

# HALO-(AC)<sup>3</sup> – 2022/03/30 – POLAR 5 research flight 08

## Objectives:

- Sampling the weak outflow of a CAO
- Sampling the target area of the POLAR 6 before and after their measurements
- Sampling circle 2 of the HALO flight track with Dropsondes after HALO left

## Mission PI POLAR 5:

Marcus Klingebiel

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POLAR 5 Crew	
Mission PI	Marcus Klingebiel
AWI	Maximilian Stöhr
AWI	Janosch Michaelis
SMART/EAGLE/HAWK	Sebastian Becker
MiRAC/AMALi	Nina Maherndl
Dropsondes	Imke Schirmacher
Pilots	James Steward Aron Westerbeek
Ground PI	Johanna Mayer

## Flight times:

POLAR 5	
Take off	11:37 UTC
Touch down	16:00 UTC

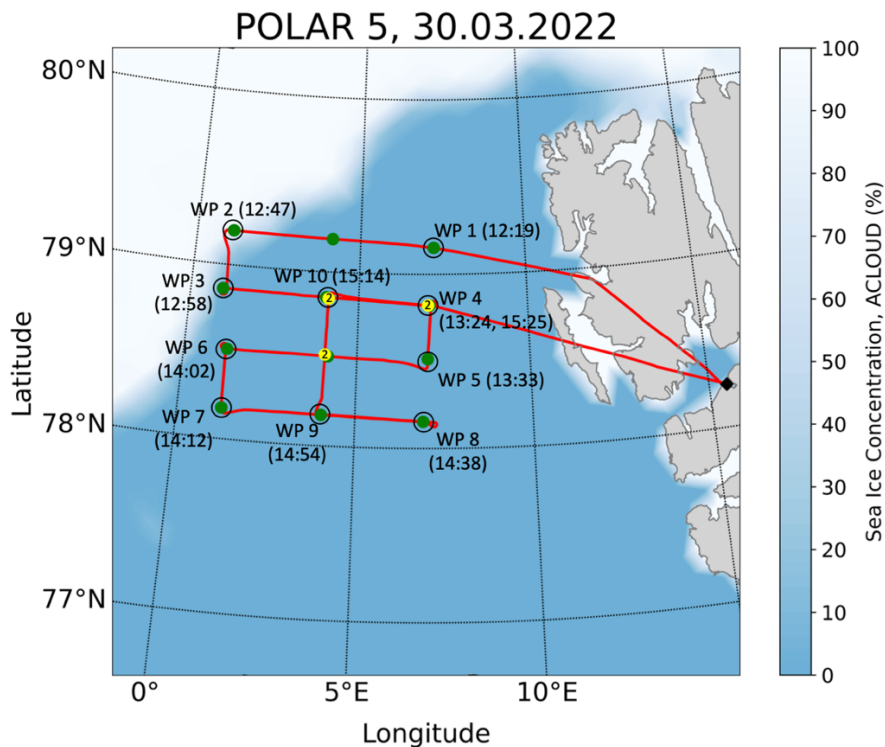


Fig. 1: Flight track with AMSR sea ice concentration and location of the launched dropsondes (green dots, second dropsonde at the same location in yellow) and waypoints (WP), including the passing times of the waypoints in UTC.

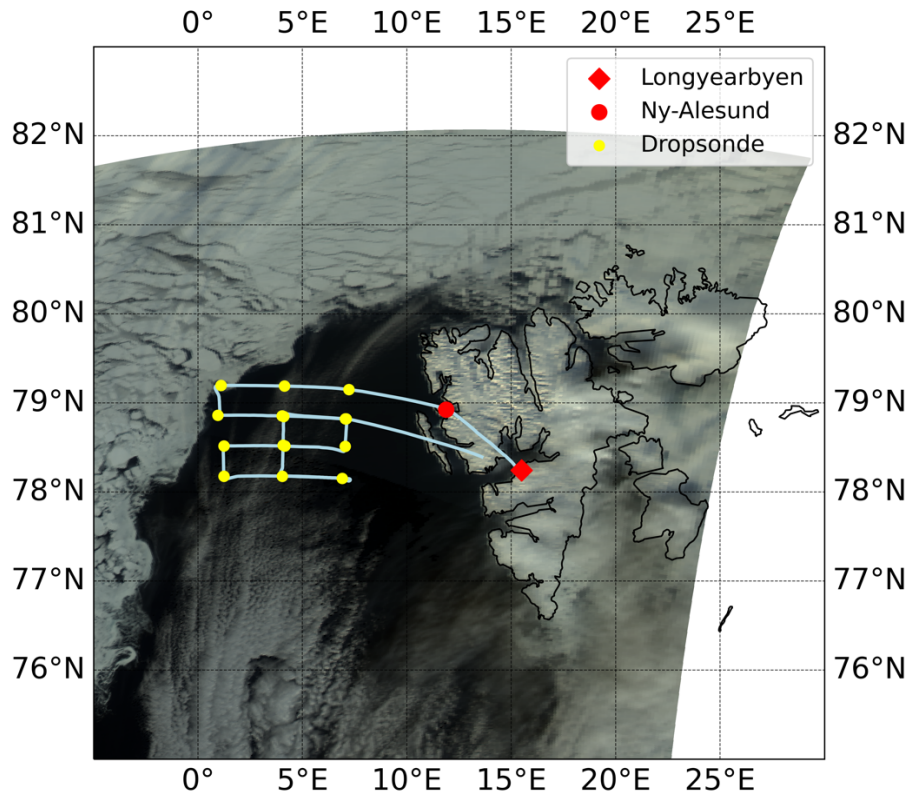


Fig. 2: Flight track with MODIS satellite image (from 30.03.2022, 12:45 UTC) and location of the launched dropsondes.

