

# HALO-0207 (7 February 2020)

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Draft, February 14

## 1. Objective

9th local research flight of HALO with take-off at 08:00 LT. The objective was to fly the standard pattern at FL 320 with 3 circles and dropping 36 sondes, followed by the excursion to the NTAS buoy, and another 3 circles with 36 dropsondes. On the excursion to NTAS, one dropsonde was launched near the eastern most point of the spur close to the NTAS buoy, followed by a radar calibration manoeuvre. The flight was finished with a low leg for WALES at FL 160 on the approach to Barbados.

The flight was coordinated with ATR-42 and Twin Otter, and included regular overflights of R/V Meteor and R/V Maria S. Merian (both located at 5 o'clock of the circle), and overflights of R/V Ron Brown in the first quarter of the NTAS spur.

At the beginning of the flight, there were some issues with the Inmarsat communication and we had to temporarily switch to Iridium. During circle four and six, we had to slightly deviate from the circle due to air traffic and dropped the sondes at 11 o'clock slightly to the north of the circle.

## 2. Crew

Raphaela Vogel (Mission PI), David Farrell (Flight scientist), Marcus Klingebiel (Dropsonde), Florian Ewald (HAMP), Kevin Wolf (SpecMacs), André Ehrlich (SMART/Velox), Andreas Fix (WALES), Stefan Grillenbeck & Roland Welser (Pilots), Thomas Leder (Engineer)

## 3. Synoptic Situation

A ridge dominated the area of aircraft operations. The day was characterised by a dry and stable atmosphere and fairly strong winds. The Meteor, located near 5 o'clock on the Halo circle, measured an 11 m/s average wind speed from a north-easterly direction.

The first set of circles was dominated by (feather-)flowers with large stratiform layers near 2 km height. Some stratiform layers were associated with overshooting cumuli reaching to a height of about 3 km, often associated with precipitation (see the radar quicklook in Figure 3). There were many large cold pools with remnants of stratiform clouds in the middle (see Figure 1 top). Cloud-base heights were on average about 1 km high, indicating drier surface conditions compared to most of the other days.

On the spur to the NTAS buoy we were in a dry clear-sky area, sandwiched between two big fish-like structures (see Figure 1 bottom and the right photo in the middle panel of Figure 2).

For the second set of circles, the stratiform layers have become less abundant and the cloud pattern transitioned into more sugar and gravel-like fields of trade cumuli. The HAMP radar recorded frequent showers.

## 4. Flight Elements

Table 1: Overview of main flight elements. The numbers in the Loc. column refer to the position along the HALO circle clock.

Element	Loc.	Flight Level (FL)	Time (UTC)	Notes
<b>Takeoff</b>	GAIA	Ascent to 320	12:00	
<b>C1</b>	CW / 9	320	12:22	
<b>Note</b>	5-6	“	~13:00	Meteor and Merian overpass (same Loc. for subsequent circles)
<b>C2</b>	CN / 12	“	13:32	1 dropsonde lost
<b>C3</b>	CE / 3	“	14:41	2 dropsonde failed, 1 didn't report pressure, temperature and humidity
<b>Spur</b>	CE	“	15:35	Left circle for NTAS buoy
<b>Note</b>			15:51	Ron Brown overpass
<b>Note</b>	near NTAS (14.5985°N, 51.9228°W)	“	16:15	Dropsonde at easternmost point of excursion
<b>Note</b>	near NTAS	“		Radar manoeuvre flown
<b>Spur</b>	near NTAS	“	16:30	Return to circle
<b>C4</b>	CE / 3	“	17:14	1 dropsonde lost
<b>Note</b>	10 - 11	“	17:50	8 min deviation from the circle due to air traffic - sonde dropped slightly N of circle
<b>C5</b>	CS / 6	“	18:29	
<b>C6</b>	CW / 9	“	19:44	2 dropsonde failed, 1 didn't report pressure, temperature and humidity
<b>Note</b>		11 “	19:53	4 min deviation due to traffic - sonde dropped slightly N of circle
<b>Lidar leg</b>		8 descent to FL160	20:36	
<b>Landing</b>	GAIA	n/a	21:11	

## 5. Instrument Status

**BACARDI:** No issues reported.

**BAHAMAS:** No issues reported.

**HAMP Radar:** No issues. Calibration loop and roll manoeuvres on spur.

**HAMP Radiometer:** 183 GHz stopped working on ground. Kv came back after take off. 90/119 GHz worked well.

**SMART / VELOX:** No issues reported. Flushing with nitrogen helped.

**specMACS:** No issues reported.

**WALES:** No issues reported.

**Dropsondes:** 73 sondes were dropped. 6 sondes failed due to ‘no launch detected’, with signal lost near 320 hPa. 2 sondes didn’t report Pressure, Temperature and Humidity. Reason of failures is not clear. Reducing speed to 390 knots didn’t prevent failures.

