

ATR-0209 (09 February 2020)
Flight #15 and #16 – as200015 and as200016
Cyrille Flamant, Pierre-Etienne Brilouet
Sandrine Bony, Julien Delanoë, Alfons Schwarzenboeck
09 February 2020

1. Objective

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

HALO, TO, P3, Boreal and RSS-A2 flew this day.

During the second flight, the RSS-A2 aircraft flew a coordinated pattern with the ATR to map the clouds over a swath of ~5 km to the right of the ATR, using their IR/VIS/SWIR cameras. The objective was to map from above the cloud field sampled by the sideways radar BASTA and lidar ALIAS. RSS-A2 flew at FL120, 2.5 km to the right of the ATR which flew at CBH.

2. Crew

Flight A (8:37 – 13:08 UTC):

Cyrille Flamant (Mission PI, Lidar), Julien Delanoë (RASTA), Marius Lena (BASTA), Alfons Schwarzenboeck (Microphysics), Franziska Aemisegger (Picarro), Julian Furtina (turbulence), Hubert Bellec (SAFIRE Engineer), Gille Vergez (SAFIRE Engineer), Dominique Duchanoy (Pilot), Christophe Lendroit (Pilot), Kevin Salaun (Mechanics)

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

Flight B (14:04 – 18:23 UTC):

Pierre-Etienne Brioulet (Mission PI, turbulence), Christophe Caudoux (RASTA), Nicole Alexander (BASTA), Julien Totems (Lidar), Pierre Coutris (Microphysique), Leonie Villiger (Picarro), Tetyana Jiang (SAFIRE Engineer), Michel Cluzeau (SAFIRE Engineer), Dominique Duchanoy (Pilot), Christian Lendroit (Pilot)

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

2. Synoptic Situation

A ridge dominates the observation area, with very strong pressure gradient and wind conditions. Gale Warning issued for the area. Isolated showers related to patchy clouds on the moist easterly winds. Cloud field moving from the west at about 12 m/s was of type sugar/gravel with a few occurrences of cold pools and stratiform layers from time to time. The CBL was around 800 m. During the two flights, the cloud fraction was larger than previous days. The clouds were generally more developed, sometimes reaching 7500 ft (observations from the TO pilot). During both flights, the ATR encountered very active cells and rain.

Flight #15

The ATR performed all of its 3 rectangles at CBH (820 m). The lidar sampled plenty of clouds on all 3. CBH was found to be steady at 820 m. The boundary layer appeared to be very hazy below the cloud base, suggesting that the aerosol load was higher than on previous days (mostly sea salts and likely not dust, as depolarization was low). The aircraft then descend to 600 and 300 m to perform the L-shape pattern (1st at 600 m). Convective cells were present in the NE corner of the L and were sampled 3 times with RASTA / BASTA and μ phys. The aircraft then descended to 60 m for 7 min along a leg perpendicular to the wind direction. In the end, the ATR performed a sounding to FL140. A dust layer was sampled above the clouds and just below the upper level inversion (below ~2700 m) which was characterized by enhanced lidar depolarisation and large aerosols as seen with the μ physics probes.

Flight#16

As the second flight was coordinated with RSS-A2 aircraft, the ATR performed 4 rectangles at the cloud base height (800 m). The conditions were very similar to the first flight with a well-defined cloud base. The sampling of the shallow cumulus field inside the rectangle might be qualitative for the statistics. Some well-developed cells with vertical extension up to 4 km (according to RSS-A2) were on the track but, unfortunately, we missed them. As for the first flight, the boundary layer appeared to be very hazy below the cloud base and according to the Lidar observations, the aerosol were mostly sea salts and likely not dust, as depolarization was low.

The RRS videos suggest that the geometry of observations of the cameras changed during the flights. The ATR was first captured on the RSS video at 1430 UTC (with a zoom on the aircraft at 1431 UTC). The ATR is not within the field of view of the RSS camera between 1510 and 1555 UTC. The ATR is last seen in the field of view of the camera at 1701 UTC.

