken by H. Müller).

Overview:

The targets of this research flight were on the one hand the collocation with POLAR 6 and on the other hand the collocation with HALO. The collocation with POLAR 6 worked out very well and we sampled the first flight leg together as it was planned. The collocation with HALO didn't work out because of a delayed takeoff (around 3 hours) by HALO. Nevertheless, the collocated flight pattern with HALO was planned to sample the cirrus clouds, which were not in the target area at all. For this reason, it doesn't seem too bad that the collocated flight with HALO didn't work out. The second, third and fourth leg between WP1 and WP2 worked out well. For the whole flight the POLAR 5 stayed at 10000 ft and we dropped 19 sondes. Sonde number 18 failed (it was an old sonde).

Instrument Status:

POLAR 5	
SMART	
EAGLE	
HAWK	Condensation occurred
MiRAC	
AMALI	
Noseboom	Few sensors didn't work
HATPRO radiometer	
Broadband radiation	
Sunphotometer	
Nikon Camera	
Dropsondes	19 (1 failed)
GoPro	

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

Detailed Flight Logs (Times in UTC):

08:45 Science Power on
09:15 Takeoff
09:32 On the way to WP1, clouds ahead
09:44 Clouds are below us now
10:01 1. Dropsonde
10:05 Clouds are changing from shallow cumulus to more stratocumulus clouds. In the distance we see some convective clouds
10:14 2. Dropsonde
10:25 On first leg, no Cirrus above
10:28 3. Dropsonde
10:34 Clouds are getting thinner as closer we come to the ice
10:39 4. Dropsonde
10:48 Clouds over the ice are very thin
10:52 5. Dropsonde (WP2)
11:07 6. Dropsonde
11:24 7 Dropsonde
11:37 8. Dropsonde (Nice stratocumulus clouds below)
11:20 9. Dropsonde (Birthday Sonde)
11:31 10. Dropsonde
11:43 11. Dropsonde (WP 1)
11:55 12. Dropsonde
12:17 It gets hazier now to the west. Maybe the higher clouds are moving in
12:21 13. Dropsonde
12:30 14. Dropsonde (WP2)
12:45 15. Dropsonde
12:56 16. Dropsonde
13:08 17. Dropsonde
13:13 Cirrus seem to move in from the south
13:21 18. Dropsonde (old one failed)
13:27 19. Dropsonde (old one)
13:40 No clouds near Longyearbyen
14:11 Touchdown

Quicklooks:

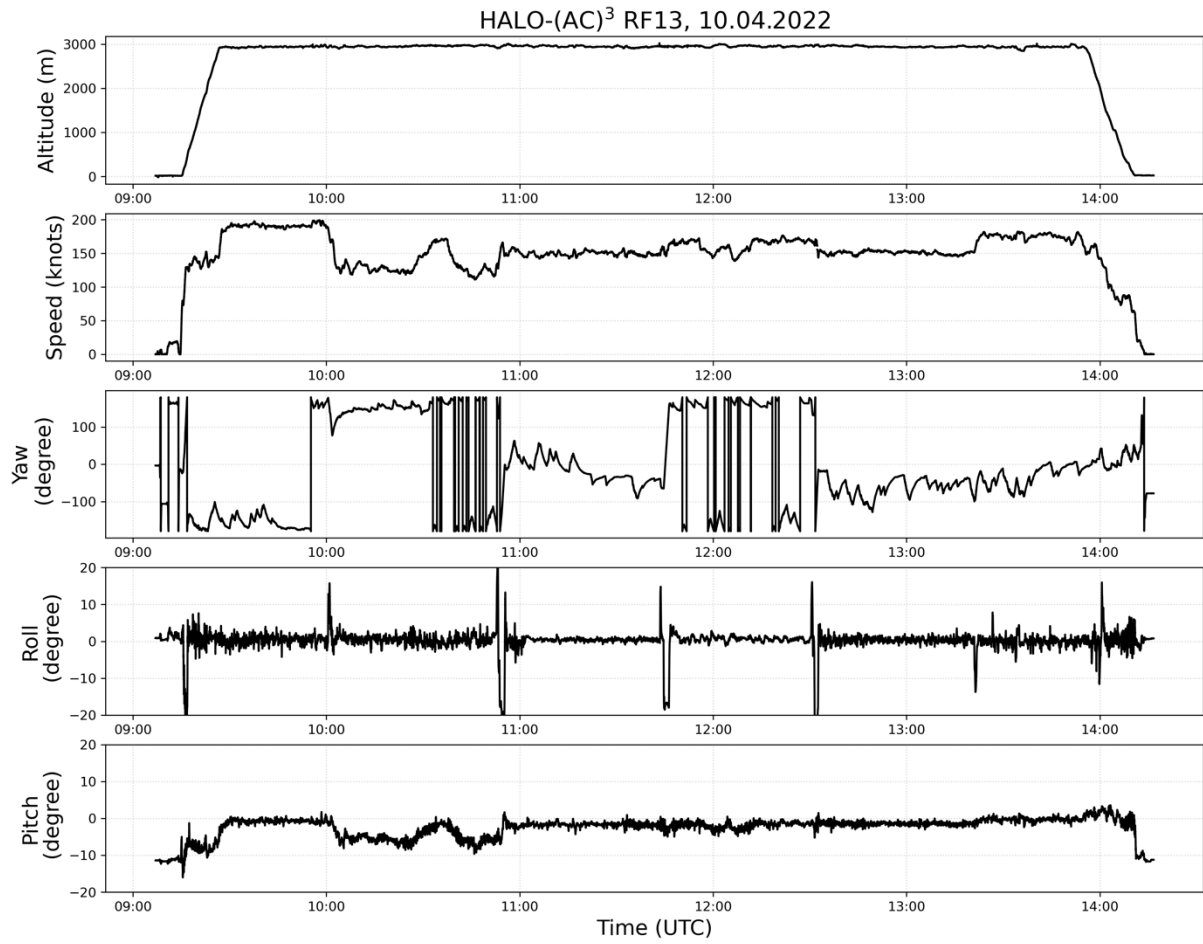


Fig. 7: Altitude, speed and attitude measurements.

