

HALO-0213 (13 February 2020)

Jessica Vial

February 20th

1. Objective

This was the 12th local research flight of HALO, with take-off at 04:00 LT. The objective was to fly the standard pattern: (i) 3 circles, clockwise at FL 320, dropping 12 sondes; (ii) excursion in direction to NTAS buoy at FL 320, dropping 1 sonde just before the turn back nearby NTAS, followed by a radar calibration manoeuvre; (iii) 3 circles, clockwise at FL 320, dropping 12 sondes; (iv) low leg for WALES at FL 160 on the way back to Barbados.

The flight was coordinated with ATR-42 and Twin Otter, and included regular overflights of R/V Meteor (located at 1 o'clock on the circle).

2. Crew

Jessica Vial (Mission PI), Andreas Fix (WALES), Hauke Schulz and Eleni Tetoni (HAMP), Veronika Pörtge (SpecMacs and Smart/Velox), Geet George (Dropsonde), Jude Charles (Flight scientist), Roland Welser and Stefan Grillenbeck (Pilots), Sebastian Gerstner (Engineer)

3. Synoptic Situation

Atlantic high pressure and ridging pattern extending up to the Caribbean area continue to persist, maintaining a steep pressure gradient and strong easterly to north-easterly winds over the operational area. Surface wind speed at NTAS was 9.5 m/s, 11.8 m/s at Meteor and around 10 m/s at BCO. Wind shear was weak up to about 750 hPa.

The subtropical upper-level jet stream was tilted in SW-NE direction over the Atlantic and passing through the Caribbean islands (Fig. 1). Upper-level wind speed divergence on the west end of the jet and moist mid tropospheric air masses originating from South America caused moist conditions in the mid-troposphere (around 6 km, especially in the southern part of the circle) with patches of thin altocumulus above the low-level cloud layer. Soundings indicate three inversion layers at 2, 4 and 6 km (see Figure 4), also suggesting potential occurrences of stratiform clouds at these levels. Mid-level clouds were present since the beginning of the flight and became more prominent with time.

