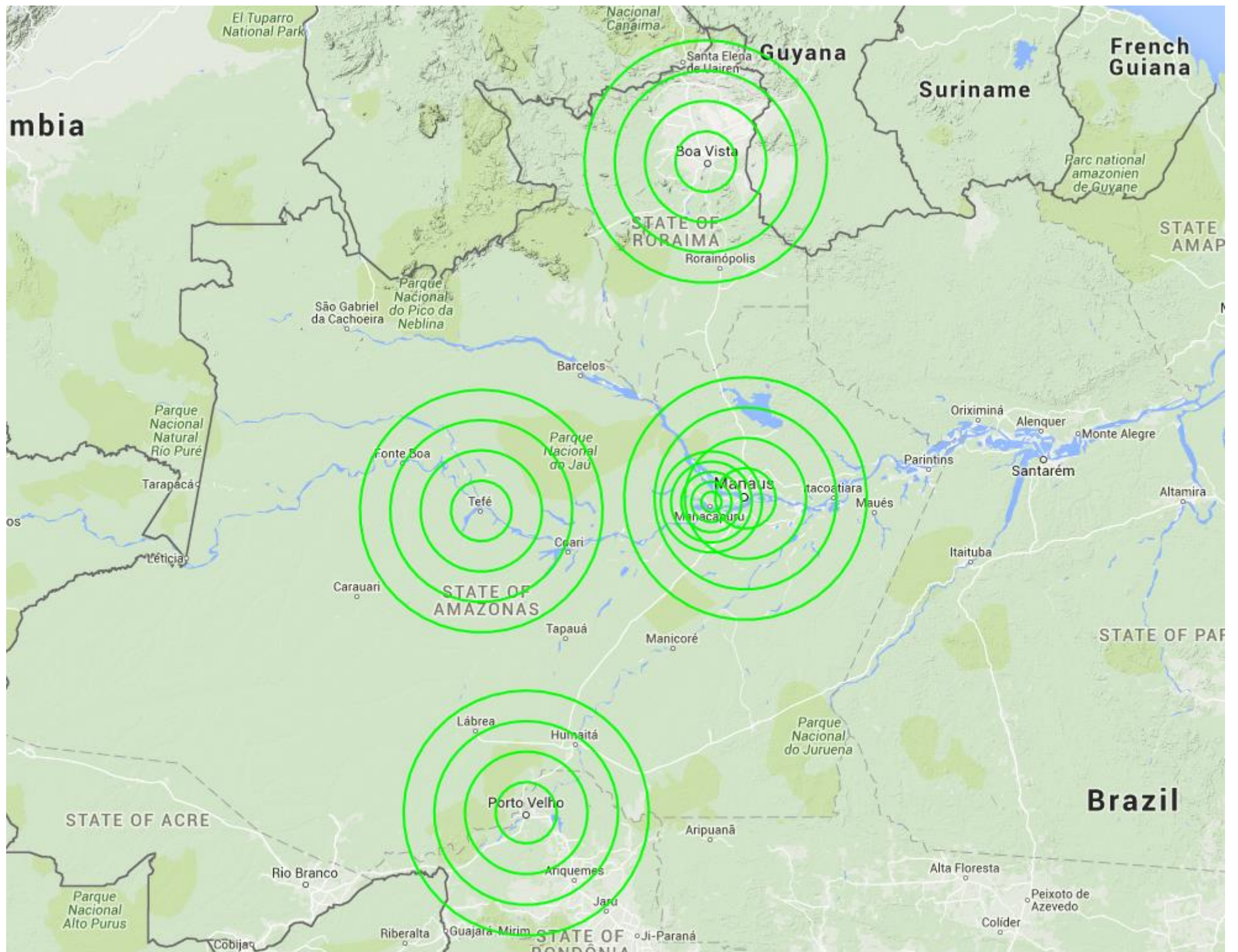# Flights and X-Band radar

Thiago Biscaro – DSA/CPTEC/INPE

thiago.biscaro@inpe.br

Topics

- Radar coverage during CHUVA-ACRIDICON-GoAmazon

- Radar data availability during G1 and HALO flights

- Preliminary results from X-Band observations

  - Hydrometeor classification

  - Different conditions and regimes

Data availability

- ## SIPAM (S-Band)
  - Manaus – 2014
  - Tefé, Porto Velho, Boa Vista – SEP/OCT 2014
  - Issues: missing elevations (Manaus)

