

ATR-0130 (30 January 2020)

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1. Objective

The objective of this flight was to characterize the cloud and boundary layer properties, focusing on the cloud base level and the subcloud-layer. At the beginning of this flight, HALO was flying along the same race track pattern as the ATR, and therefore the ATR was flying within the field of view of HALO radiometers. This offers the opportunity to compare the cloud field inferred from HALO instruments (e.g. SpecMACS) with that inferred within the race track from horizontal lidar/radar measurements on board the ATR. Note that HALO dropped sondes at both extremities of the race track: one at 12:05 UTC (South) and another at 12:19 UTC (North). After having flown the ATR rectangle 1.5 times, HALO left the race track (around 12:38 UTC) and made an excursion to the East.

1. Crew

Raphaëla Vogel (Mission PI), Julien Delanoë (RASTA), Sandrine Bony (BASTA), Patrick Chazette (Lidar), Alfons Schwarzenboeck (Microphysics), Jansen Friedhelm (Picarro), Claude Lainard (SAFIRE Engineer), Thierry Perrin (SAFIRE Engineer), Jean-François Bourdinot (Pilot), Guillaume Seurat (Pilot)
Flight-level support on ground: Jessica Vial

2. Synoptic Situation

A ridge continues to dominate over the experimental area.

Mostly clear with fair weather cumulus: sugar pattern.

Light winds (5-10 kts) :

BCO: $V_s = 3$ m/s easterlies, LTS = 15.2 K, EIS = 3.9 K, PW = 33.4 mm

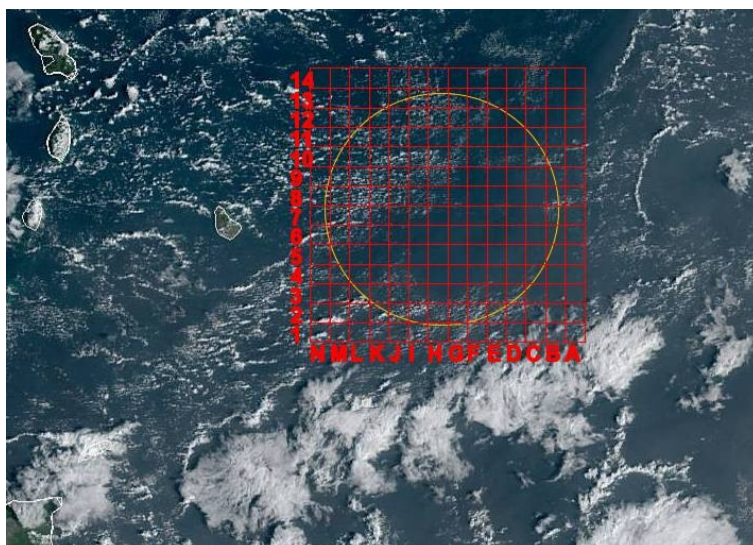
Meteor: $V_s = 8$ m/s easterlies, LTS = 16.3 K, EIS = 4.9 K, SST = 27.5 C, PW = 38.6 mm.

Observations from the flight:

South-Western part of circle largely cloud free. North West has scattered ShCu.

Getting less and less cloudy with time. Lots of dust in the subcloud layer in the Southern half of the race track.

NS gradient in LCL height (estimated from HALO): 680m in Southern half, 760m at North



Target area superimposed on GOES satellite picture at 12:00 UTC. Courtesy Phil Rosenberg (Leeds).

3. Flight Elements

R: Rectangular (race track) pattern starting at Entry Point (Northward); L: L-shape pattern round trip (one leg along wind, one crosswind); EP: Entry Point race track (13.25N, 58.41W)

Flight B:	(°N, °W)	Flight Level (FL)	Time (UTC)	Notes
Takeoff	GAIA		11 :11	
Ferry	To EP	FL80	11:20-11:33	about 2.5 km.
R1		FL23	11:45-12:34	cloud base (740-750 m). ATR within the field of view of HALO
R2		FL22	12:34-13:20	cloud base (760 m)
R3		FL22	13 :20-14:08	cloud base (650-740 m)
L1		FL17	14:09-14:41	top subcl layer (520- 550 m)
L2		FL13	14:44-15:05	mid subcl layer (300 m)
Leg		FL02	15:08-15:14	Close to surface (60 m)
Ferry back	From EP	FL50	15:18-15:21	Upper level leg (1500 m)
Landing	GAIA		15:31	

4. Instrument Status

Radars: RASTA: no nadir antenna

BASTA: worked fine (good surface echo) but cloud droplets too small to be detected.

