

## ATR-0128 (28 January 2020)

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Draft, 29 January 2020

### 1. Objective

The objective of this flight is to characterize the cloud and boundary layer properties within the HALO circle, focusing on the cloud base level and the subcloud-layer.

Owing to problems with the positioning system of the instruments on board the aircraft, the first flight of today (Flight A) had to be cancelled. The second flight (Flight B) took place, slightly delayed compared to nominal plan, and with a degraded INS (50Hz instead of 100Hz).

### 1. Crew

**Flight A (15 – 19 UTC): cancelled**

**Flight B (20:30 – 01:00 UTC):**

Marie Lothon (Mission PI), Julien Delanoë (RASTA and BASTA), Christophe Le Gac (RASTA and BASTA, Engineer), Patrick Chazette (Lidar), Christophe Gourbeyre (Microphysics), Vincent Douet (Picarro), Frédéric Pouvesle (SAFIRE Engineer), Thierry Perrin (SAFIRE Engineer), Jean-François Bourdinot (Pilot), Guillaume Seurat (Pilot)

Flight-level support on ground: Raphaëla Vogel

### 2. Synoptic Situation

Sugar clouds. Light winds (5-10 kts)

Meteor:  $V_s = 4$  m/s, LTS = 14.4 K, EIS = 3.4 K, SST = 27.4 C, PW = 26.3 mm.

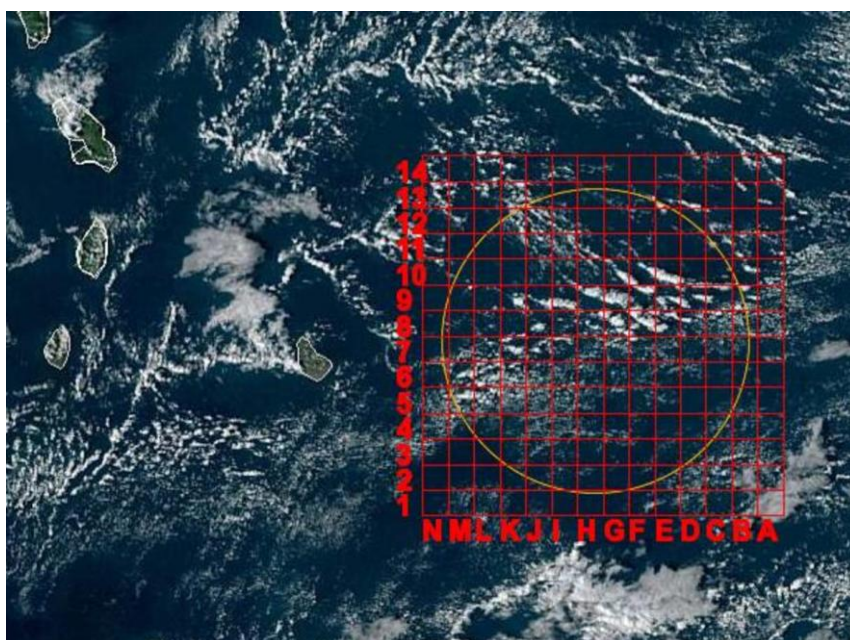
Observations from the flight:

Sugar pattern. Small clouds and cloudiness. Getting smaller as the flight is progressing into the night.

Cloud base around 600 m Highest cloud top around 1400 m (2300m along the ferry to Entry Point)

Very weak turbulence. Intermittently less weak, in some clouds and in mid-subcloud layer.

Close-to-saturated subcloud layer, and extremely dry upper layer (1-3%).



Target area superimposed on GOES satellite picture at 20:30 UTC. Image credit from 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		20:35	
Ferry	To EP	FL80	20:44-21:00	about 2.5 km.
R1		FL22	21:04-21:51	cloud base (670 m)
R2		FL22	21:51-22:37	cloud base (670 m)
R3		FL22	22:37-23:26	cloud base (680 m)
L1		FL15	23:30-23:54	top subcl layer (450 m)
L2		FL13	23:57-00:19	mid subcl layer (300 m)
Ferry back	From EP	FL60	00:22-00:29	Upper level leg ()
	id	FL100	00:32-00:39	Upper level leg ()
Landing	GAIA		00:50	

### 4. Instrument Status

**Radars:** RASTA nadir did not work (no surface echo). Cloud layer too thin (geometrically and optically) to be observed by RASTA.

BASTA is working with the new frequency – no pollution from RASTA anymore

**Lidar:** Worked fine. GPS now working too.

**Picarro:** The instrument was switched on shortly before take off. Therefore, owing to the warming phase, the first measurements started about an hour after take off. But then the measurements were nice (a quick-look is presented below).

