



Flight Report

September 16, 2014

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1. G1/HALO Flight Report - Flight#7 and AC11

1.1 Flight Strategy

In September 16, 2014 occurred the first joint flight with G1 and HALO aircraft. The objective was the intercomparison of measurements in lower (G1) and higher (HALO) levels. For G1 the specific objective was aerosol characterization and for HALO was quantify vertical distribution of air pollutants, determine LNO_x emissions and study new aerosol formation in convective outflow. The HALO flight occurred between 14:30 and 21:40 UTC and G1 from 15:35 and 18:28 UTC. The moment of joint flight was between 17 and 18 UTC. A Fig. 1.1 show the flight path for G1 (blue balloon) and HALO (green triangles) aircraft.

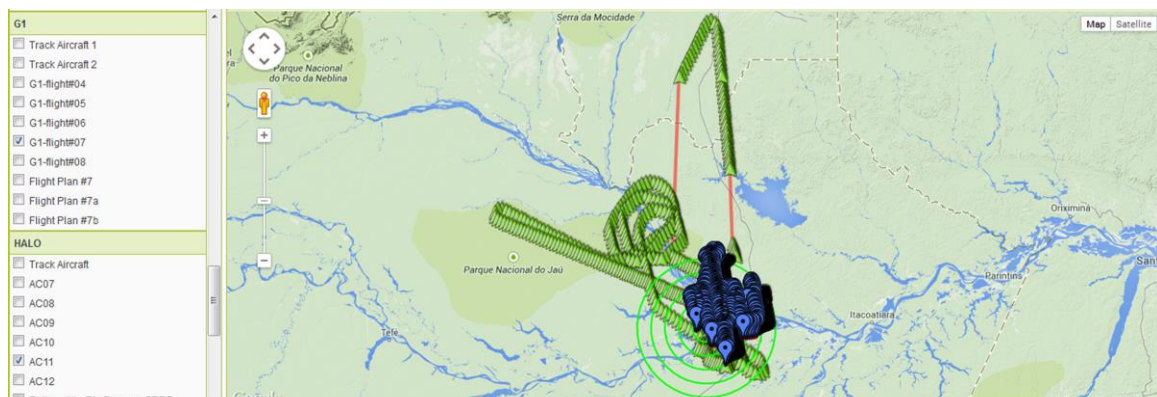


Figure 1.1 - Flight path of G1 (blue balloon, Flight#7) and HALO (green triangles, AC11) aircraft in September 16, 2014 (Flight#5). Source: <http://sigma.cptec.inpe.br/sosmanaus/#>.

1.2 Weather Conditions Before the Flight

The Fig. 1.2 shows the IR image, fire spots (accumulated for the day, red dots) and lightning (colored dots) at 13:30 UTC (1 hour before the flight). Large systems occurred in the south of radar and the west of Amazon region, with several lightning associated. In addition, several fire spots in neighboring states were observed.

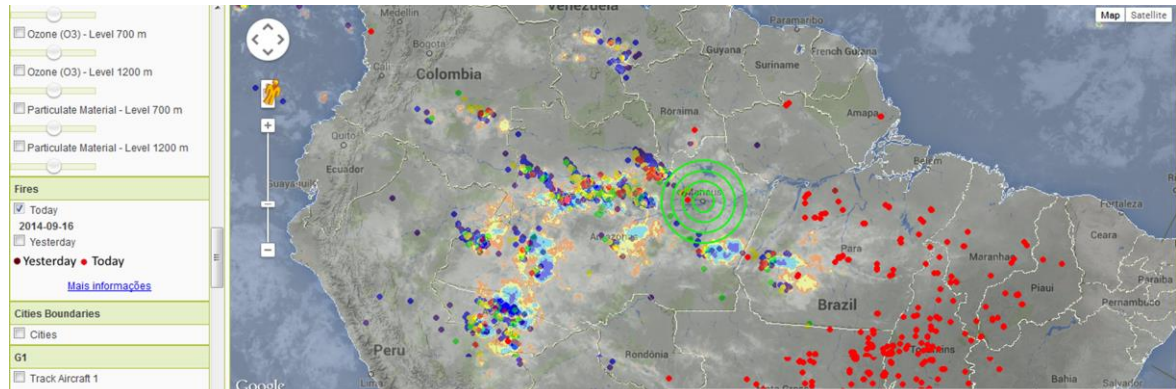
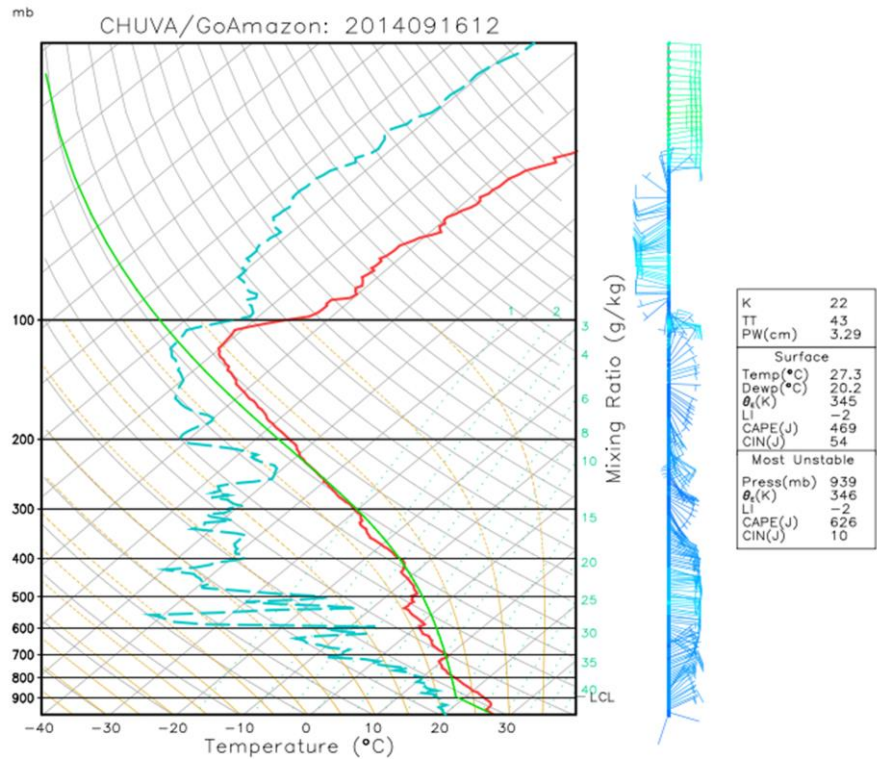
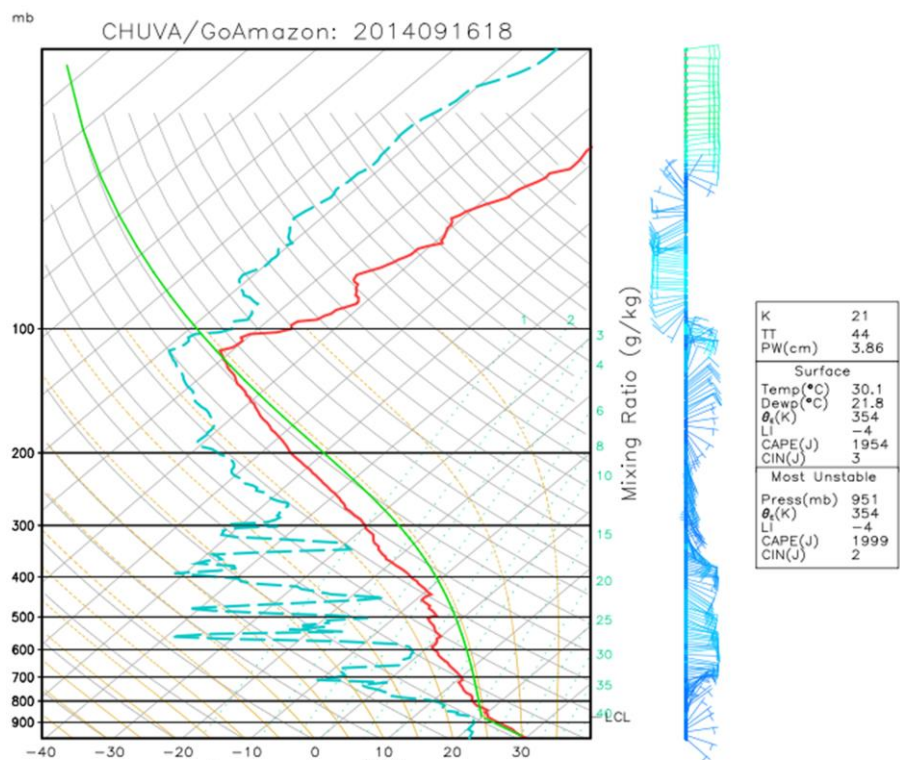


Figure 1.2 - Weather conditions before the G1 (Flight#7) and HALO (AC11) in September 16, 2014 at 13:30 UTC (09:30 Local Time). It is showed the IR GOES-13 images (for 1 hour before), fire spots (for the day, red dots) and lightning occurrence (colored dots) from STARNET network. The green circles are the distance ring from X-Band radar. Source: <http://sigma.cptec.inpe.br/sosmanaus/#>.

