

ATR-0202 (02 February 2020)
Flight #9 and #10 – as200009 and as200010
Marie Lothon, Cyrille Flamant
Sandrine Bony, Jumien Delanoë

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. Take off was 30 min earlier, for HALO to fit to a GPM overpass (with a clover trajectory for part of its flight). TO flew SW of the ATR rectangle during [Flight #9, probing the NW corner of a flower. TO had to cancel its second flight.

2. Crew

Flight A (7:30 – 11:30 UTC):

Marie Lothon (Mission PI), Christophe Caudoux (RASTA and BASTA), Christophe Le Gac (RASTA and BASTA, Engineer), Julien Totems (Lidar), Alfons Schwarzenboeck (Microphysics), Leonie Villiger (Picarro), Hubert Bellec (SAFIRE Engineer), Gilles Vergez (SAFIRE Engineer), Dominique Duchanoy (Pilot), Guillaume Seurat (Pilot)

Flight-level support on ground: Jessica Vial, Nicolas Rochetin, Sandrine Bony

Flight B (12:30 – 16:30 UTC):

Cyrille Flamant (Mission PI, Lidar), Julien Delanoë (RASTA and BASTA), Ms Young (visitor CIMH), Mr Reyes (visitor CIMH), Pierre Coutris (Microphysique), Pierre-Etienne Brilouet (Turbulence), Michel Cluzeau (SAFIRE Engineer), Tetyana Jiang (SAFIRE Engineer), Dominique Duchanoy (Pilot), Guillaume Seurat (Pilot)

Flight-level support on ground: Raphaëla Vogel, Nicolas Rochetin, Sandrine Bony

3. Synoptic Situation

Ridge in place over area with patches of clouds and few brisk showers from the east and southeast. Flower patterns over the area. Winds are light. Dust haze persists.

A flower is located SE of the rectangle during the first flight.

The dust layer is observed up to 2500 m. It induced small visibility and fuzzy (and rare) cloud base.

Observed CBH between 745 m to 810 m during first flight, with a North-South gradient of CBH (750 m in southern part, 810 m in northern part).

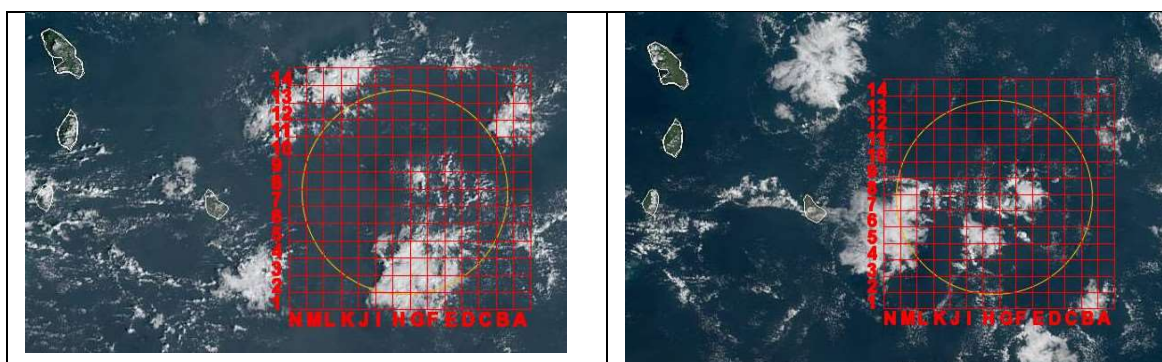
It was almost cloud-free in the northern part of rectangle. Only rare and tiny and thin cumulus clouds were seen, and generally (but not always) caught by the ALIAS lidar.

A few clouds at the northern tip of the rectangle. Part of the flower clouds were present and sampled in the southern part.

After the two subcloud layer L, that were done from bottom to the top, an extra L pattern was flown into the flower, SE of the rectangle. Rain and turbulence were encountered below and within the flower inflow. The final leg into the flower has been flown at 3500 ft. This leg should be used for intercomparison of microphysical properties between TO and ATR-42, knowing that TO sampled this flower at the same altitude some 20 minutes before the ATR-42. On this leg in the lower part of the flower 300-370 droplets / cm³ and 0.4-0.5 g/m³ were measured.