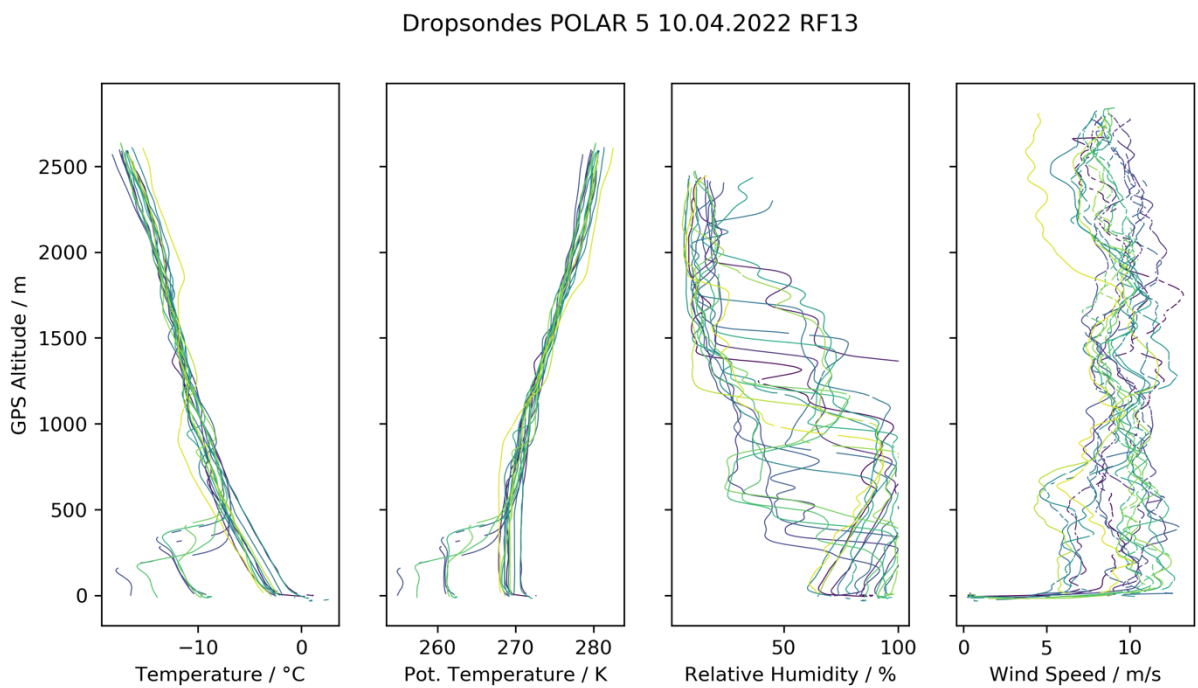


Fig. 8: Profiles of all launched dropsondes.

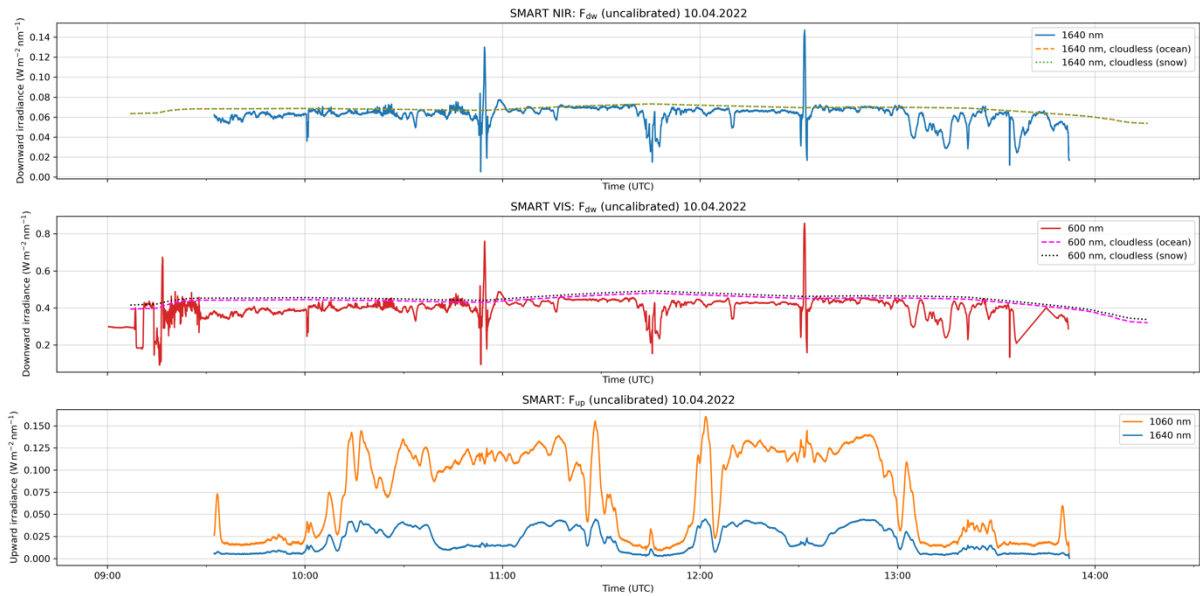


Fig. 9: SMART measurements along the flight.