## 6. Figures

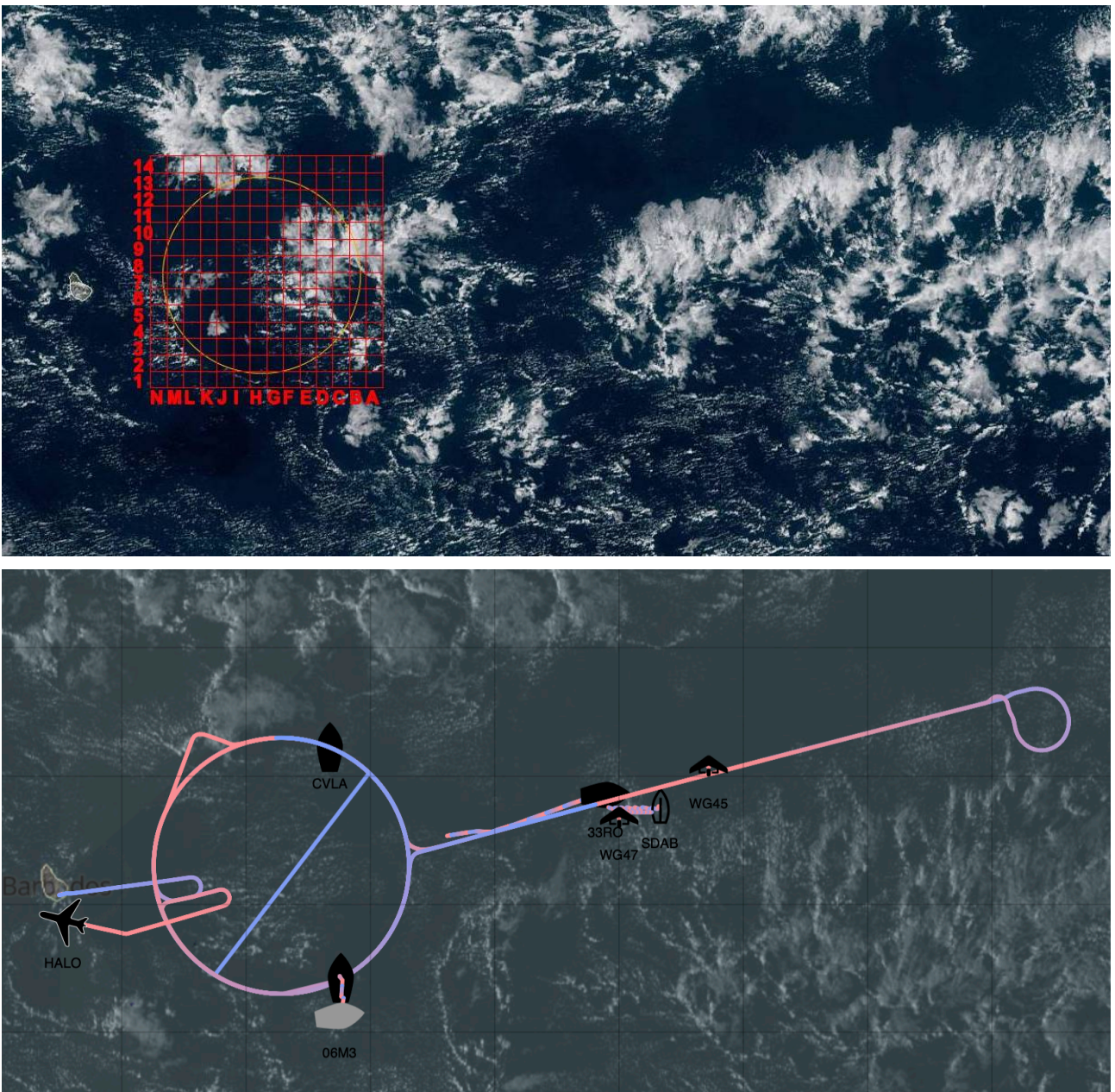


Figure 1: (top) Satellite image at 11 LT with (feather-)flowers in the eastern part and a big cold pool with a cloud arc in the south-western quadrant. (bottom) Flight track screenshot from PLANET taken at 21 UTC. (Ignore the diagonal through the circle.)



