Radar calibration

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Objectives

Evaluate the performance of XPOL during the CHUVA Field Campaigns, i.e, check the radar calibration (Level 0) and attenuation correction scheme (Level 1).

Approaches:

TRMM intercomparison

DSD measurements

TRMM-PR

methodology: Anagnoutou et al. (2001)

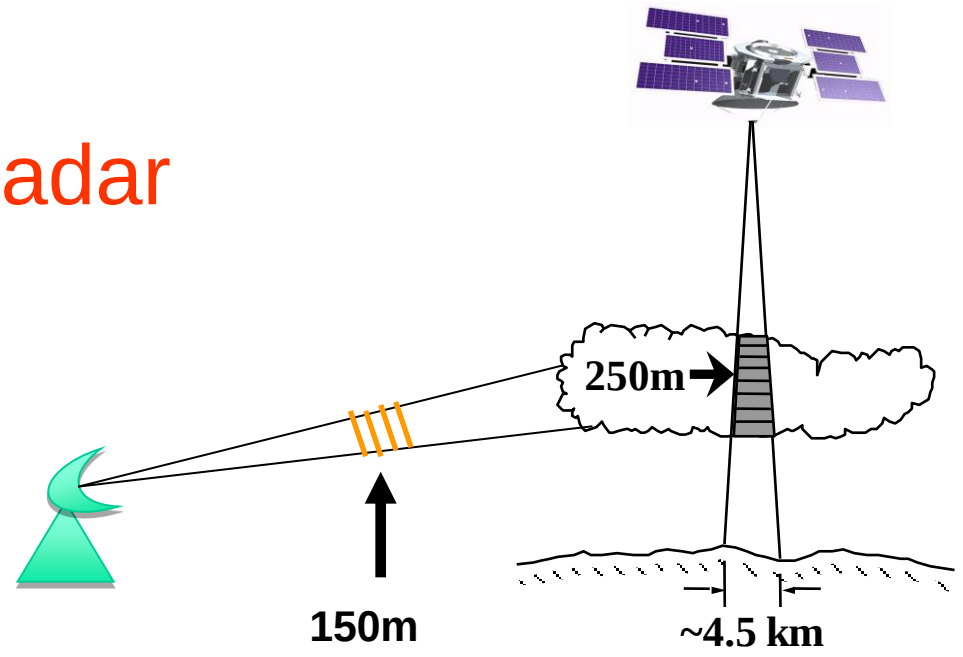
2A25 Coincident measurements:

7-15 km CAPPIs (2km depth) with 5x5 km

15-35 dBZ

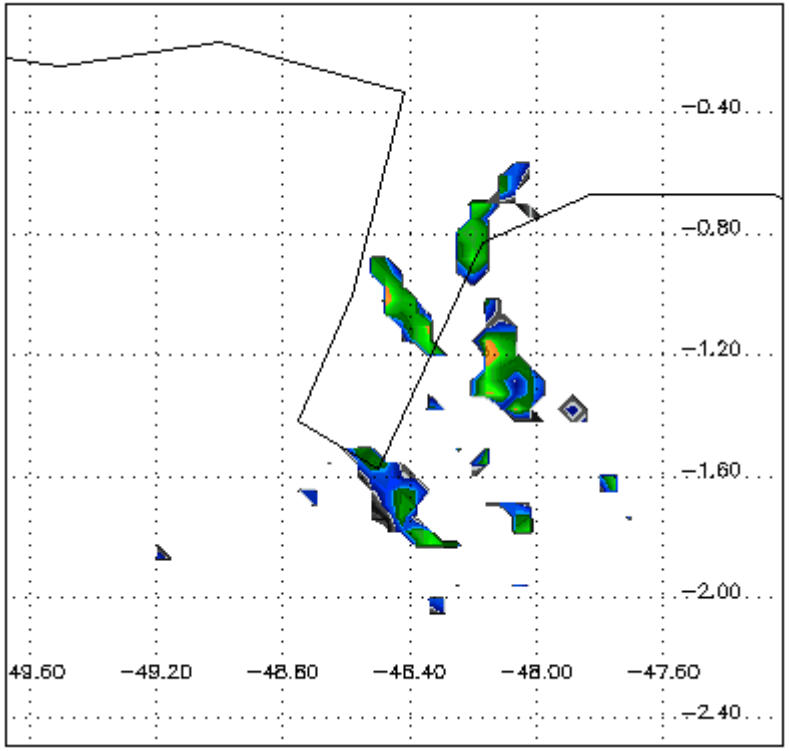
Stratiform rain

up to 60 km from the radar

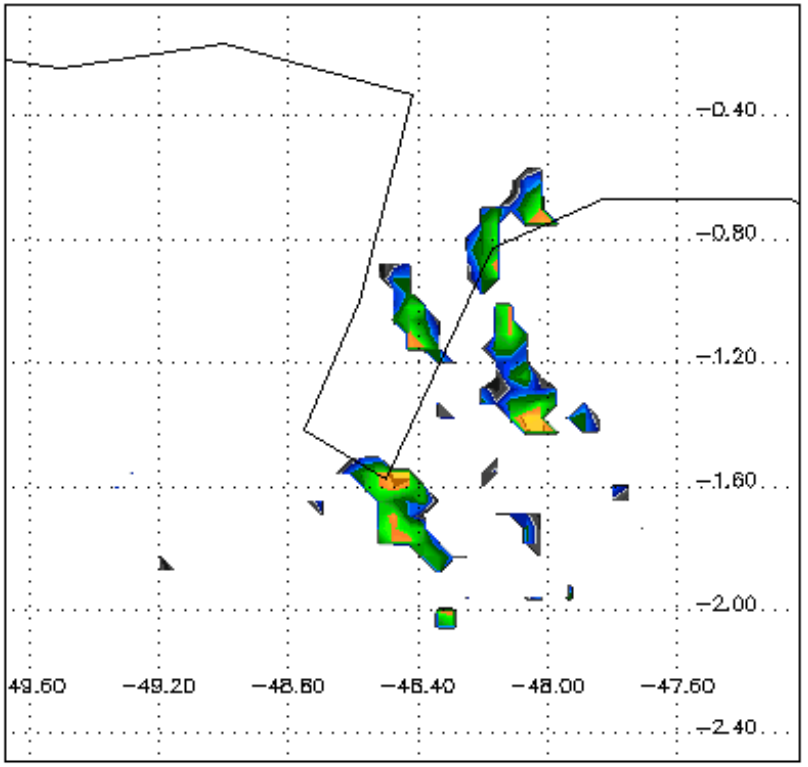


Belém

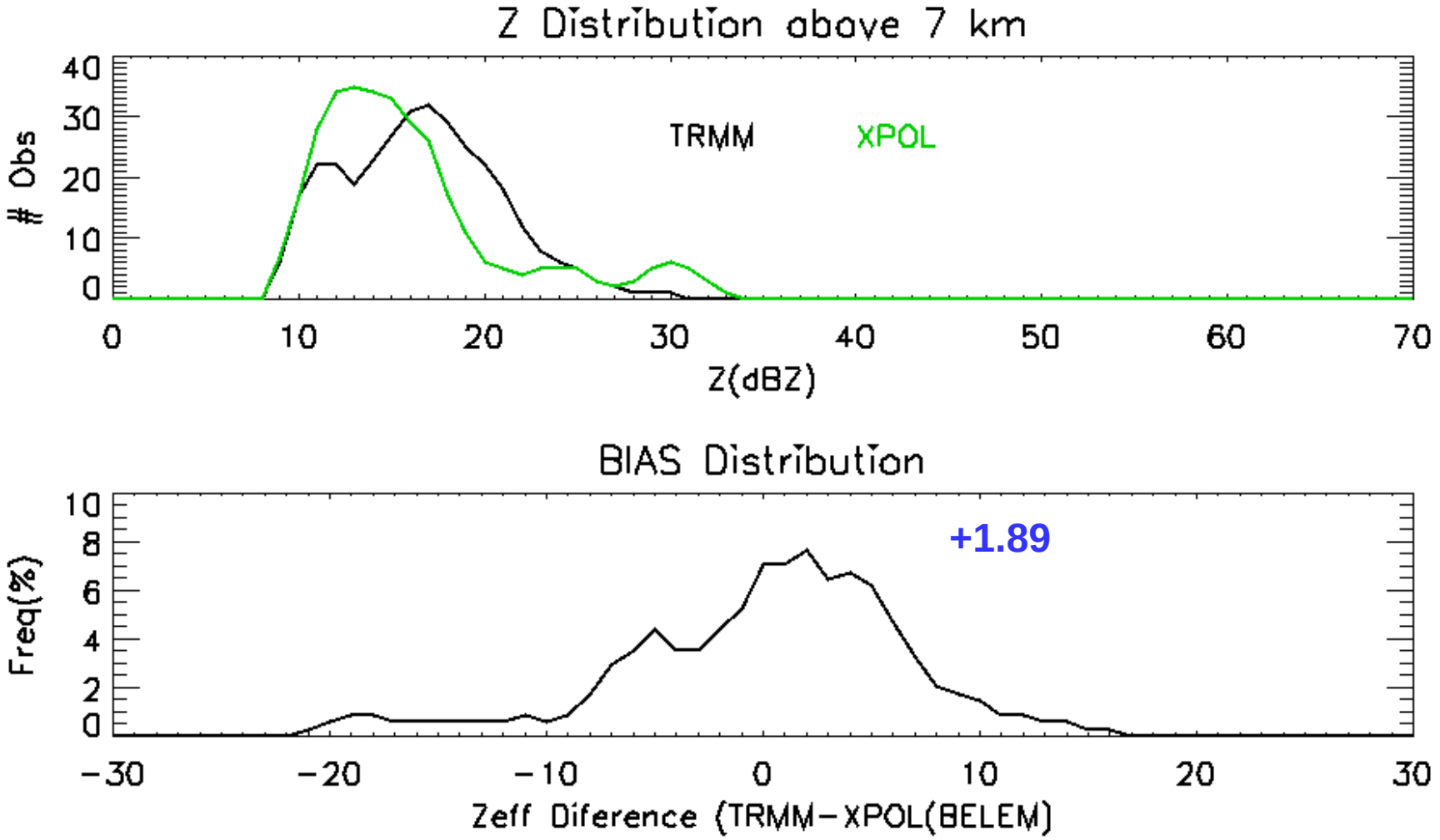
XPOL



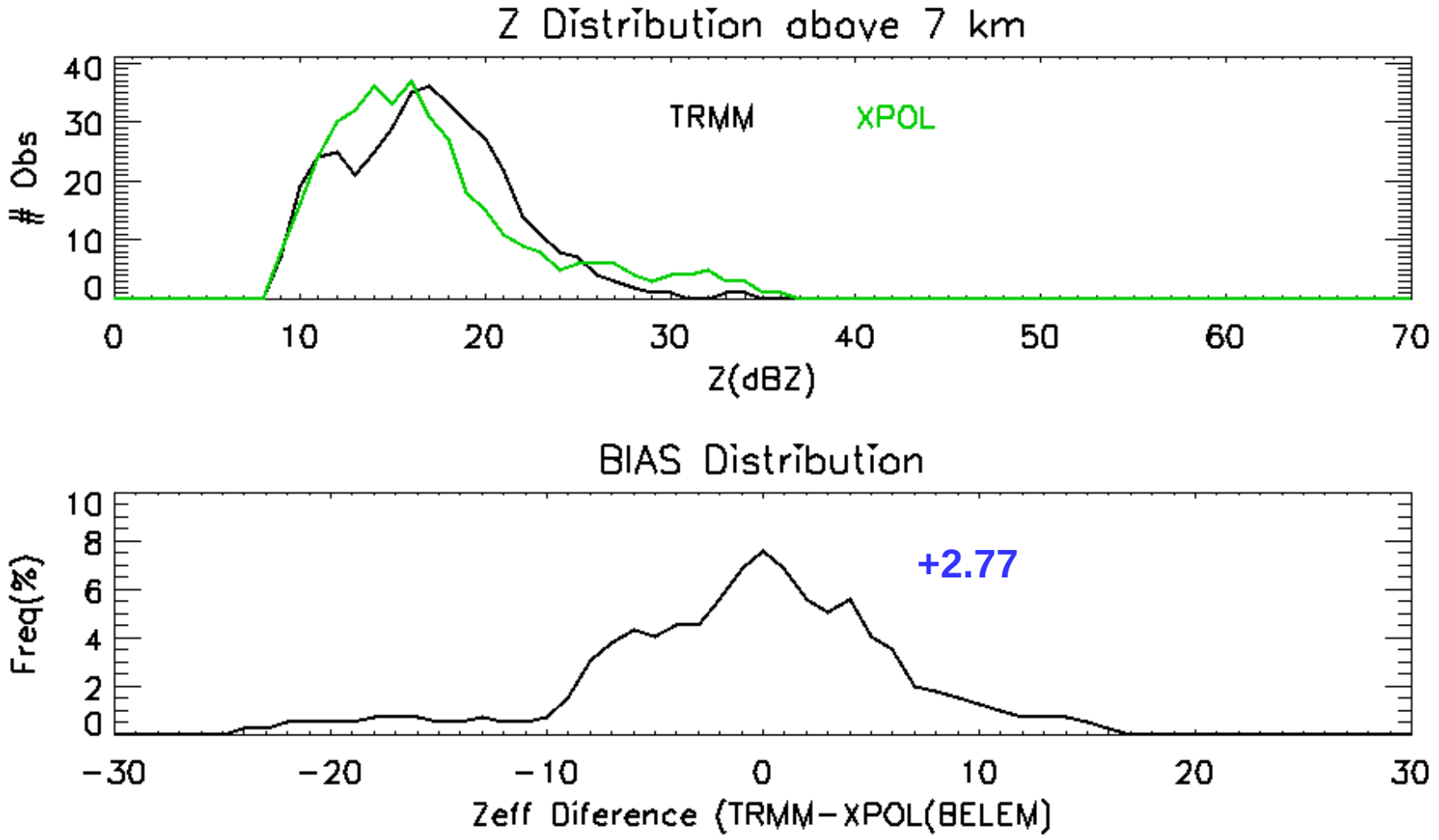
TRMM



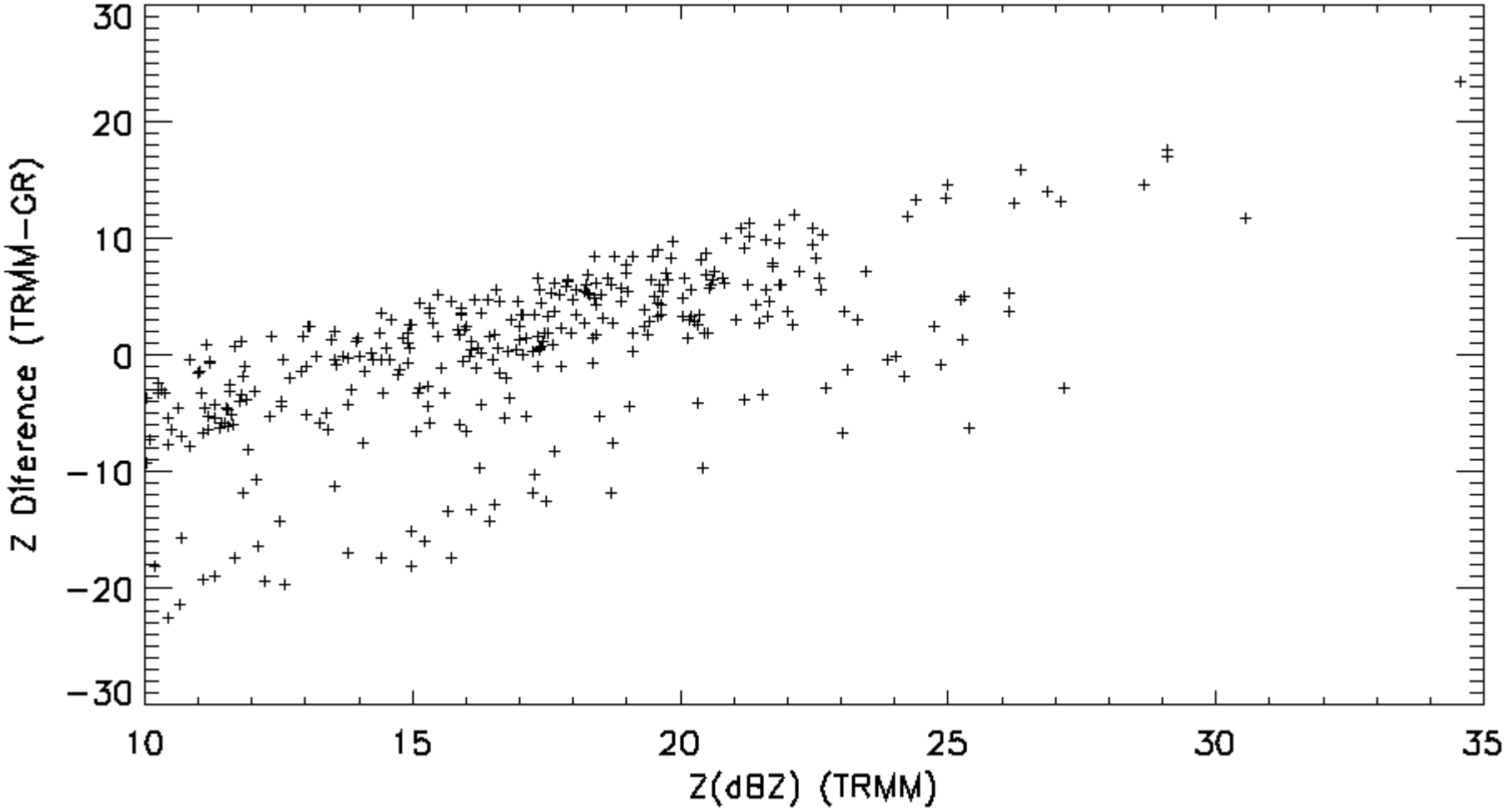
Level 0


Z Distribution above 7 km
Obs
TRMM
XPOL
Z(dBZ)
BIAS Distribution
Freq(%)
+1.89
Zeff Diference (TRMM-XPOL(BELEM)

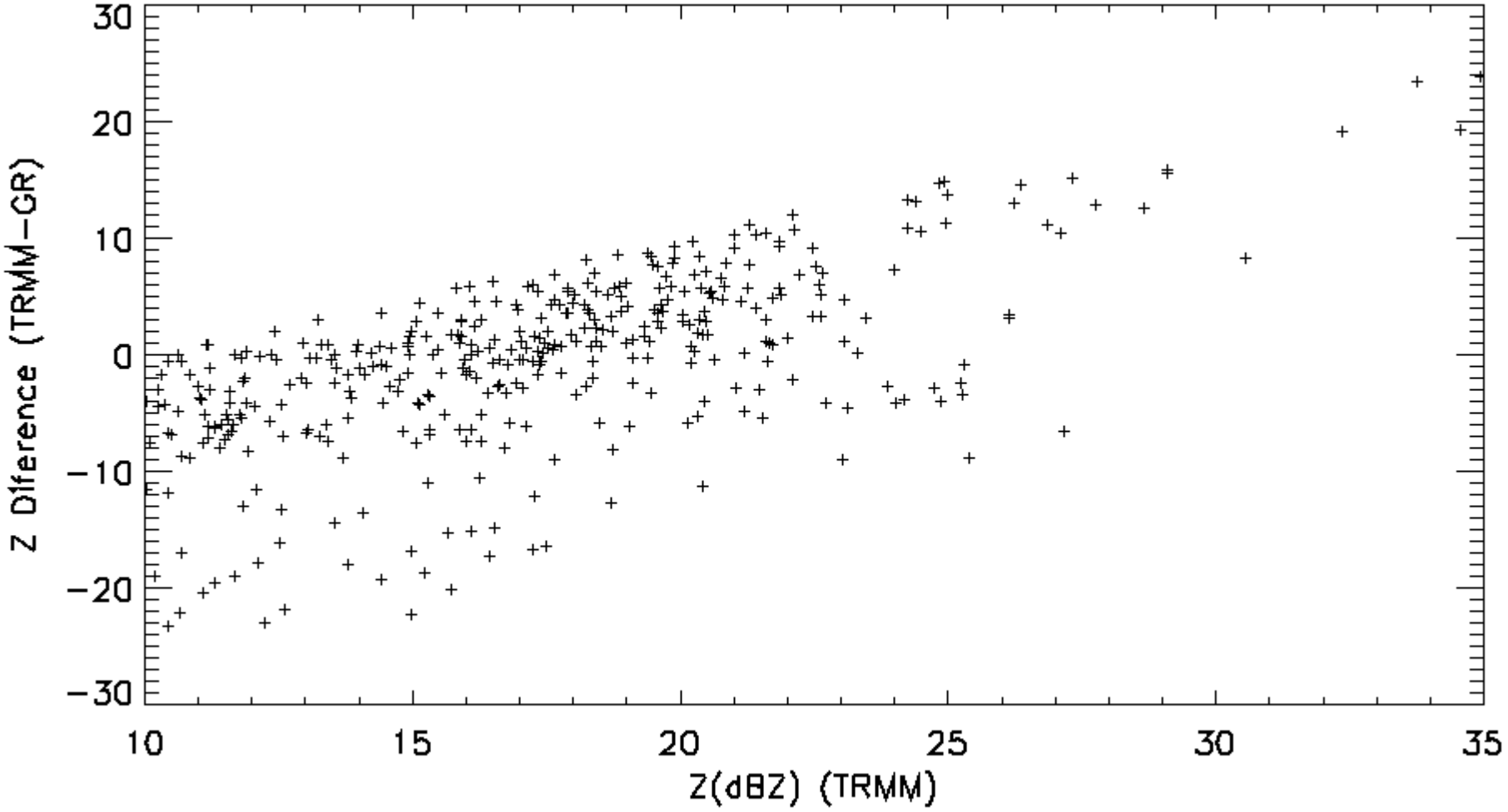
Level 1


Z Distribution above 7 km
Obs
TRMM
XPOL
Z(dBZ)
BIAS Distribution
Freq(%)
+2.77
Zeff Diference (TRMM-XPOL(BELEM)