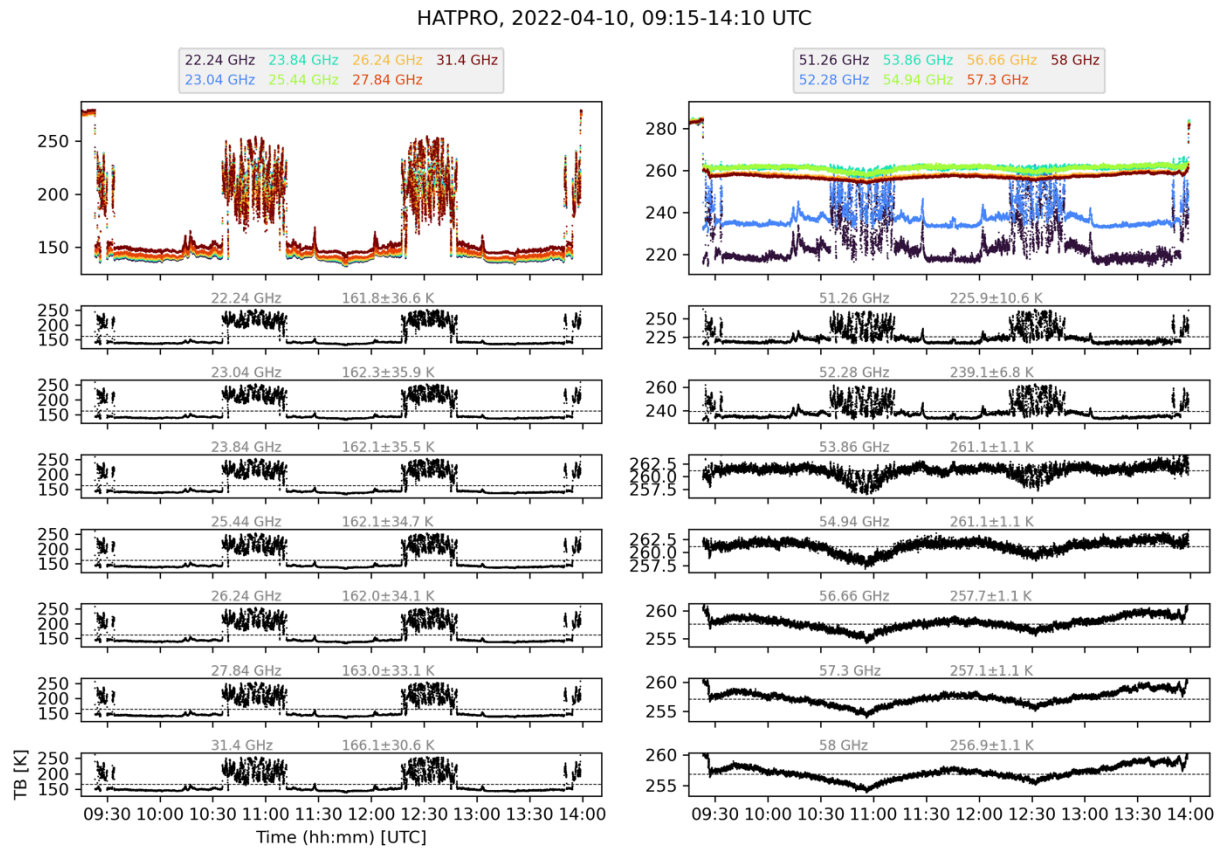


Fig. 10: HATPRO Radiometer measurements along the flight.