Figure 2: Selection of representative photos from the flight. From left to right: (top) 12:04 UTC, 12.18 UTC; (middle) 12:57 UTC, 16:50 UTC; (bottom) 17:20 UTC, 19:08 UTC.

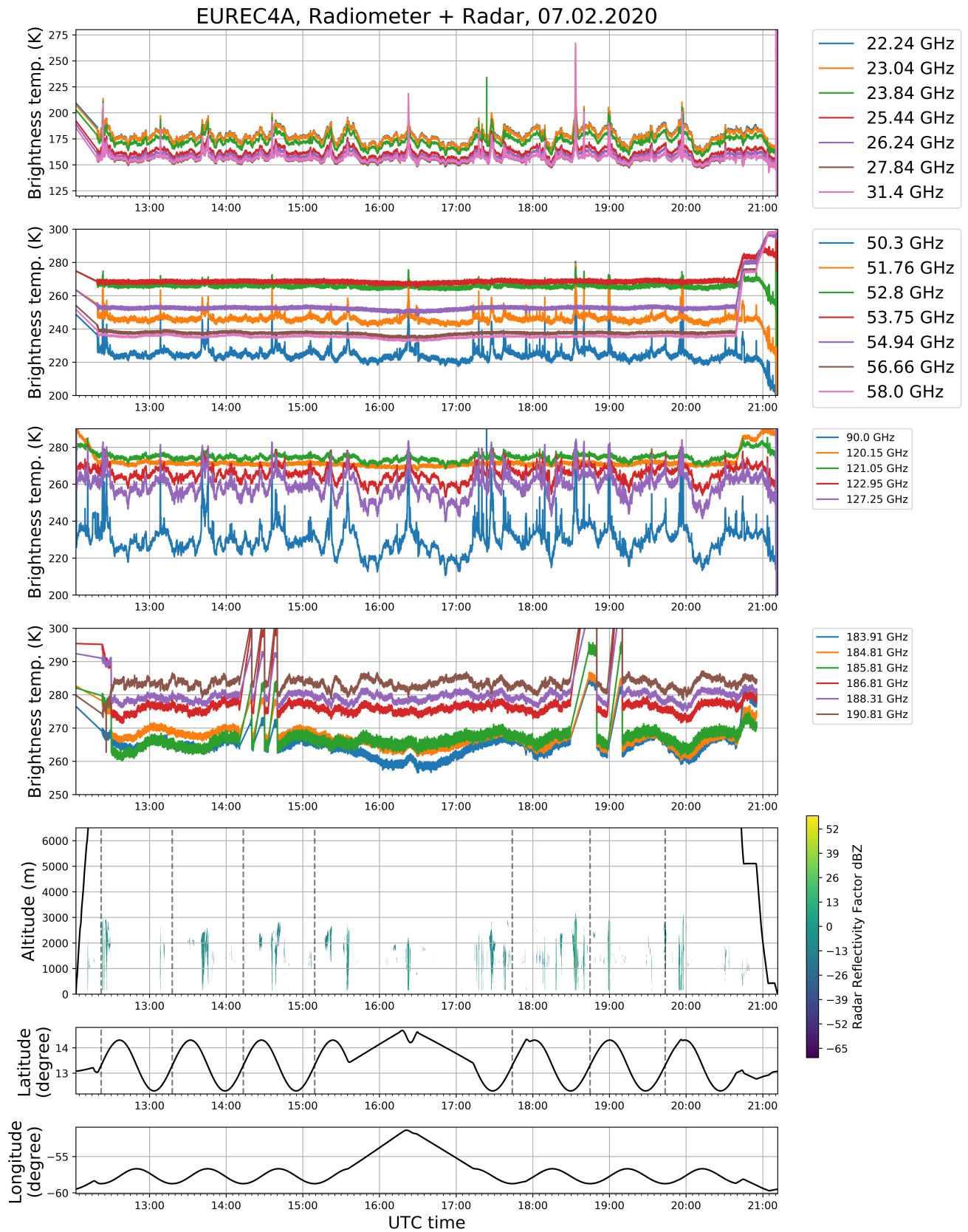


Figure 3: HAMP radiometer and radar data.