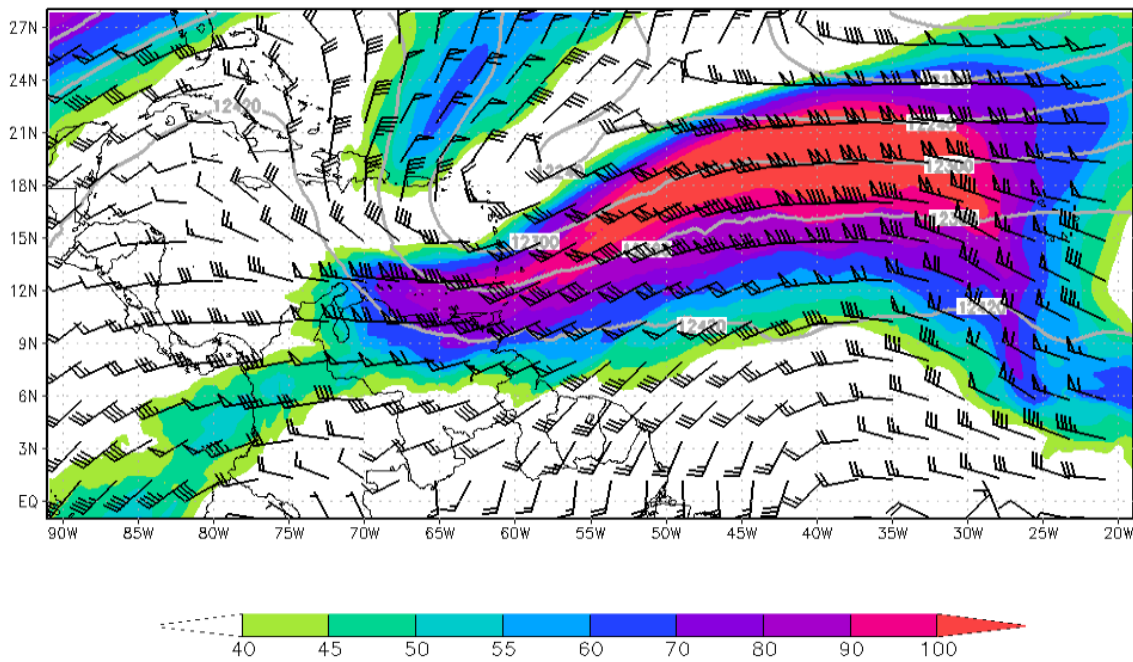


Figure 1. Winds (kts) and geopotential heights (m) at 200 mb at 12:00 UTC

Overview of the situation in the lower troposphere. Overnight and at the beginning of the flight, the area was dominated by a flower pattern with stratiform layers at around 2 km (source: radar from BCO and Meteor), small overshoots above the stratiform clouds and few precipitating cells. With time, the flowers slowly collapsed into fish type of clouds (with more apparent 'bones' within the cloud structure), with perhaps larger precipitating cells as indicated by Poldirad echos at 10 o'clock on the circle (compare Fig. 2a and 2b). The fish located in the NE corner of the circle continued its way to the south-east, moving outside the circle area by the middle of the morning and leaving behind it more scattered shallow convection on the northern half of the circle for the rest of the flight (Fig. 2c). In the southern half of the circle a larger fish structure remained all day in the operational area (Fig. 2a-c).

Leaving the circle, on the way to NTAS, we observed cold pools close to the circle, scattered shallow convection (sugar type) half way through to NTAS and drier conditions to the eastern end of the excursion (Fig. 2c).

Figure 2: Flight track of HALO on top of GOES imagery at 09:00 UTC (top), 11:30 UTC (middle) and 16:20 UTC (bottom).