The Fig.1.3 shows the radiosonde for Ponta Pelada site at (a) 12 (before the flight) and (b) 18 UTC (during the flight). Before the flight (Fig. 1.3a) was observed a environmental relatively dry between surface and 250 mb, with CAPE around 626 J/kg and CINE of 10 J/kg. In contrast during the flight (Fig. 1.3b), more wet environmental between surface and 300 mb can be observed. The great potential for convection in this day is consistent with higher CAPE of 1999 J/kg and low CINE around 2 J/kg. The Fig. 1.4 shows the balloon trajectory for both radiosonde. The predominant wind comes from east and an maximum speed around 25 m/s was observed in higher levels.

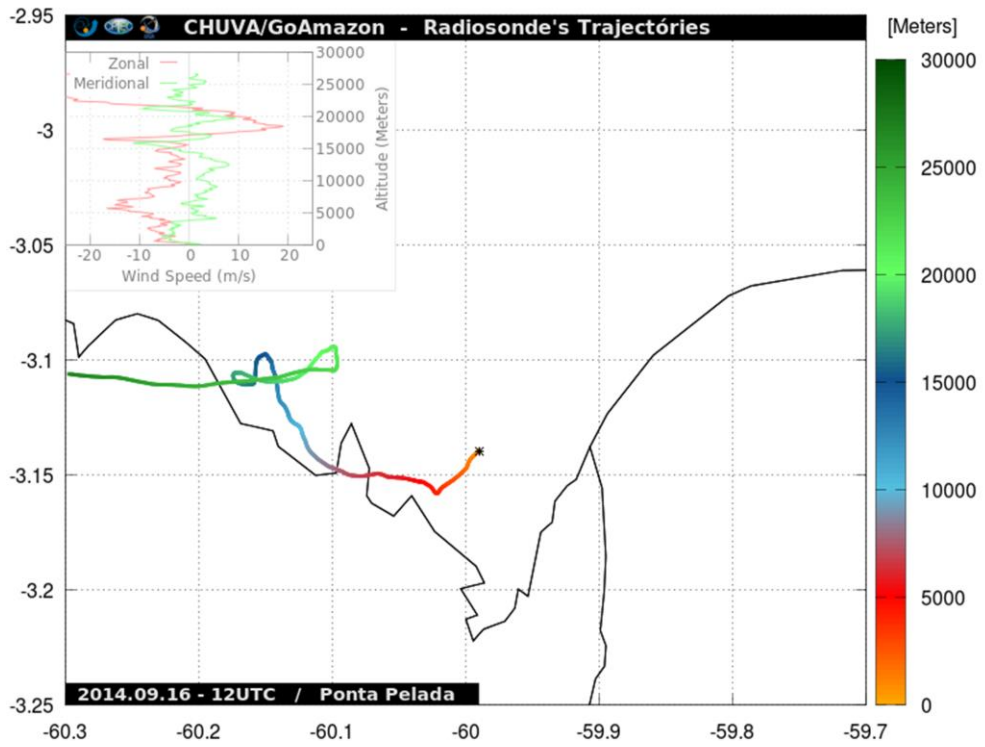


(a)

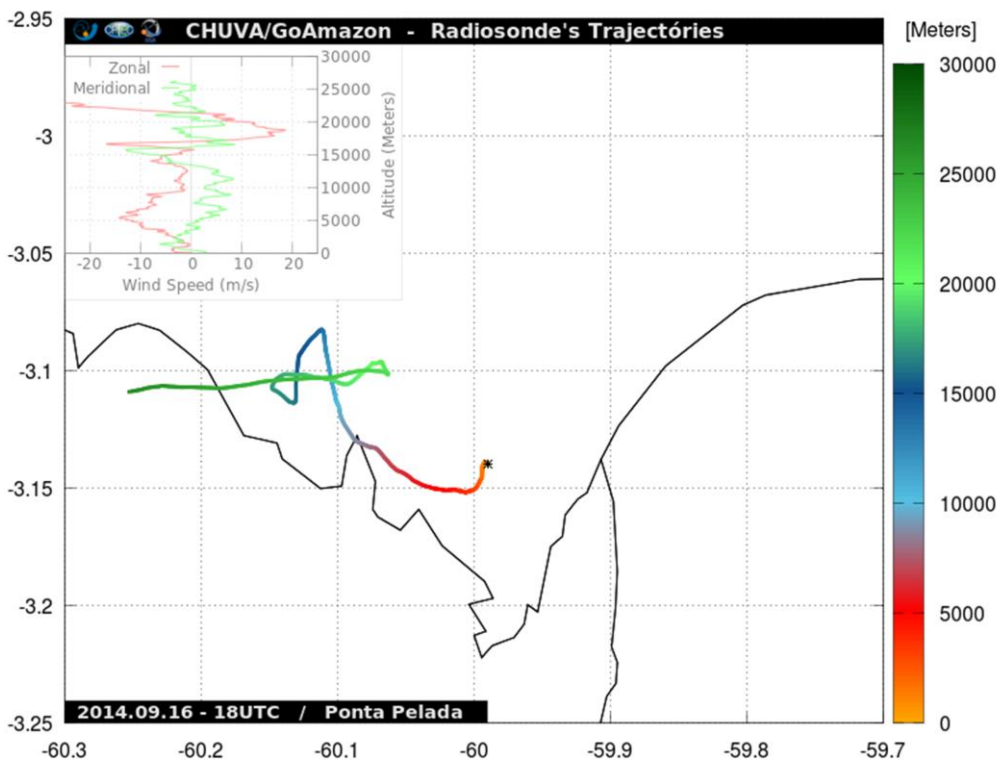


(b)

Figure 1.3 - Skew-t plot from radiosonde taken at Ponta Pelada site in September 16, 2014 at (a) 12 and (b) 18 UTC. Source: CHUVA/GoAmazon.



(a)



(b)

Figure 1.4 - Balloon trajectory from radiosonde taken at Ponta Pelada site in September 16, 2014 at (a) 12 and (b) 18 UTC. Source: CHUVA/GoAmazon.

1.3 Conditions During the Flight

The Fig. 1.5 shows the weather conditions during the G1 and HALO flight from SOS website. During the first hours of flight the G1 done measurements close to Manaus, while HALO went to north of Amazon region. During that time deep clouds was observed in the west of flight path. After that 17-18 UTC the HALO returned to close Manaus and started the joint flight. While G1 aircraft flew close to 500 meters the HALO flew between low and higher levels. After the joint flight, the HALO aircraft has done several measurements in the northwest of Manaus. Close that time several deep clouds was observed in that region.

