ATR-0207 (07 February 2020)

Flight #13 and #14 – as200013 and as200014

Pierre-Etienne Brilouet, Cyrille Flamant
Sandrine Bony, Julien Delanoë, Alfons Schwarzenboeck
07 February 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.
HALO, TO, P3[Auteur in1], Boreal flew this day.

2. Crew

Flight A (11:30 – 16:50 UTC):
Pierre-Etienne Brilouet (Mission PI, Turbulence), Julien Delanoë (RASTA), Geet George (BASTA), Alfons Schwarzenboeck (Microphysics), Julien Totems (Lidar), Sandrine Bony (Picarro), Michel Cluzeau (SAFIRE Engineer), Tetyana Jiang (SAFIRE Engineer), Dominique Duchanoy (Pilot), Guillaume Seurat (Pilot)
Flight-level support on ground: Nicolas Rochetin, [Auteur in2]

Flight B (17:45 – 22:15 UTC):

Cyrille Flamant (Mission PI, Lidar), Adanna Robertson (RASTA), Christophe Caudoux (BASTA), Pierre Coutris (Microphysique), Nicolas Rochetin (Picarro), Hauke Schulz (Turbulence), Hubert Bellec (SAFIRE Engineer), Gilles Vergez (SAFIRE Engineer), Dominique Duchanoy (Pilot), Guillaume Seurat (Pilot)
Flight-level support on ground: Anna Lea Albright, Ludovic Touzé Peiffer, Sandrine Bony[Auteur in3]

3. Synoptic Situation

According to the weather forecast, a ridge is dominant over the observation area (see GOES satellite pictures below). Transported air masses from the northwest are very dry. The cloud cover is characterized by shallow scattered clouds (gravel and sugar) with heterogeneous properties (cloud base, cloud top, stratiform or convective,…). The wind conditions are around 8 – 10 m/s from east/ northeast. The sea surface conditions are from moderate to rough.

Flight #13
From the take-off to the ferry leg, the inversion appeared less marked than the other flights (cf skew-T diagram below). The first rectangle has been performed in the stratiform layer. The flight altitude was not easy to defined due to heterogeneities of the cloud structures with a mix of convective and stratiformf stratiform clouds with also areas of shallow cumulus. The following two rectangles have been performed at the cloud base with also difficulties to target the cloud base with various altitudes from a branch of the rectangle to the other. The first L-shaped track has been started as usual, from the entry point to the East, at 600 m AMSL. As the clear sky conditions were prevalant in this area, a choice has been done to skip the north-south part of the L-leg and to fly back at 60 m AMSL to capture a flower in the south part of the rectangle. As shown on the GOES pictures above, the flower was dissipated when we arrive on the area. We then performed two other legs in the subcloud layer at 300 m and 600 m, respectively. It might be an interesting study case of the subcloud layer structure just after a dissipated flower pattern. The ascent to FL100 presents an inversion much more marked than at the beginning of the flight at ~ 1900 m and the stratiform layer of the clouds was more clearly identified.

Flight #14
Flowers were still present in the HALO circle and to the west of it during the 2nd flight. They progressively fainted during the flight, especially to the west of the circle, the skies being quite clear near the end of the flight. Large scale organized cloud structures (fish?) were observed to the east of the HALO circle, with clear air between them.
POLDIRAD was showing raining cells along the west-most leg of the rectangle. During the ascent to FL80, the upper level inversion was found to be ~2400 m. As there was no developed stratiform layer associated with the flowers, the ATR performed 3 rectangles at CBH. The CBH was difficult to assess during the 1st rectangle, and showed a lot of variability between 1000 and 900 m. The CBH was lower during the 2nd and 3rd rectangles (detected at 795 m with the lidar). The first part of the L was performed at 650 m and the return part at 325 m. The ATR then descended to 60 m for 7 min to measure turbulence in the surface layer. At times RASTA was seeing the top of the clouds between 500 and 3000 m above the ATR. No well-defined depolarizing layer (indicative of dust) was identified during the flight, but rather bursts of depolarization.

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). For the Flight #13, The L?_half means that only half of the L-shape pattern is performed (see details in the flight description above).