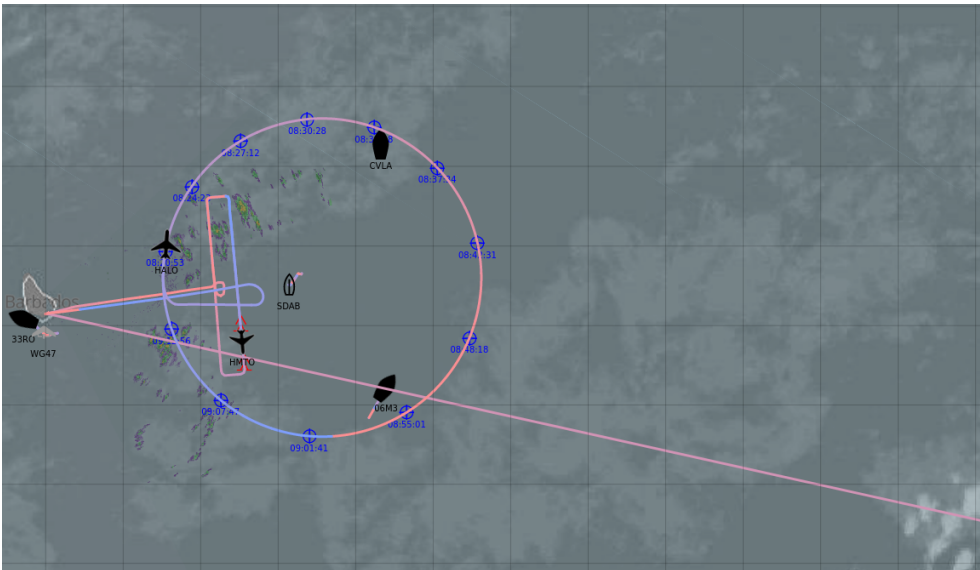


Fig. 2a) GOES infrared at 09:00Z

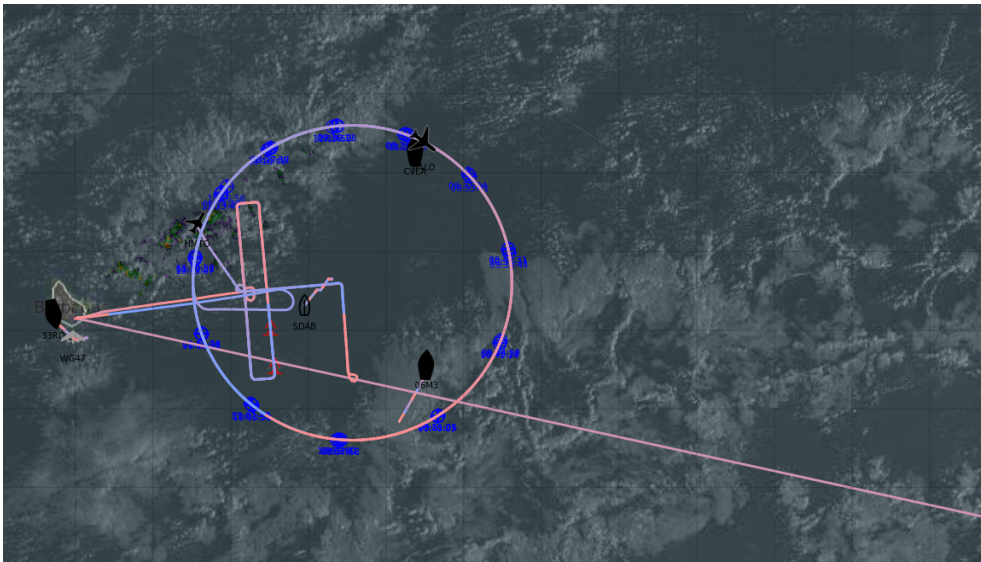


Fig. 2b) GOES visible at 11:30Z

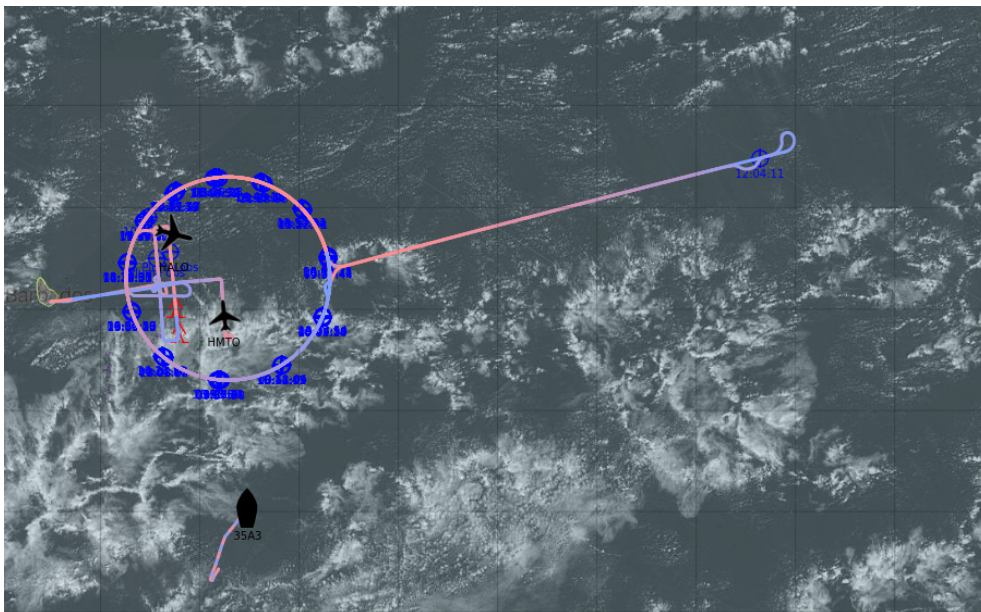
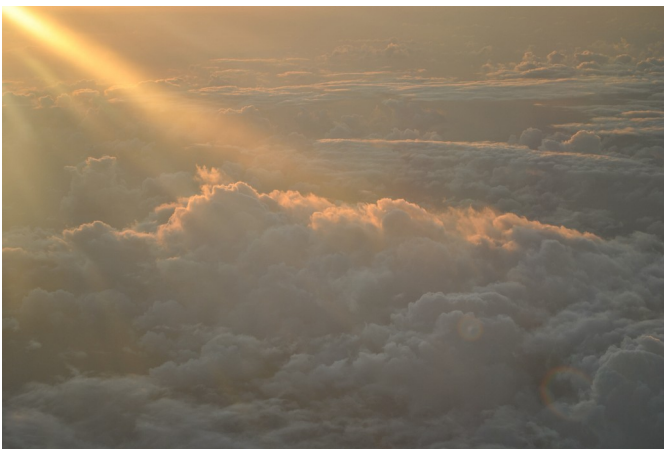