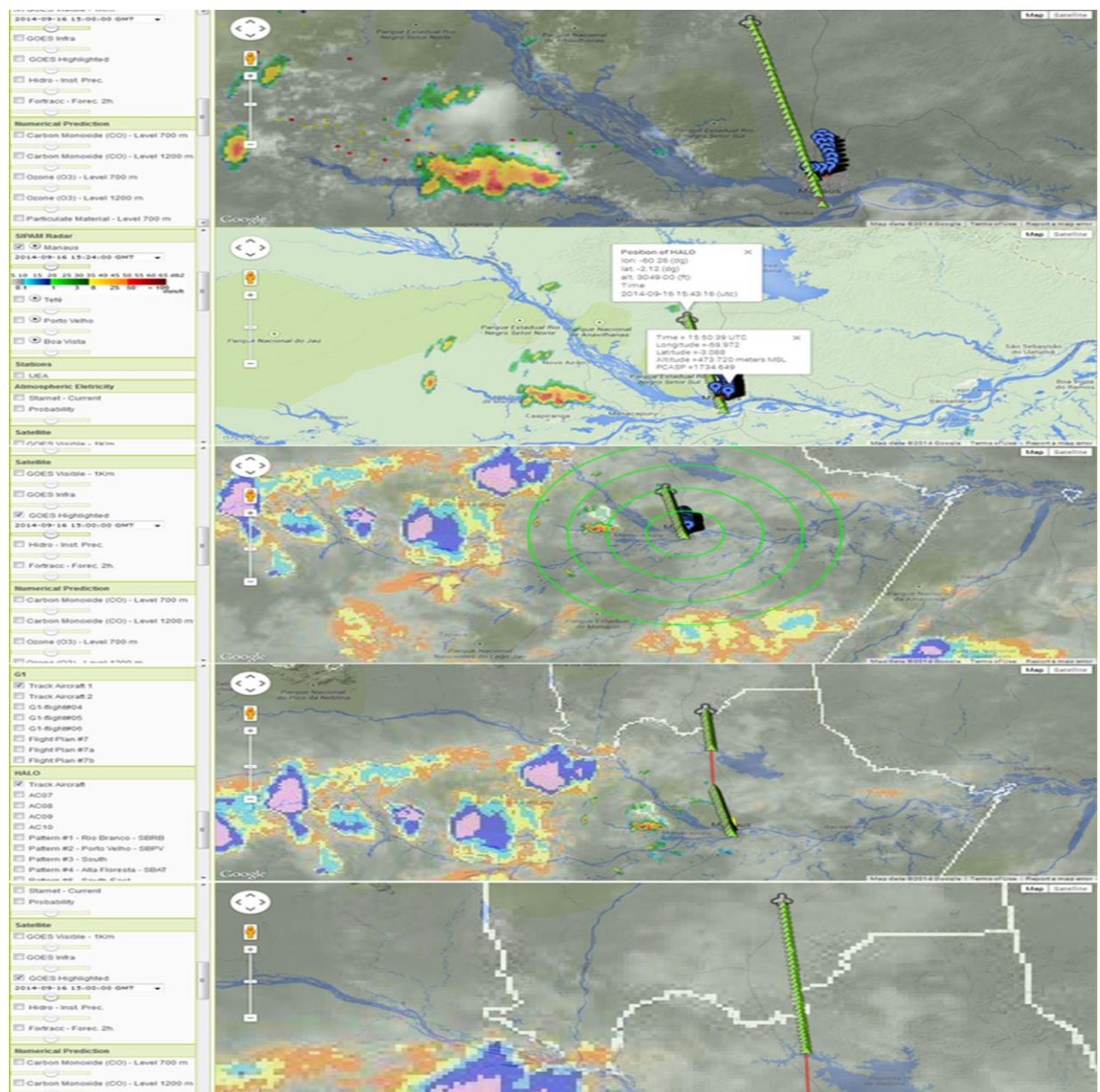


Figure 1.5 - Weather conditions during the G1 (Flight#7) and HALO (AC11) flight

Source: <http://sigma.cptec.inpe.br/sosmanaus/#>

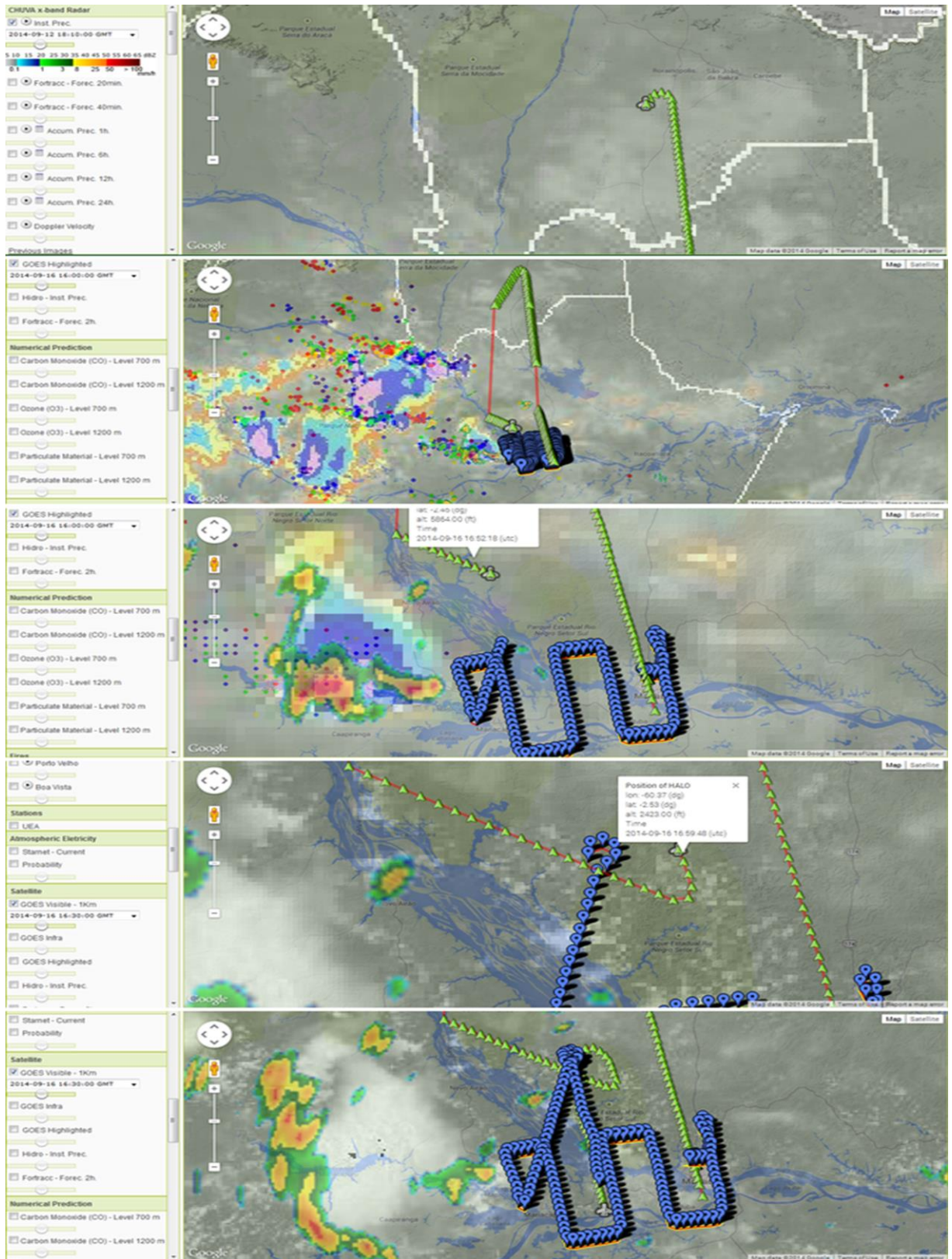


Figure 1.5 - Continuation.