During the second flight (Flight #10), the ATR flew in the remains of a flower that was located in the southern half of the rectangle. The decision was made to start the rectangle heading south (past the EP) in order to fly at the CBH in the flower that was slowly vanishing. Turned out to be a good strategy for the flower then advected west of the rectangle and was not sampled again. During the 2nd rectangle, an arcus was seen to emanate from the flower located to the west of the track, which intersected the ATR track along the western leg in the northern part of the rectangle. A smaller flower advected from the east was then sampled at CBH and below during the 3rd rectangle and the first L, respectively. During the return along the L at lower levels, the flower had almost vanished.

Hazy conditions were encountered during Flight #9, the ALIAS lidar showing high depolarization value up to ~2 km AMSL. This was confirmed by AERONET measurements in Ragged Point (Aerosol Optical Thickness of 0.4). Upon landing, the ATR crossed an aerosol plume (black carbon) from a fire.



*Target area superimposed on GOES satellite picture at 12:40 UTC and 18:10 UTC.
The flower in the southern part of the circle at 12:40
has moved to the West at 18:10, on the eastern side of the circle.
Image credit from Phil Rosenberg (Leeds).*

3. Flight Elements

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

Flight #9:	(°N, °W)	Flight Level (FL)	Time (UTC)	Notes
Takeoff	GAIA		11:39	
Ferry	To EP	FL80	11:39-12:00	2500m
R1		2270-2600 ft	12:05-12:53**	cloud base (600 m)
R2		2400-2600 ft	12:58-13:40	cloud base (600 m)
L1		1000	13:45-14:07	mid subclد layer (300 m)
L2		1800-200 ft	14:12-14:24	top subclد layer (600 m)
L3-WE axis		2000 ft	14:29-14:49*	top subclد layer (600m)
L3-NS axis		3500 ft	14:50-14:59	Flower inflow
EW leg		3500 ft	15:00-15:10	Flower inflow

Flight #9:	(°N, °W)	Flight Level (FL)	Time (UTC)	Notes
Ferry back	From EP	FL100	15:15-15:26	Upper level leg (3000m)
Landing	GAIA		15 :39	

Flight #10:	(°N, °W)	Flight Level (FL)	Time (UTC)	Notes
Takeoff	GAIA		16:44	
Ferry	To EP	FL80 FL100	16:53-17:04 17:06-17:08	
R1		2340-2550 ft	17:14-18:02	Cloud base
R2		2460 ft	18:03-18:49	Cloud base
R3		2460 ft	18:49-19:36	Cloud base
L1		1920 ft	19:43-20:05	
L2		980 ft	20:08-20:30	
Leg	To EP	220 ft	20:33-20:42	Close-to-surface
Ferry back	From EP	FL100	20:49-20:56	
Landing	GAIA		21:03	

A detailed report of the start time and ending time of all legs is accessible on EUREC4A AERIS website (EUREC4A Operational Center, <https://observations.ipsl.fr/aeris/eurec4a/#/>)

4. Instrument Status

Radars: RASTA did not work as well as expected.
BASTA worked fine.

Lidar: Worked fine.

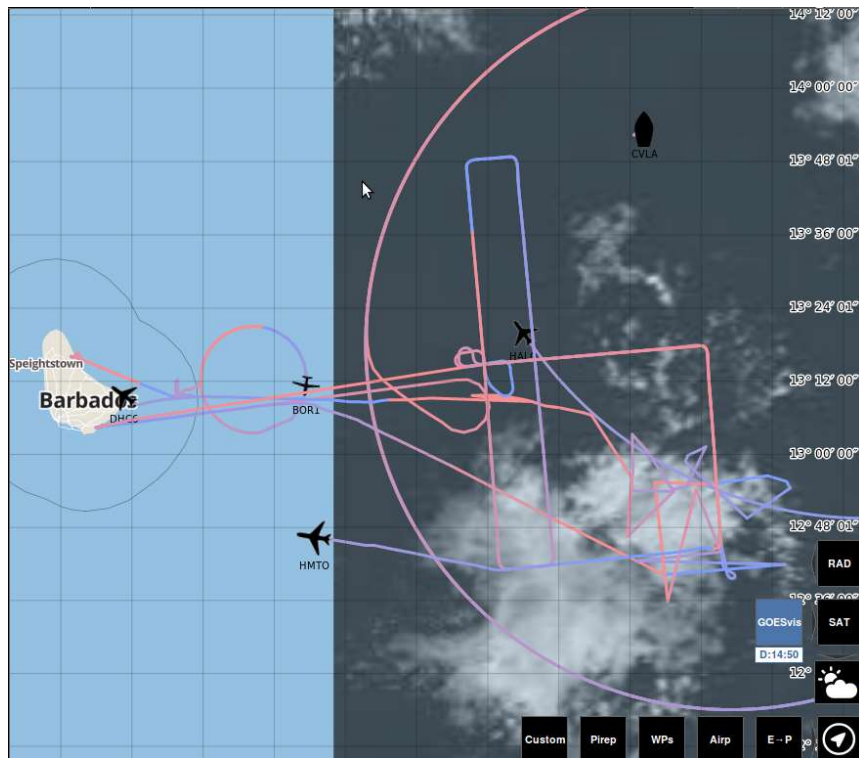
Picarro: Worked fine.