Fig. 2c) GOES visible at 16:20Z

Figure 3. Selection of photos of the flight



Flower's stratiform layers with overshooting convection underneath at 10:03Z



Zoom on a precipitating cell (10:17Z)



Large precipitating cells at 10 o'clock (11:09Z)



On the way to NTAS: stratiform clouds at different altitudes at 11:46Z (left) and 12:05Z (right)



Inside the big fish at 15:23Z (6-7 o'clock)



Underneath the altocumulus when approaching Barbados at 17:10Z

4. Flight elements

Element	Altitude	Time (UTC)	Notes
Take-off	Ground	07:56	
Circle 1	FL 320	08:18	1 st sonde at 08:20 Last sonde at 09:12
Circle 2	FL 320	09:26 (1 st sonde)	1 st sonde failed
Sunrise from HALO	FL 320	09:30	
Circle 3	FL 320	10:32 (1 st sonde)	
Excursion to NTAS	FL 320	11:33 12:03 12:10	Distance from circle to eastern most point of the excursion: 125 km. Total duration of excursion: 1h30 1 dropsonde at eastern most point Radar manoeuvre during 3 minutes (20° wriggle)
Circle 4	FL 320	13:02	1 st sonde at 13:03
Circle 5	FL 320	14:34 (1 st sonde)	
Circle 6	FL 320	15:40 (1 st sonde)	
Lidar leg	Descent to FL 160	16:40	
Landing	Ground	17:18	

Table 1: Overview of flight elements

5. Instrument Status

Dropsondes: 74 sondes launched, one failed (the first of the 2nd circle)

HAMP Radiometer: 183 GHz channel stopped working after 30 minutes

HAMP Radar: No issues reported

SpecMACS: No issues reported

SMART: No issues reported

Velox: Measurements stopped at about 13:16 UTC for 15 minutes and landing was not recorded