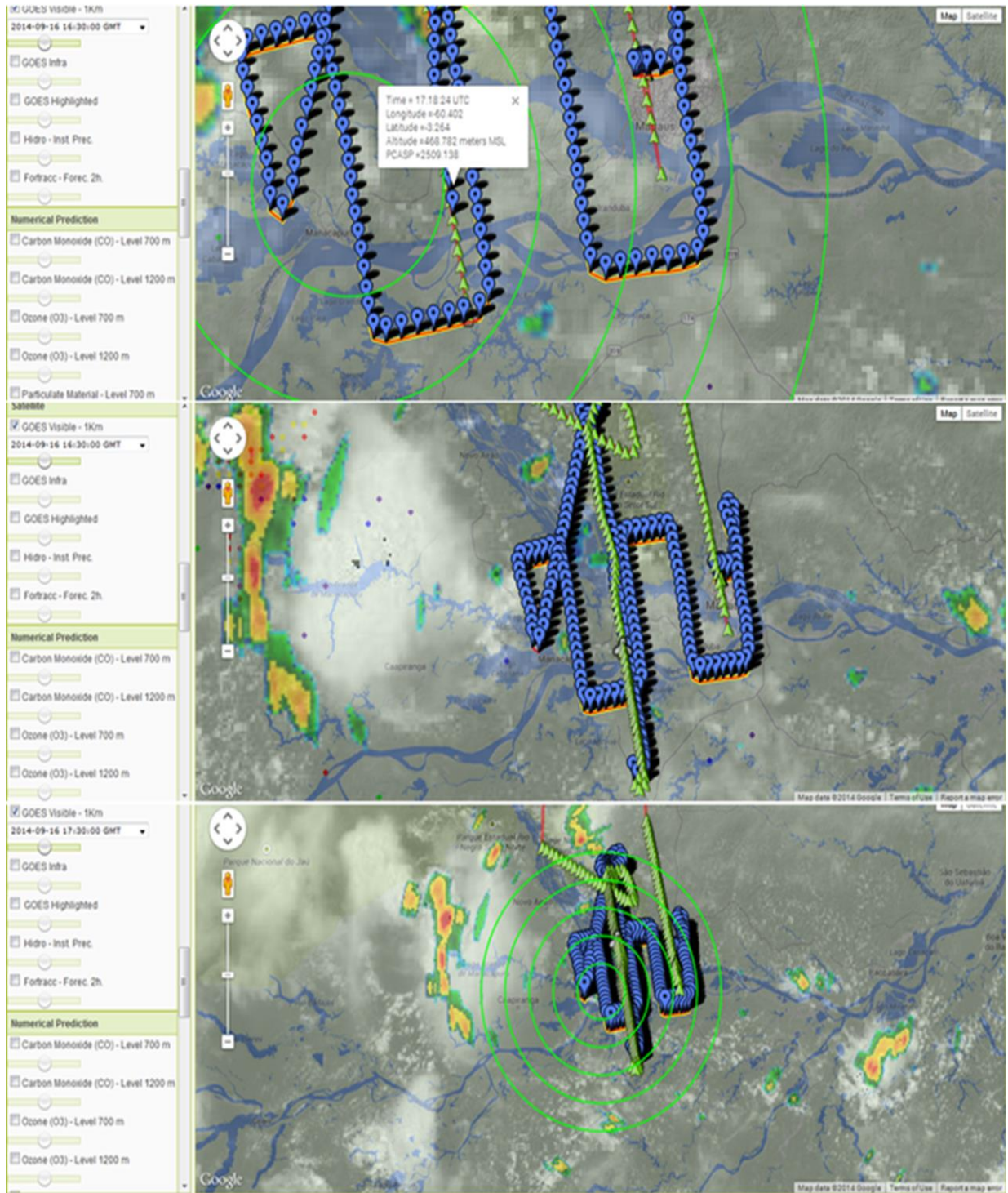


Figure 1.5 - Continuation.

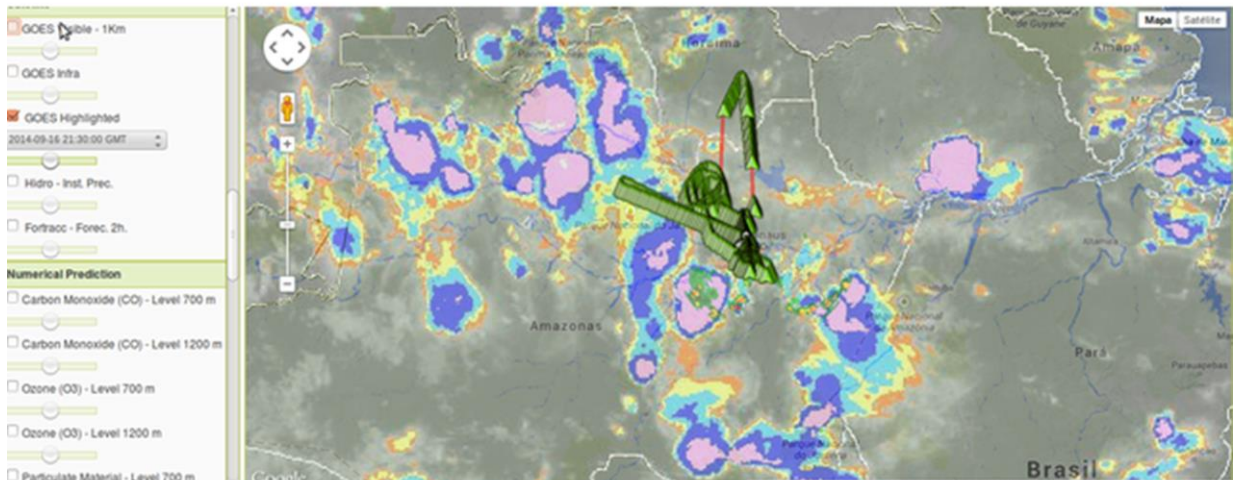
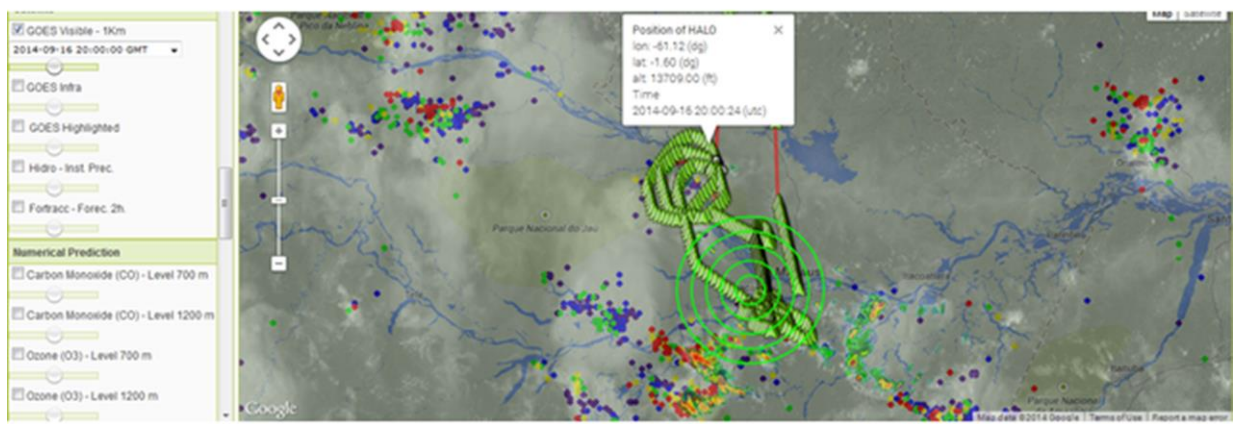
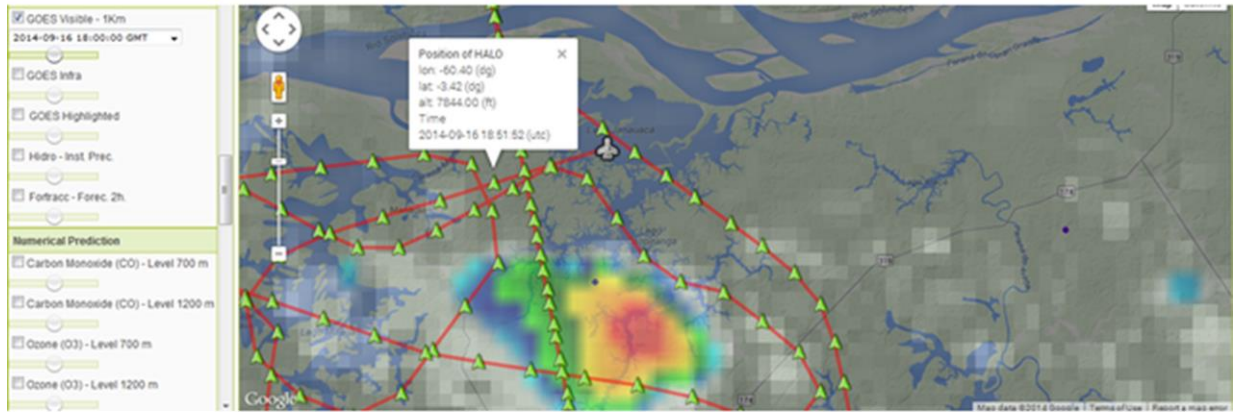


Figure 1.5 - Continuation.

The Fig. 1.6 shows images in visible channel from GOES-13 since 13 until 22 UTC. Before the flight some large deeps cloud was observed in the south of Amazon region with several Cirrus clouds related. After the 14:30 UTC some local storms was formed, which has merged with others storms close to Manaus.

The Fig. 1.7 shows the Infrared (T Enhanced) image from GOES-13 satellite from 13:00 until 22:00 UTC in September 16, 2014. The images suggested just deep clouds in the south and west part of Amazon state, with some cells reaching -80°C before the takeoff. After 18:30 UTC the deep clouds has merged with others and large clouds was observed close to Manaus. Close to landing and after that time, several deeps clouds continued close to Manaus city.