Flight #13:	**(ºN, ºW)**	**Flight Level (FL)**	**Time (UTC)**	**Notes**
Takeoff	GAIA		11:30	
Ferry	To EP	FL080	11:39-11:48	Inversion less strong than usual
R1		FL070 - FL066	11:58-12:42	Cloud top, stratiform clouds
R2		2480 ft-3380 ft	12:46-13:28	Cloud base
R3		3380 ft – 3070 ft	13:31-14:17	Cloud base
L1_half		1770 ft	14:20-14:34	Top subcld layer
L2		120 ft	14:38-14:56	Surface leg
L3_half		915 ft	15:01-15:13	Mid subcld layer
L4_half		1890 ft	15:16-15:27	Top subcld layer
Ferry back	From EUR5	FL100	15:33-15:44	Reference for lidar and Picarro, sounding
Landing	GAIA		15:51	

Flight #14:	**(ºN, ºW)**	**Flight Level (FL)**	**Time (UTC)**	**Notes**
Takeoff	GAIA		17:20	
Ferry	To EP	FL080	17:29-17:47	
R1		2910-3220 ft	17:50-18:39	Cloud base

Flight #14:	(°N, °W)	Flight Level (FL)	Time (UTC)	Notes
R2		2540 ft – 2910 ft	18:40-19:27	Cloud base
R3		2540 ft	19:27-20:14	Cloud base
L1		2120 ft	20:21-20:44	Top subcld layer
L2		1070 ft	20:49-21:10	Mid subcld layer
Leg	To EP	250 ft	21:12-21:19	Surface leg
Ferry back		FL100	21:26-21:33	
Landing	GAIA		21:42	

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.
BASTA worked fine.

Lidar: Worked fine.

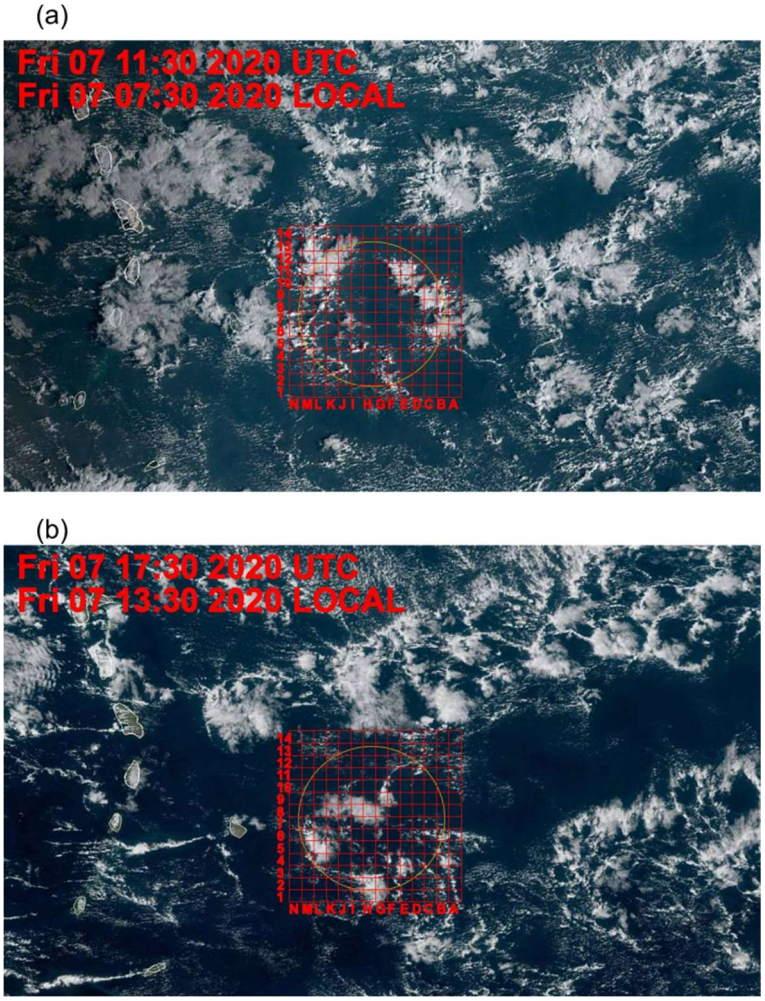
Picarro: Worked fine.