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 #15:	(°N, °W)	Flight Level (FL)	Time (UTC)	Notes
Takeoff	GAIA		8:37	
Ferry	To EP	FL100	8:48-8:59	Reference for lidar and Picarro, sounding
R1		820 m	9:05-9:50	Cloud base
R2		820 m	9:50-10:38	Cloud base
R3		820 m	10:38-11:25	Cloud base
L1		620 m	11:28-11:51	Top subcld layer
L2		300 m	11:58-12:31	Mid subcld layer
Low level		200 ft	12:33-12:41	Turbulence
Ferry back	From EP	FL140	12:52-12:59	Reference for lidar and Picarro, sounding
Landing	GAIA		13:08	

Flight #16:	(°N, °W)	Flight Level (FL)	Time (UTC)	Notes
Takeoff	GAIA		14:03	
Ferry	To EP		14:06 - 14:27	Reference for lidar and Picarro, sounding
R1		800 m	14:31 - 15:18	Cloud base
R2		800 m	15:18 - 16:05	Cloud base
R3		800 m	16:05 - 16:53	Cloud base
R4		800 m	16:53 - 17:40	Cloud base
Leg	To EP	200 ft	17:46 - 17:53	Close-to-surface
Ferry back		FL140	18:04 - 18:11	Reference for lidar and

Flight #16:	(°N, °W)	Flight Level (FL)	Time (UTC)	Notes
				Picarro, sounding
Landing	GAIA		18:23	

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 now works well (and concentrated) on the vertical beam. No other beam.
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: OK.

Water vapour: some uncertainties on the KH20 after the calibration.

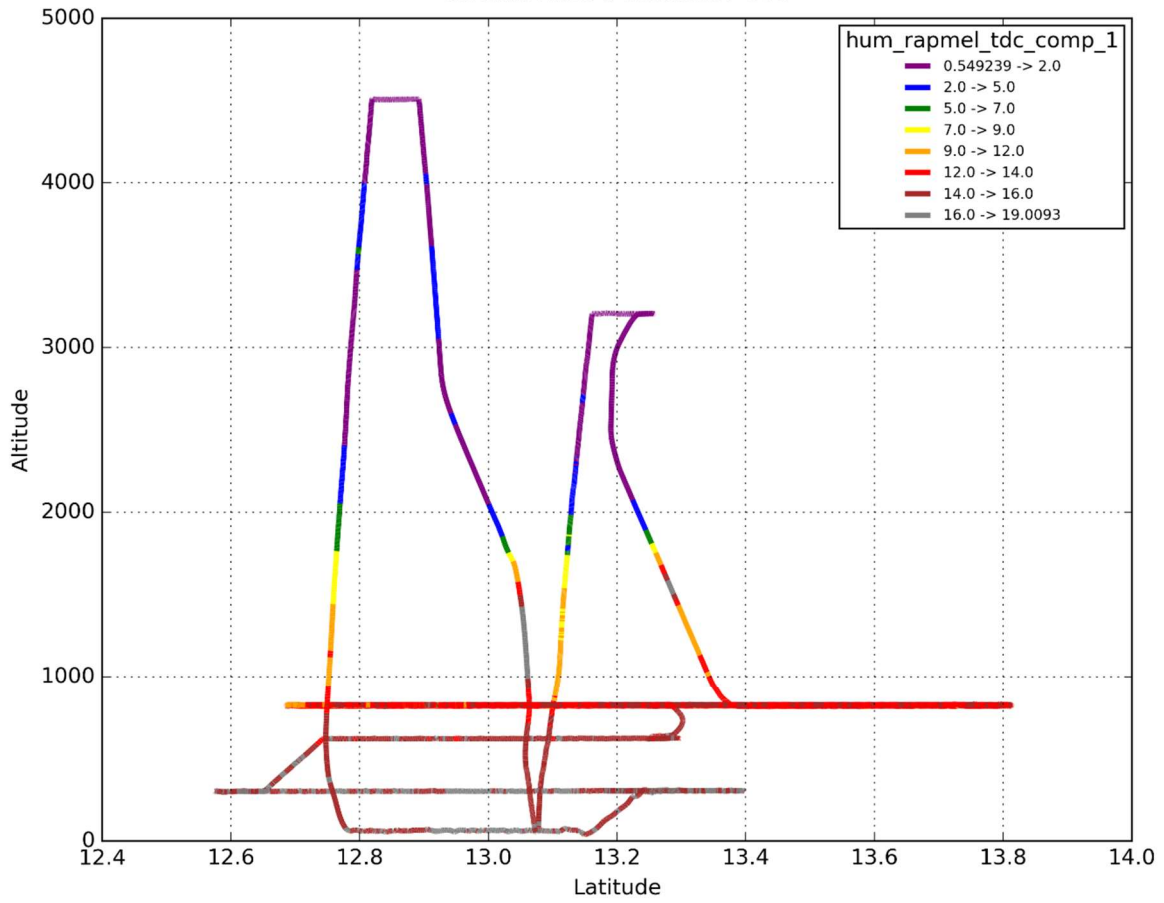
Temperature: OK.