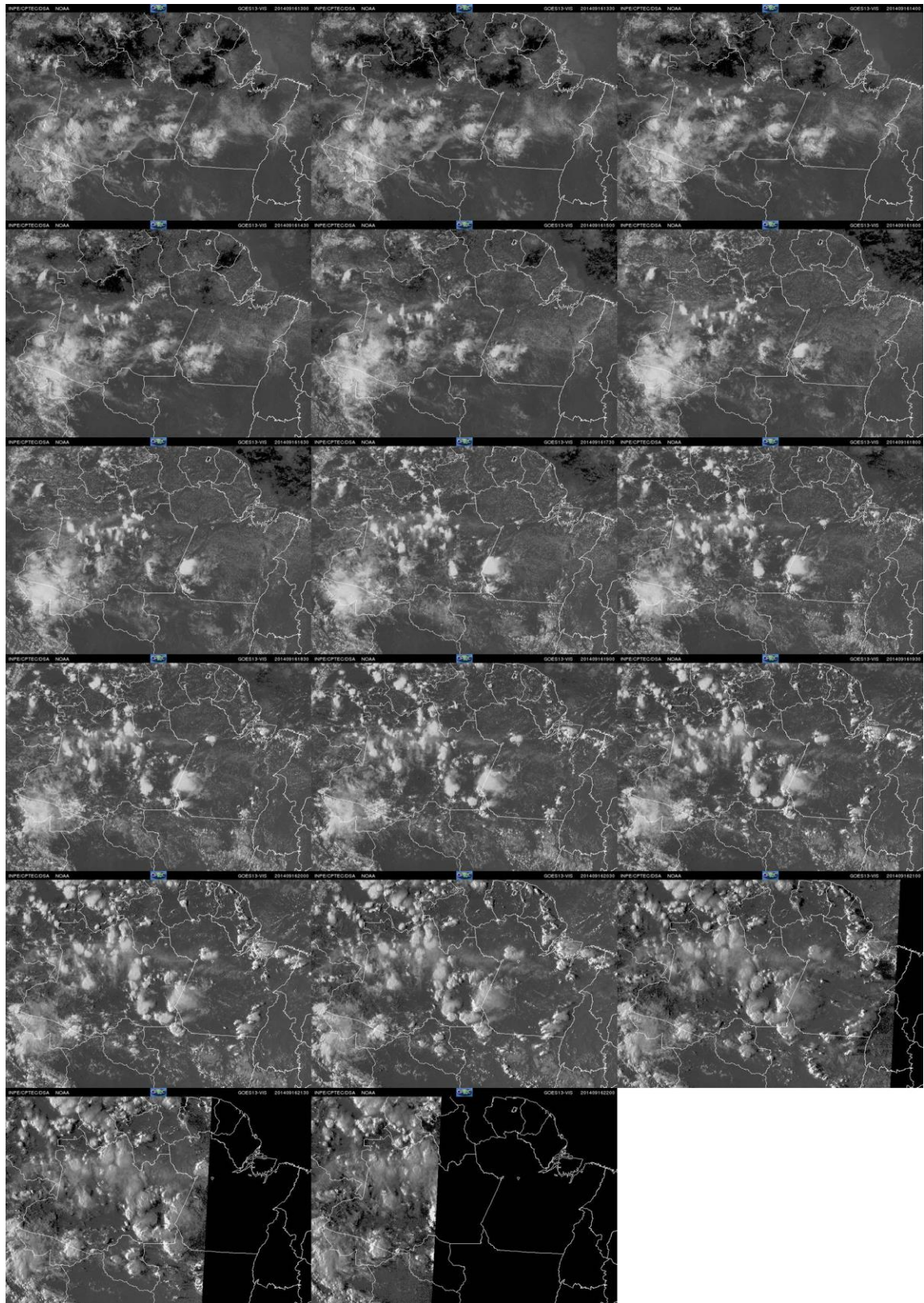


Figure 1.6 - Visible image from GOES-13 satellite from 13:00 until 22:00 UTC in September 16, 2014.

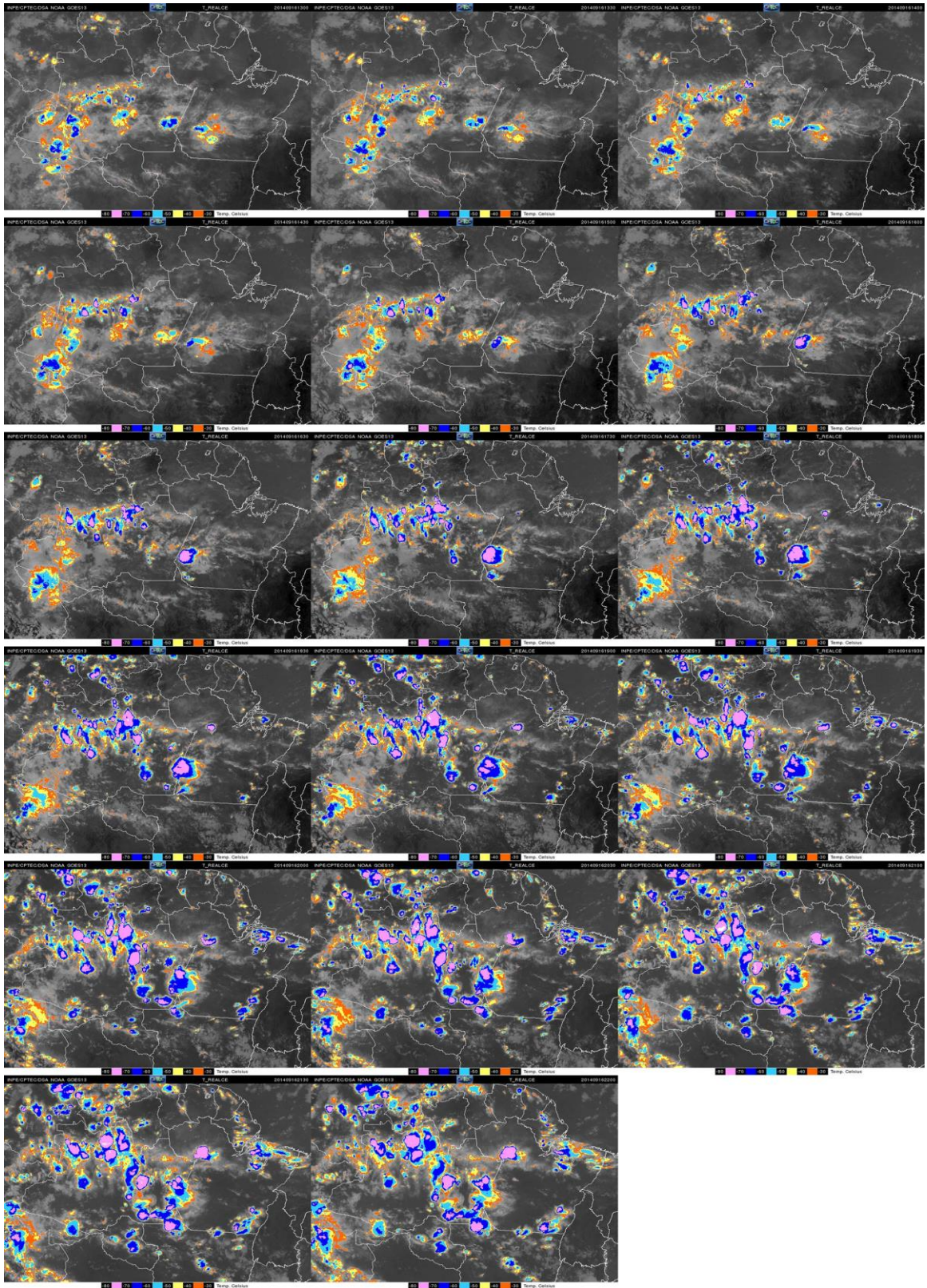


Figure 1.7 - Infrared (T Enhanced) image from GOES-13 satellite from 13:00 until 22:00 UTC in September 16, 2014.

The Fig. 1.8 shows the CAPPI in 3.1 km altitude of reflectivity (dBZ) from Manaus radar at 14:00 (minutes before HALO and G1 departure), 14:36 (close to HALO aircraft departure), 15:36 (close to G1 aircraft departure), 18:24 (close to G1 aircraft landing), 21:48 (close to HALO aircraft landing) and 22:00 UTC (minutes after HALO and G1 departure) in September 15, 2014. Before the flight takeoff just two small cells occurred in the west-northwest of radar. During the takeoff some precipitation cells appeared in the west part of radar, with core around 50 dBZ. Close to G1 aircraft landing (18:24 UTC), some organized cells line was observed over the Rio Negro River. The biggest one occurred in the southeast of radar, and some small in the south. After the landing of G1 and Halo we see large stratiform precipitation in the south of radar, with values around 25 dBZ, but some deep clouds was observed in the southwest.

The Fig. 1.9 shows the RHI from X-band radar in September 16, 2014 at 1521 (296°), 1525 (288°), 1530 (288°), 1535 (292°), 1545 (292°), 1647 (312°), 1736 (136°), 1816 (140°). We can see clouds with 40 km of maximum horizontal extension reaching until 14 km altitude. Some precipitation core presented until 56 dBZ of reflectivity.

