

# HALO-0131 (31 January 2020)

Geet George

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## 1 Objective

This was HALO's sixth local research flight for EUREC4A. Takeoff was planned at 11:00 LT. with 3.5 standard circles (3 sonde-circles of 12 sondes each at 30° heading). The first sonde launch was planned around half an hour after take off. A 90° break (circa 20 minutes) each between two circles were planned, other than the excursion break between the two sets of circles. This would be followed by an excursion in the direction of the NTAS buoy to carry out HAMP radar's 10° bank manoeuvre circling around the Ron Brown (planned to be at 13.9°N, 54.75°W), as much as the wind would allow while keeping the bank steady. On the way back to the circle, the Flo-manoevre (the wiggle of 20° bank to both sides) would be carried out with one sonde each launched before and after the manoeuvre. Then, we would complete the second set of 3.5 standard circle (3 sonde-circles of 12 sondes each at 30° heading). Finally, we would head back towards Barbados and descend to FL160 for the short, low-level lidar leg before landing at 20:00 LT.

## 2 Crew

Geet George (Mission PI), Manuel Gutleben (WALES), Marek Jacob (HAMP), Kevin Wolf (SMART/Velox and SpecMACS), Ann Kristin Naumann (Flight Scientist), Allison Wing (Dropsondes and meteorological observations), Jule Radtke (Dropsondes); Stefan Grillenbeck and Marc Puskeiler (Pilots), Thomas Leder (Engineer)

Contact at ground : Marc Prange

Average age of science crew : 29 years

## 3 Synoptic Situation and Met Observations

Half an hour before the flight, there was a dissipating flower-y cell in the middle of the circle, surrounded by bright specks, some stratiform towards the north and northwest of the circle and some sugar-y clouds towards the east. For takeoff, the sky was partly

cloudy from surface. The atmospheric column seemed hazy, including in the sub-cloud layer, during the ascent to FL320.

As we entered the first circle, looking inwards from the northwestern and northern parts of the circle, the central cloud cluster seemed to have a big core and few smaller cores surrounding it, with a well-spread stratiform layer throughout. Shallower cumuli at nadir had tops at 1-1.2 km and base at 0.7 km (from WALES). Towards the southern and southeastern part of the circle, throughout the flight, the dust layer was very prominent (hazy visually and confirmed by lidar), which was accompanied with many shallow, suppressed clouds. As per WALES, the dust layer was shallow at 2-3 km with a gap between it and shallow cumuli observed at 500 m.

Throughout the first set of 3.5 circles, the cloud cluster in the middle of the circle seemed to dissipate (reducing in area), leaving behind stratus and shallow cumuli, with some streaks of deeper cumuli and cloud free air in between the streaks. During the 3rd circle, more developed clouds were observed in the nadir with the radar observing cloud base at 0.8 km and cloud top at 2 km.

For the excursion, we started in the direction of the NTAS buoy around 14:55 LT. On the way, a sonde was launched in cloud-free area for purposes of the MWR. The 10° bank started at 15:08 LT, and took around 20-25 minutes, before returning to the same path that we took while departing the circle. While successfully spotting Ron Brown from the airplane, we also noticed that clouds in the vicinity of the Ron Brown were mostly sugar, shallow clouds arranged in streaks. The atmosphere was also very hazy (dust?) thus making it difficult to see many clouds.

On the return leg of the excursion, a sonde was launched at the beginning of the Flo-manoevre, but towards the end of the wiggle, we realised that the radar had stopped functioning (the transmitter breaker had come out) just at the beginning of the manoeuvre. The launch post-manoevre was cancelled, as the radar couldn't have used it anyway. The radar breaker was pushed back in, and the transmitter along with the radar PC was restarted, and everything was functioning again. We were 3-4 sondes into the 4th circle by this time. The MWR-183 also had a few hiccups a little later, but worked well after restarting.