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

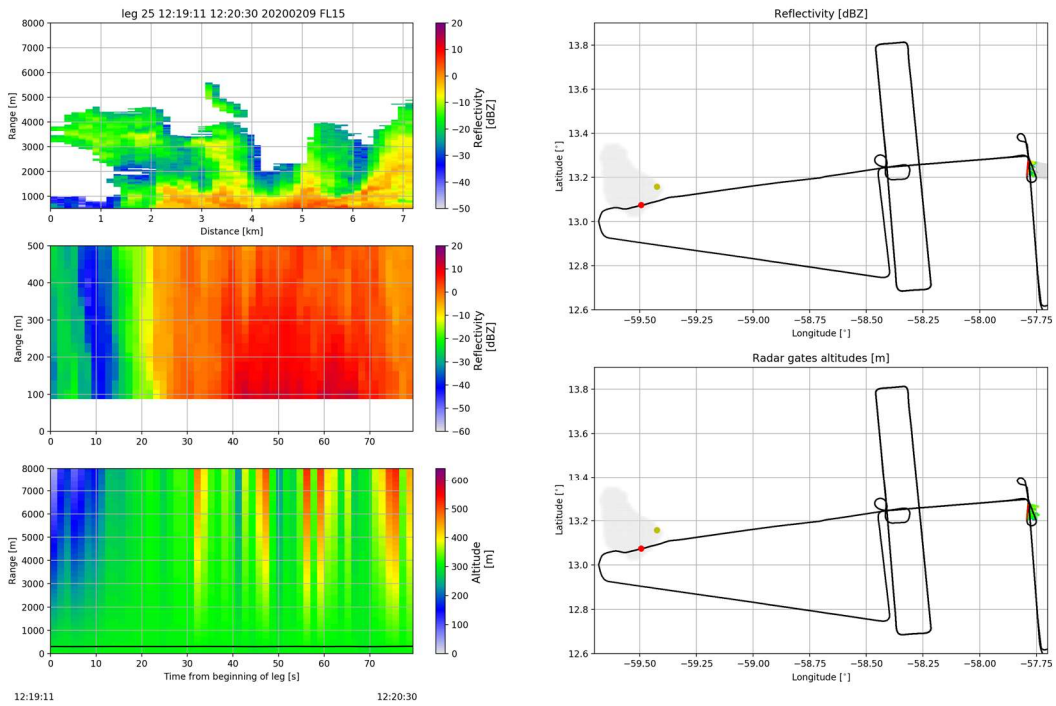
Uncalibrated LWV Gerber and LWC300

Figures

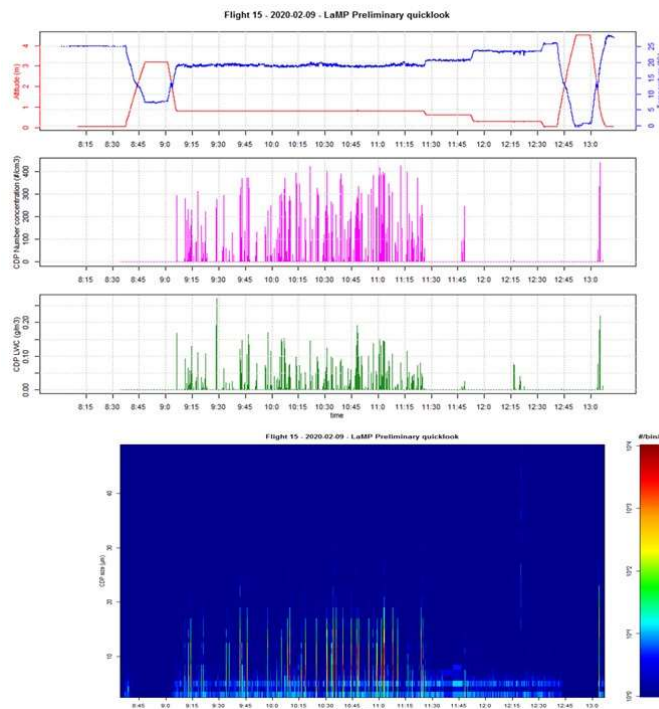
Campagne EUREC4A
Vol atr as200015 du 09/02/2020
de 08h37m20 a 13h08m37 UTC