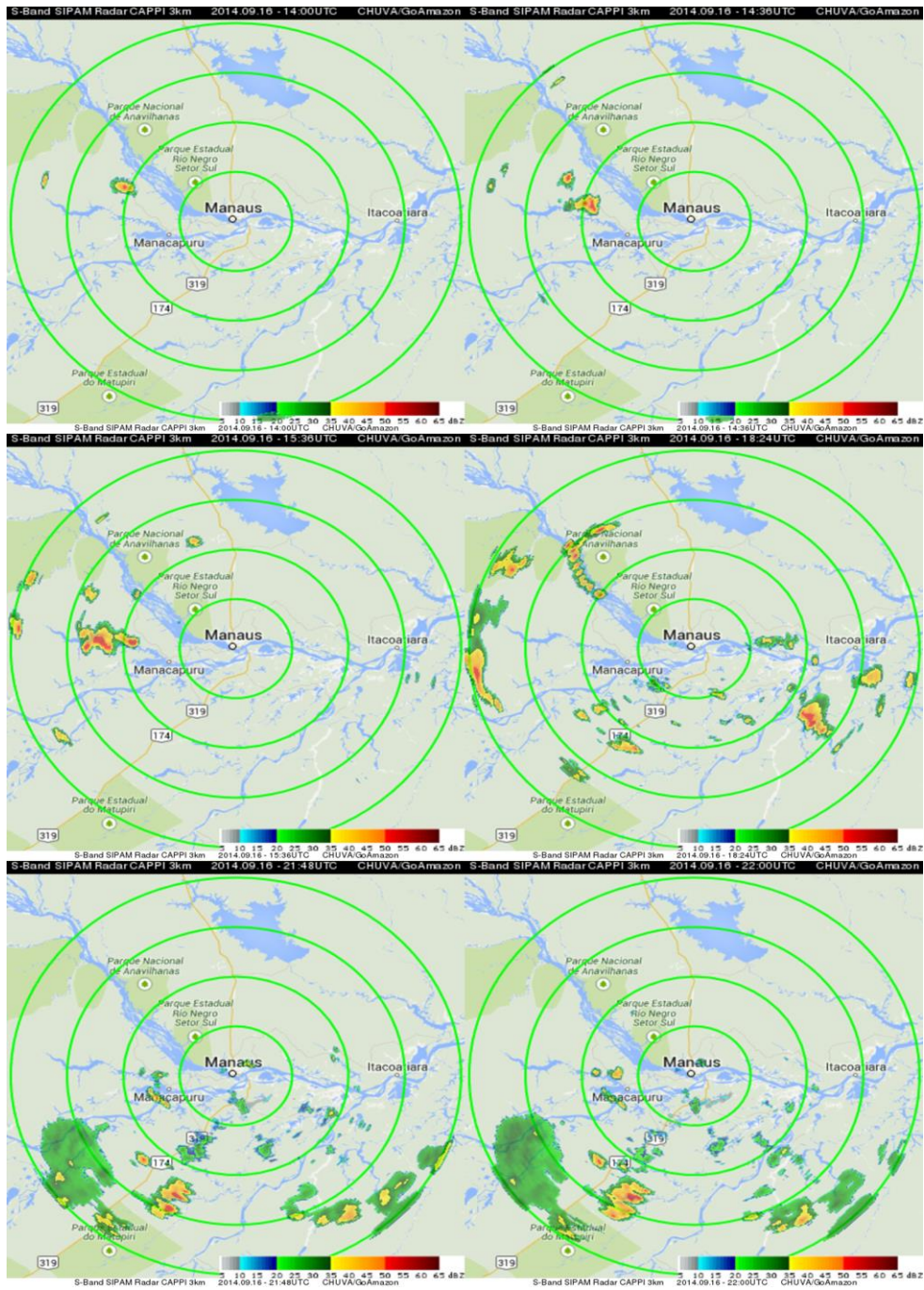


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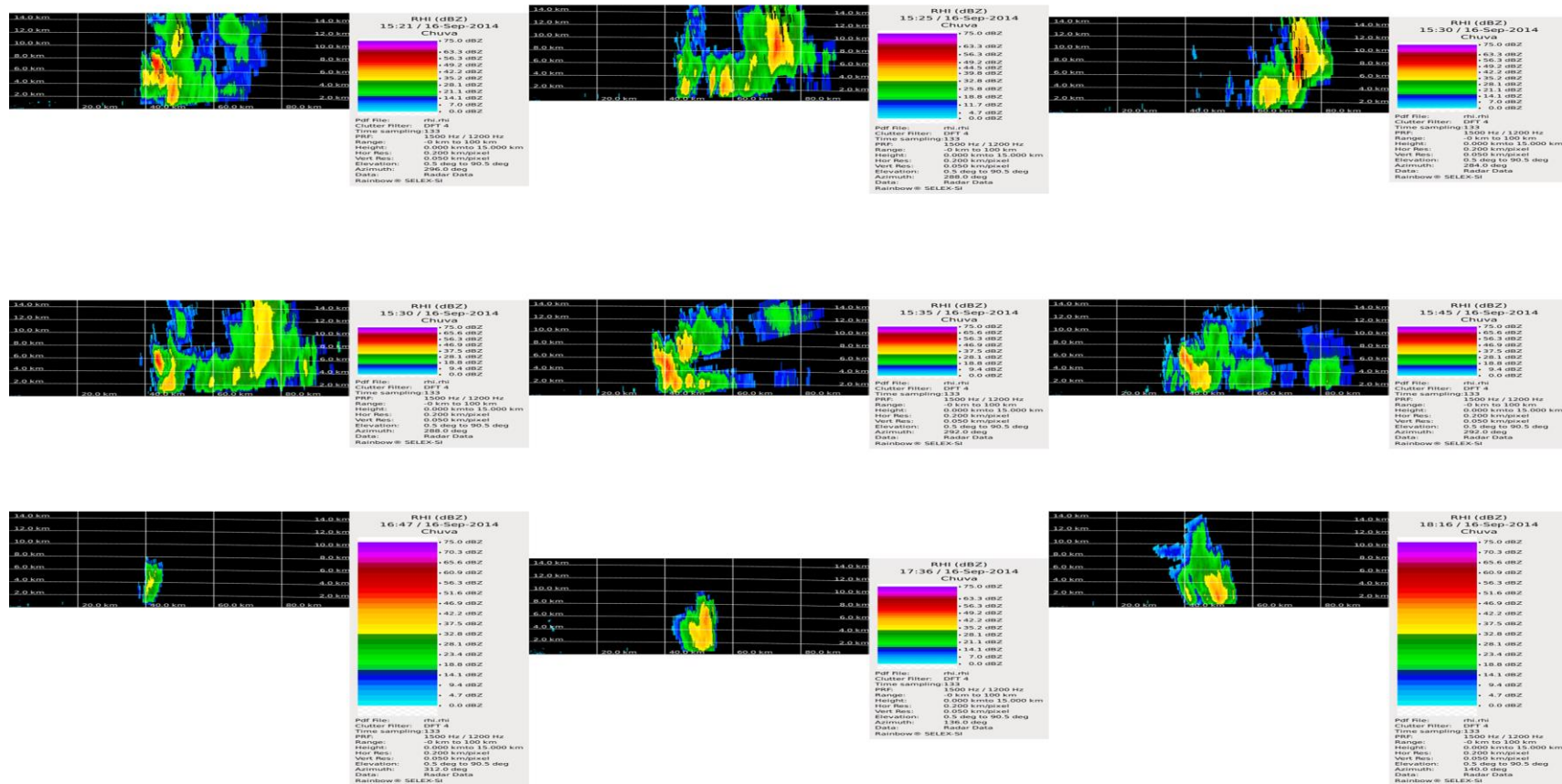


Figure 1.9 - RHI from X-band radar in September 16, 2014 at 1521 (296°), 1525 (288°), 1530 (288°), 1535 (292°), 1545 (292°), 1647 (312°), 1736 (136°), 1816 (140°).

The Fig. 1.10 represents the quick-look from THIES Disdrometer installed in UEA Manacapuru site in September 16, 2014. Maximum precipitation around 60 mm/h was registered at 2100 UTC close to landing of HALO aircraft. The size distribution has a bi-modal behavior with maximum around 1-1.7 mm and 2.5-3.5 mm, with velocity around 4-6 m/s and 7.5-9 m/s, respectively.