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

Base:

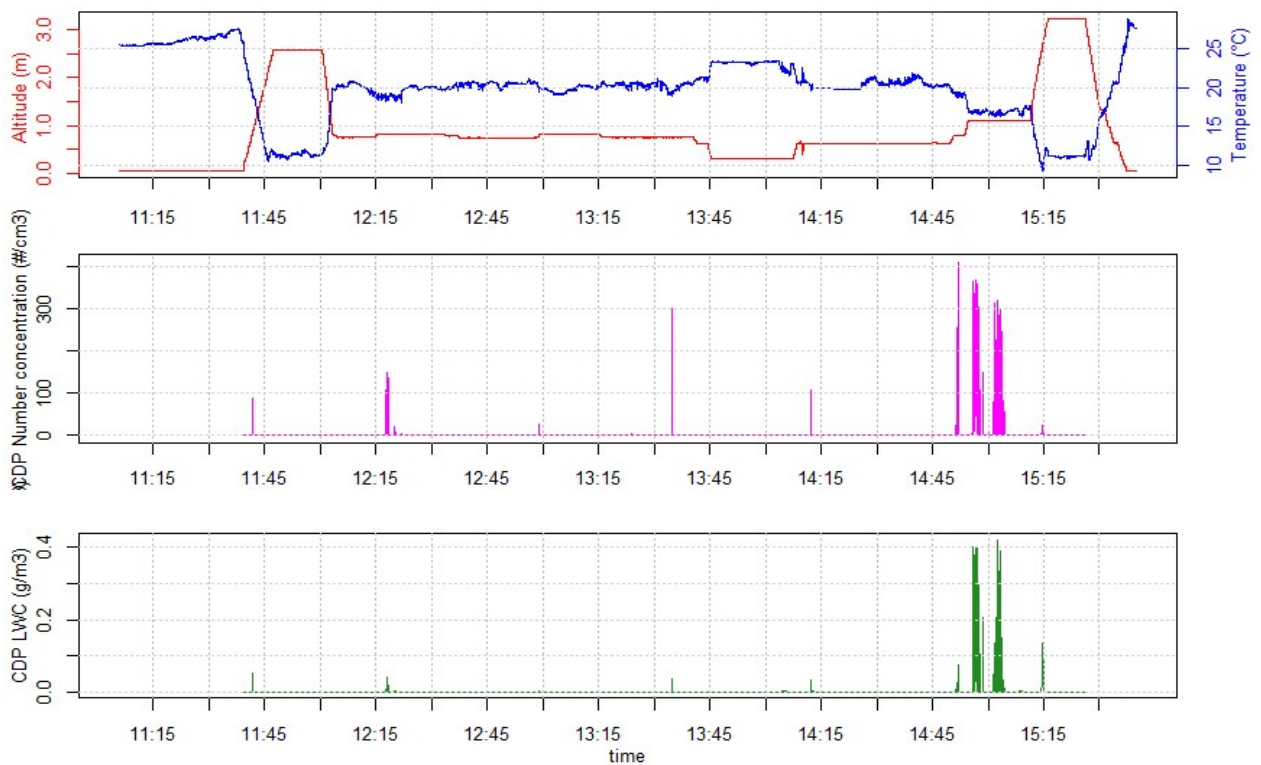
INS degraded to 50Hz instead of 100Hz normally.
Fast wind, water vapour and temperature: OK. Uncertainties on fast wv.
PVM, LWC-300, Aerosol, microphysics: OK except Nevzorov (LWC).
Uncalibrated LWV Gerber and LWC300