Level 0

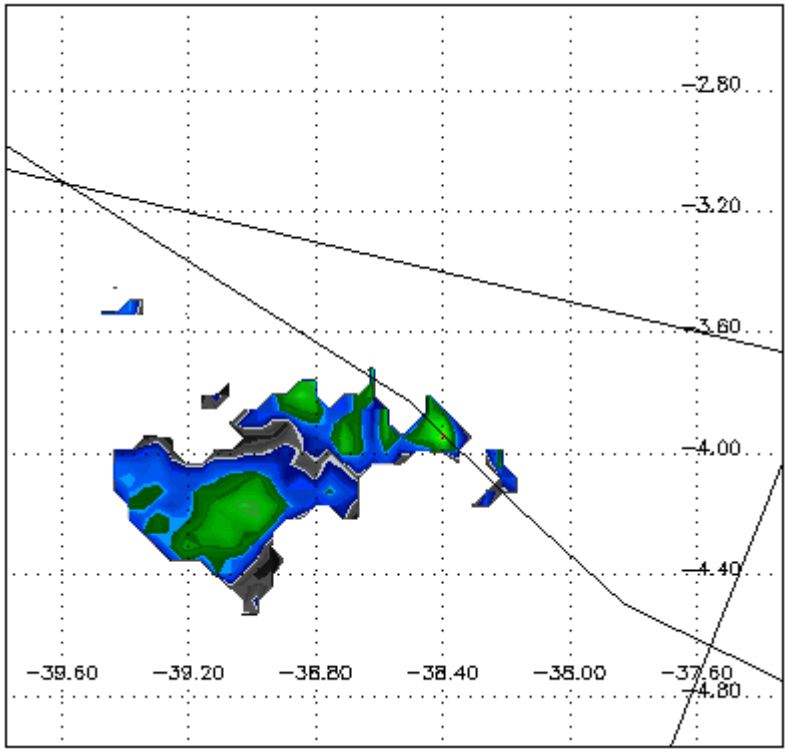


Level 1

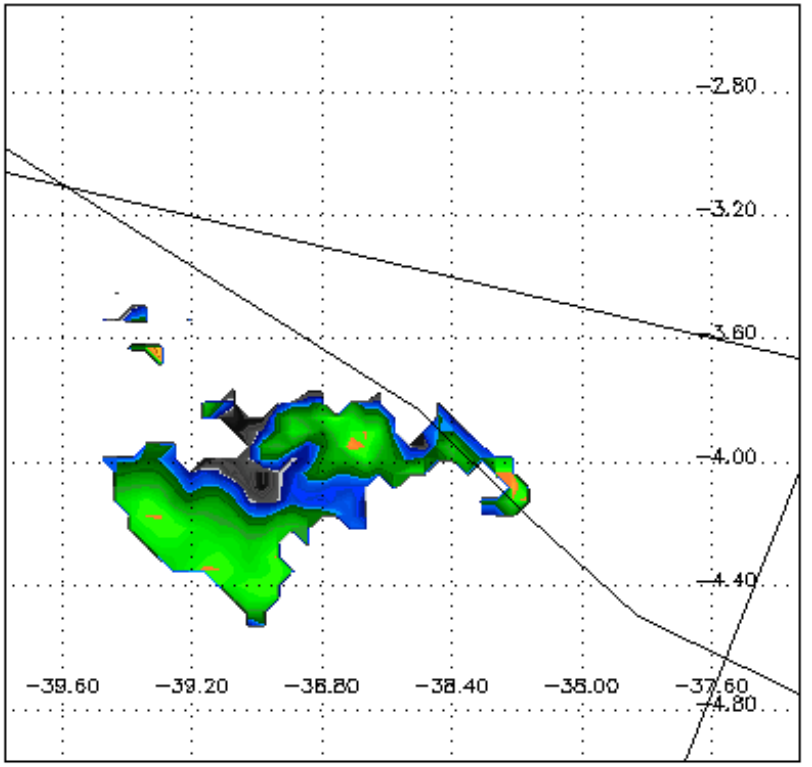


Fortaleza

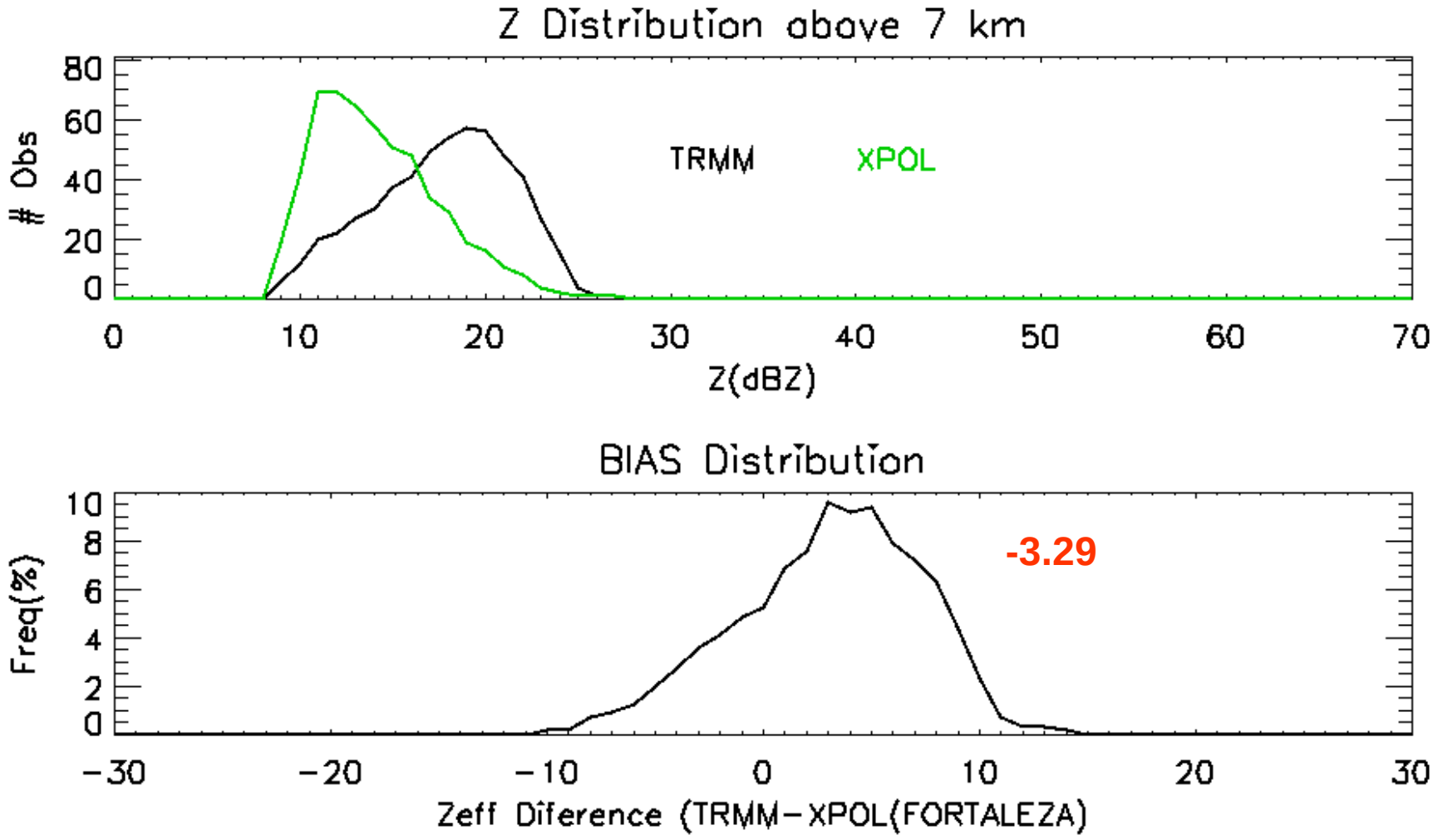
XPOL



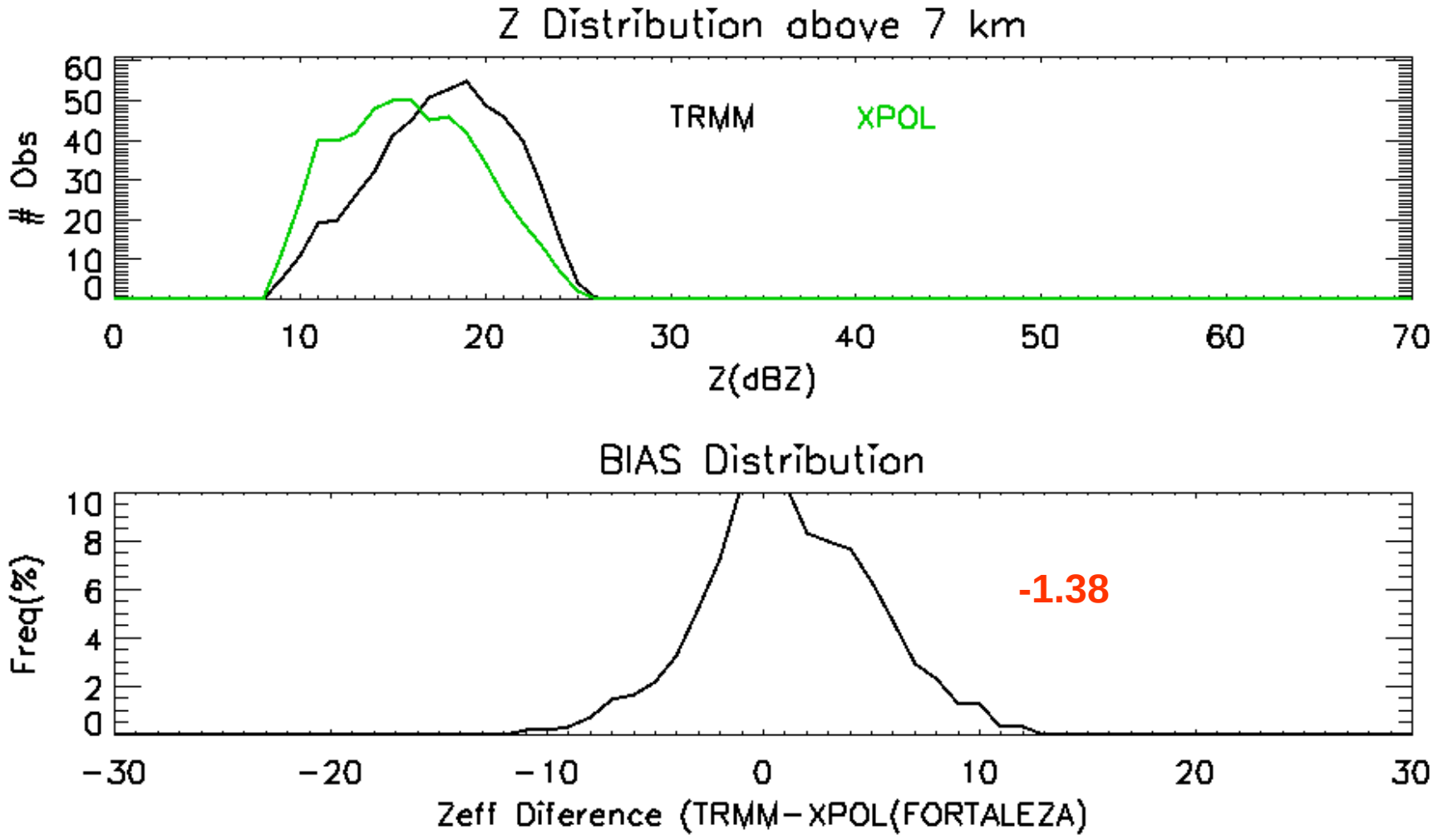
TRMM



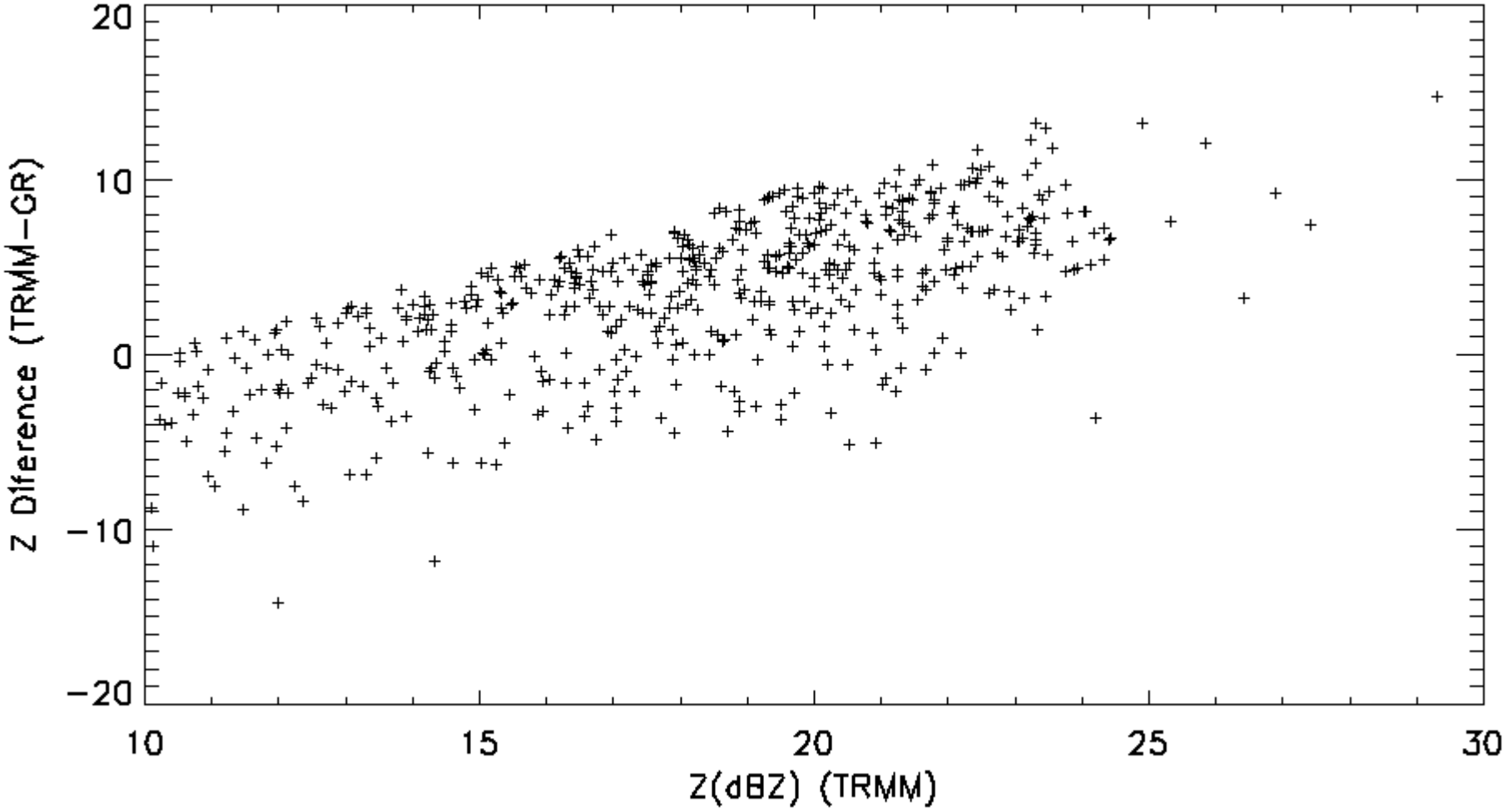
Level 0


Z Distribution above 7 km
Obs
80
60
40
20
0
TRMM