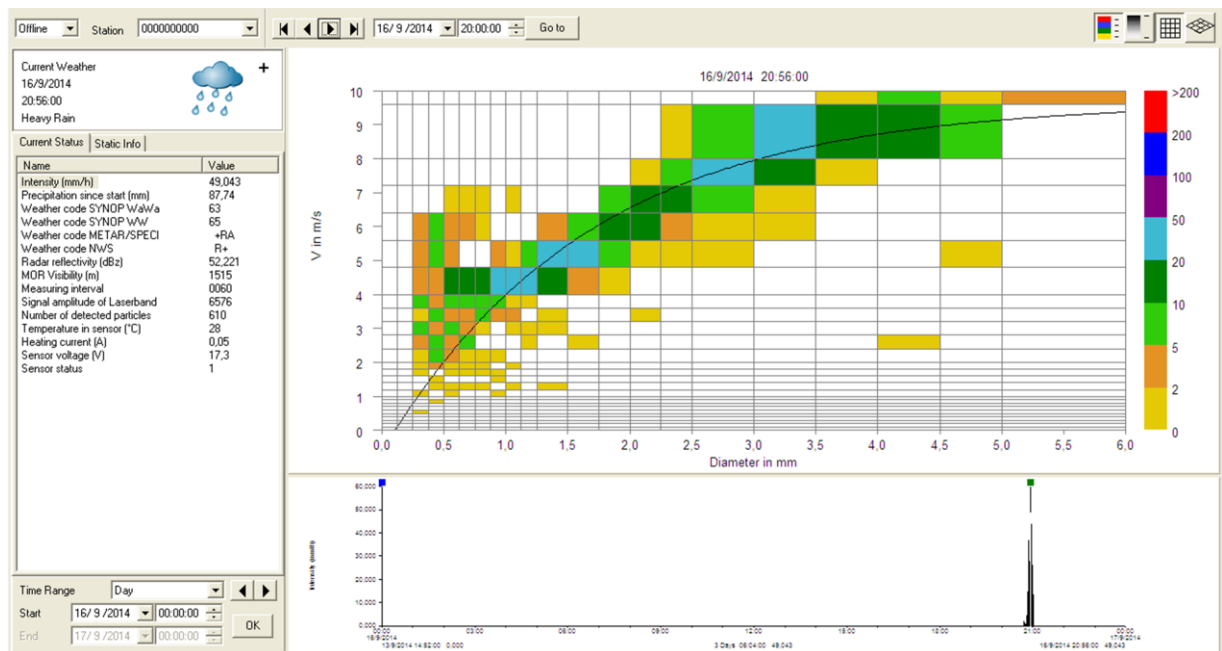


Figure 1.10 - Quick-Look from THIES Disdrometer installed in UEA Manacapuru site in September 16, 2014.

The Fig. 1.11 shows the quick-look from MP3000 installed in UEA Manacapuru site in September 16, 2014 for (a) temperature (K), (b) vapor density (g/m^3) and (c) water liquid (g/m^3). In surface the temperature was around 300 K and higher vapor density of 5 g/m^3 in 4 km and 15 g/m^3 in surface was noted. In addition, was observed a liquid column of 3 g/m^3 from surface to 6-7 km altitude close to 21 UTC. This column probably represents the precipitation that occurred in that time, as also suggested by THIS disdrometer (Fig. 1.10)

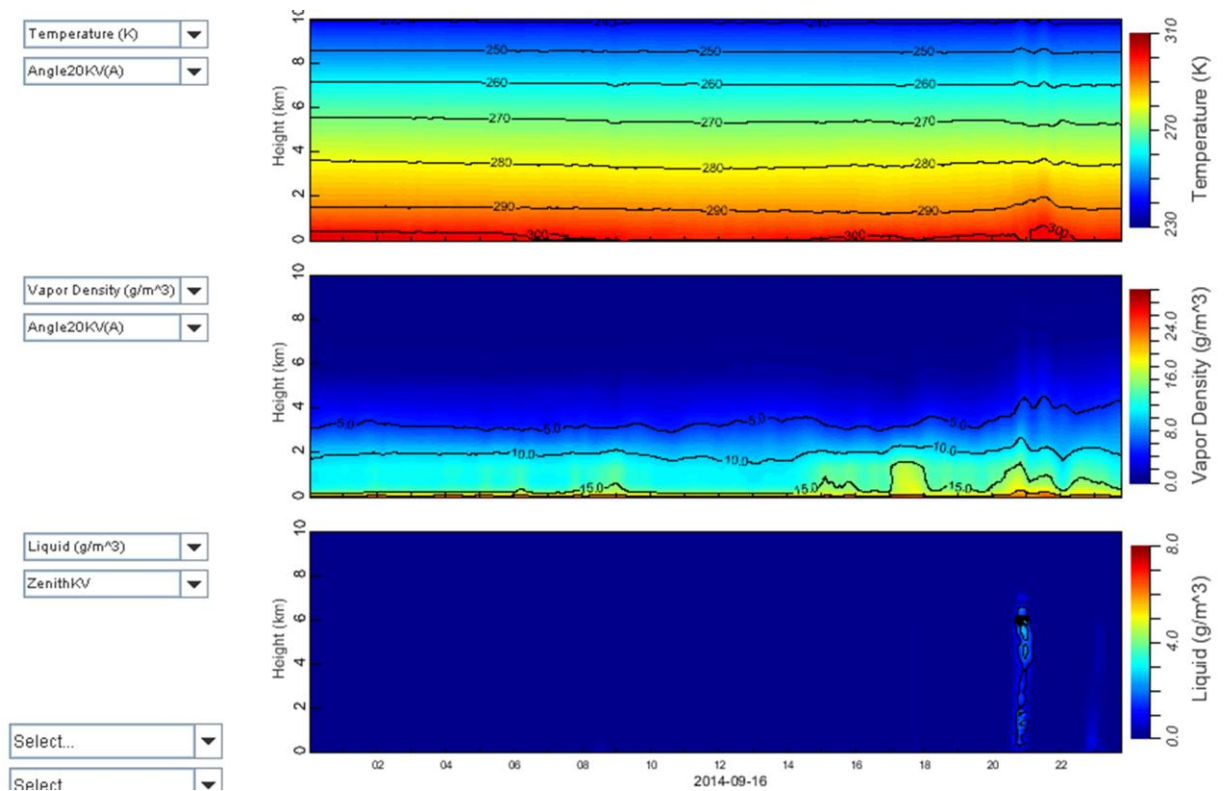


Figure 1.11 - Quick-Look from MP3000 installed in UEA Manacapuru site in September 16, 2014.

1.4 HALO Team Summary

Flight Summary: HALO-Campaign ACRIDICON-CHUVA

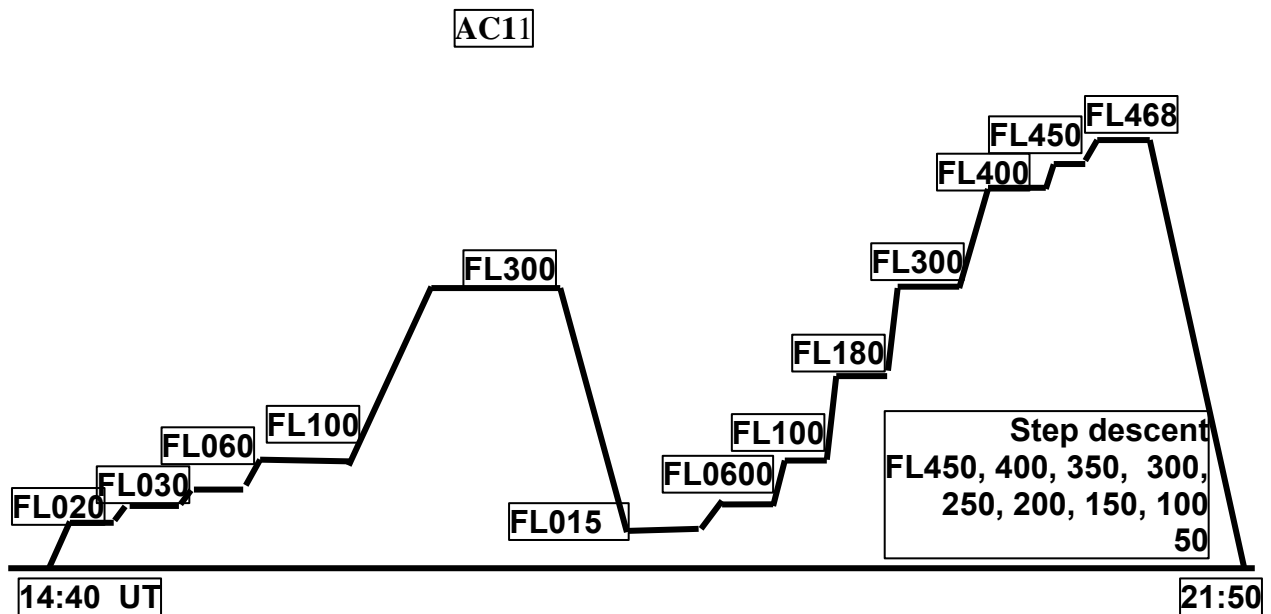
Flight number:	AC11
Date, base:	2014-09-16 (Tuesday), Manaus (SBEG)
Block/TO/ LDG/Block/FH:	14:35/14:40/21:49/21:55/7:20 (Block)
Mission type:	Convective inflow/outflow & tracer experiment
Flight pattern:	1 st tracer sampling: #13, WP2-WP3-WP2; Cloud profiling & outflow: #7, WP1 (North of Manaus), G1 intercomparison & 2 nd tracer sampling: . #13: WP6-WP7- WP6-W7 Cloud profiling & outflow & radiation : #13: WP6-WP7 Cloud profiling & outflow & radiation: west of Manaus (dir. #8, WP7)
FX-Aircrew:	Pilot: Steffen Gemsa Co-Pilot: Michael Grossrubatscher Technician: Thomas Leder
Scientists:	Hans Schlager (Mission PI) Micael Cecchini (Brazilian P) Martin Schnaiter (PMS instruments) Adrian Walzer (Aerosol instruments) Sandra Kanter (Radiation instruments)
Observer:	Ten. Fialho
Main objectives.	Inflow/outflow: to quantify vertical redistribution of air pollutants and their processing / removal in clouds (e.g. SO ₂ , BC, ..), to determine LNOx emissions, to study new aerosol formation in convective outflow Tracer experiment: to study vertical air mass transport and mixing associated with deep convection using ambient and PFC tracer
Tracer release 60.1103908)	Park Suites Hotel, 16 floor (Position: -3.05823114, - 10.02 – 11.42 UT, 9.4 liter PMCP
Time line: characterization	14:30 UT: Take-off: 14:45-15:30 UT: 1st tracer sampling , BL 15:30-17:00 UT: Cloud profiling/outflow north of Manaus 17:00-18:00 UT: G1 intercomparison, 2 nd tracer sampling, BL characterization