### Weather situation as observed during the flight:

During the whole research flight, the observed weather situation matched the forecast from the day before very well. We observed low level clouds in the target area and saw higher clouds approaching from the sea ice in the late afternoon. In the following, the weather forecast and the observed weather is described in detail and a summary is given in the end.

### Weather forecast:

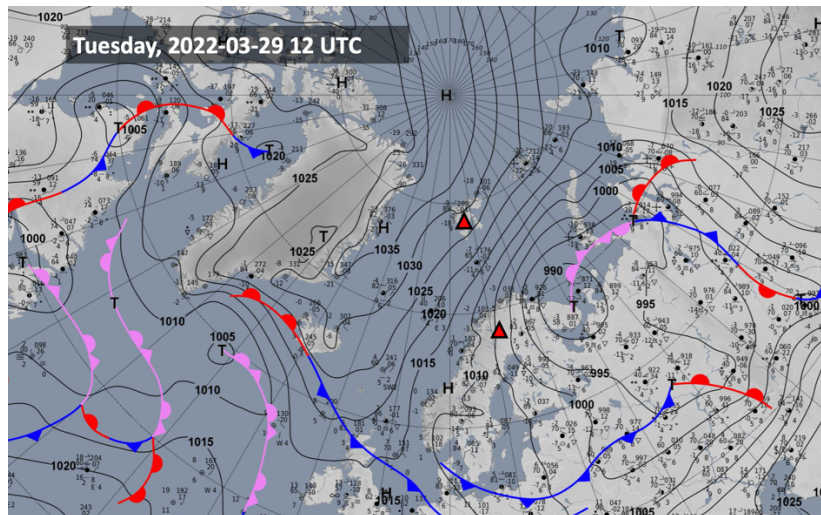


Fig. 3: Weather situation on Monday, 29.03.2022 at 12 UTC, one day before the research flight.

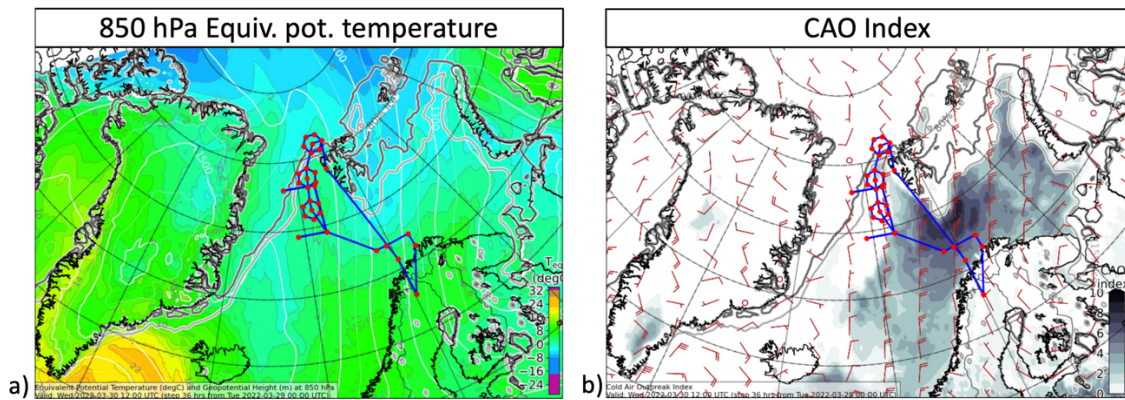


Fig. 4: a) ECMWF forecast of the temperature at 850 hPa valid for 30.03.2022, 12 UTC (from 29.03.2022, 00:00 UTC). b) CAO index for the same times. Both maps include the planned flight track from HALO.

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 in the Barent Sea. The combination of both systems lead to a weak cold air outbreak in the Fram Strait, moving cold air masses from the Arctic sea towards the open ocean (see Fig. 4a and 4b). The forecast by ECMWF indicated low level clouds in the target area and higher clouds moving into the target area from the west in the afternoon (see Fig. 5a and 5b).