- ## CHUVA (X-Band)
  - 2014
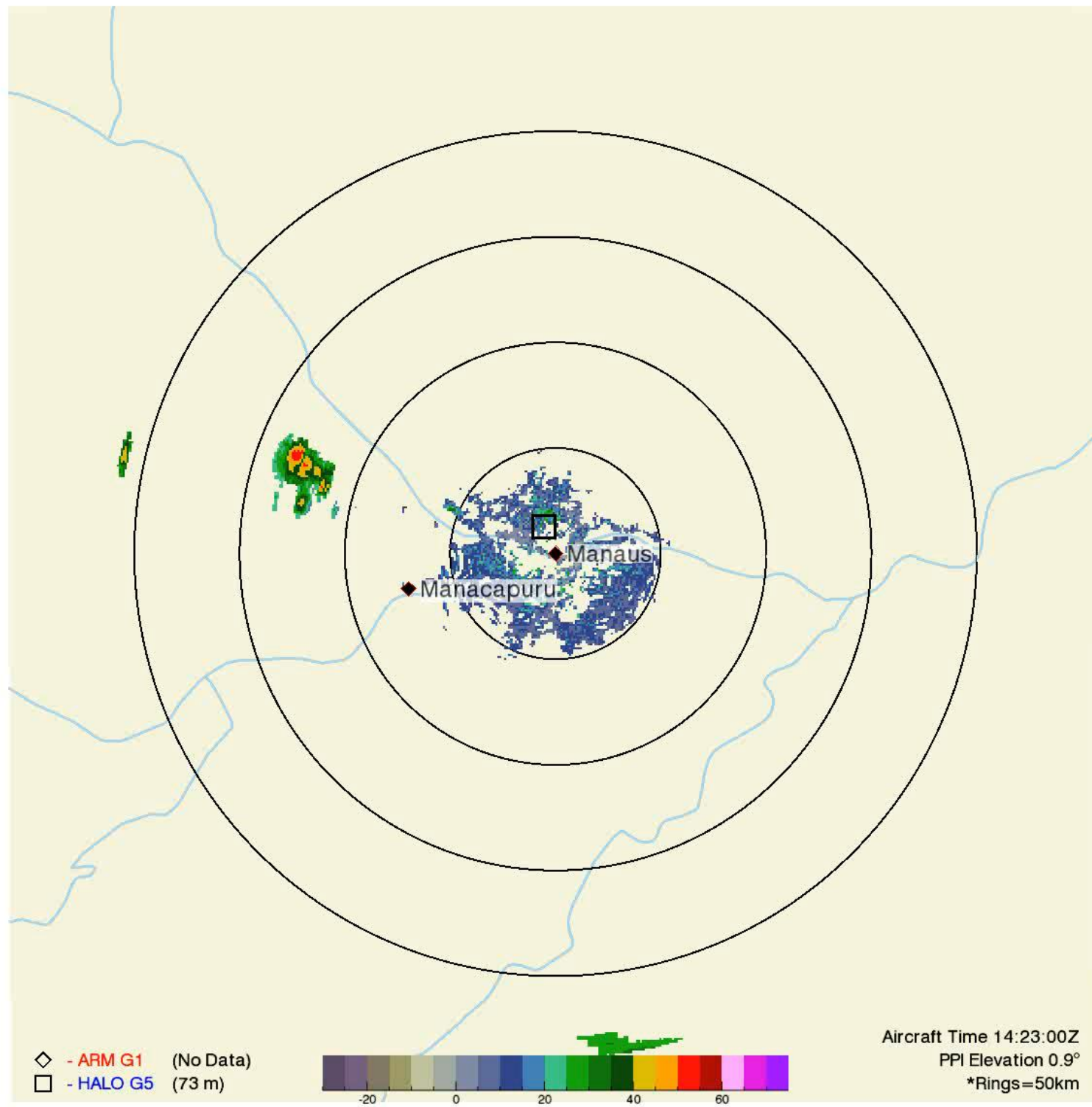 - Issues: missing periods, some scans with no dual pol information
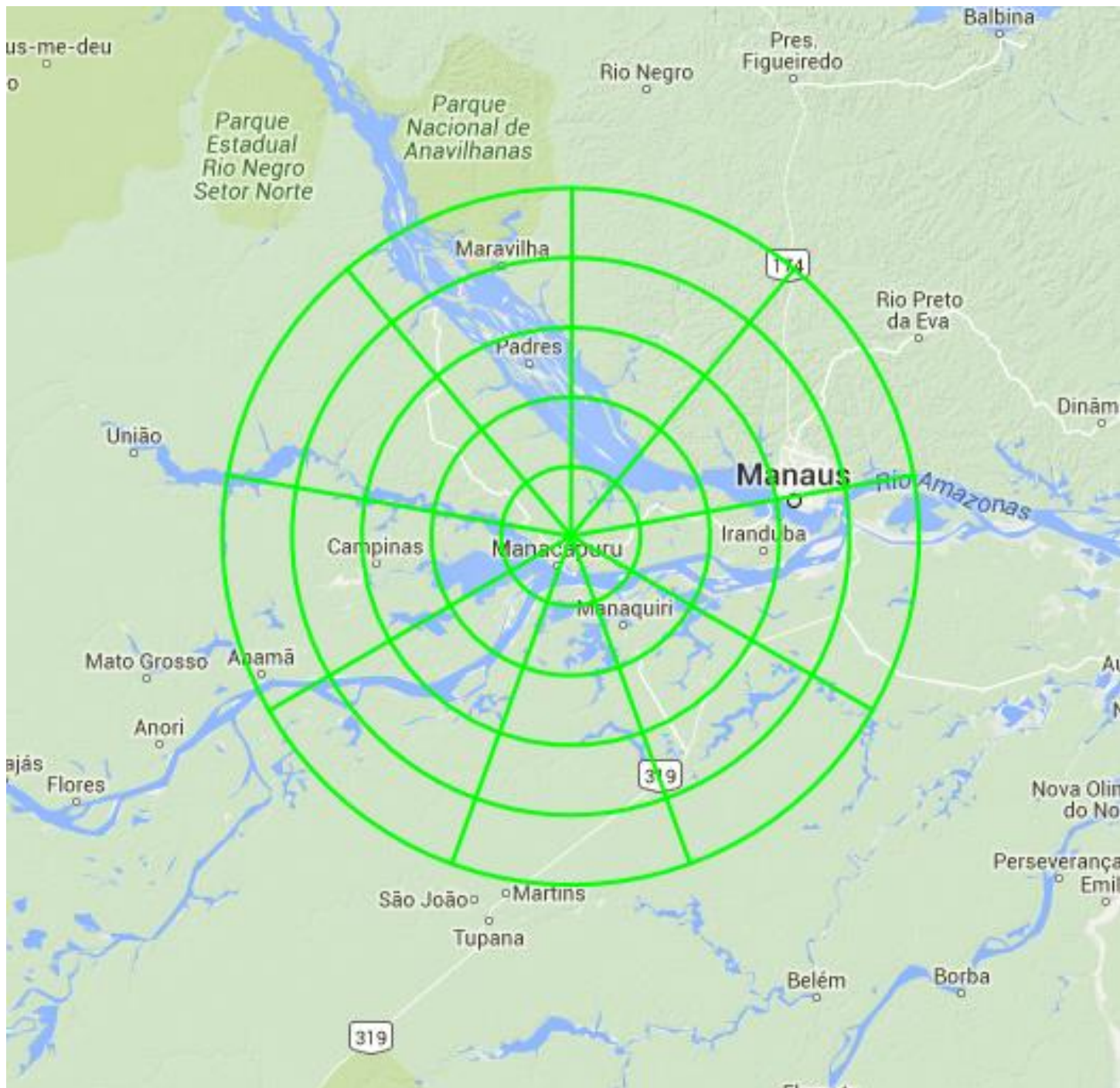
G1 Flights and X-Band radar data