Lidar: Worked fine. A lot of dust and of depolarization in the subcloud layer and above. GPS ok.

Picarro: Worked fine.

Microphysics: CDP-2, 2DS and FCDP worked well. Small droplets (10-15 microns). See QL

Base:

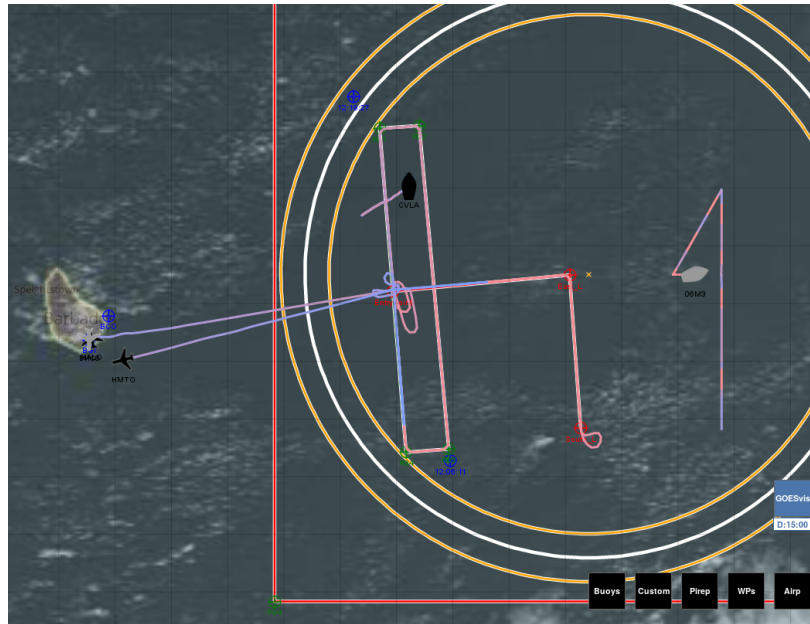
Acquisition rate still 50Hz instead of 100Hz normally.

No record of camera (because PC used for INS acquisition)

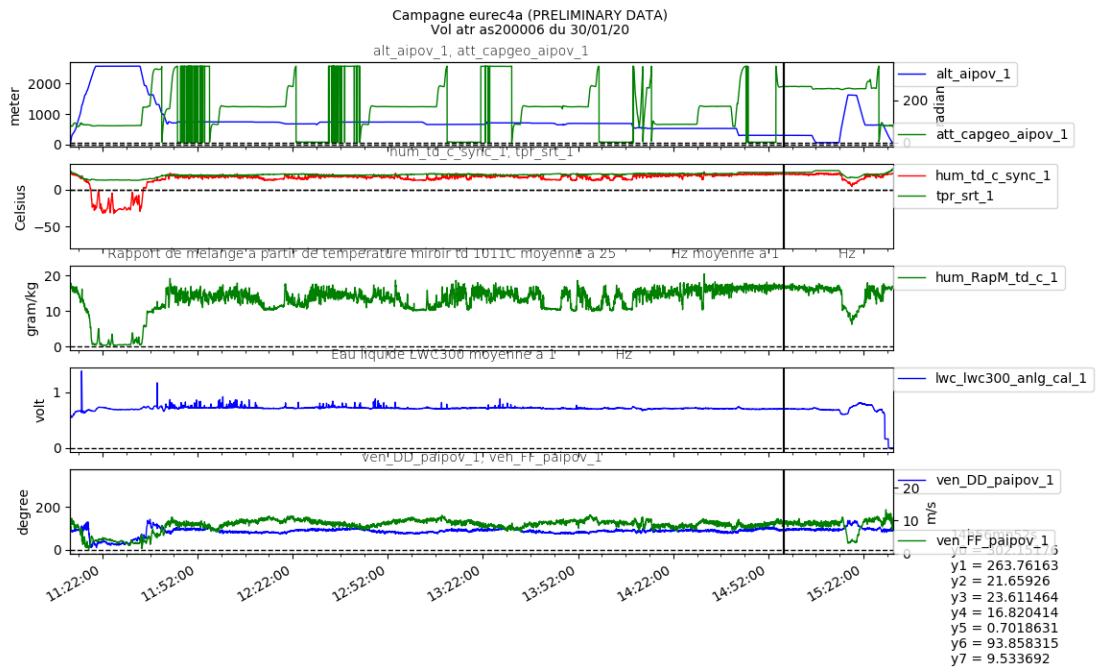
Fast water vapour: one KH20 sensor working