WALES: No issues reported

BACARDI: No issues reported

BAHAMAS: No issues reported

6. Figures

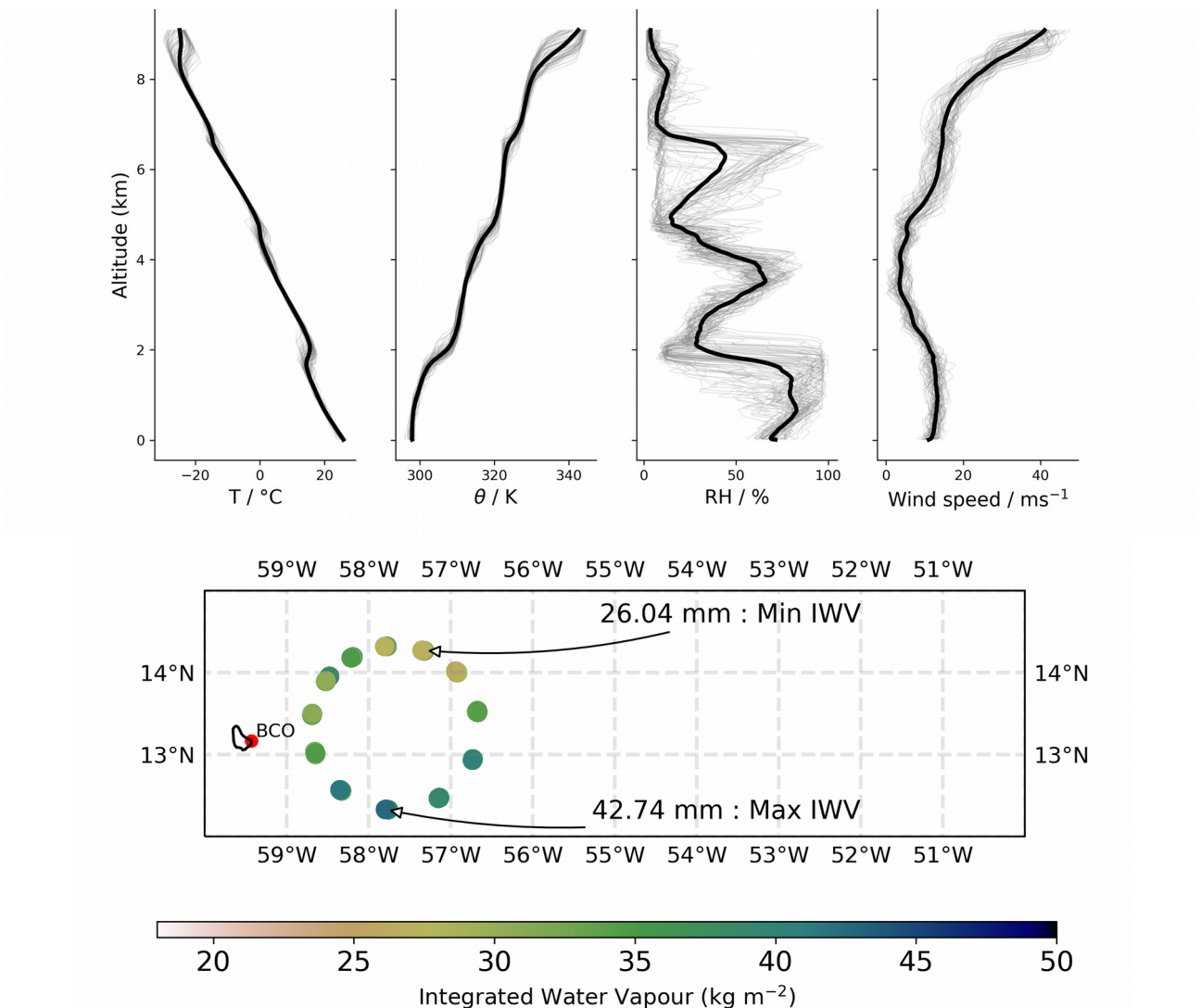


Figure 4. Dropsonde overview: (top) mean and individual profiles and (bottom) integrated water vapor from all soundings.