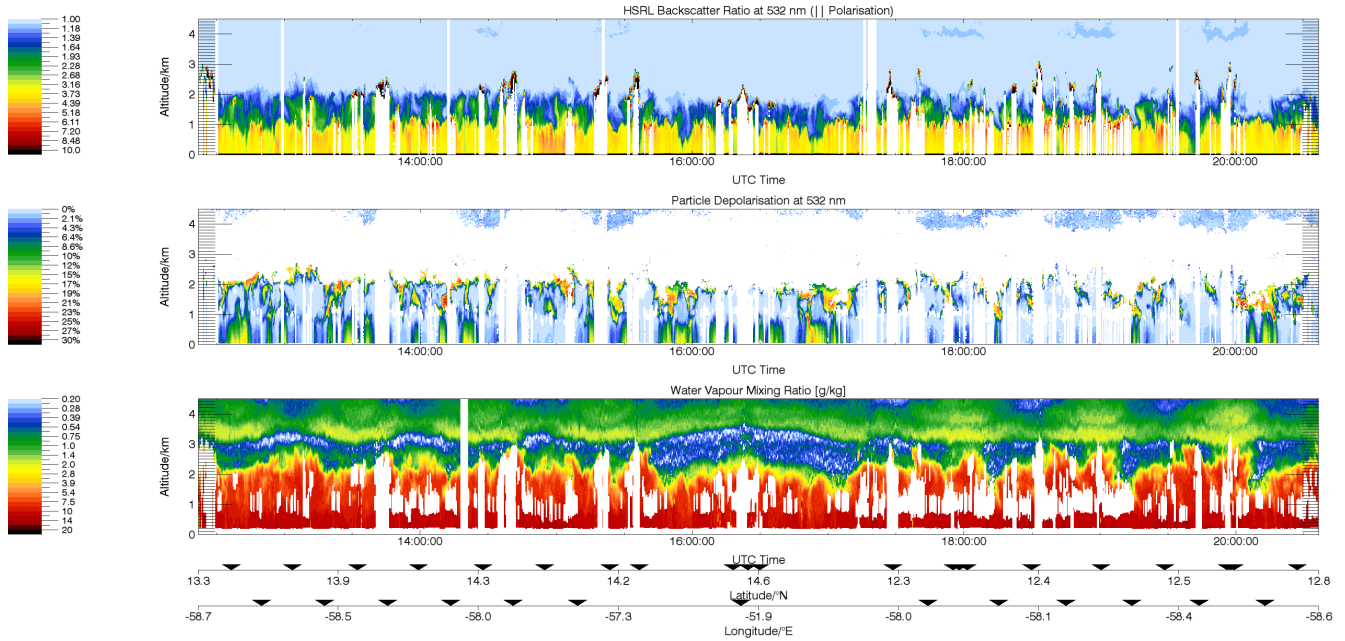


# WALES

## EUREC4A 07-02-2020



### 9th Local HALO Flight



Preliminary quick-look data. Processed on 10-02-2020 Contact: DLR Institute of Atmospheric Physics Martin.Wirth@dlr.de

Figure 4: WALES backscatter ratio (top), particle depolarisation (middle) and water vapour mixing ratio (bottom).