Figures

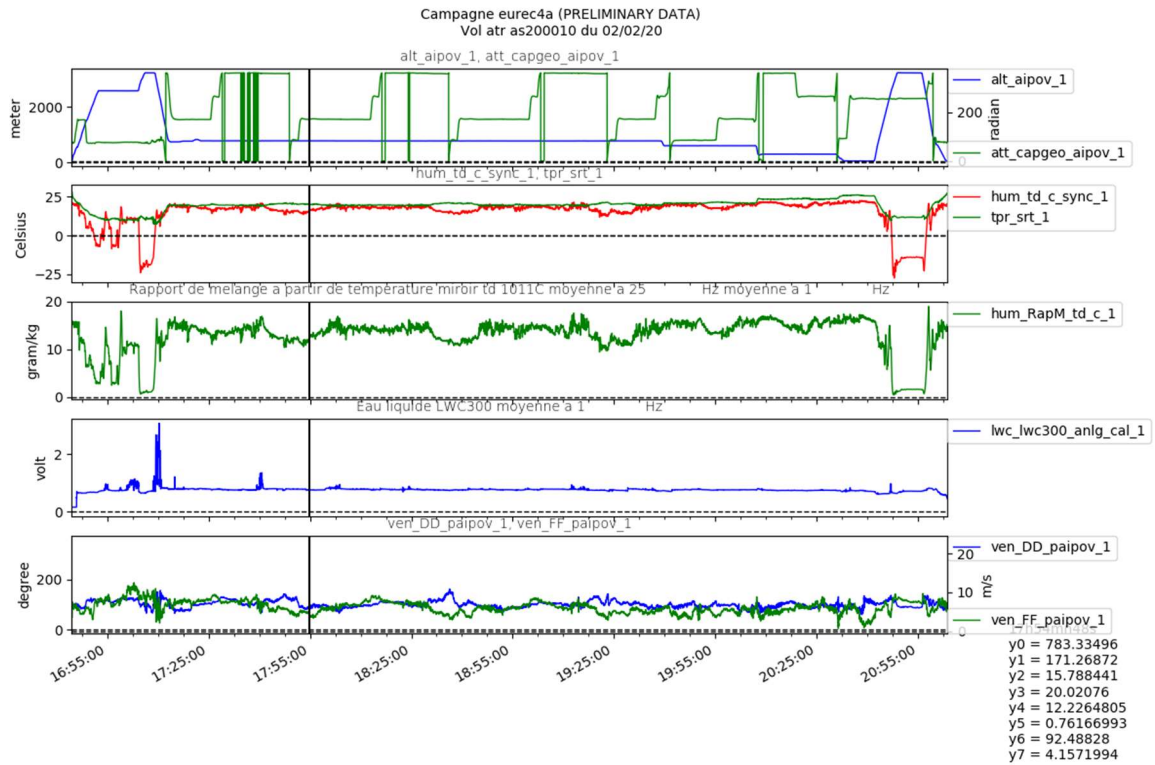


Trajectory at the end of first flight (with superimposed TO flower exploration, Bore and HALO circle)

