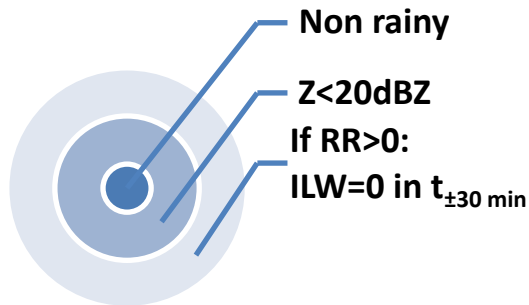


Cloud

ILW_C and ILW_{adi} Regional

ILW_C vs thickness



ILW_C

- Ground based radiometer
- Neural network (Solheim et al. 1998)

ILW_{Adi}

- Radiosonde
- Ingold et al. (1998)

Rain

ILW_R Regional

ILW_R by Rainy Systems

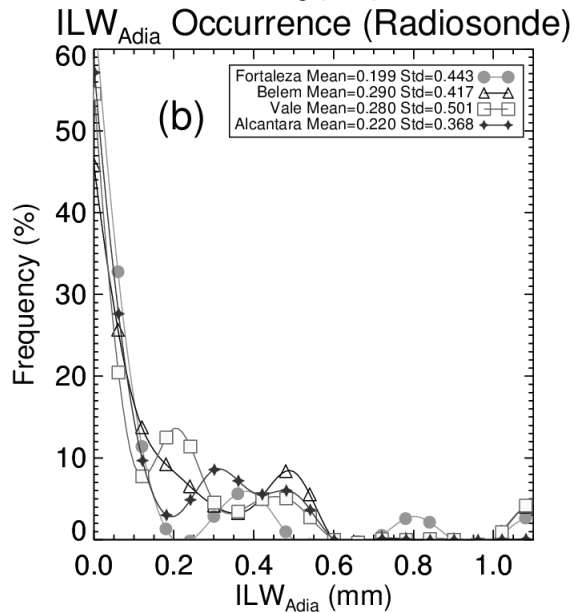
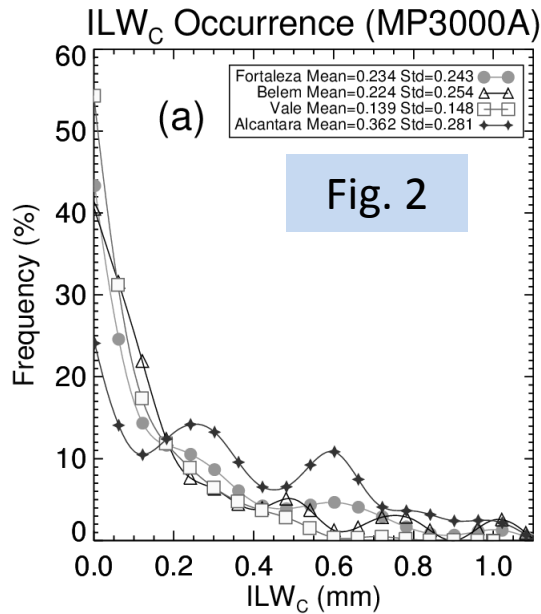
LWC_R profiles and DSD

RR > 0.1mm/h = Rainy event

LWC_R/ILW_R

- Greene and Clark (1972)

Cloud Liquid Water



Tab. 1
Site

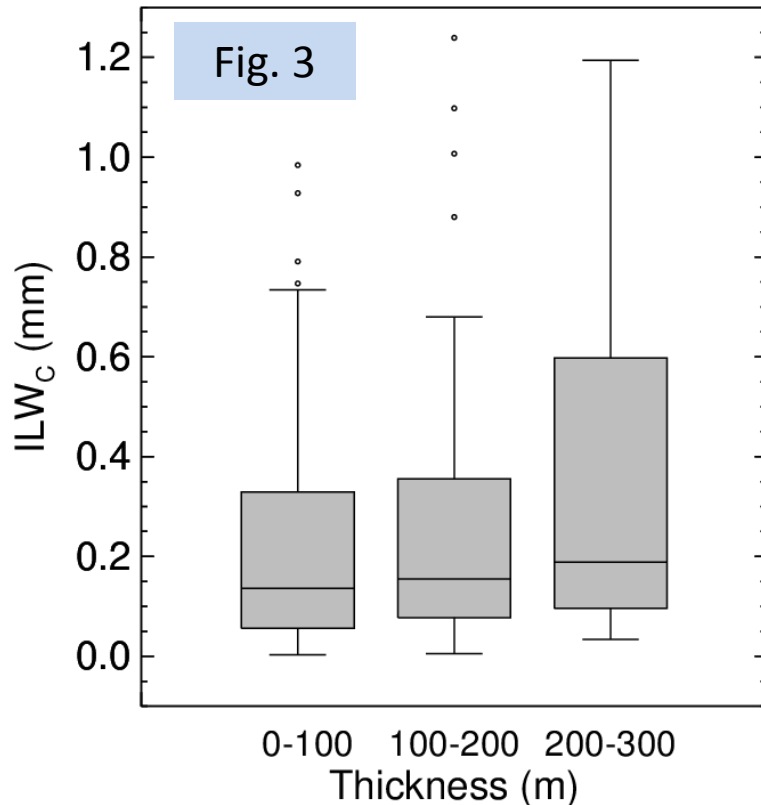
Site	Stat	Non rainy	
		ILW _C	ILW _{adia}
Fortaleza/CE	Mean	0.23	0.19
	Std	0.24	0.44
Belem/PA	Mean	0.22	0.29
	Std	0.25	0.41
Alcântara/MA	Mean	0.36	0.22
	Std	0.28	0.36
Vale do Paraíba/SP	Mean	0.14	0.28
	Std	0.15	0.50