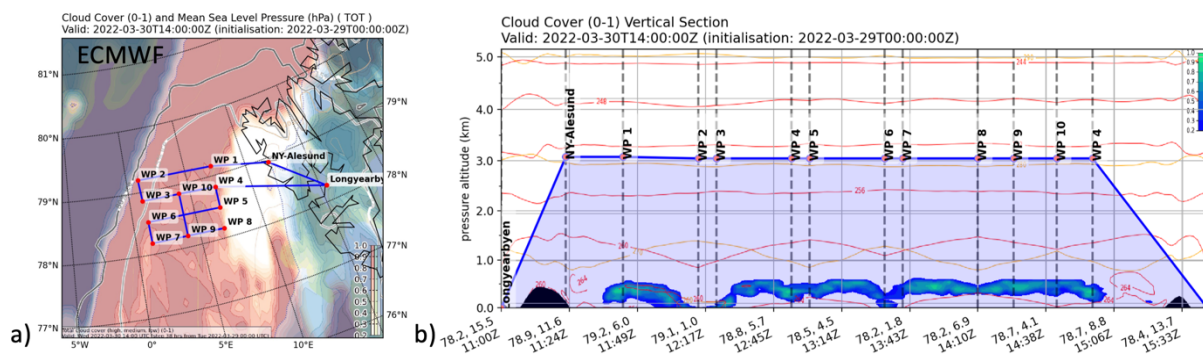


Fig. 5: a) ECMWF forecast of the total cloud cover (ref = low, green = mid-level, blue = high clouds) valid for 30.03.2022, 12 UTC (from 29.03.2022, 00:00 UTC). b) Side view of the cloud cover for the same forecasting times. Both panels include the planned flight track.

### Observed Weather:

On the way from WP 1 to WP 2, we could see stratocumulus clouds over the water. These clouds were not present over the Arctic ice in the west. Instead, we could see high level clouds approaching from the Arctic ice towards the open ocean. The stratocumulus clouds seemed to intensify towards the south, which is also visible in Fig. 6a to 6c. This was expected based on the recent satellite image from the morning of the flight day (see Fig. 7). Towards the end of the flight, the high level clouds, which were seen over the ocean moved towards the east approaching the ocean.

### Differences between Forecast and Observations:

During this flight the ECMWF forecast matched the observed conditions very well. Low level clouds were present in the target area like the forecast indicated. In addition, the movement of the high level clouds from the ice towards the ocean was predicted accurately.





a) 13:27 UTC, left window

b) 14:14 UTC, left window

c) 14:25 UTC, left window

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

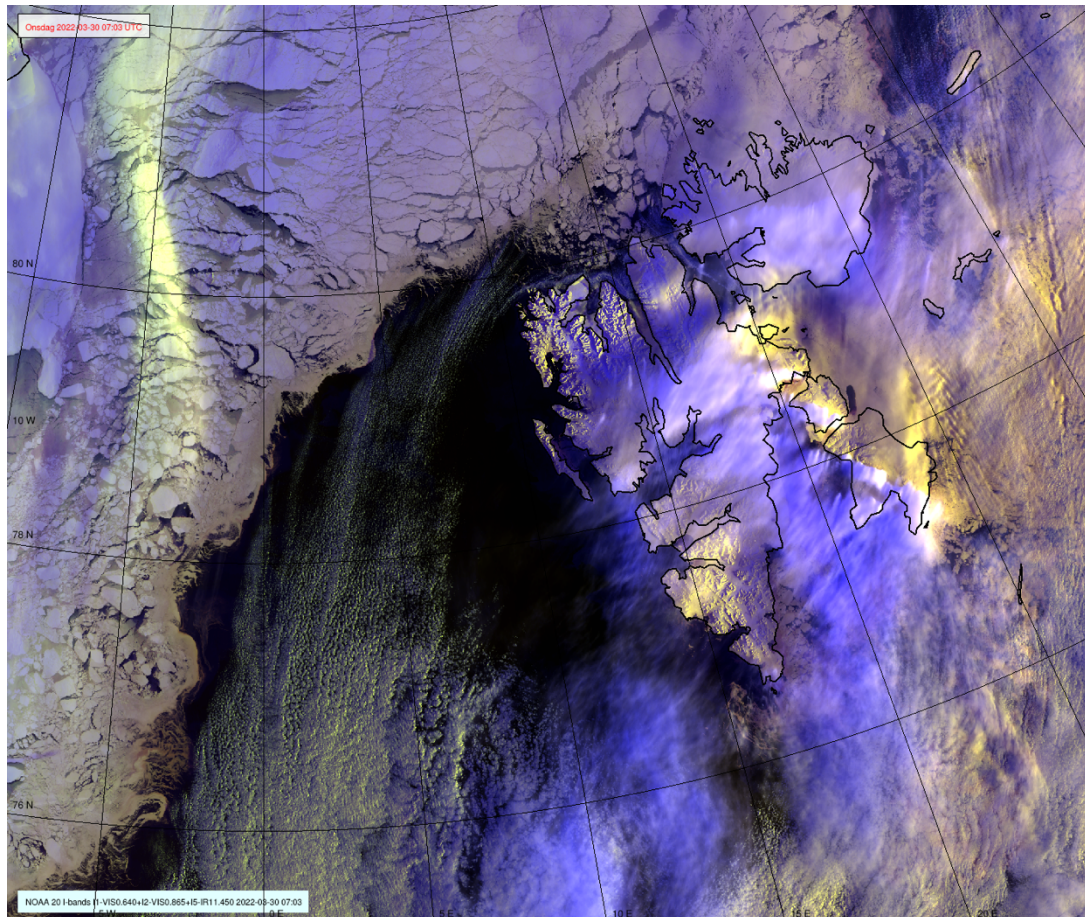


Fig. 7: NOAA Satellite image from 07:03 UTC on the flight day.