MiRAC-A, 2022-04-10, 09:15-14:10 UTC

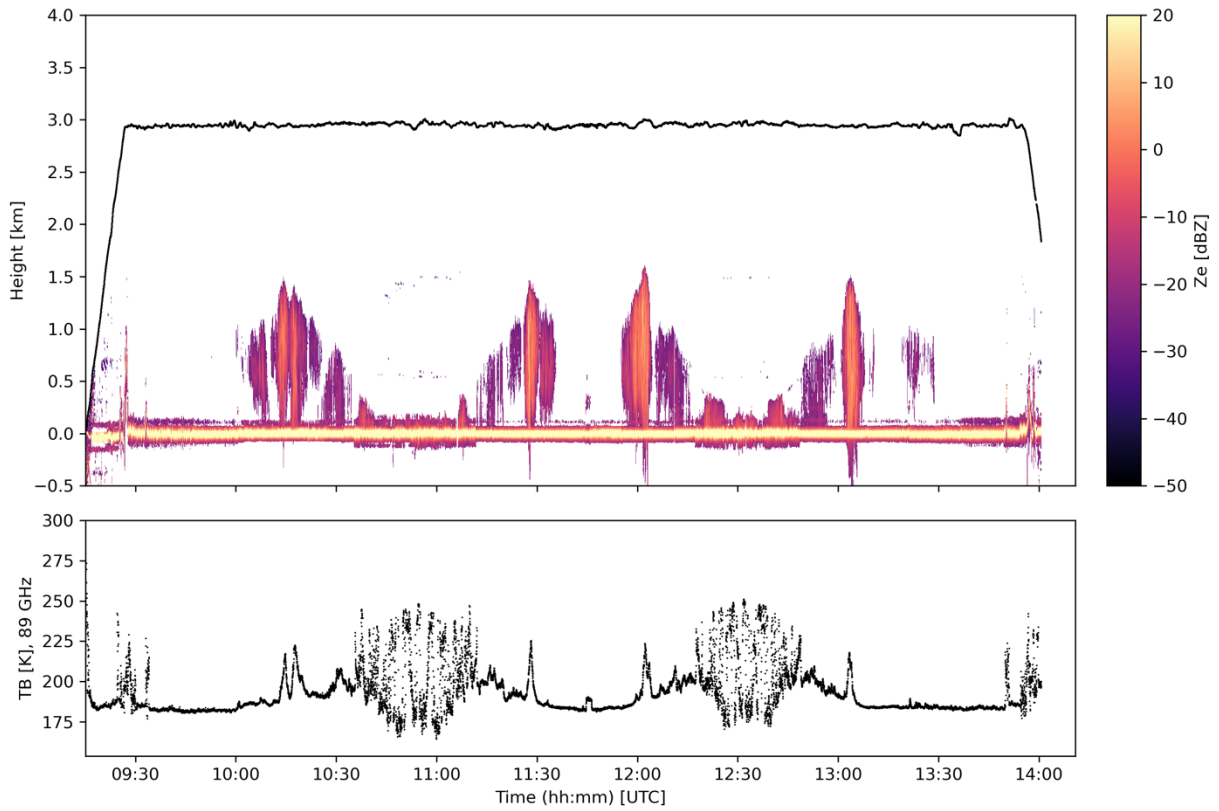


Fig. 11: MiRAC radar measurements.

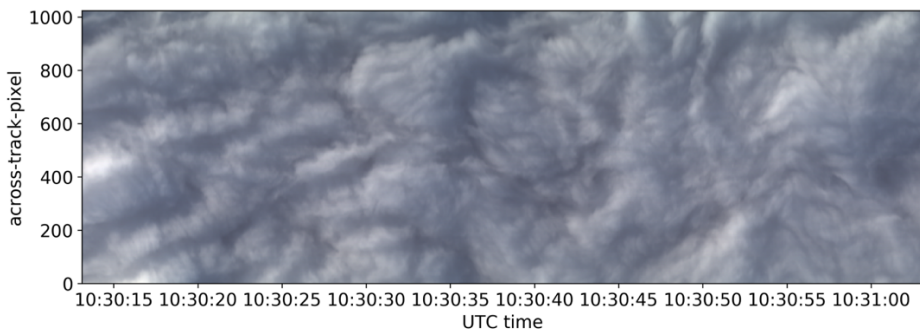


Fig. 12: RGB picture taken by the spectral imager AISA Eagle.

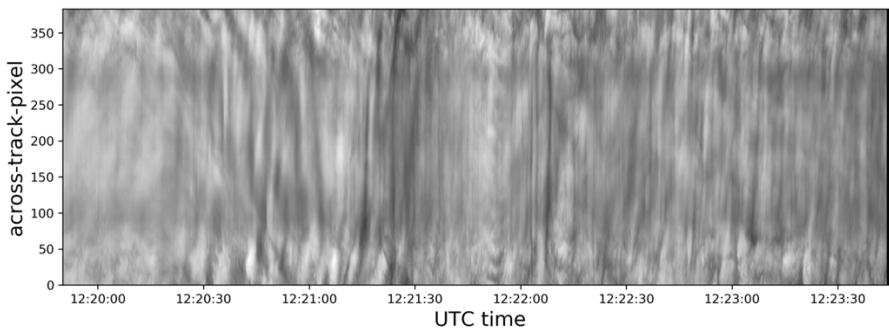


Fig. 13: Picture taken at 1200nm by the spectral imager AISA Hawk. The aspect ratio is not correct and a stripe in the center is caused by condensation.