XPOL
0
10
20
30
40
50
60
70
Z(dBZ)
BIAS Distribution
Freq(%)
10
8
6
4
2
0
-3.29
-30
-20
-10
0
10
20
30
Zeff Diference (TRMM-XPOL(FORTALEZA)

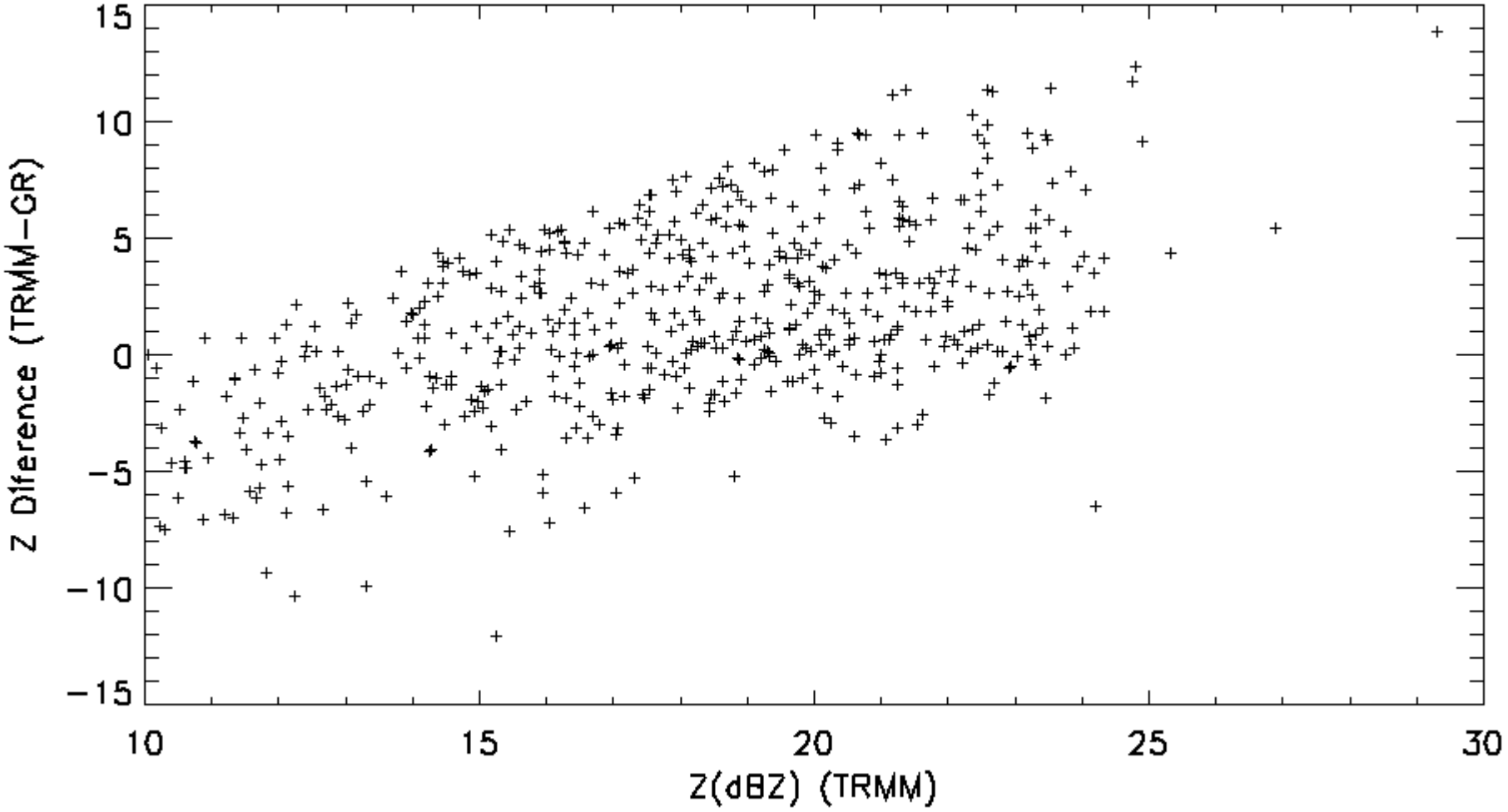
Level 1


Z Distribution above 7 km
Obs
TRMM
XPOL
Z(dBZ)
BIAS Distribution
Freq(%)
-1.38
Zeff Diference (TRMM-XPOL(FORTALEZA)