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## Overview:

The flight strategy worked out well and all the objectives (see first page of this report) were achieved. Even though the takeoff was late because of technical issues, the POLAR 5 was able to reach the target area shortly after HALO left. In the target area, 15 dropsondes were launched at the waypoints and in between. All dropsondes worked. A calibration for the noseboom was performed between WP 8 and WP 9. The leg between WP 10 and WP 4 was sampled twice, shortly before the POLAR 6 was sampling it (see Fig. 8) and roughly 45 minutes after they left. During the whole flight we stayed at a constant altitude of 10,000 ft.



All key instruments on board the POLAR 5 were working without any issues. Only the GoPro camera had issues and didn't record any pictures.

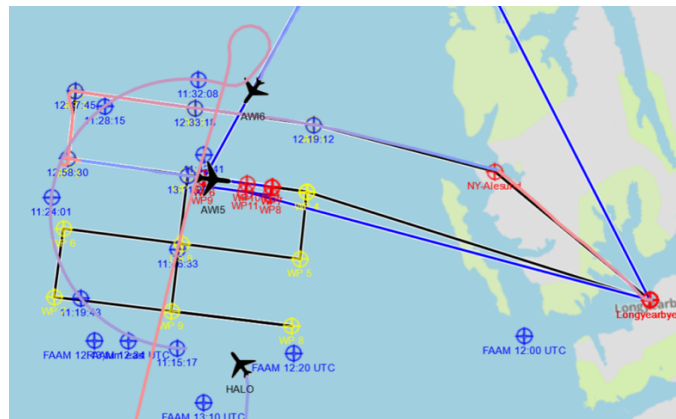


Fig. 8: Position of POLAR 5 (AWI5), POLAR 6 (AWI6) and HALO on 30.03.2022 at 13:14.

### Instrument Status:

POLAR 5	
SMART	
EAGLE	
HAWK	
MiRAC	
AMALi	
Noseboom	
HATPRO radiometer	
Broadband radiation	
Sunphotometer	
Nikon Camera	
Dropsondes	
GoPro	

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

### Detailed Flight Logs (Times in UTC):

- 11:37 Takeoff
- 12:19 WP 1, 1. Dropsonde
- 12:33 2. Dropsonde
- 12:47 WP 2, 3. Dropsonde
- 12:58 4. Dropsonde
- 13:11 5. Dropsonde
- 13:24 6. Dropsonde
- 13:33 7. Dropsonde
- 13:48 8. Dropsonde
- 13:58 Hazy over ice (high clouds moving in, like it was forecasted), shallow cumulus over the ocean. Like on the satellite picture from the morning.

- 14:02 9. Dropsonde
- 14:12 10. Dropsonde
- 14:25 11. Dropsonde
- 14:25 Leg for Noseboom calibration
- 14:38 12. Dropsonde (WP 8)
- 15:00 An update for the 17:00 meeting. P5 started around 35 minutes later because of some technical issues. Nevertheless, we reached the circle shortly after HALO left, and we sampled the low level clouds. Very shallow (reminds us to the clouds in Barbados). No high level clouds above. Mid level clouds are visible over the ice in the west and coming closer. The cloud situation matches the forecast very well.
- 15:06 13. Dropsonde
- 15:14 14. Dropsonde
- 15:25 15. Dropsonde
- 16:00 Touchdown