For the second set of the circles, the cluster from the morning was slowly fading away a little west of the circle. The circle meanwhile was seeing the spine of a fish-like cluster cutting across its NE-SW parts. From the airplane, the fish-like cluster looked like a big spread of closely connected cumuli, with some towers rising (around 16:40 LT). Towards the northeastern part after the fish, the clouds seemed like a sparse, sugar-y spread of popcorn cumuli. Around the time of the last circle, with the clouds coated in a reddish orange hue by the setting sun, we saw the fish developing a big spread of stratiform clouds (at 2-2.5 km), with some shoots coming off the top, but difficult to identify any cores. Some popcorn cumuli could be seen below the stratiform, with a base of 0.5 and top of 1 km. One sonde around 18:48 LT was delayed slightly (by about 2° heading) so as not to deconflict with the P3. After the last sonde, on our way back, the short lidar leg at low level was carried out, before landing at around 20:10 LT.

Element	Altitude	Time (UTC)	Notes
Take-off	Ground	14:07	
Note	FL320	15:32	First sonde launched
Note	”	18:31	Very bumpy for 7 minutes; had to put seatbelts on
Note	”	18:46	Excursion to Ron Brown starts
Note	”	19:08	540 heading bank starts
Note	”	19:30	540 heading bank ends; return to excursion path
Note	”	19:42	Sonde before Flo-manoevre (radar stops working)
Note	”	20:15	Second set of circles starts
Note	”	20:20	HAMP radar works again after the restart
Note	”	20:40	MWR-183 stopped briefly, but okay after restarting
Note	”	23:40	Last sonde of last circle launched
Note	FL160	23:50	Low-level lidar leg
Landed	Ground	00:10	

Table 1: Overview of flight elements

Overall, throughout the flight, there was a persistent dust layer, more intense towards the south, accompanied there by shallow cumuli. The first set of circles saw a fading flower, and the second set of circles saw the malnourished spine of a fish. The excursion was partly successful with the 10° bank (or 540° heading) manoeuvre, but the Flo-manoevre failed as the radar stopped right before it.

## 4 Instrument Status

**Dropsondes:** A total of 74 sondes launched; one sonde fail in each of the first 3 circles, and one sonde at the beginning of the excursion. All others worked well.

**HAMP:** Didn't work during the Flo-manoevre (breaker came out), and worked again around half an hour later after restart. 183 channel stopped briefly, worked again after restarting.