**Microphysics:** CDP-2, 2DS and FCDP worked well.

#### Base:

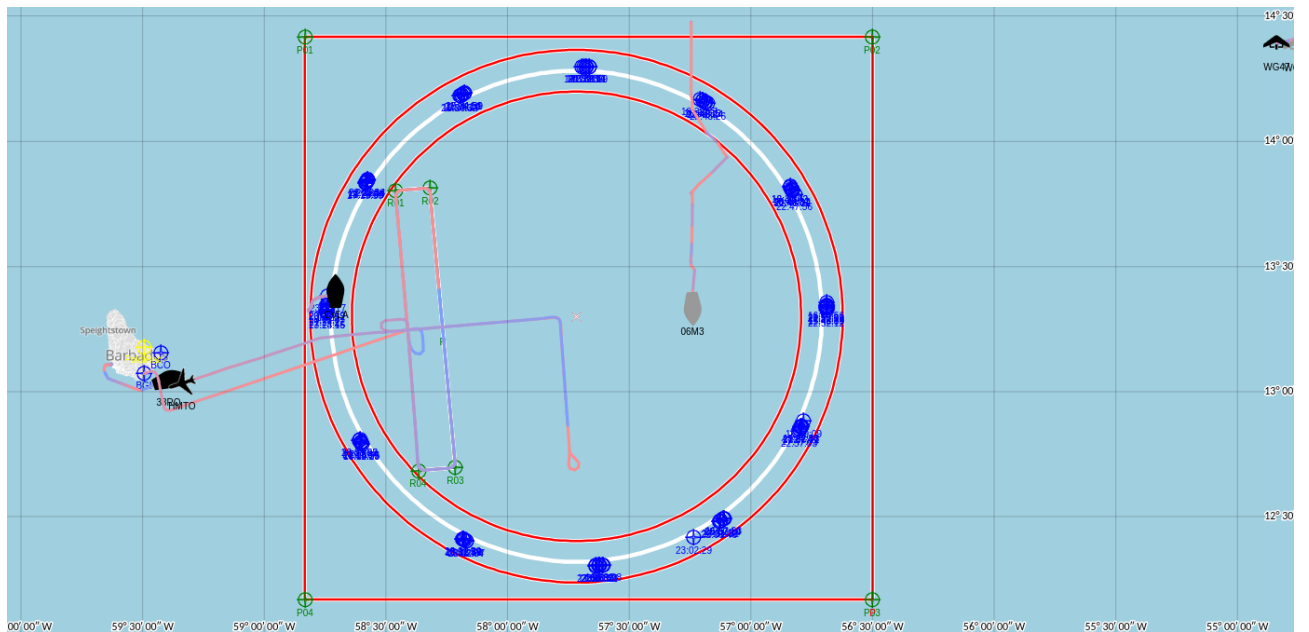
Problems on INS temporarily solved by using the aircraft INS. But the acquisition rate is 50Hz instead of 100Hz normally.

Fast water vapour: KH20-A combined with KH20-B amplifier seemed to work OK. To be confirmed. KH20-B in repair at ground. Licor quite noisy.

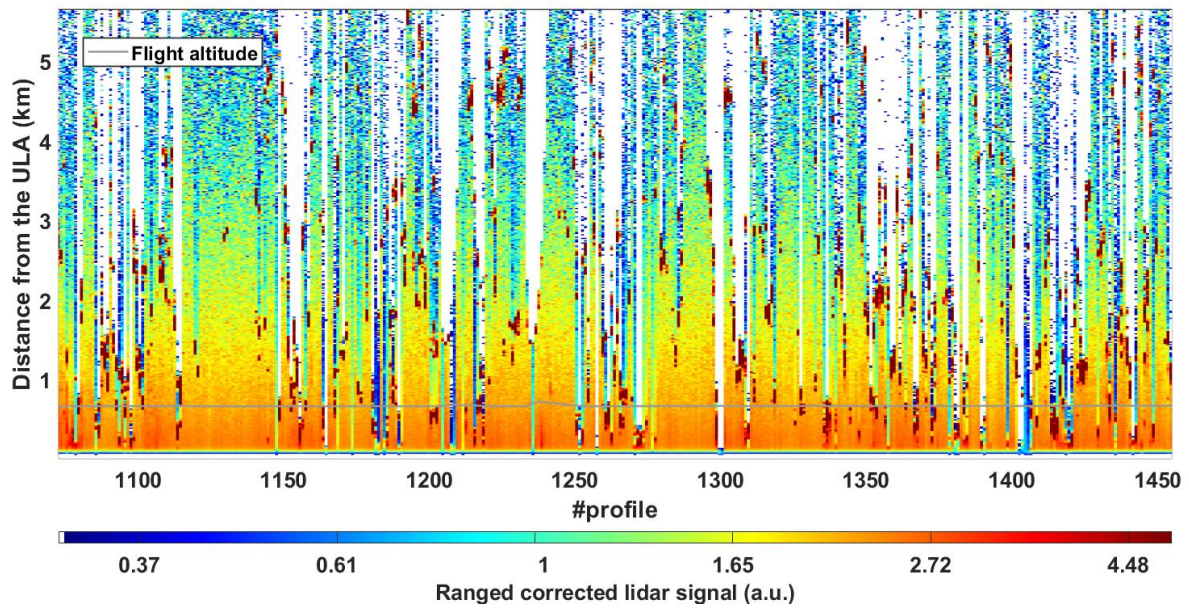
Wind and temperature: Temperature OK. Wind undisplayed due to INS issue. Specific post-processing will be needed to recover the high rate measurements of the wind.