**Quicklooks:**

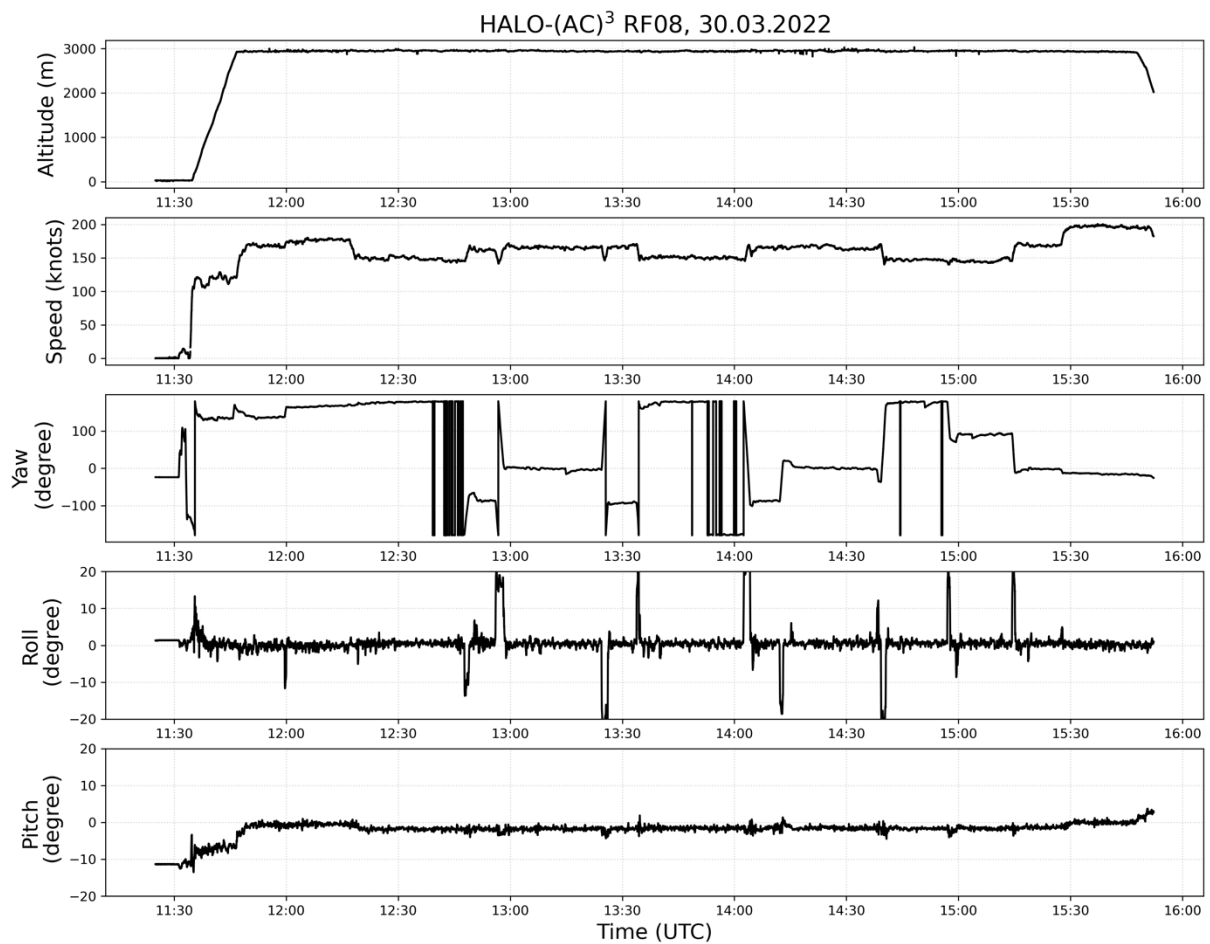


Fig. 9: Altitude, speed and attitude measurements.



Dropsondes POLAR 5 30.03.2022 RF08

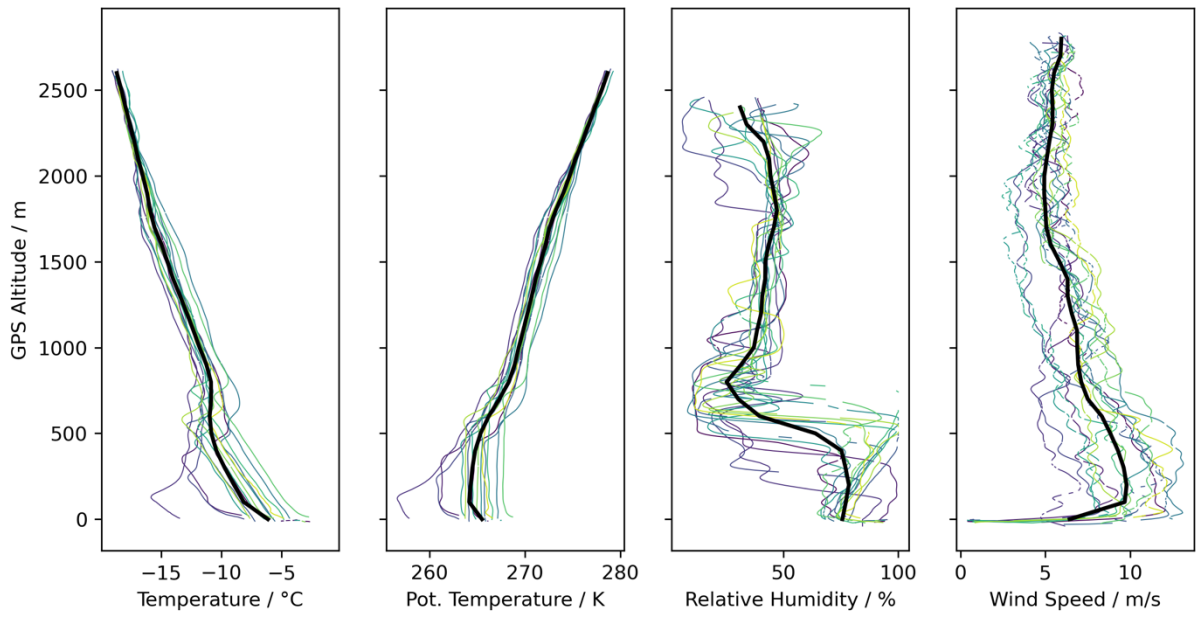


Fig. 10: Profiles of all launched dropsondes. Mean values are indicated by the black line.