**SpecMACS :** No issues reported

**SMART :** No issues reported

**Velox :** No issues reported

**WALES :** Trouble during the low-level leg? (need confirmation)

BAHAMAS : No issues reported

BACARDI : No issues reported

## 5 Figures (photographs will be updated soon)

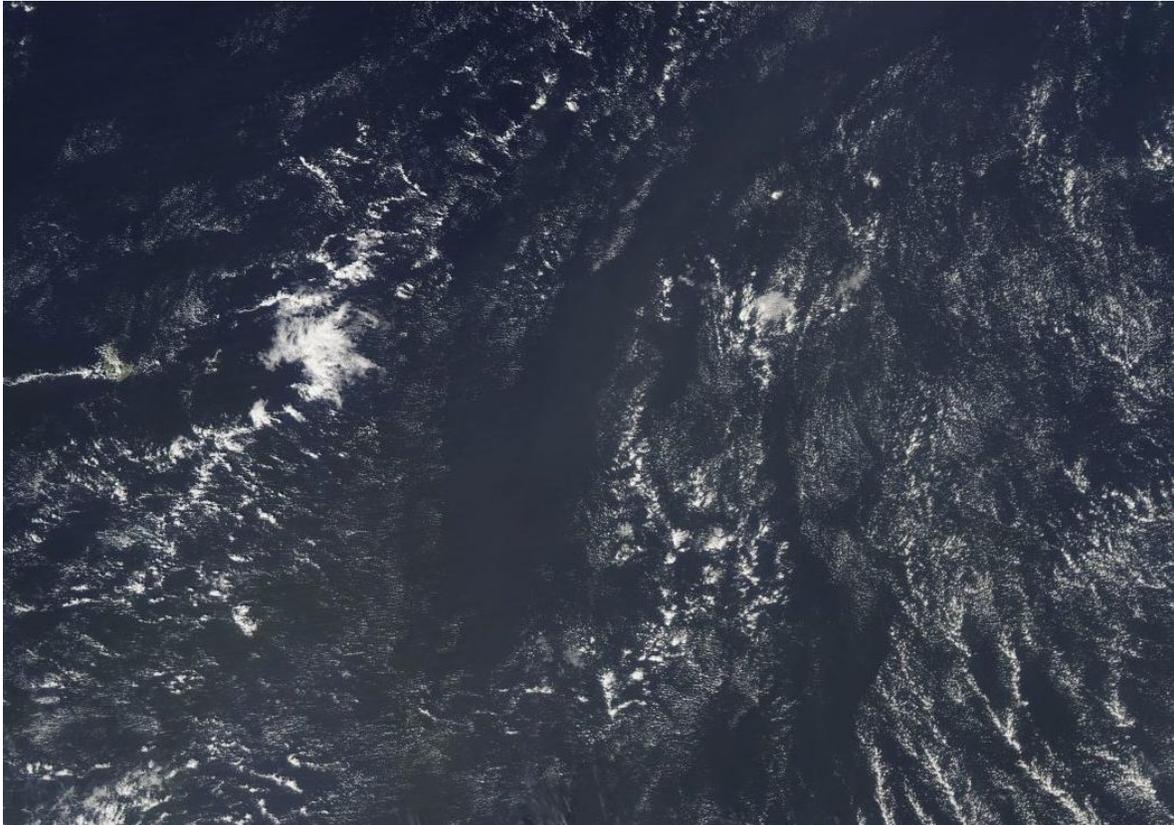


Figure 1: MODIS Aqua image from 31.01.2020, with NE corner at 16.05N,51.18W and SW corner at 9.52N,60.44W

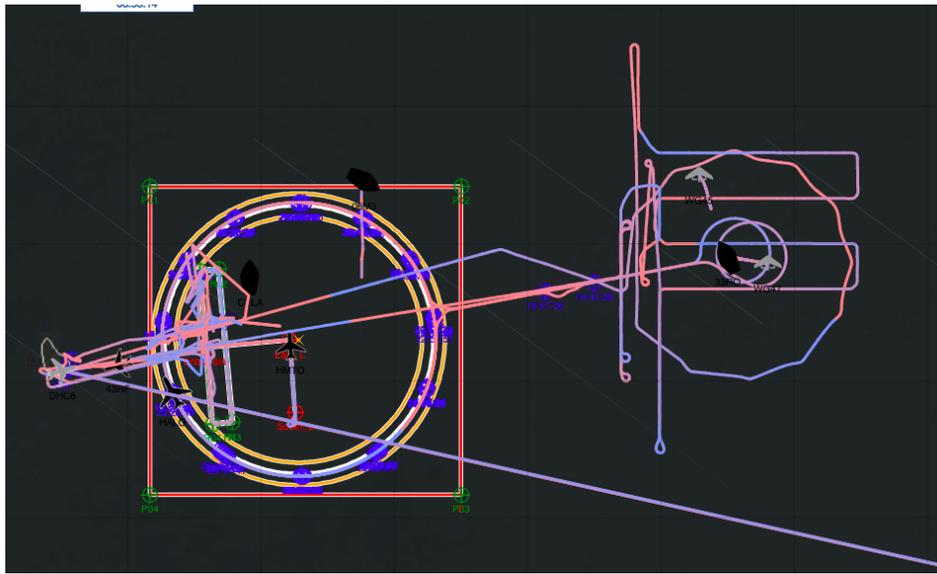


Figure 2: Screenshot from PLANET towards the end of the flight; prominent circular and mattress pattern towards the east are P3 tracks.