Date	Time	RHI	RHI DP	Vol Scan	Vol Scan DP
2014-02-22	1437	N	N	Y	Y
2014-02-25	1630	N	N	Y	Y
2014-03-01	1333	N	N	Y	Y
2014-03-01	1714	N	N	Y	Y
2014-03-03	1736	N	N	Y	Y
2014-03-07	1308	N	N	Y	Y
2014-03-10	1422	N	N	Y	Y
2014-03-11	1440	N	N	Y	Y
2014-03-12	1720	N	N	N	N
2014-03-13	1414	N	N	Y	Y
2014-03-14	1417	N	N	Y	Y
2014-03-16	1438	N	N	Y	Y
2014-03-17	1623	N	N	Y	Y
2014-03-19	1425	N	N	Y	Y
2014-03-21	1632	N	N	N	N
2014-03-23	1456	N	N	N	N
2014-09-06	1516	N	N	Y	Y
2014-09-09	1501	Y	Y	N	N
2014-09-11	1432	Y	Y	Y	Y
2014-09-12	1441	N	N	Y	Y
2014-09-13	1450	Y	Y	Y	Y
2014-09-15	1459	Y	Y	Y	Y
2014-09-16	1540	Y	Y	N	N
2014-09-18	1436	Y	Y	Y	Y
2014-09-19	1430	Y	Y	N	N
2014-09-21	1517	Y	Y	Y	Y
2014-09-22	1423	Y	Y	Y	Y
2014-09-23	1546	Y	Y	N	N
2014-09-25	1709	N	N	Y	Y
2014-09-27	1829	N	N	Y	Y
2014-09-28	1509	N	N	Y	Y
2014-09-30	1455	N	N	Y	Y
2014-10-01	1439	N	N	Y	Y
2014-10-03	1450	N	N	Y	Y
2014-10-04	1624	N	N	Y	Y