Level 0

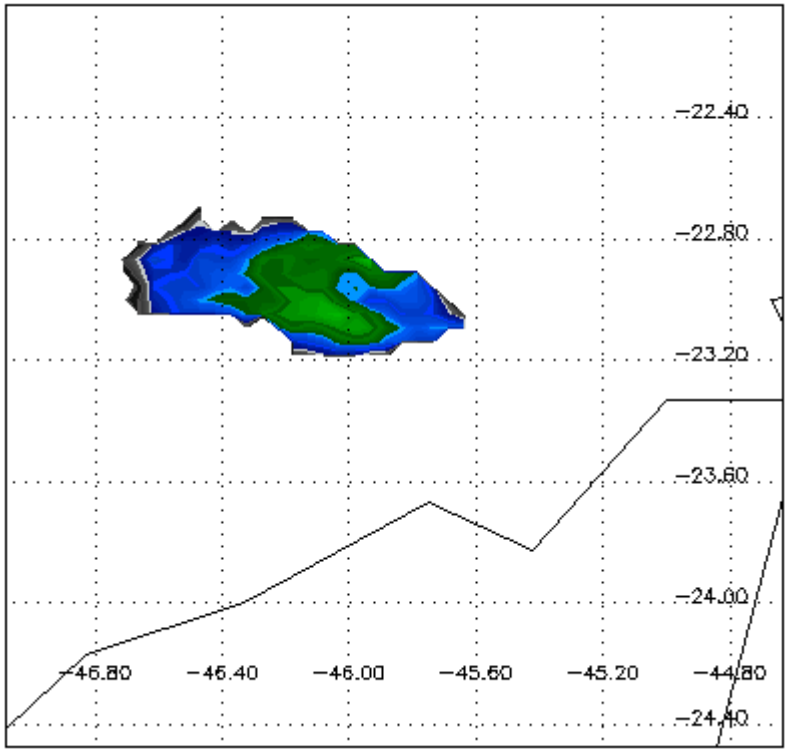


Level 1

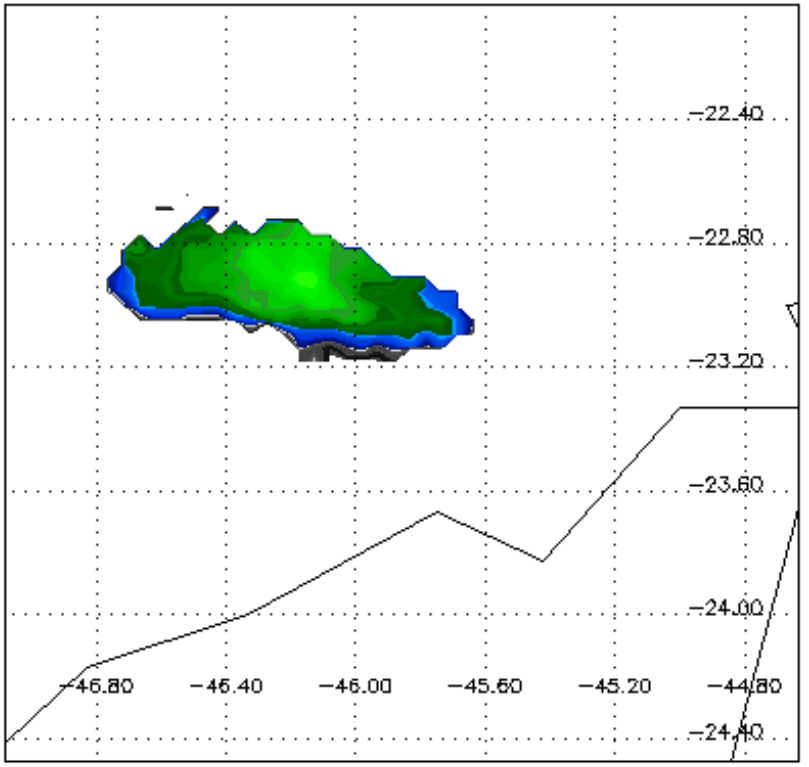


Vale - GLM

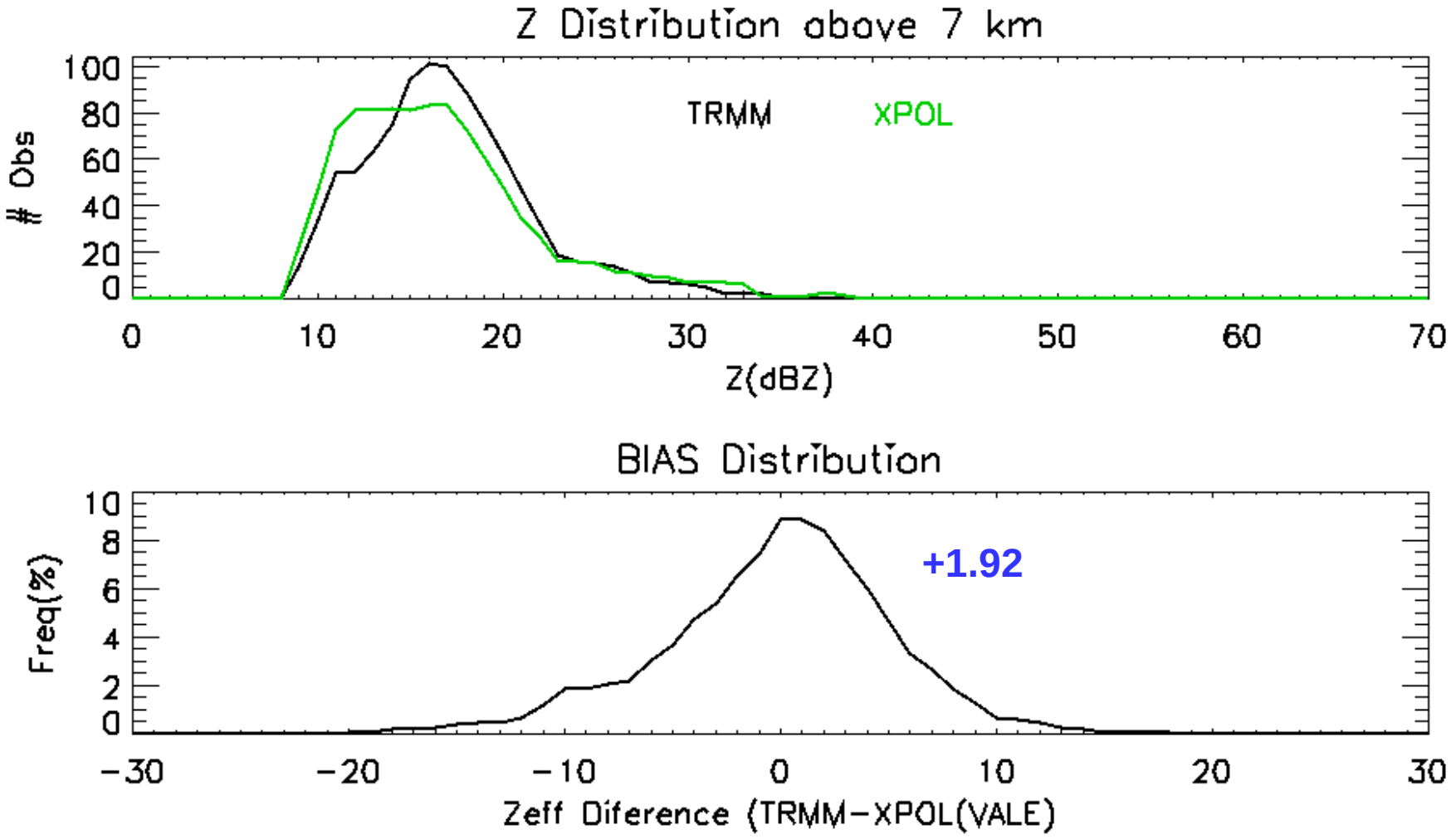
XPOL



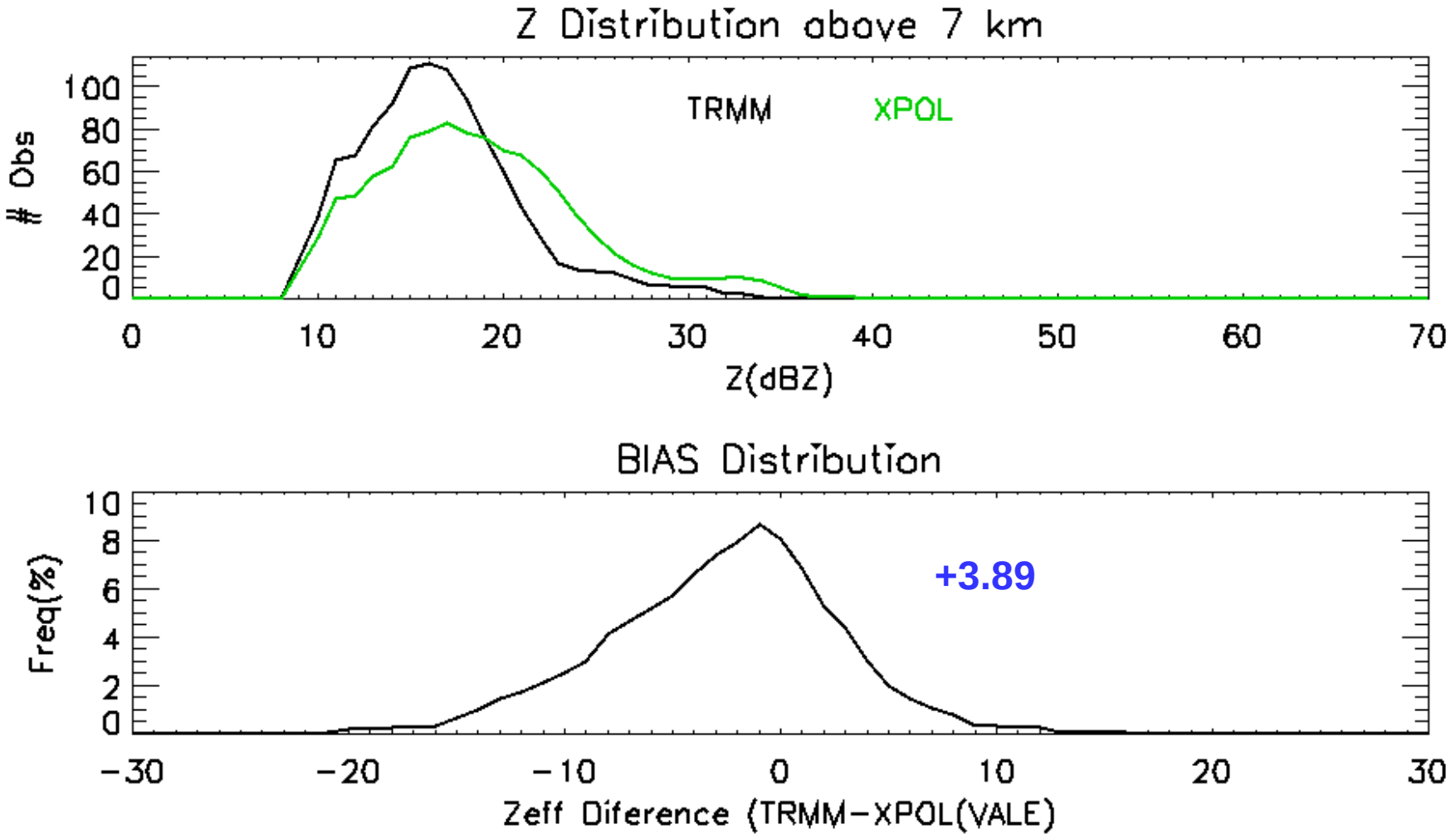
TRMM



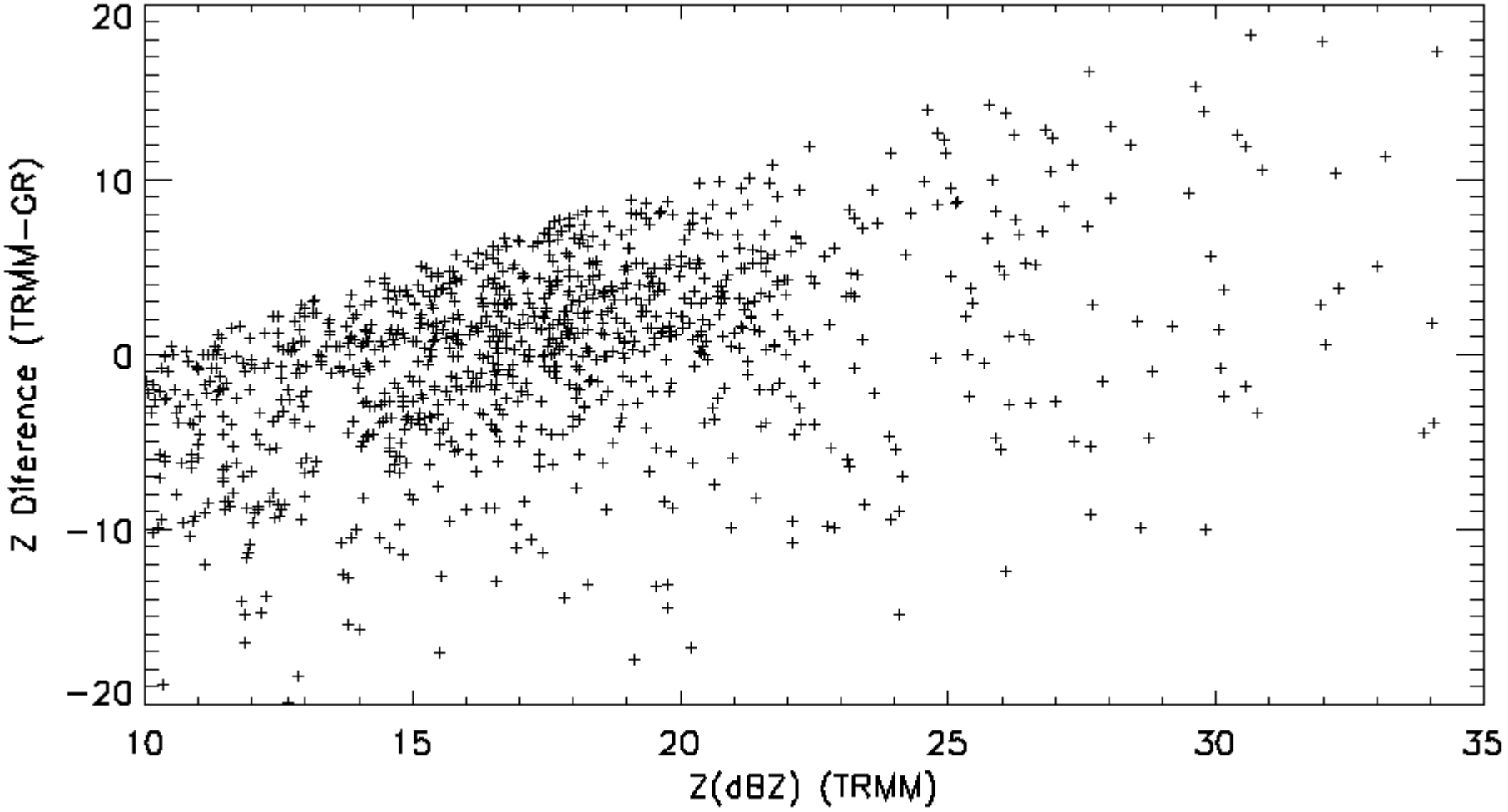
Level 0


Z Distribution above 7 km
Obs
100
80
60
40
20
0
TRMM
XPOL
0
10
20
30
40
50
60
70
Z(dBZ)
BIAS Distribution
Freq(%)
10
8
6
4
2
0
+1.92
−30
−20
−10
0
10
20
30
Zeff Diference (TRMM−XPOL(VALE)

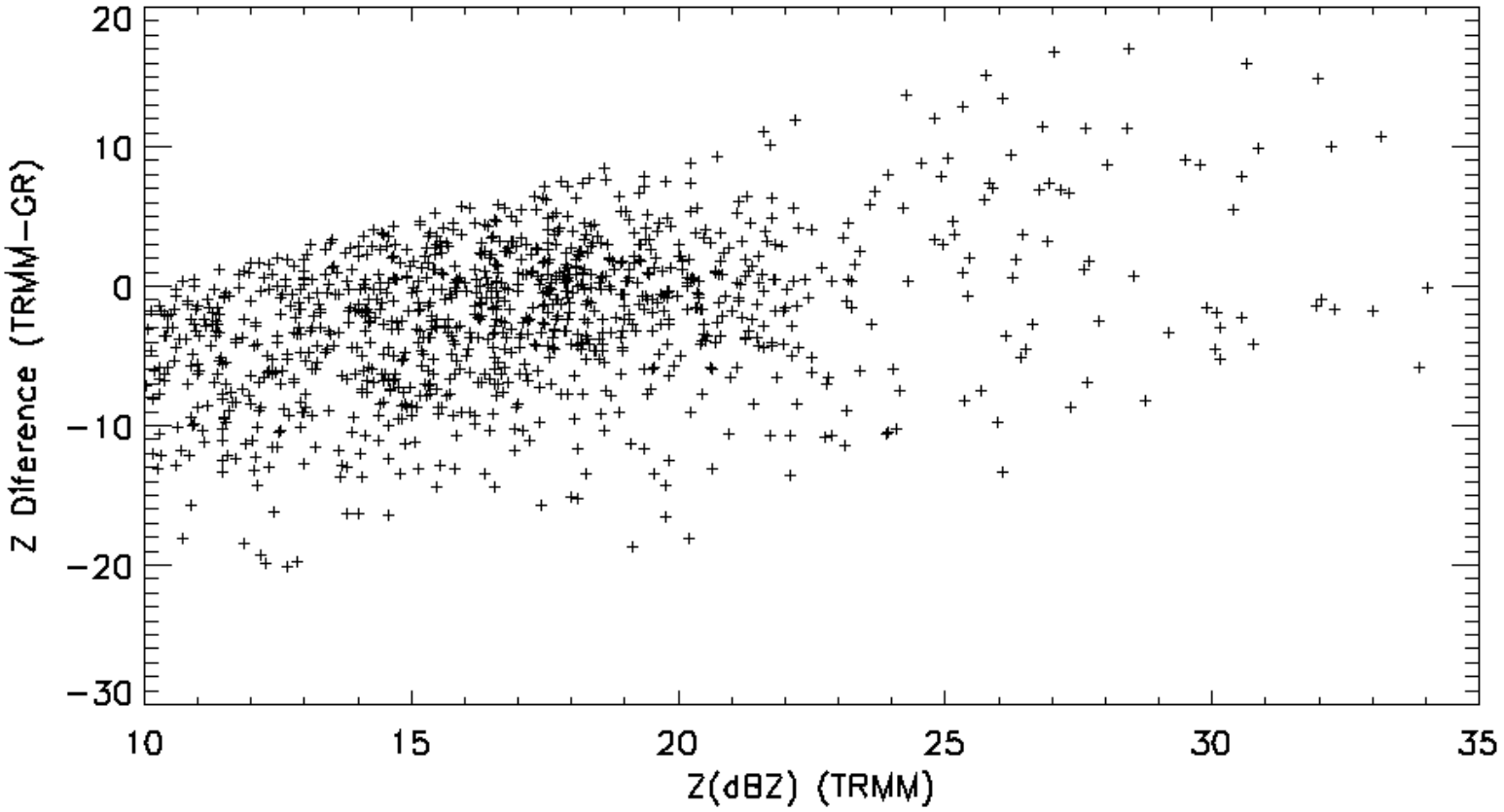