18:00-18:45 UT:	Cloud sampling, 3 rd tracer sampling, radiation (cloud cycling)
18:45- 20:15 UT:	Outflow, 4 th tracer sampling west of Manaus, radiation (cloud cycling)
20:15-21:30 UT:	Outflow layers (step descent)
21:40 UT	Landing

Flight route (plan):



Vertical flight pattern



Flight remarks (UTC)

13:10 Scientific crew briefing
14:40 Take off
14:58 Start run WP2-WP3 (pattern #13), 2000 ft, below cloud base
14:59 Tracer sampling (16 tubes)
15:04 climb to 3000 ft (ATC request), cloud base level
15:16 climb to 6000 ft
15:20 Start run WP3-WP2 (#13), tracer sampling (8 tubes), shallow convection,
problem with planet chat tool
15:30 heading north, cloud penetrations (tops), planet chat tool works
15:34 climb to 10000 ft, cloud penetrations, cloud drops on HALO wind shield, 10 °C
15:48 Photo 1: cloud penetration, CO: 300 ppb (CO-BG: 90 ppb)
15:49 cloud penetration, cloud drops on wind shield
16:22 photo 2 Cb before anvil sampling

Photo 1



Photo 2



- 16:32-16:34** **anvil sampling, lightning, ice particles on wind shield**
- 16:35-16:39** **anvil sampling**
- 16:40** **descend to 5000 ft**
- 17:03** **rendezvous with G1, run WP6-WP7 (#13), 1500 ft, G1 slightly behind on left side**
- 17:11** **tracer sampling (8 tubes)**
- 17:23** **fires near WP7**
- 17:24** **BB plumes (photo 3), penetration of BB plume**
- 17:30** **run WP7-WP6, tracer sampling (8 tubes), BB impact**

Photo 3



- 17:50** **climb to FL 060 (cloud base FL045)**
- 17:55-18:12** **cloud penetrations**
- 18:13** **climb to FL100**
- 18:17-18:27** **cloud penetrations**
- 18:28** **climb to FL180**

- 18:30ff cloud penetrations
- 18:35 tracer sampling (8 tubes)
- 18:37 outflow, ice particles
- 18:46 climb to FL300
- 18:50 tracer sampling in outflow, -13°C
- 18:57 in outflow, -30°C,
- 19:01 last tracer sampling (8 tubes), enhanced CO in outflow
- 19:15 climb to FL400
- 19:26 cloud cycling for radiation measurements (photo 4)

Photo 4



- 19:40-19.46 outflow sampling, ice particles on wind shield, HALO ice detection
- 19:50 climb to FL450
- 20:00 outflow sampling, ice particles on wind shield, -66°C
- 20:05 climb to FL470
- 20:33 max FL468, -70°C
- 20:38 start descent, 5000 ft steps
- 20:55 during descent multiple CO layers
- 21:10 FL250, cloud layers
- 21:20 FL200, photo5: cloud layers and waves
- 21:49 Landing

Photo 5



Instrument status:

<u>Radiation</u>	
EAGLE/HAWK:	Okay
HAI:	Ok
miniDOAS:	Ok, motor problems for the last one and a half hour
SMART:	Problems after take-off, ASP 6 and 7
SNOOPY:	Ok
<u>PMS</u>	
CAS-DPOL:	Ok, also hot wire ok
CCP:	Ok
MTP:	Ok
NIXE-CAPS:	CAS Ok, hot wire possible issues, steps/jumps, error #23 for CIP, stripes in the CIP images
PHIPS:	Ok!!! Minor issues with flash
PCASP-100X:	Ok
PIP:	Ok
SID-3:	Ok
UHSAS-A:	Ok
<u>Gas</u>	
ALABAMA-NOy:	Ok, lightning NOx, in-flight calibration partly switched off
PAN-MS:	Ok, reduced sensitivity
AMTEX:	Ok, CO 30 min mission data, ok after reset
TDS:	Ok
<u>Aerosol</u>	
C-ToF-AMS:	Ok
CVI-Rack:	Ok
CCN:	Some problems toward the end of the flight, software, restart needed, flow problems at high altitudes, HASI connected during the whole flight
AMETYST:	Ok

FINCH:	Seems ok
<u>BAHAMAS</u>	
<u>SatCom</u>	ok

1.5 G1 Team Summary

GOAmazon_Flight_Journal_template.doc

Flight date (YYYYMMDDa): 20140916

Pilots: Hubbell, Ray

Scientists: Tomlinson, Nelson, Fortner, Marcia, Major Julio

Start 1118

Shutdown 1438

Eng Time 3+20

Takeoff 1135

Land 1428

Flt Time 2+53

Science Meter: 1076.8

Flight Summary: Flight plan 7 aerosol characterization and cloud profiling and HALO intercomparison

Weather: Scattered clouds and building. Cirrus shield above entire time. Thick haze.

Flight Details: Flight plan 7 followed except very last leg cut short to make rendez-vous. Intercomparison at 1500ft. Then 6000 ft in clouds first 10-15 miles. Cut some other corners due to convection.

No issues on the aircraft.

Cabin low to mid 30C again. Good.

Background CPC 2000-2500 /cc, Neph 50 Mm-1, PCASP 1300 /cc, O3 -20, CO 110 ppb, AMS 3 microg/cc

Plume: CO over 250 ppb, NOy 6-7 ppb, O3 100 ppb, AMS 40 micorg/cc

Fires around B56. B53 Big Fires. Had to turn on diluter. Changed PSAP filter.

Cloud base ft 4800, Cloud tops above towering Cu.

Plume was well defined.

Instruments: NO2 might be OK

PCASP needs to be cleaned..

Layers (Height):

Boundary Layer:

Aerosol Layers:

Plume Layers:

Clouds:

Atmospheric state:

Rosemount 102, 101F1, GE-1011B:

Gust Probe 1221F2 x3:

TANS:

DSM:

AIMMS:

TDL:

Aerosol inlet collection:

Iso-Kinetic inlet:

Diluter

Aerosol properties:

UHSAS:

PCASP:

UCPC TSI 3025:

CPC TSI 3010:

PSAP:

Nephelometer (TSI 3563):

DMT CCN counter (dual SS):

Hr-ToF-AMS:

FIMS:

OPC:

Cloud Probes:

WCM:

CDP:

FCDP:

2DS:

HVPS:

CPI:

Radiation:

SPNs:

Gases:

CO analyzer:

Oxides of Nitrogen:

Ozone:

PTRMS:

PICARRO:

Other:

Video camera:

Power System
downlink:

Xchat:

KML:

1.6 G1 Quick-look