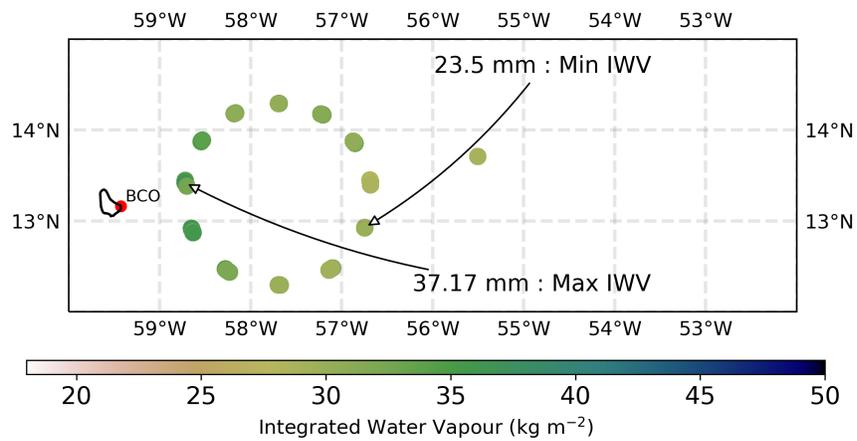


Figure 3: Dropsonde launch locations with colours showing column moisture upto flight altitude