Level 1


Z Distribution above 7 km
TRMM
XPOL
Obs
100
80
60
40
20
0
0
10
20
30
40
50
60
70
Z(dBZ)
BIAS Distribution
+3.89
Freq(%)
10
8
6
4
2
0
−30
−20
−10
0
10
20
30
Zeff Diference (TRMM−XPOL(VALE)

Level 0



Level 1



Calibration Summary - TRMM

Campaign	TRMM	XPOL	BIAS	XPOL +Level1	BIAS	# Obs
Belém	19.34	21.24	+1.89	22.85	+2.77	554
Fortaleza	19.14	15.94	-3.29	22.85	-1.38	340
Vale-GLM	20.36	22.28	+1.92	23.53	+3.89	1014

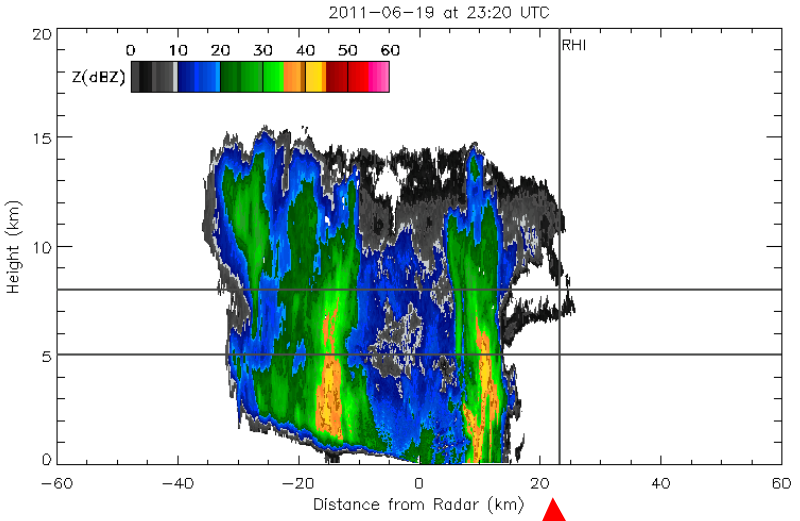
DSD

RHI Coincident measurements:

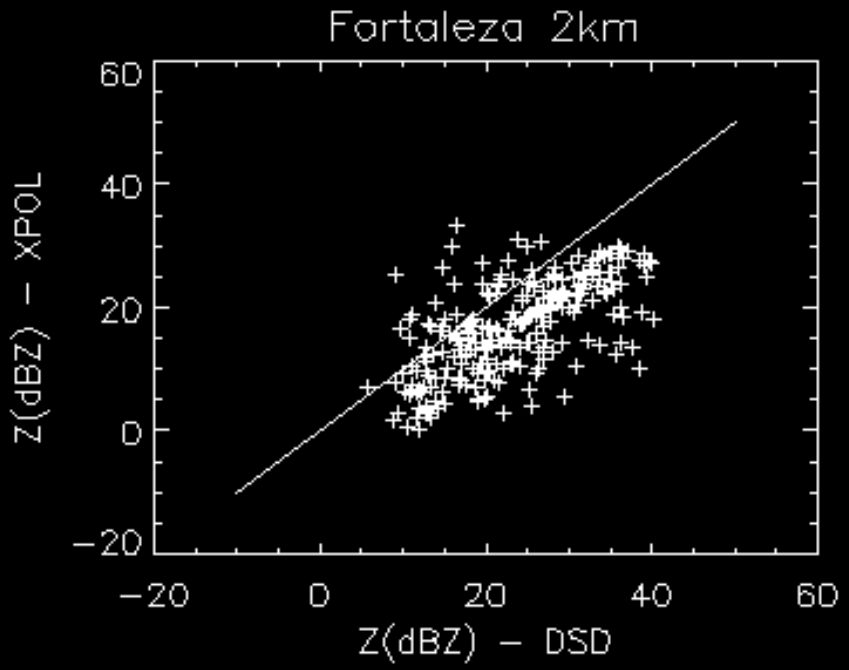
500-2km mean Z values

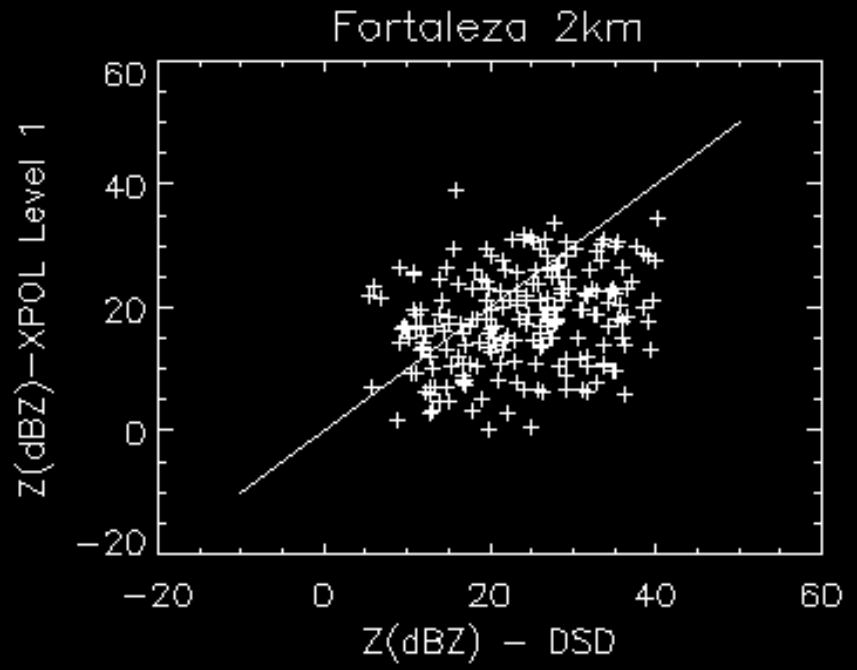
gate +- 150m

Rain Rate (DSD) > 0.1 mm/h



Fortaleza

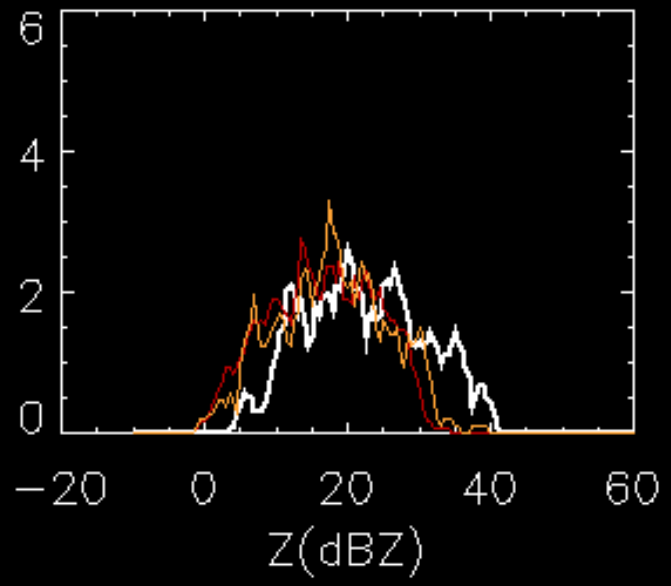


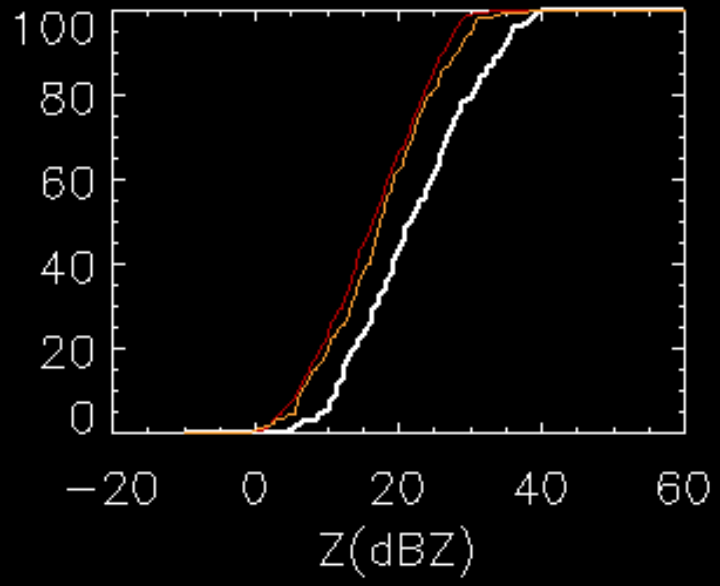


DSD

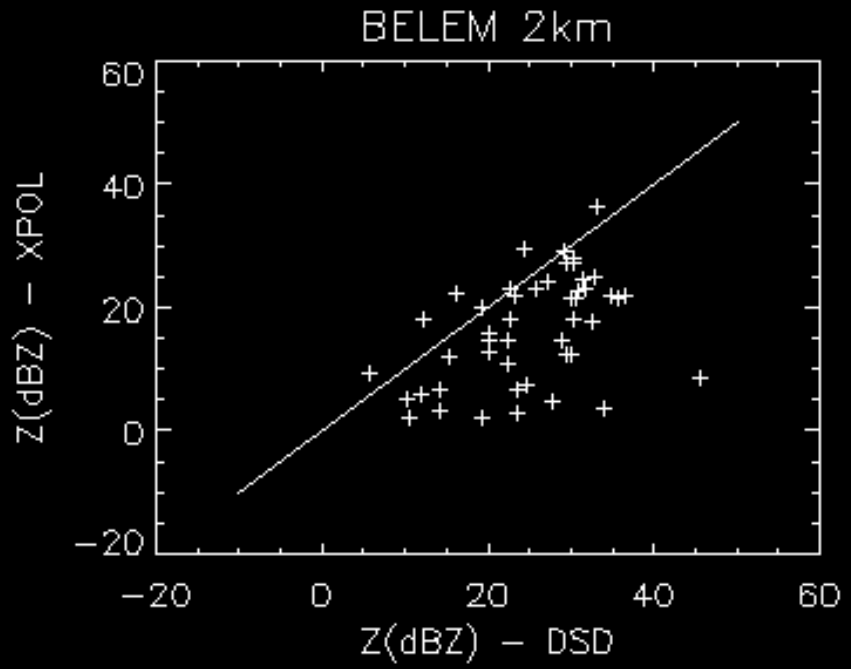
Level 0

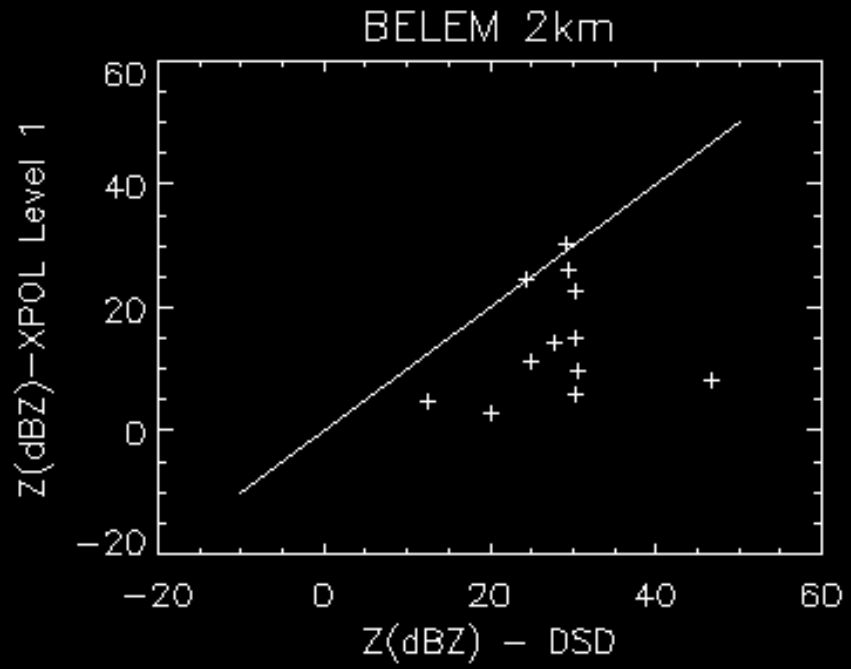
Level 1





Belem

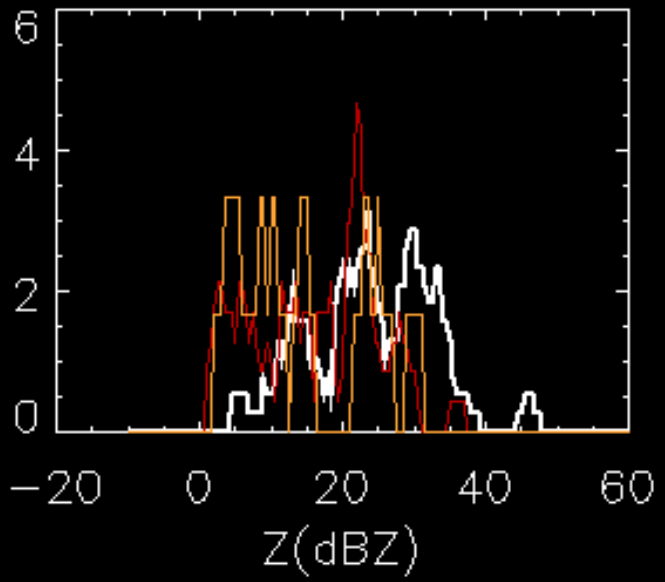


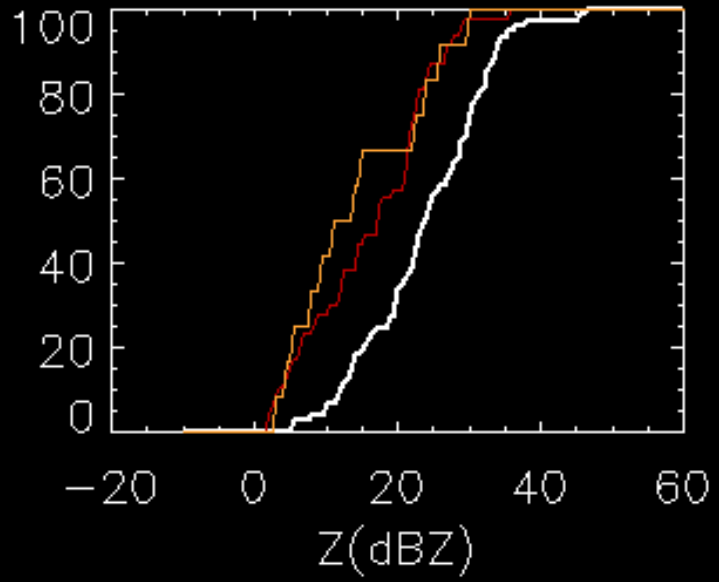


DSD

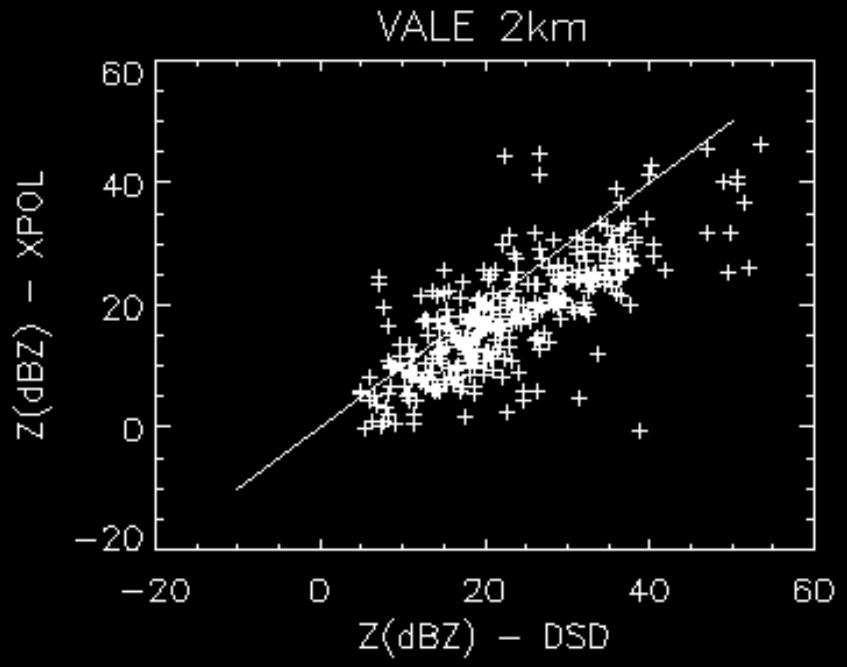
Level 0

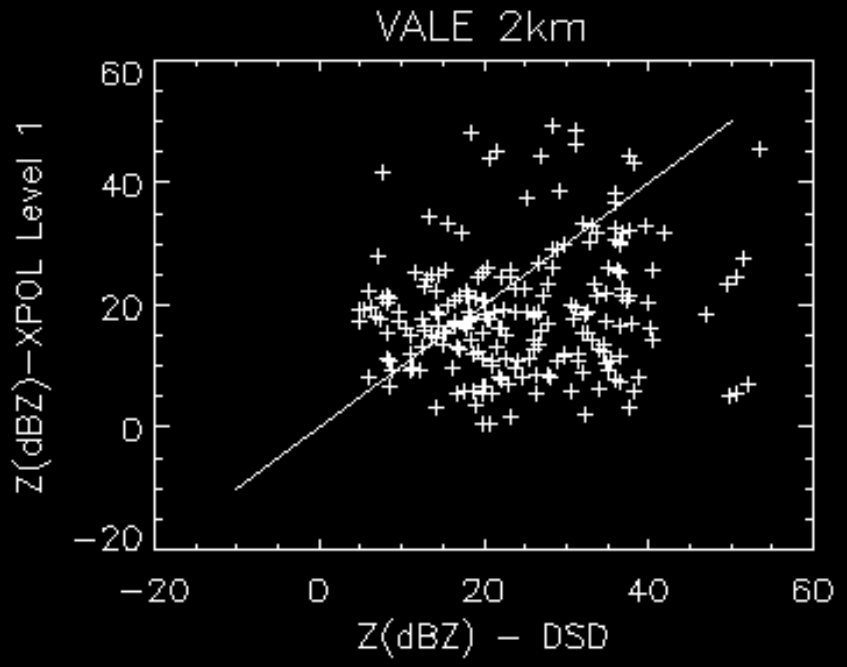
Level 1





Vale

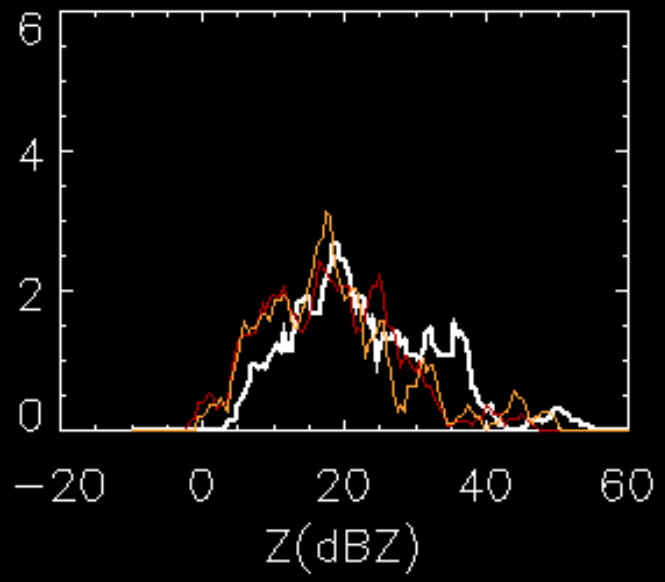


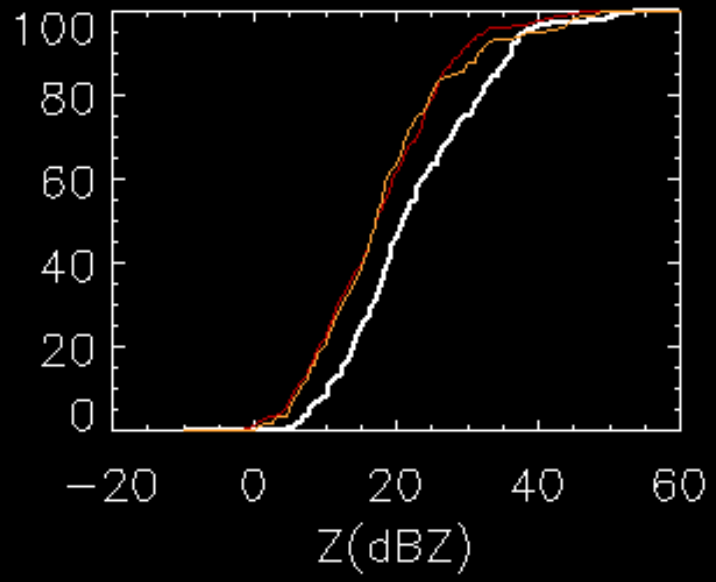


DSD

Level 0

Level 1





Calibration Summary - DSD

Experiment	DSD	XPOL	BIAS	DSD Level1	BIAS	# Obs
Fortaleza	33.12	21.97	-11.15	26.60	-6.5	276
Belém	32.97	27.17	-5.80	26.77	-6.2	77
Vale-GLM	37.04	23.93	-13.11	28.19	-8.85	339

Conclusion

On TRMM intercomparison +- 1.5 dBZ is expected due to radar frequency differences.

We did find some difference some bias that need to be investigated further and corrected

Level 1 adds ~ 2dBZ implying in an excessive over-estimation

Campaign	BIAS-Level0	BIAS-Level1
Belém	+1.89	+2.77
Fortaleza	-3.29	-1.38
Vale-GLM	+1.92	+3.89

On DSD intercomparison, we did find an under-estimation

Level 1, thought, add ~4-5 dBZ

The under-estimation needs to be further evaluated because the radome could be wet and we had more attenuation than expected.

Experiment	BIAS Level 0	BIAS Level 1
Fortaleza	-11.15	-6.5
Belém	-5.80	-6.2
Vale-GLM	-13.11	-8.85

Final remarks

We need to define a task force to inspect these bias differences and attenuation correction scheme. Probably correct for the TRMM bias and then apply the correction scheme.

We need to play with the radar to check radome wetting to evaluated another correction scheme.

We need to play with the radar parameters (# of samples per ray, gate resolution and etc) to know how the system works and then define better volscan strategies.