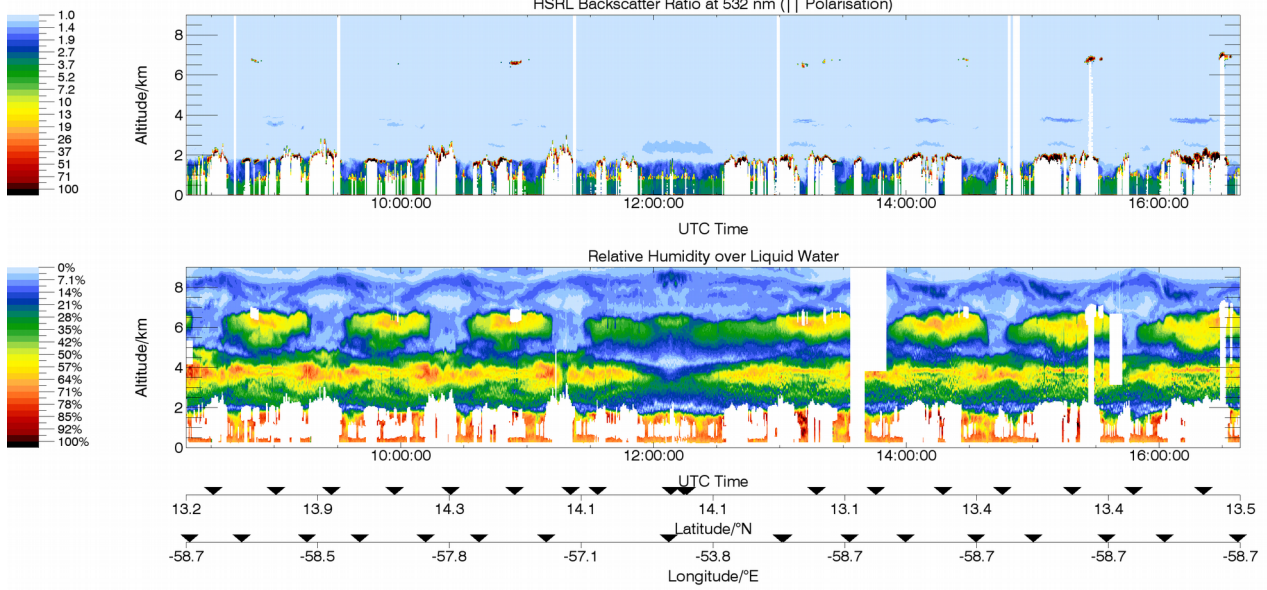


WALES

EUREC4A 13-02-2020



12th Local HALO Flight



Preliminary quick-look data. Processed on 14-02-2020 Contact: DLR Institute of Atmospheric Physics Martin.Wirth@dlr.de

Figure 5. WALES backscatter ratio (top) and relative humidity (bottom)

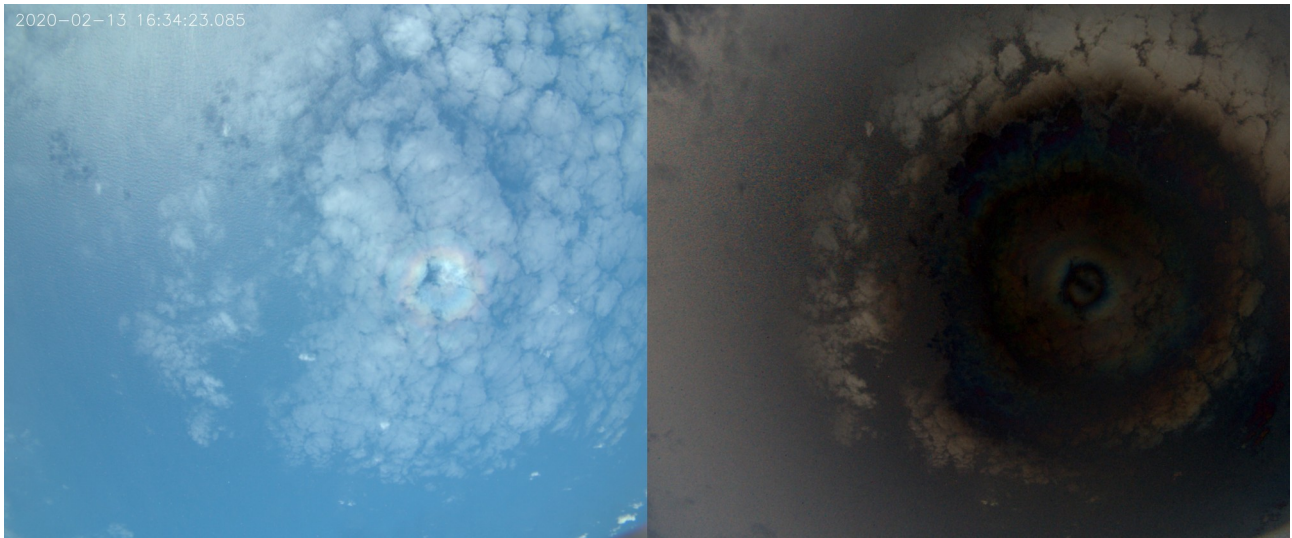


Figure 6. specMACS measurement taken at 16:34:23 UTC: (left) visible image showing the glory slightly to the right of the center and (right) degree of polarization with a large glory and a small cloudbow. This indicates rather small cloud droplets.