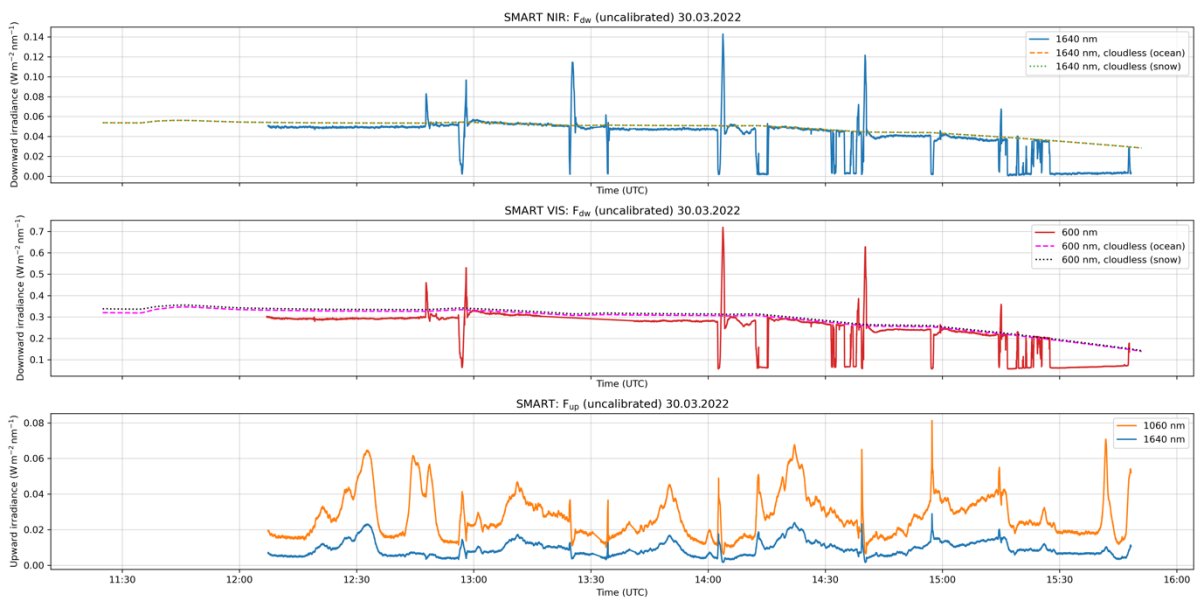


Fig. 11: SMART measurements along the flight.





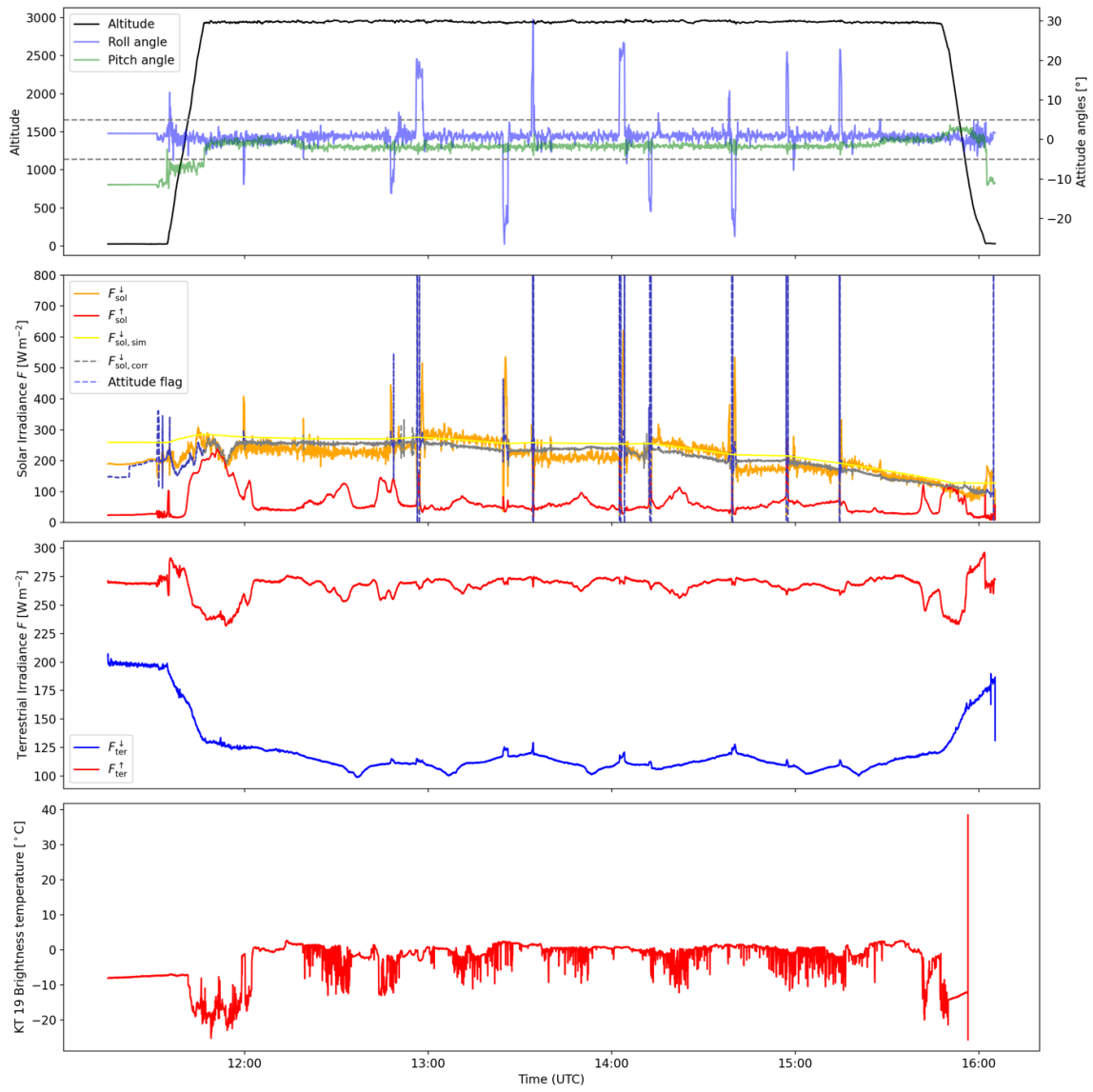


Fig.

