

## **ATR-0126 (26 January 2020)**

*Sandrine Bony, Julien Delanoë, Marie Lothon*

*Draft, 26 January 2020*

### **1. Objective**

This was the first pair of Research Flights coordinated with HALO, Twin-Otter and Boreal. The goal is to probe the cloud amount and boundary layer properties into the HALO circle, together with the other aircraft in a complementary way.

### **1. Crew**

#### **Flight A (12 – 16 UTC):**

Marie Lothon (Mission PI), Christophe Legac (RASTA and BASTA, Engineer), Christophe Caudoux (RASTA and BASTA, Engineer), Patrick Chazette (Lidar), Christophe Gourbeyre (Microphysics), Franziska Aemisegger (Picarro), Thierry Perrin (SAFIRE Engineer), Claude Lainard (SAFIRE Engineer), Jean-François Bourdinot (Pilot), Guillaume Seurat (Pilot)

#### **Flight B (17 – 21 UTC):**

Sandrine Bony (Mission PI), Julien Delanoë (RASTA and BASTA PI), Christophe Caudoux (RASTA and BASTA, Engineer), Alexandre Baron (Lidar), Alfons Schwarzenboeck (Microphysics), Marina Dütsch (Picarro), Frédéric Pouvesle (SAFIRE Engineer), Julien Lernould (SAFIRE Engineer), Jean-François Bourdinot (Pilot), Guillaume Seurat (Pilot)

Flight-level support on ground: Raphaela Vogel and Jessica Vial

### **2. Synoptic Situation**

Clouds west and south of Barbados, remaining from the previous fish pattern, with a trough just East of the area. Dry air advection in mid and upper levels. Slack pressure gradient, inducing weak wind regime (Meteor:  $V_s=3-4$  m/s,  $LTS=15.7K$ ,  $EIS=3.3K$ ,  $SST=27.39C$ ,  $PW=34.7mm$ ).

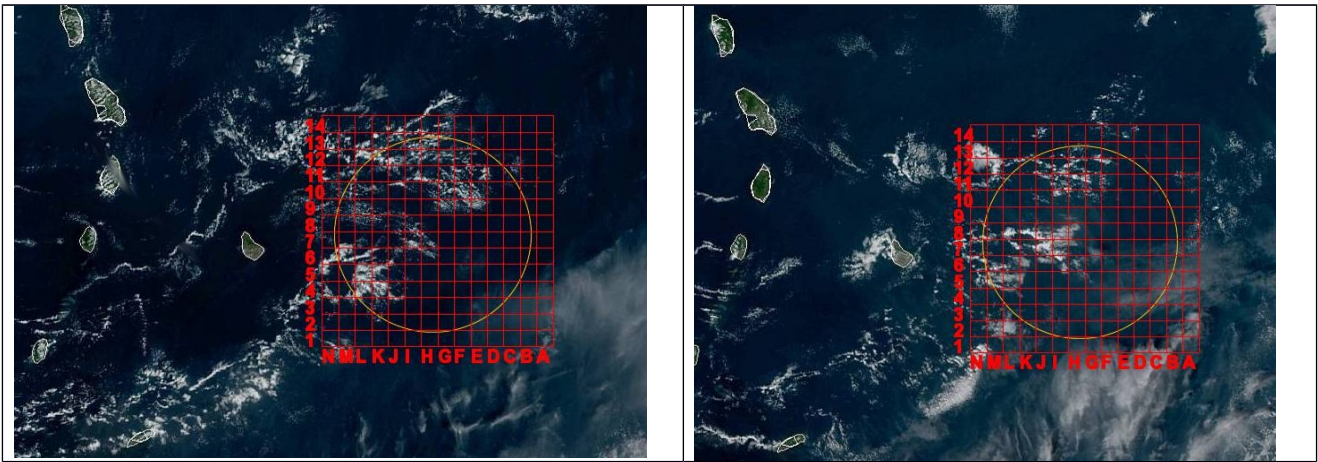
Observations from the flights:

Sugar pattern, with small cloudiness. Areas of clear air or with only scarce and very thin Cu, especially in the middle part of the rectangle, and in the SE part of the L pattern. More clouds in the northern and southern ends of rectangle. ALIAS caught small Cu, while the BASTA and RASTA caught well the bigger clouds of the northern and southern ends of rectangle. Some stratiform layers and scattered rain were observed during the 2<sup>nd</sup> flight.