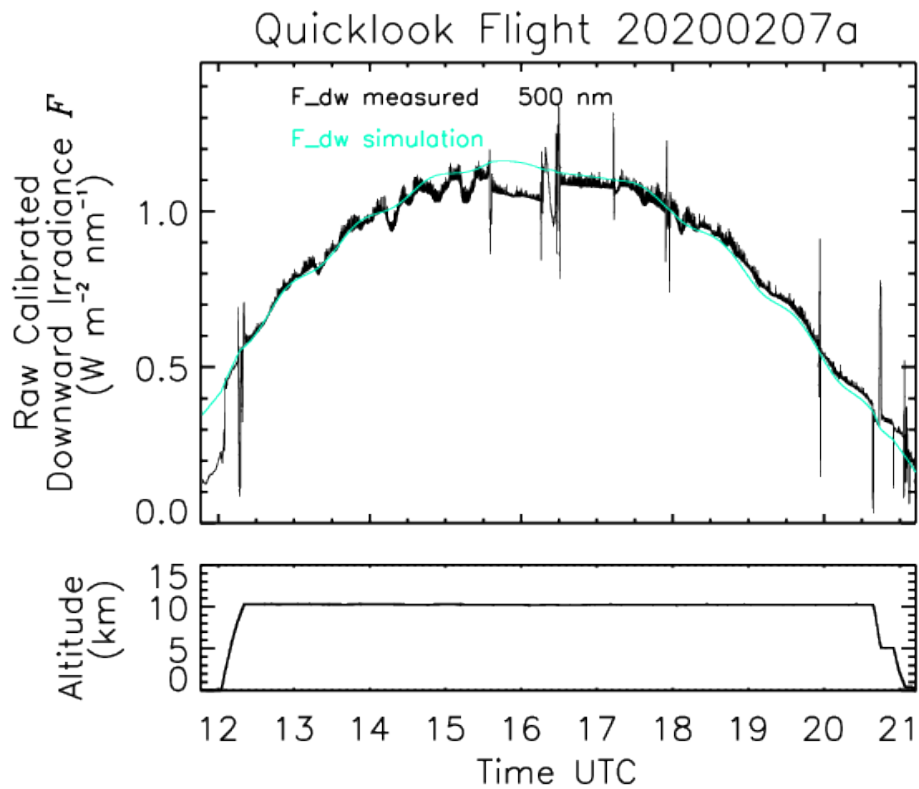


Figure 5: SMART downward irradiance.

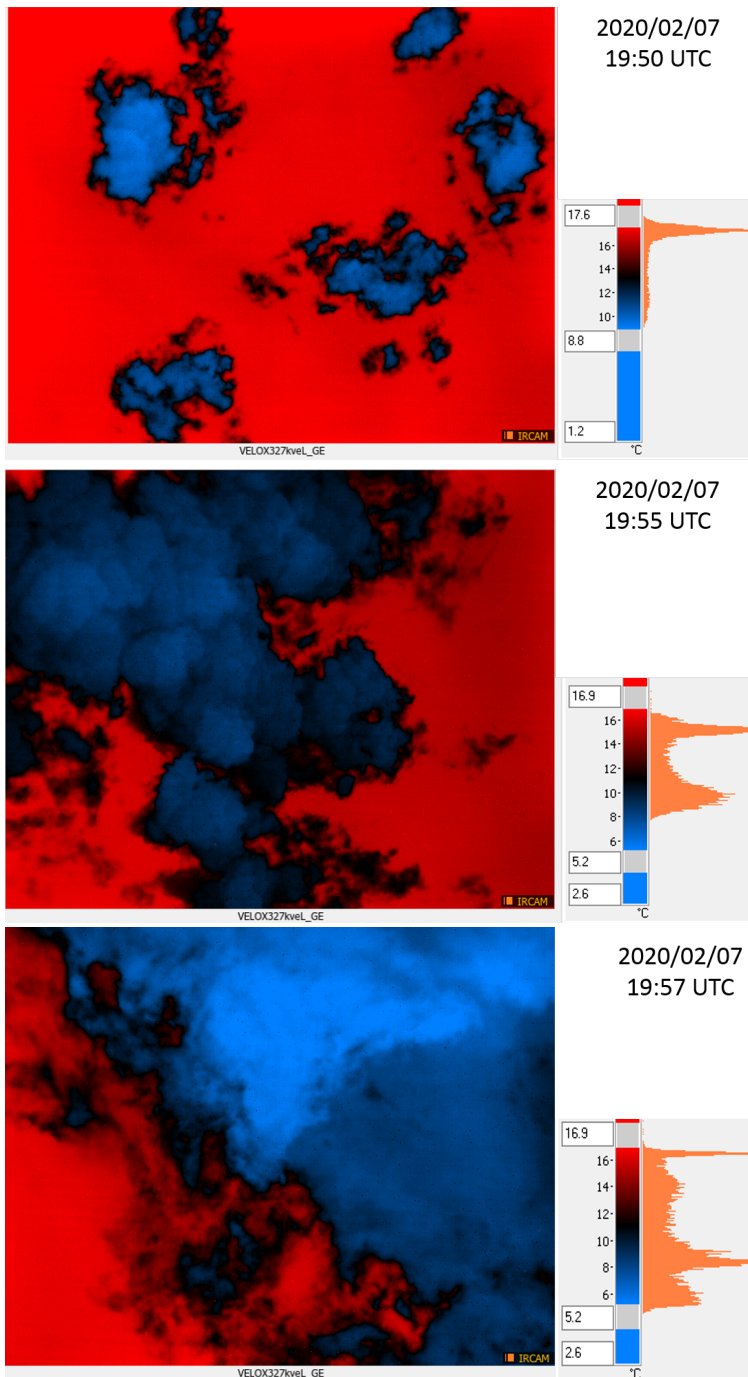


Figure 6: Three snapshots of IR brightness temperatures measured by VELOX showing different types of clouds. (top) Small scattered cumuli, (middle) a cluster of more convective cumulus cloud with a larger variety of cloud top temperatures and thus heights, and (bottom) a case of multi-layer clouds with a stratiform cloud embedded in more cumuliform-like clouds.