HALO Flights and X-Band radar data

Name	Date	RHI	RHI DP	Vol Scan	Vol Scan DP	
AC07	2014-09-06	N	N	Y	Y	Y
AC08	2014-09-09	Y	Y	N	N	N
AC09	2014-09-11	Y	Y	Y	Y	Y
AC10	2014-09-12	N	N	Y	Y	Y
AC11	2014-09-16	Y	Y	Y	Y	Y
AC12	2014-09-18	Y	Y	Y	Y	Y
AC13	2014-09-19	Y	Y	Y	Y	Y
AC14	2014-09-21	Y	Y	Y	Y	Y
AC15	2014-09-23	Y	Y	Y	Y	Y
AC16	2014-09-25	N	N	Y	Y	Y
AC17	2014-09-27	N	N	Y	Y	Y
AC18	2014-09-30	N	N	Y	Y	Y
AC19	2014-09-29	N	N	Y	Y	Y
AC20	2014-10-01	N	N	Y	Y	Y

SIPAM S-Band PPI and Aircraft - 20140916

◇ - ARM G1   (No Data)
☐ - HALO G5   (73 m)

-20   0   20   40   60

Aircraft Time 14:23:00Z
PPI Elevation 0.9°
*Rings=50km

Issues, data processing, and quality control

- Issues with the X-Pol radar

  - Magnetron failure

  - V-pol lost

  - Transmitter power loss

- Z + ZDR attenuation correction and ZDR offset calibration when DP info were available

- Z offset calibration using TRMM/GPM and clutter references (in progress, ready for SIPAM-Manaus (C. Schumacher group at TAMU))

Hydrometeor classification

- Meteo / non-meteo classification (NEXRAD algorithm)

- Echo Type classification (BMRC – Keenan et al. (2003))

- Classification at different levels. Levels calculated using sounding data (T3)

  - Cloud base

  - 0 °C isotherm

  - -15 °C isotherm

  - -30 °C isotherm

Cloud base

Class (%)	Total	IOP1	IOP2	Background	Polluted
Drizzle	38.8	46.2	1.9	40.4	47.7
Rain	61.1	53.7	98.1	59.5	52.2
Snow					
Graupel	< 0.1	< 0.1		< 0.1	< 0.1
Hail					
Rain Hail Mix					

0 °C

Class (%)	Total	IOP1	IOP2	Background	Polluted
Drizzle	10.5	11.9	4.2	9.5	12.8
Rain	6.4	3.2	25.9	6.2	5.7
Snow	40.7	45.1	30.5	43.4	38
Graupel	45.8	43.5	39.2	44.3	44
Hail	< 0.1	< 0.1			< 0.1
Rain Hail Mix	< 0.1	< 0.1	1	< 0.1	< 0.1

-15 °C

Class (%)	Total	IOP1	IOP2	Background	Polluted
Drizzle					
Rain					
Snow	91.4	92.5	88	91.5	91.8
Graupel	8.4	7.3	11.9	8.3	8
Hail	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Rain Hail Mix					

-30 °C

Class (%)	Total	IOP1	IOP2	Background	Polluted
Drizzle					
Rain					
Snow	100	100	100	100	100
Graupel					
Hail					
Rain Hail Mix					

Conclusions

- Largest differences occur between IOP1 and IOP2
  - Significant difference at cloud base between IOP1 e IOP2, practically no drizzle during IOP2
    - Real or cloud base height too variable?
  - More icy particles at 0 °C for IOP1 (~90% snow + graupel)
  - More graupel at -15 C for IOP2
  - Hail contribution is negligible
- Background and polluted cases present differences only at low levels