LCL around 760m (930hPa)

Cloud base at 700-800 m

Highest cloud top around 2500 m



Target area superimposed on GOES satellite picture at 14:10UTC (left), and 19:00UTC (right). *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 A:	(°N, °W)	Flight Level (FL)	Time (UTC)	Notes
Takeoff	GAIA		11 :59	
Ferry	To EP	FL80	12:08-12:20	
R1		FL24	12:34-13:07	cloud base (800m)
R2		FL24	13:07-13:42	cloud base (800m)
L1		FL20	14:00-14:23	top subclد layer (580m)
L2		FL13	14:26-14:47	mid subclد layer (400m)
L3		FL02	14:50-15:27	surface leg (60m)
Ferry back	4 directions	FL150	15 :39-15 :58	ascent to 2500m and BCO overflight
Landing			16:04	

Flight B:	(°N, °W)	Flight Level (FL)	Time (UTC)	Notes
Takeoff	GAIA		16:57	
Ferry	To EP	FL80	17:05-17:17	about 2.5 km.
R1		FL26	17:21-18:07	cloud base (830 m)
R2		FL26	18:07-18:53	cloud base (812 m)
R3		FL26	18:53-19:40	cloud base (810 m)
L1		FL20	19:43-20:10	top subclد layer (600 m)
L2		FL13	20:13-20:38	mid subclد layer (400 m)
L3		FL02	20:45-20:52	Surface leg (60 m)
Ferry back		FL50	21:04-21:17	
Landing			21:26	

#### 4. Instrument Status

**Radars:** RASTA nadir did not work. Transverse beam still not working.

Upward trailing and vertical beam work well.

BASTA: Works fine. Signal up to 10km but not sensible enough to see the thinnest shallow clouds. Some noise from RASTA's interference, reduced in afternoon flight with a slight change of emission frequency.

**Lidar:** GPS still not always working appropriately. But otherwise works fine.

**Picarro:** Worked well.

**Microphysics:** 2DS and CDP worked well.

**Base:**

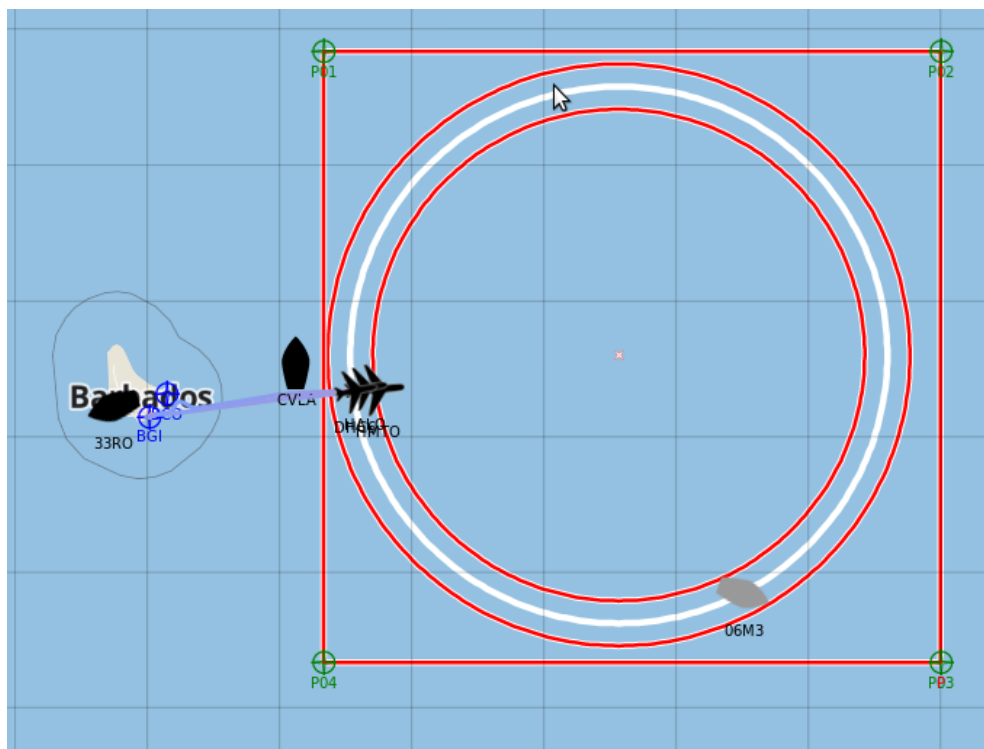
Problems on INS, which did not take account of GPS reference. Inferred drifting in INS positioning from about 12:10 to 15:05 in first flight. Will need post-processing.