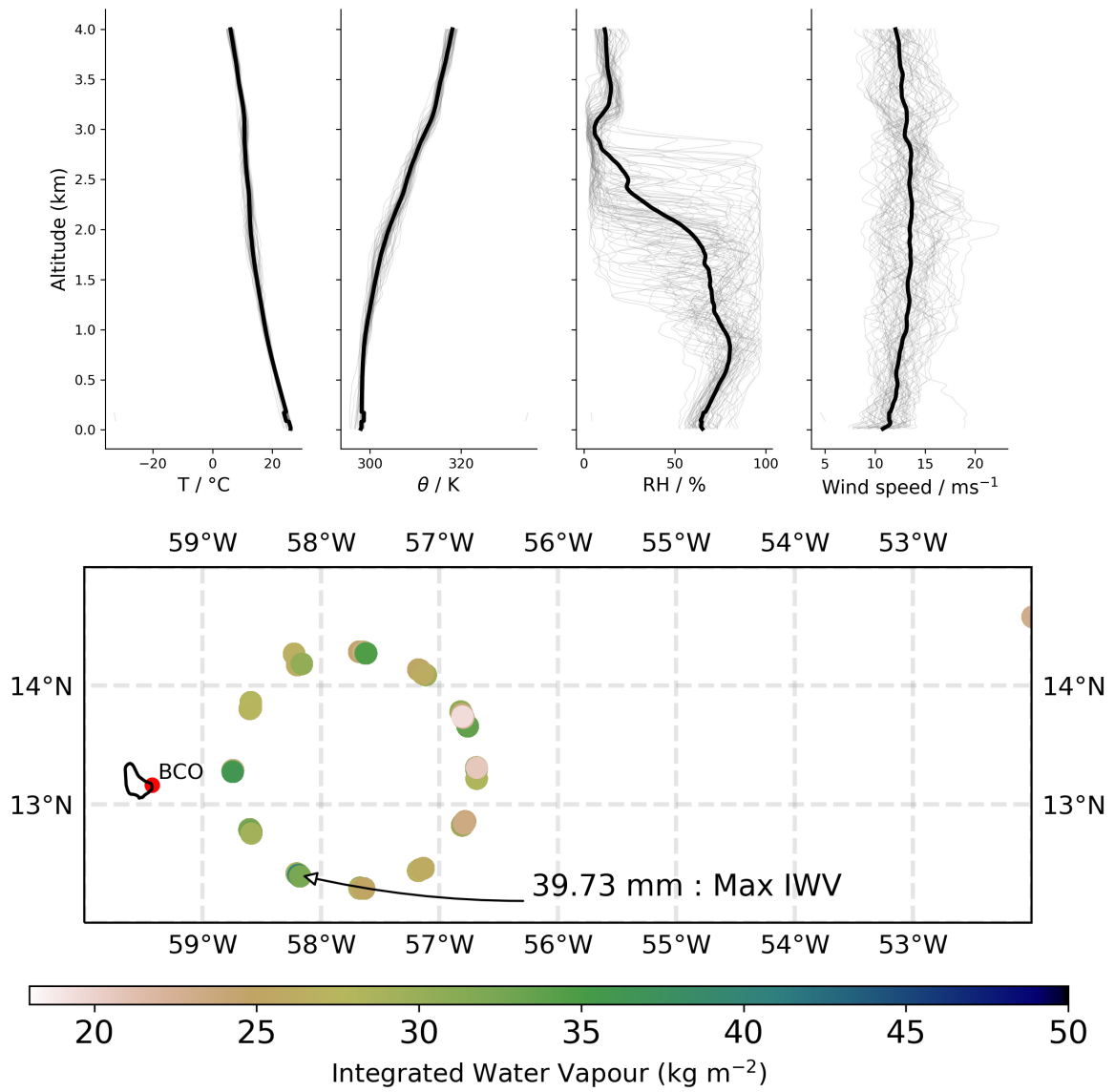


Figure 7: (top) Mean and individual profiles of dropsonde temperature, potential temperature, relative humidity and wind speed. (bottom) Integrated water vapour path of the different dropsondes and their location.