14: Broadband radiation measurements along the flight.

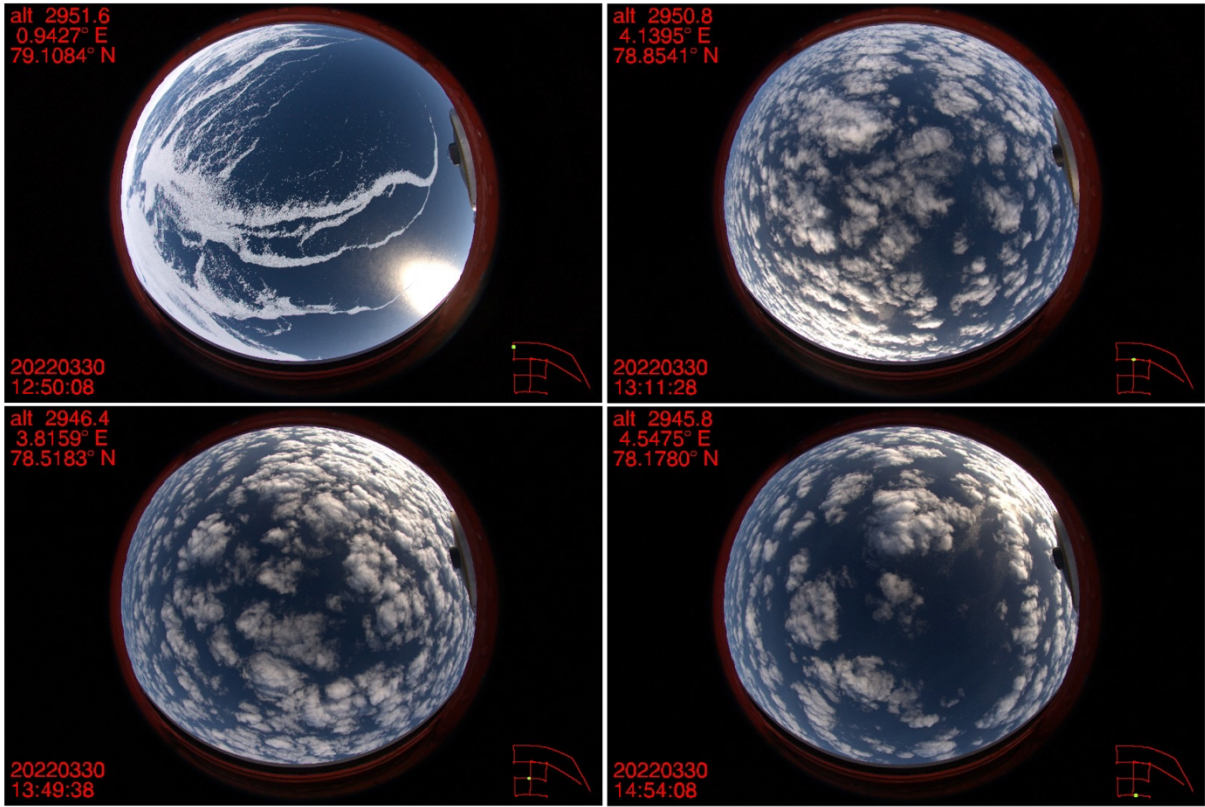


Fig. 15: Nikon camera pictures from different locations.