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

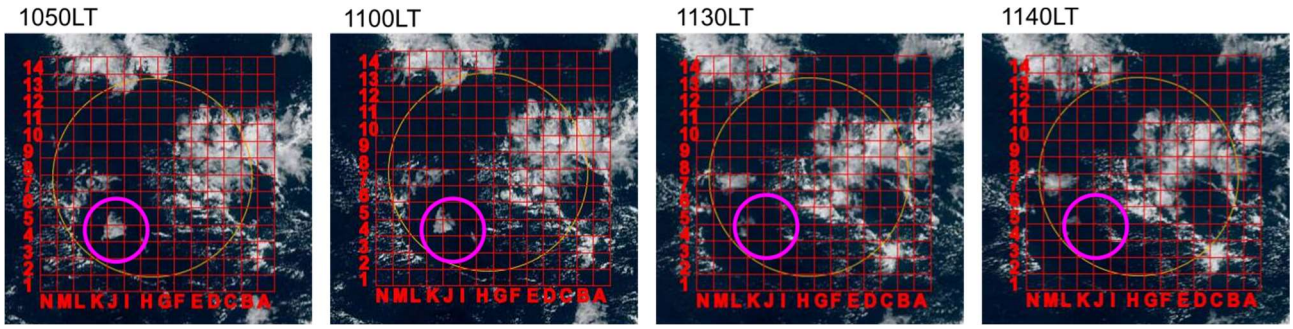
Base:

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

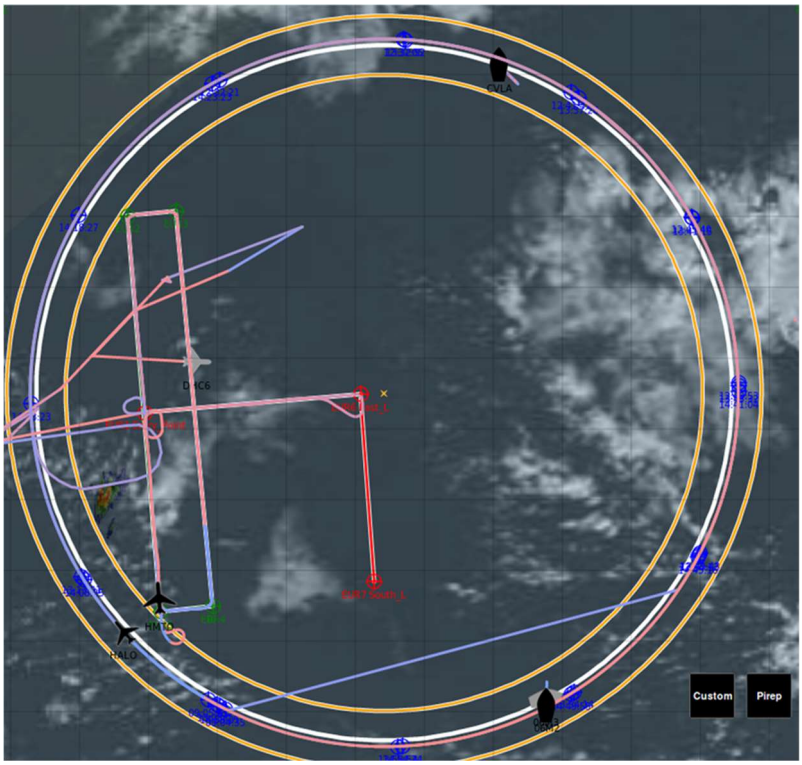
Figures



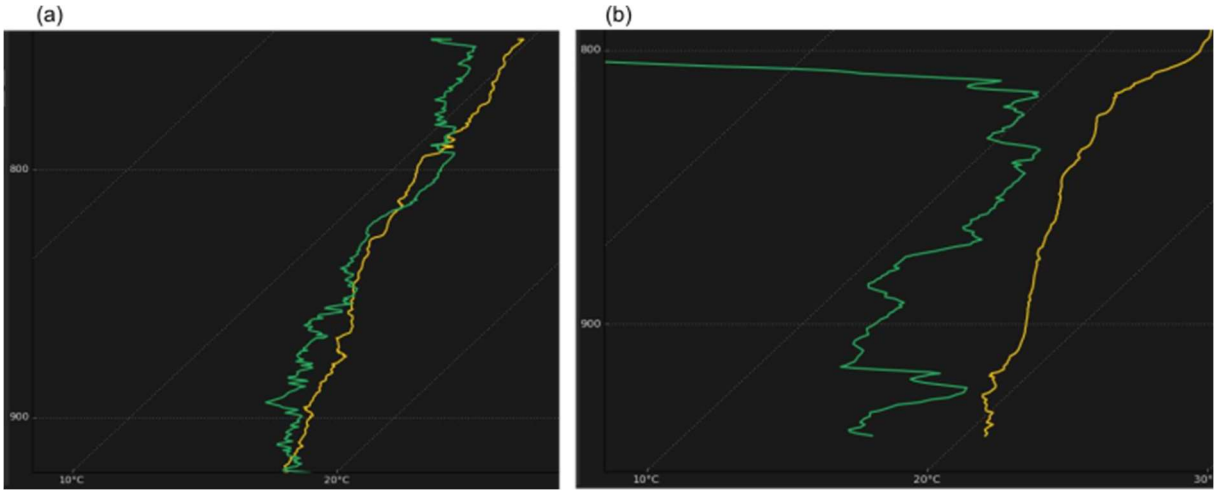
Large scale environment: GOES satellite picture at the beginning of (a) the first flight at 0730LT and (b) the second flight at 1330LT.



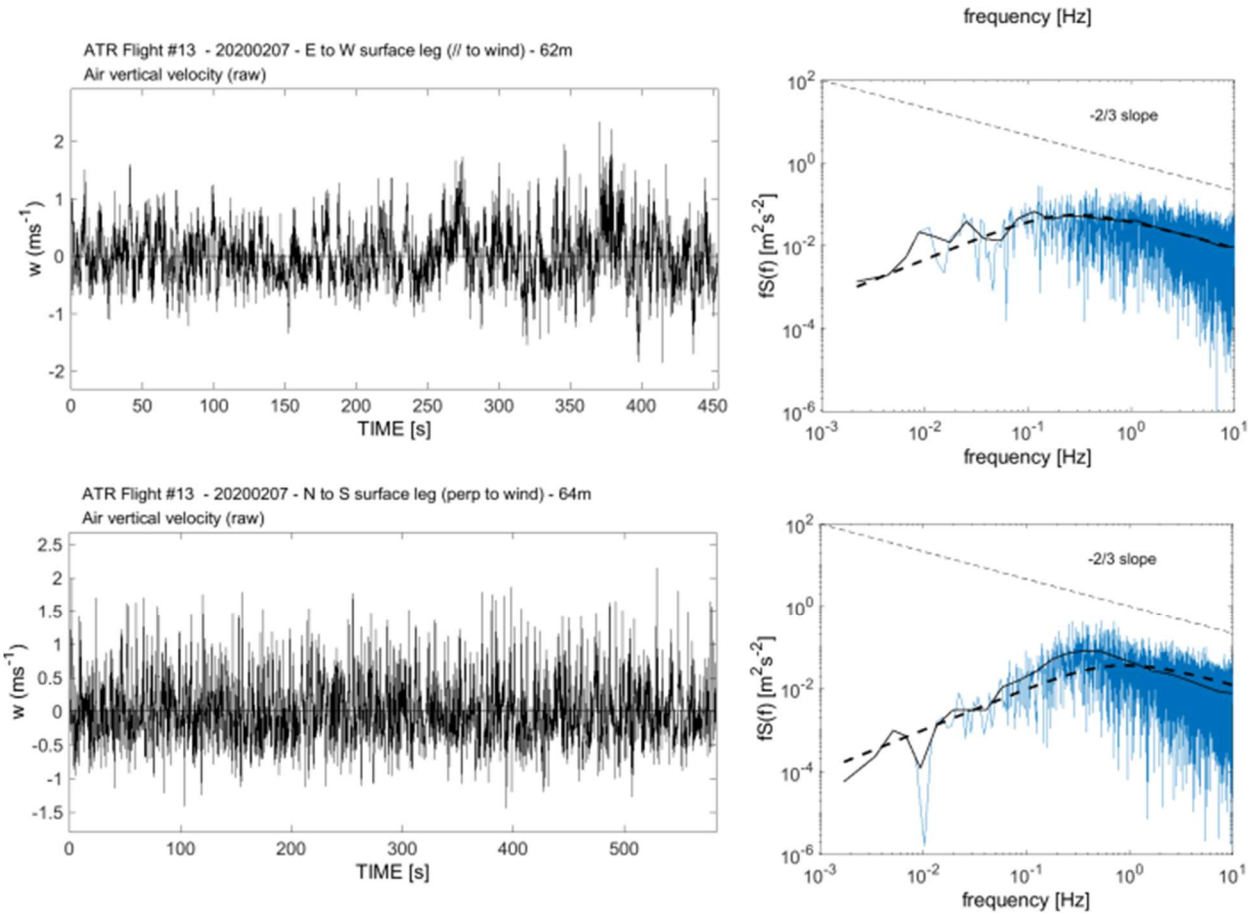
Target area superimposed on GOES satellite picture during first flight with focus on a dissipating flower in the south part of the rectangle