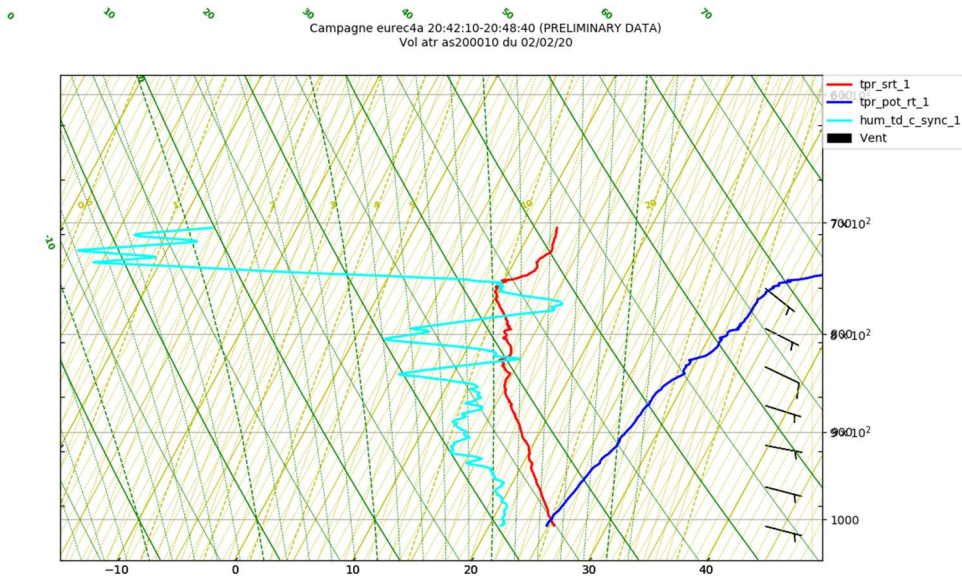
Flight 9 - 2020-02-02 - LaMP Preliminary quicklook



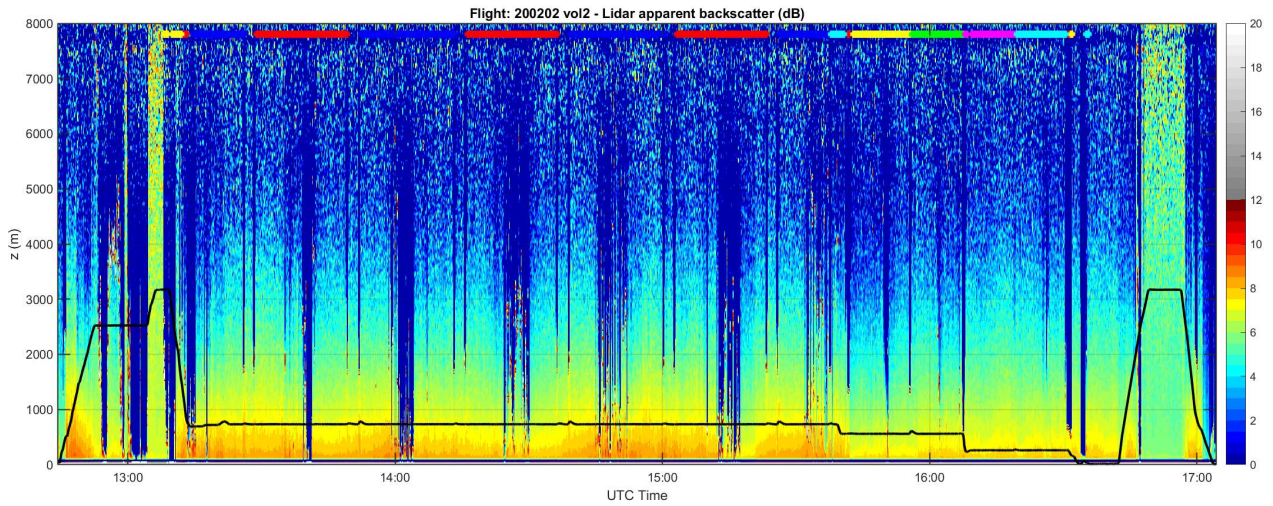
Time series of altitude, T, LWC, and droplet concentration during flight #9.



Time series during second flight of (1) altitude (blue) and heading (green), (2) Dew point temperature (red) and temperature (green), (3) water vapour mixing ratio, (4) liquid water content (uncalibrated), (4) horizontal wind speed (green) and direction (blue).
Caution: those are preliminary unvalidated data.



Skew-T diagramme during alinear ascent of second flight from the circle area to the ferry leg back



Along line of sight ALIAS backscatter signal during Flight #10. The black line at the bottom of the plot is the altitude. The color code at the top of the plot indicates the rectangle pattern (blue=aircraft heading southward, red: aircraft heading northward) and the L-pattern (yellow= aircraft heading eastward, green = aircraft heading southward, magenta= aircraft heading northward, light blue= aircraft heading westward).

4. Pictures



Above the dust layer on ferry flight 11:53



At 'cloud' base 12 :05, very fuzzy hazy layer