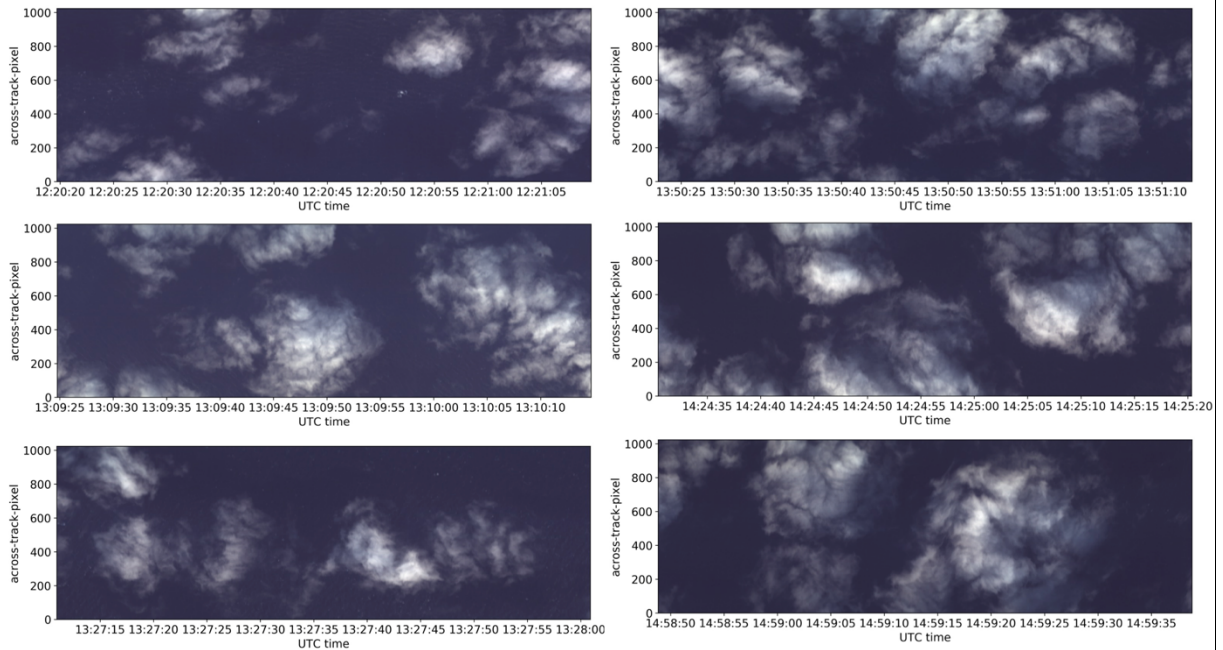


Fig. 16: RGB pictures taken by the spectral imager AISA Eagle at different times of the flight.



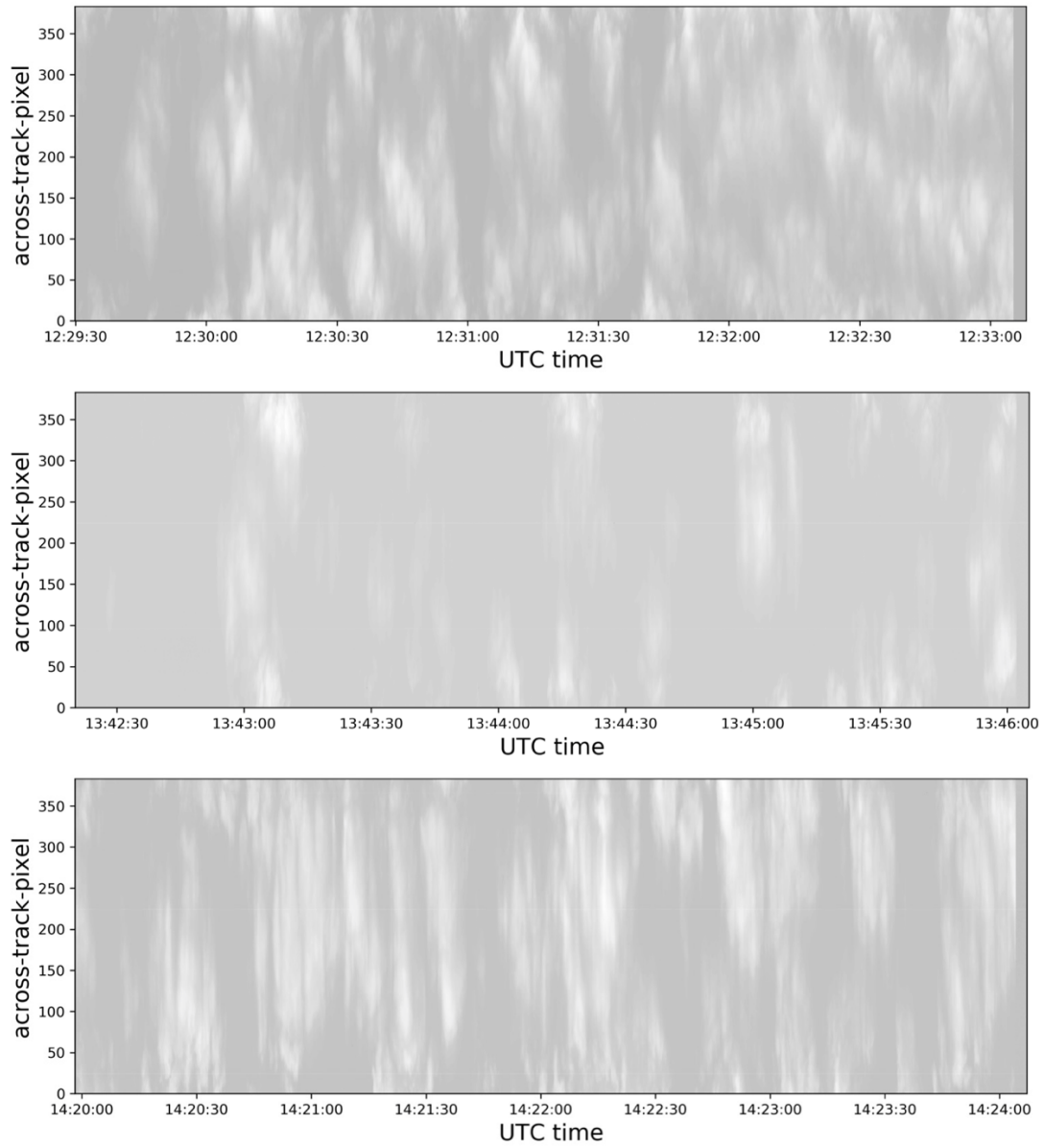


Fig. 17: Pictures taken at 1200nm by the spectral imager AISA Hawk at different times of the flight. The aspect ratio is not correct.