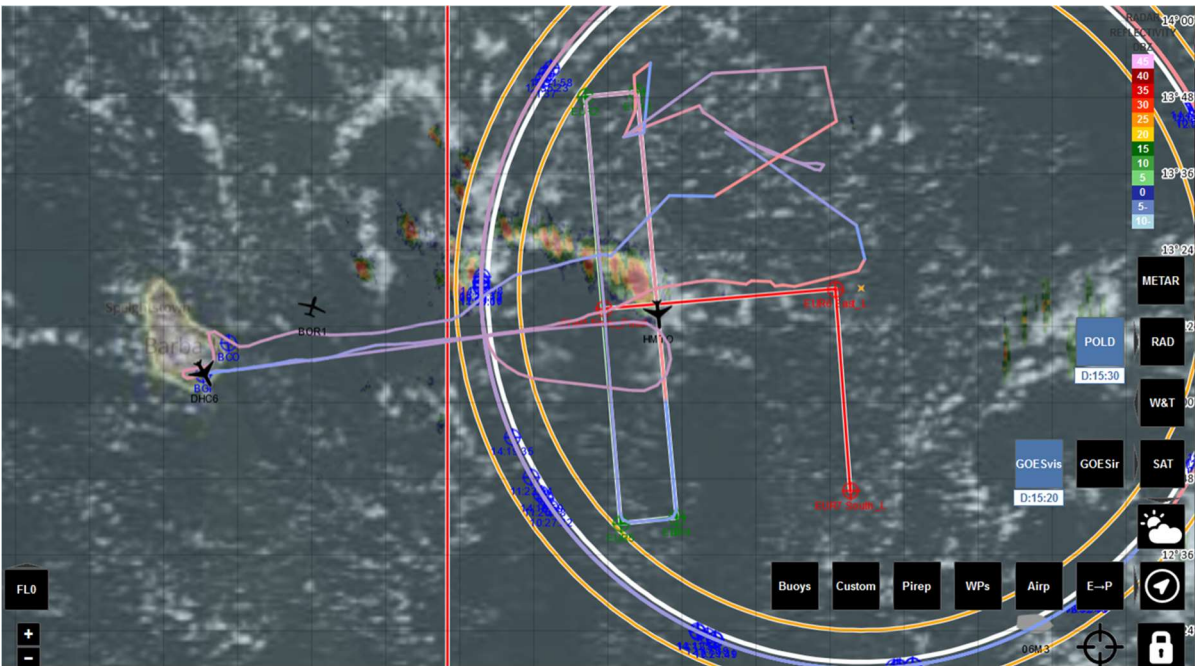
2D evolution of the water vapor mixing ratio along the ATR 42 trajectory during Flight #15.



BASTA data acquired near the end of Flight #15 around 1220 UTC while the ATR was flying the L-shape pattern L2.