PVM, LWC-300, Aerosol, microphysics: OK except Nevzorov (LWC).

3. Figures



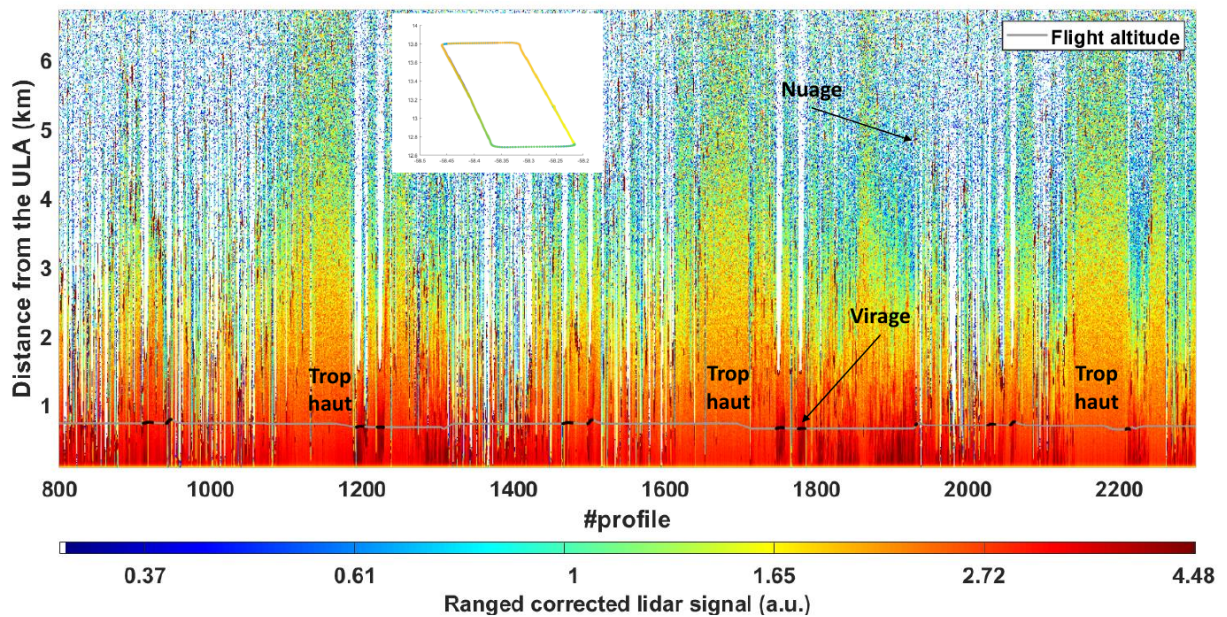
ATR trajectory.



Quick look of several time series (partially quality controlled): altitude of the flight (in blue), heading (in green), temperature and dew point temperature (green and red), water vapor mixing ratio, non calibrated liquid water path from the LWC300 instrument, direction (in blue) and strength (in green) of the wind at the level of the aircraft. *Courtesy Jean-Claude Etienne.*



Quick look of microphysical measurements: Time evolution of (Top) cloud droplet number concentration [cm^{-3}], (middle) cloud droplet sizes [microns] and (bottom) liquid water path [g/m^3].
Courtesy Alfons Schwarzenboeck.



Quick look of time series of horizontal lidar measurements (backscatter signal). Vertical axis is the horizontal distance from the aircraft (in km).
Courtesy Patrick Chazette.