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

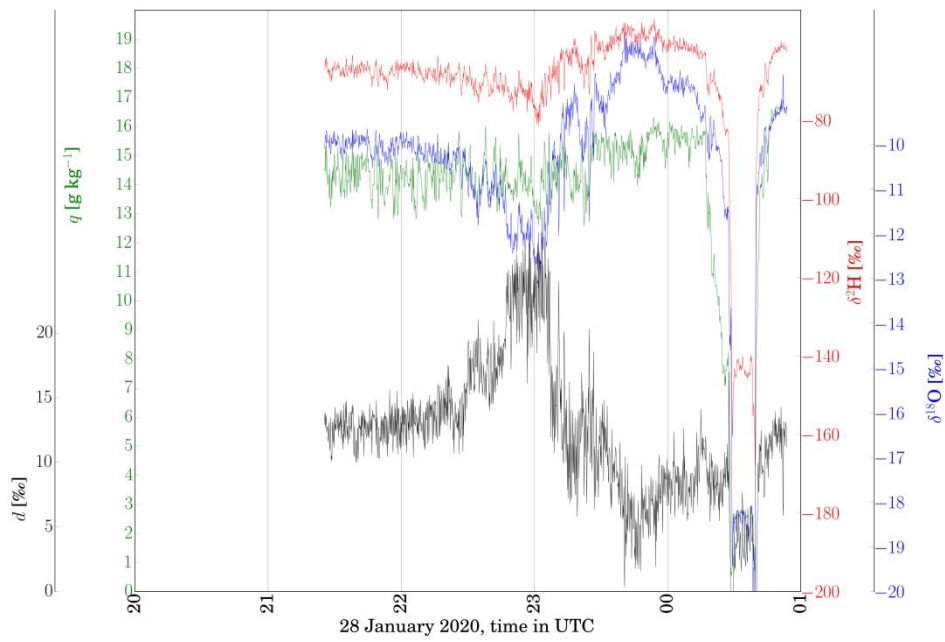
### 3. Figures



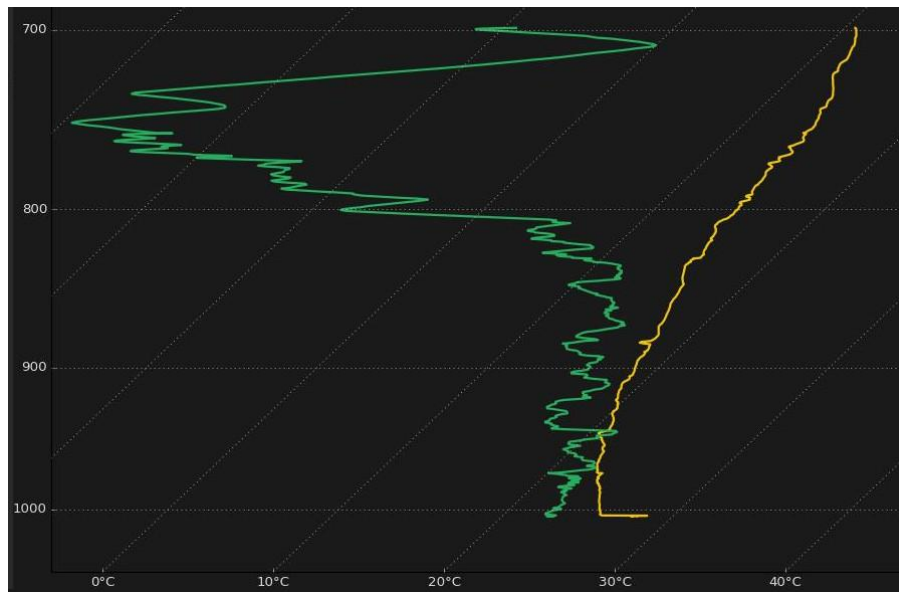
Flight B: HALO circle and ATR trajectory. INS issue temporarily fixed.



Times series of backscatter signal derived from the horizontally-looking lidar (Alias) obtained during the race track patterns flown at cloud base (vertical axis represents the distance from the aircraft, horizontal axis is a time series). Multiple thin shallow clouds associated with the Sugar pattern were detected from the lidar. Courtesy Patrick Chazette (LSCE).



*Times series of water vapor mixing ratio,  $\delta^{18}\text{O}$ ,  $\delta^2\text{H}$  and deuterium excess (expressed in permil) measured from the Picarro instrument during the flight (preliminary data). Courtesy Franziska Aemisegger (ETH Zurich).*



*Sounding from subcloud layer legs up to ferry leg back home*