Fast water vapour: The two KH20 sensors did not work in first flight. One of them improved at second flight. Licor OK.

Wind and temperature OK.

Microphysics OK, except Netzorov not working.

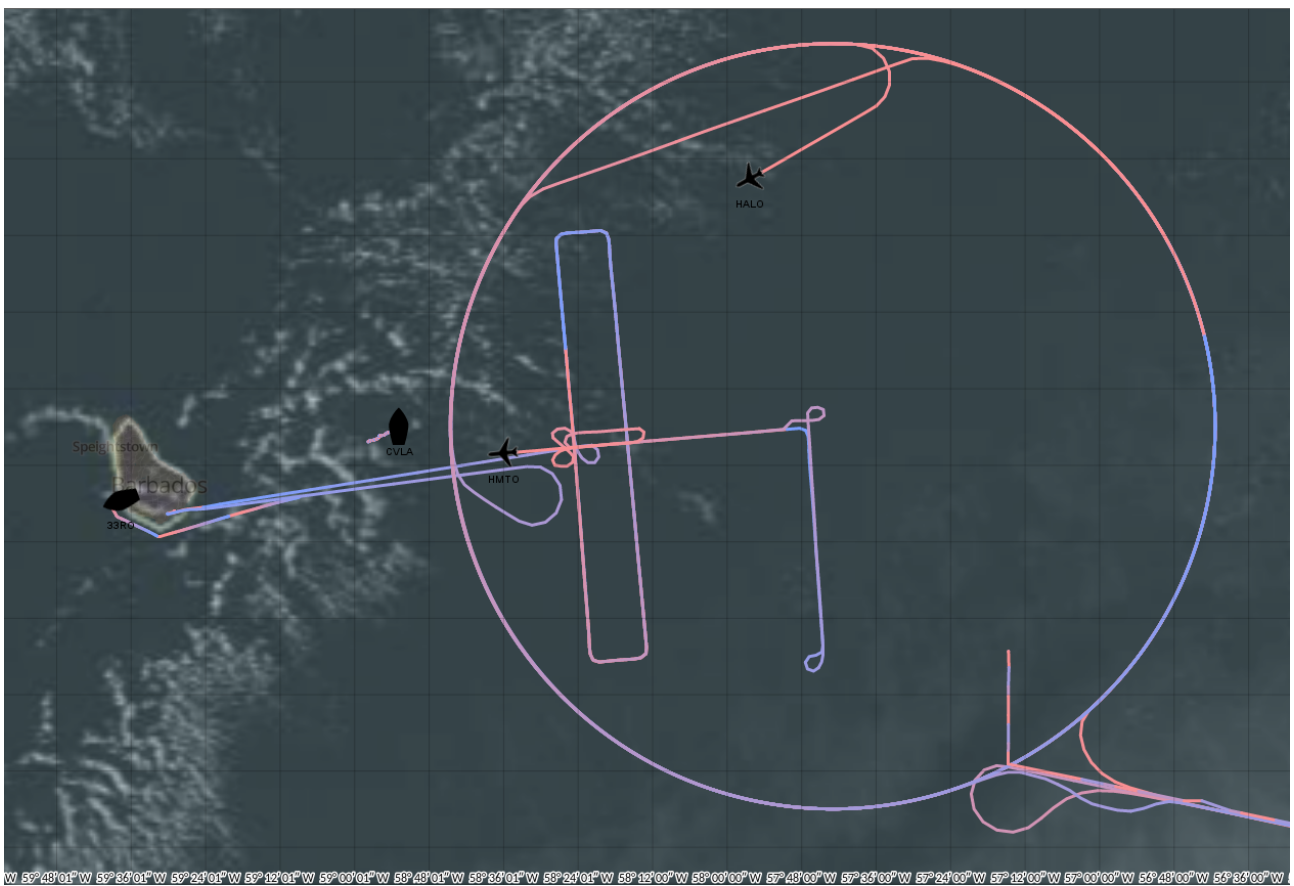
#### 3. Figures



*Flight A: "Supercurtain" pattern ongoing, with HALO, ATR and TO together on the same axis*

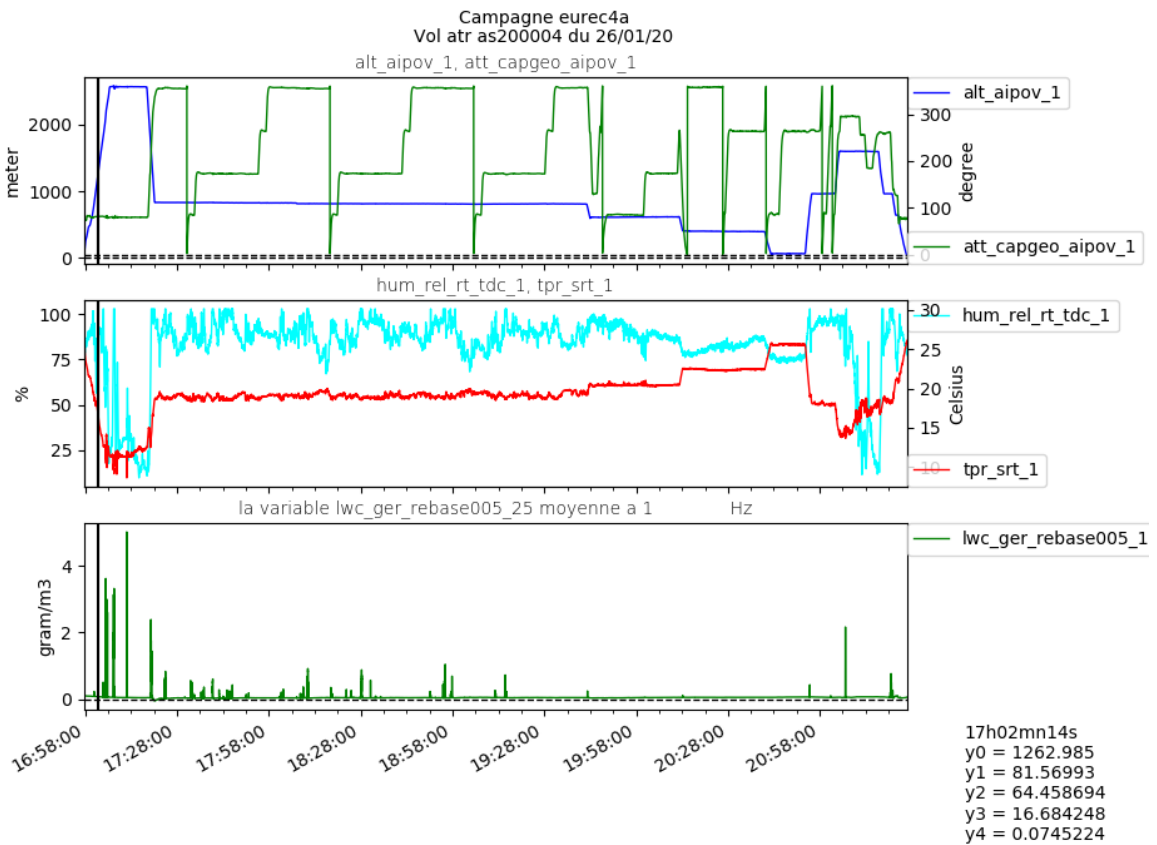
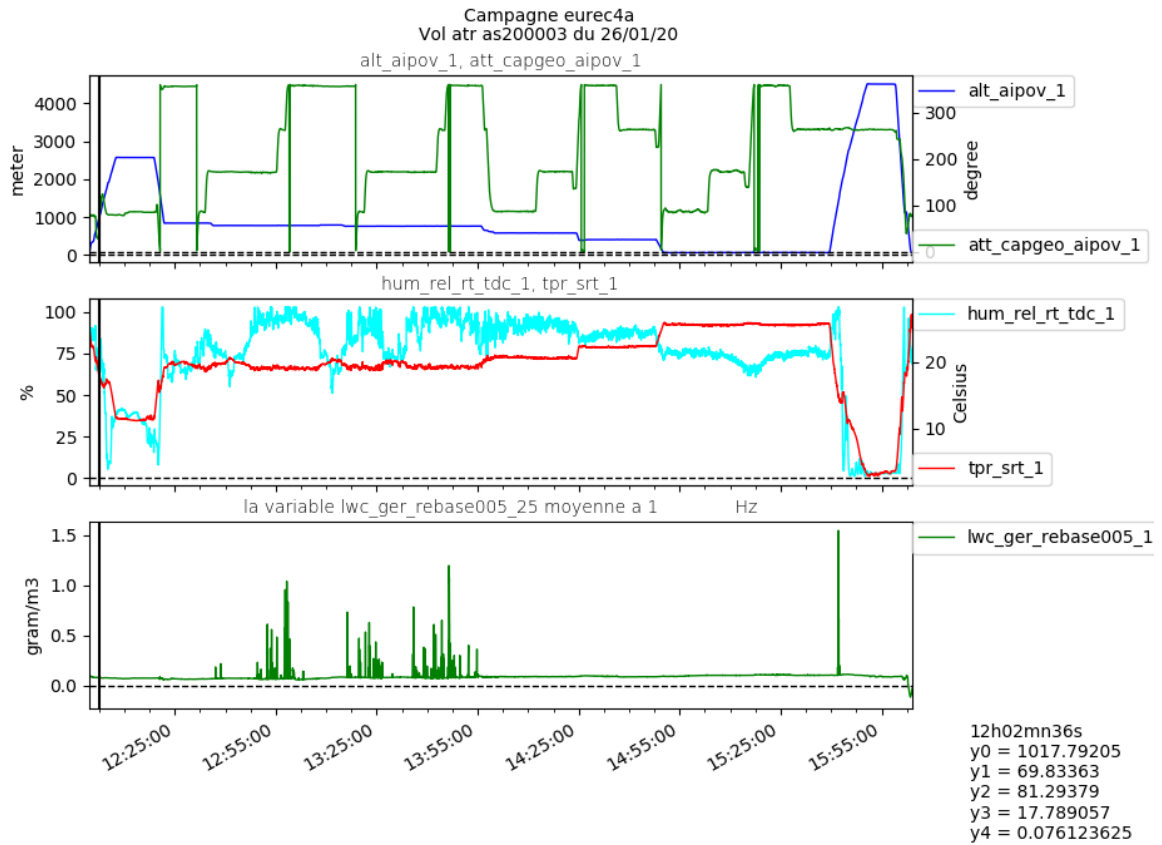


*Flight A: ATR (HMT0) trajectory. The shift in rectangles and L-patterns shows the INS problem on the ATR, that will have to be post-processed. The actual trajectory was sticking on the same tracks for both patterns.*



*Flight B: HAL0 circle and ATR trajectory. INS issue temporarily fixed.*

## 4. Time series



Flights A (top) and B (bottom): Times series of altitude (blue), heading (green), relative humidity (cyan), temperature (red) and LWC (dark green). *Courtesy Jean-Claude Etienne (TRAMM)*

#### 4. Pictures



Flight A:  
Snapshot taken at  
13:28 UTC during  
the 2<sup>nd</sup> race track  
(R2) at cloud base,  
showing very  
shallow Cu.



Flight B: Snapshots taken during the cloud base race tracks (upper row and lower left) and during the ferry back to Barbados (lower right).

From top left to lower right: 18:06 UTC (R1, looking Northward), 18:07 UTC (R1), 19:13 UTC (R3, looking Southward), 21:13 UTC (shortly before landing)