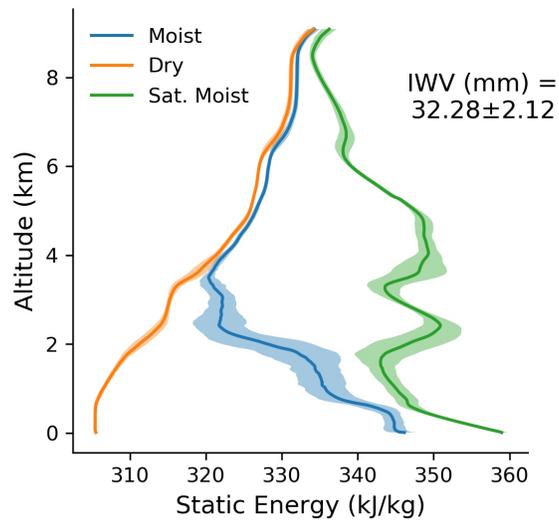


Figure 4: Mean static energy profiles of all sondes

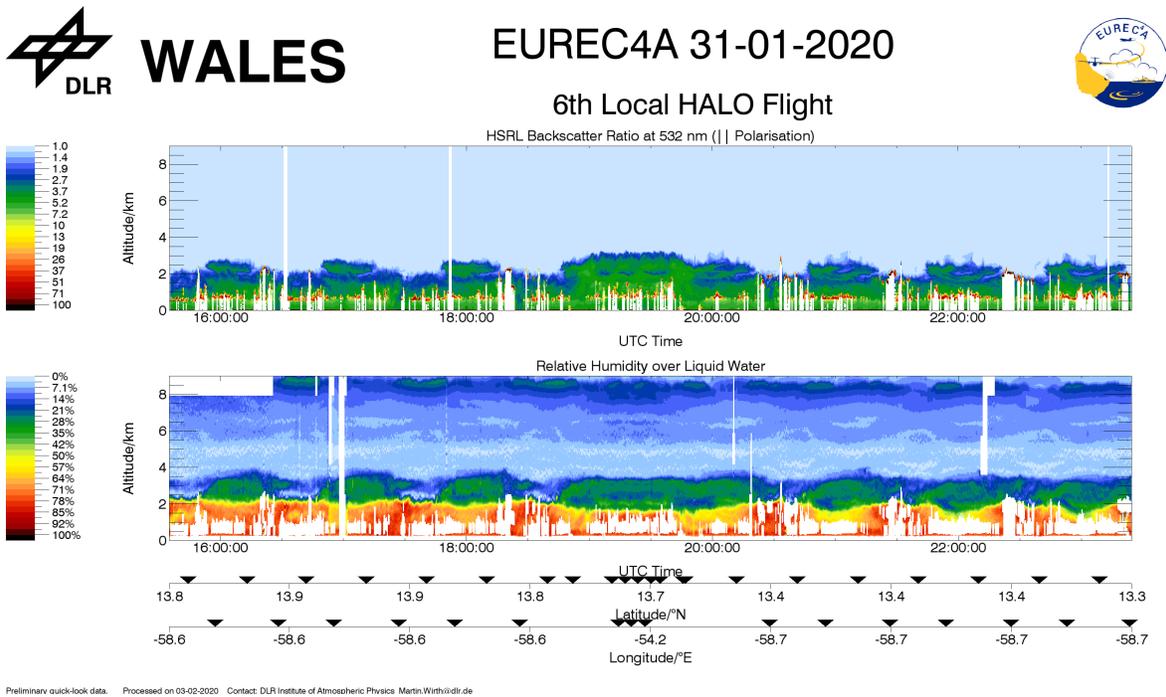


Figure 5: WALES quicklook: Backscatter and Relative Humidity

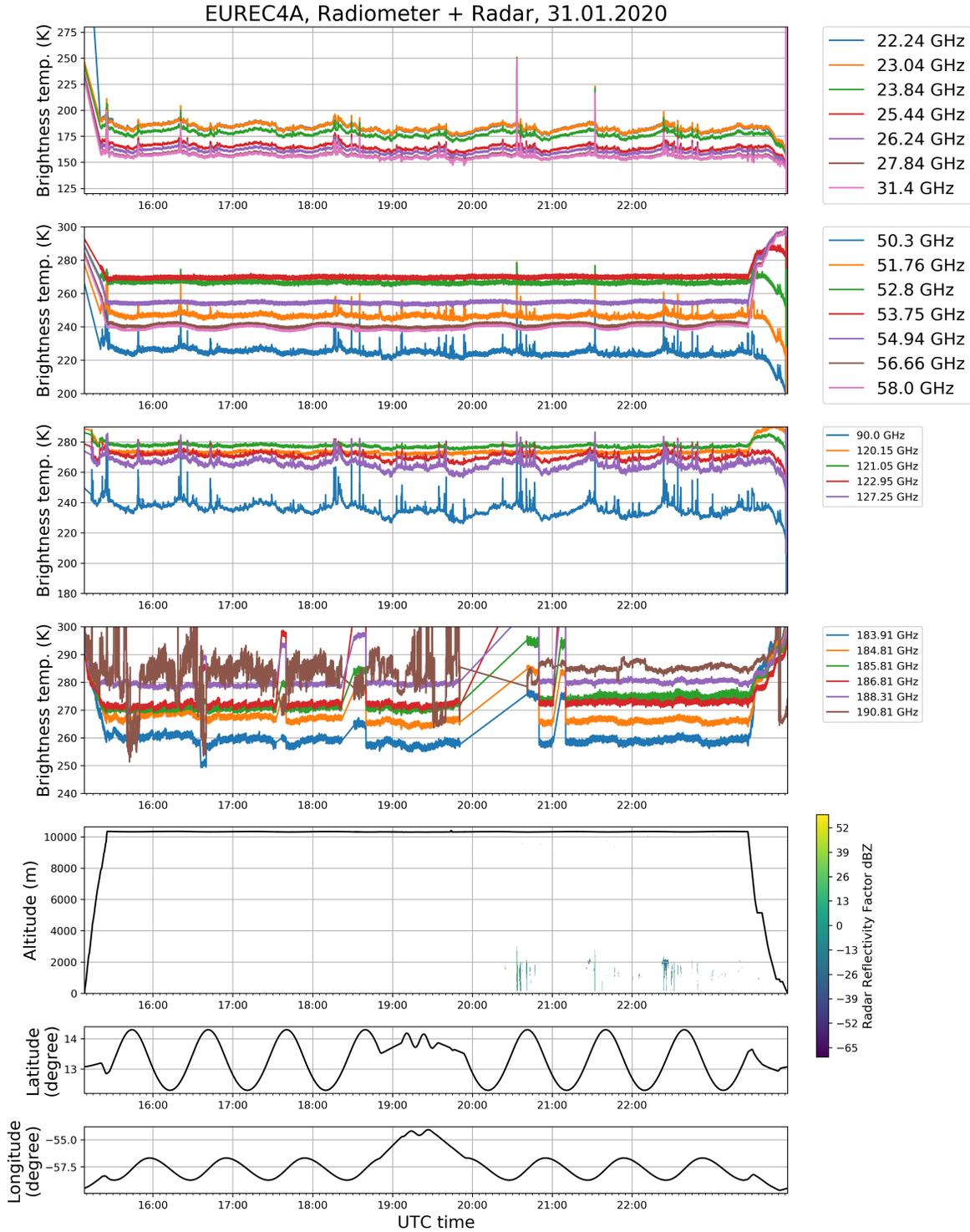


Figure 6: HAMP Radiometer and Radar quicklook