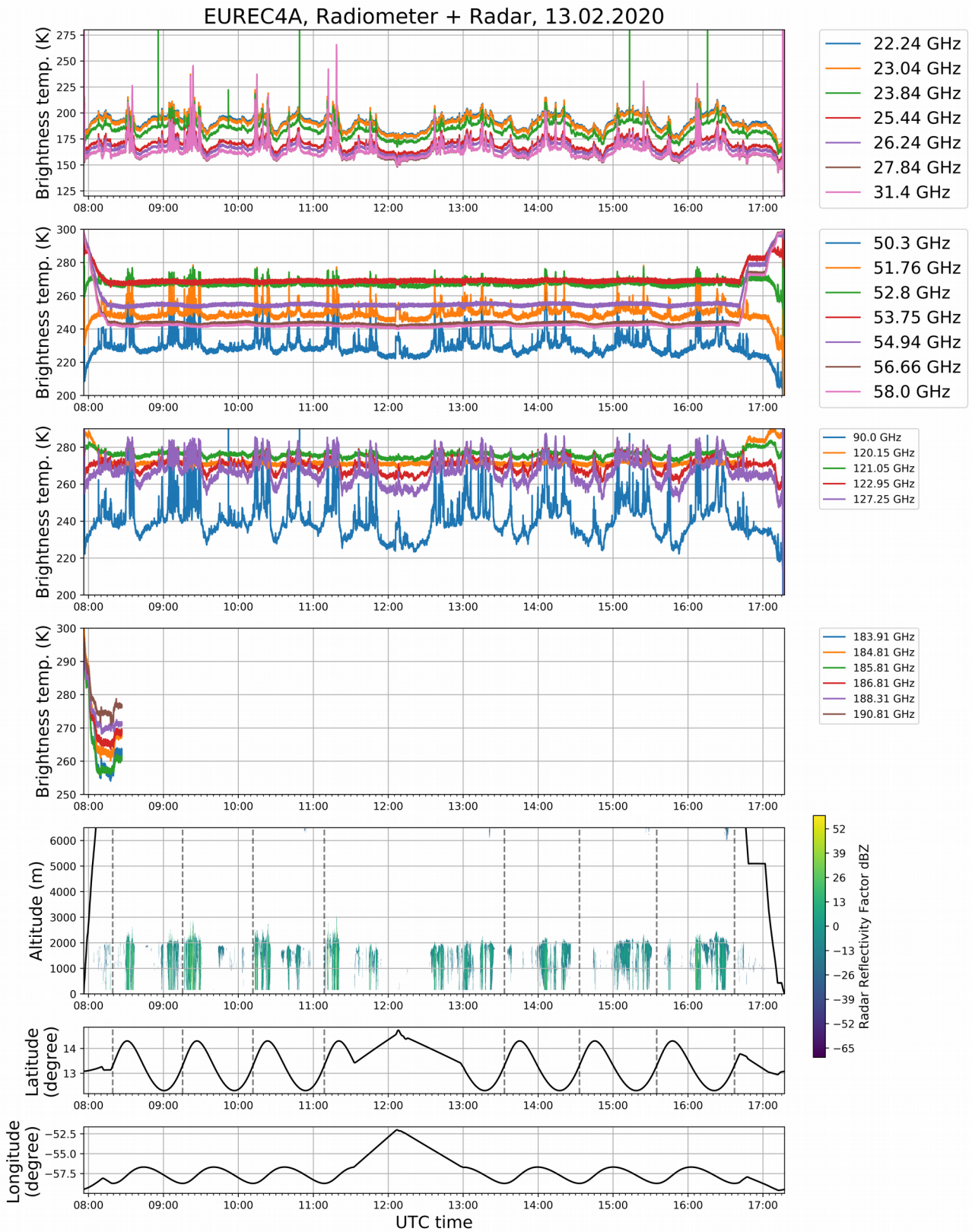


Figure 7: HAMP radiometer and radar data.