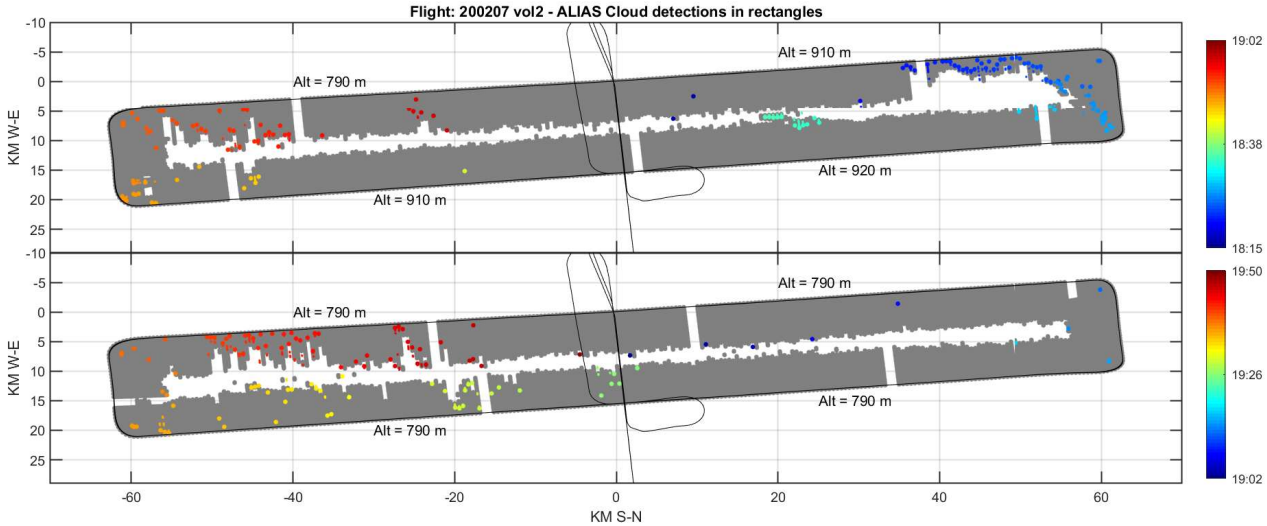
Trajectory of the first flight at 15:01utc with the L pattern adapted on the rectangle to capture the flower in the S-W part of the rectangle (instead of clear sky conditions on the usual L shape).