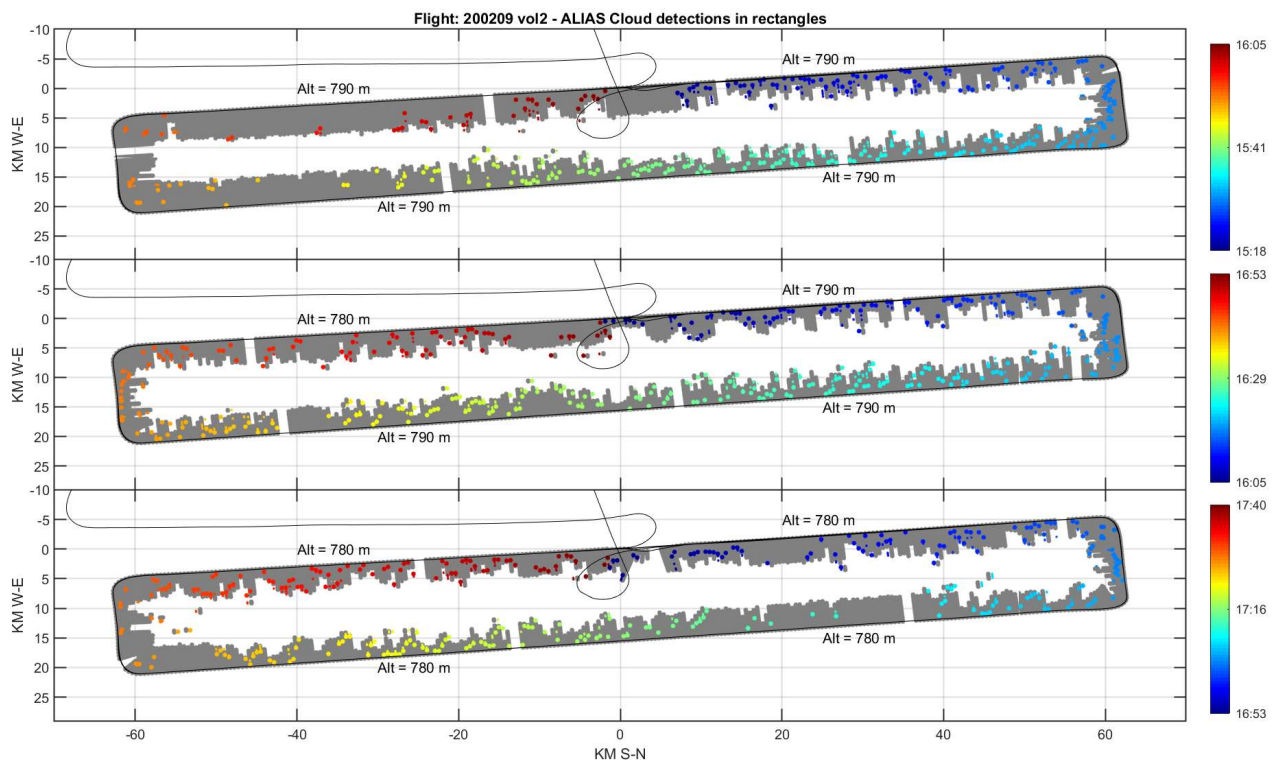
Time series of altitude, temperature, and liquid Water Content (LWC) for Flight #15, as well as contour plot of particle size distribution (PSD) from the CDP for particles with a diameter ranging from 2 to 50 μm .



Trajectory at the end the ATR flight tract of Flight #16 at 15:42 UTC (with superimposed HALO circle, GOES E visible image and POLDIRAD reflectivity).



Visible images of the ATR 42 made with the camera onboard the RSS-A2 aircraft at 1431 UTC during Flight #16.



Cloud mask based on ALIAS data for rectangles R1, R2 and R3 during Flight #16. The grey areas correspond to the areas of the rectangle where the lidar signal-to-noise ratio allows cloud detection. Color dots represent the location of the clouds detected at CBH for data acquired in each rectangle. Dots are color-coded according to time (see scale).