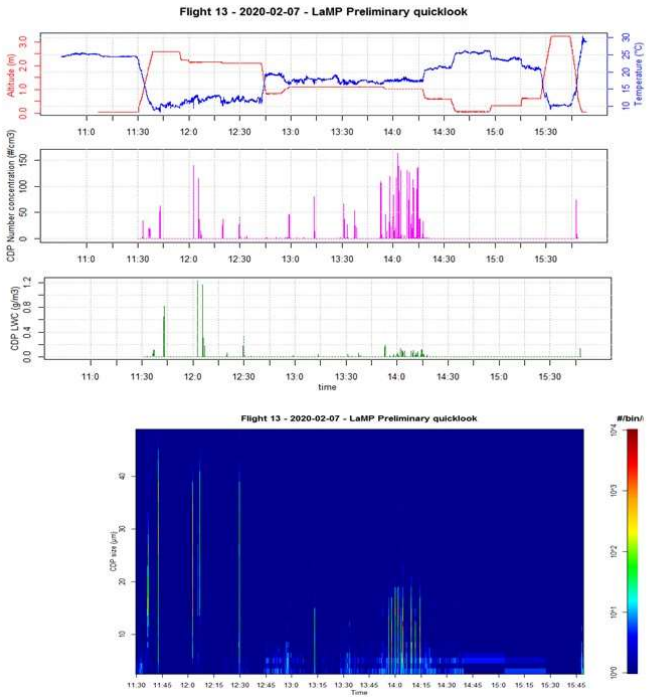
(a) Skew-T diagramme during ascent of first flight from TO to ferry leg and (b) Skew-T diagramme during ascent of first flight from EP to FL100.



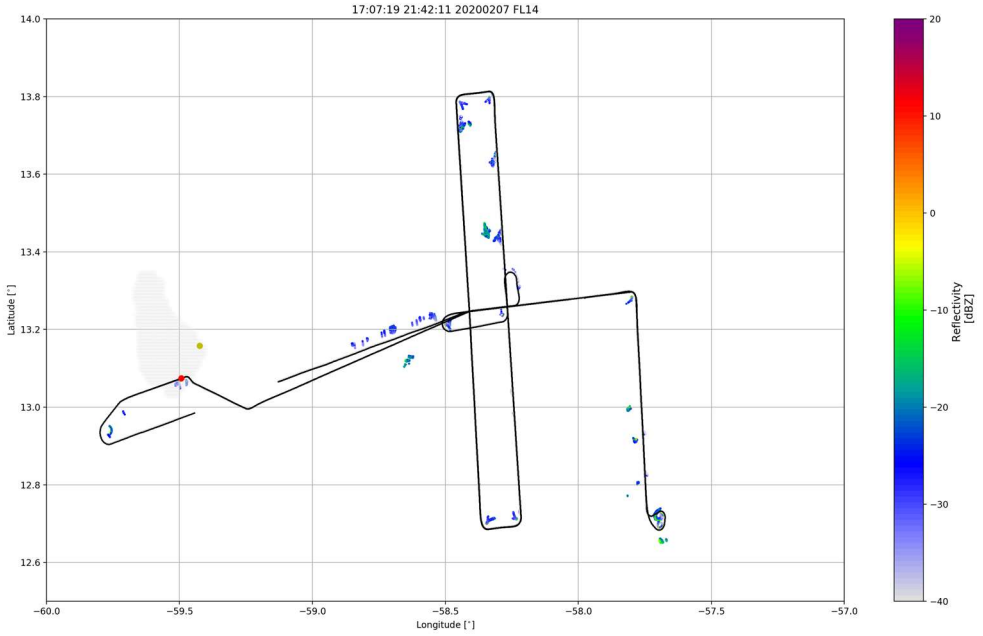
Time series of the vertical velocity fluctuations at the surface leg in the along-wind and in the crosswind direction, respectively. (Unfiltered but detrended raw data).



Cloud mask based on ALIAS data for rectangles R2 and R3 during Flight #14. 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).



Time series of altitude, temperature, and liquid Water Content (LWC) for Flight #13, as well as contour plot of particle size distribution (PSD) from the CDP for particles with a diameter ranging from 2 to 50 µm.



BASTA reflectivity data acquired for the whole of the Flight #14.

4. Pictures

Picture taken during the first flight