- ILW_C ↑ / ILW_{Adi} ↓: Alcantara and Fortaleza
- ILW_C ↓ / ILW_{Adi} ↑: Vale and Belem

coastal sites contain more liquid water than the clouds of continental sites

- **Important coalescence processes instead of entrainment on the coast**

Cloud Liquid Water vs Cloud Thickness

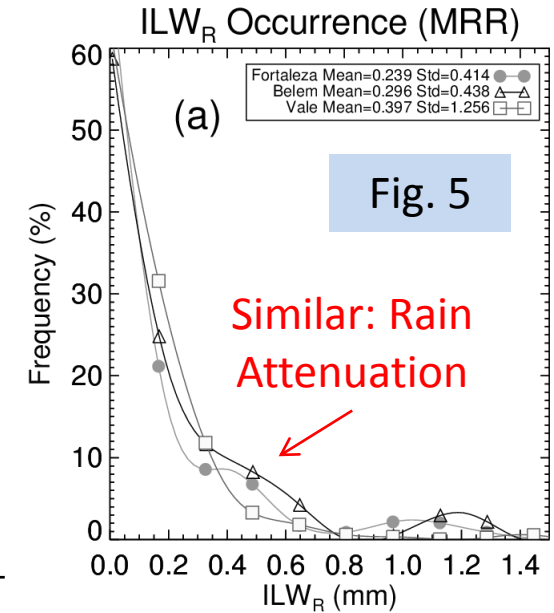
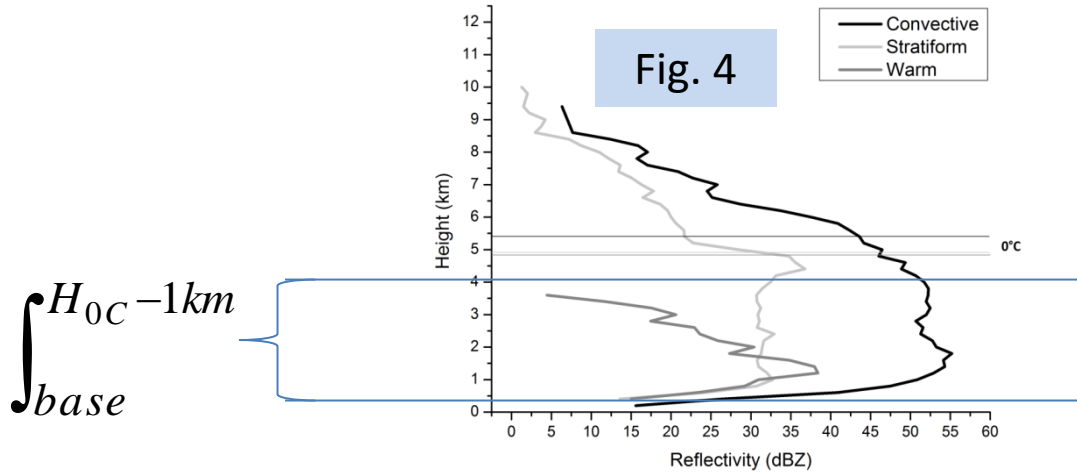


The median ILWC increases with cloud thickness

Greater variability in the values obtained for thicker clouds

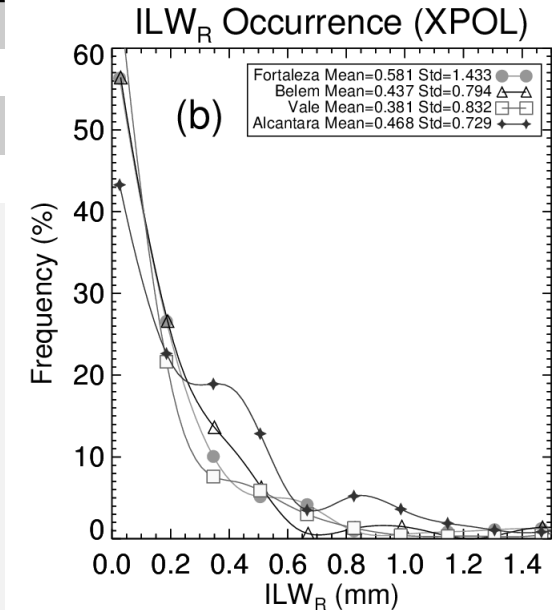
The Cloud and Rain Liquid Water Characteristics of Different Precipitation Regimes Mean in Brazil

Integrated Rain Liquid Water



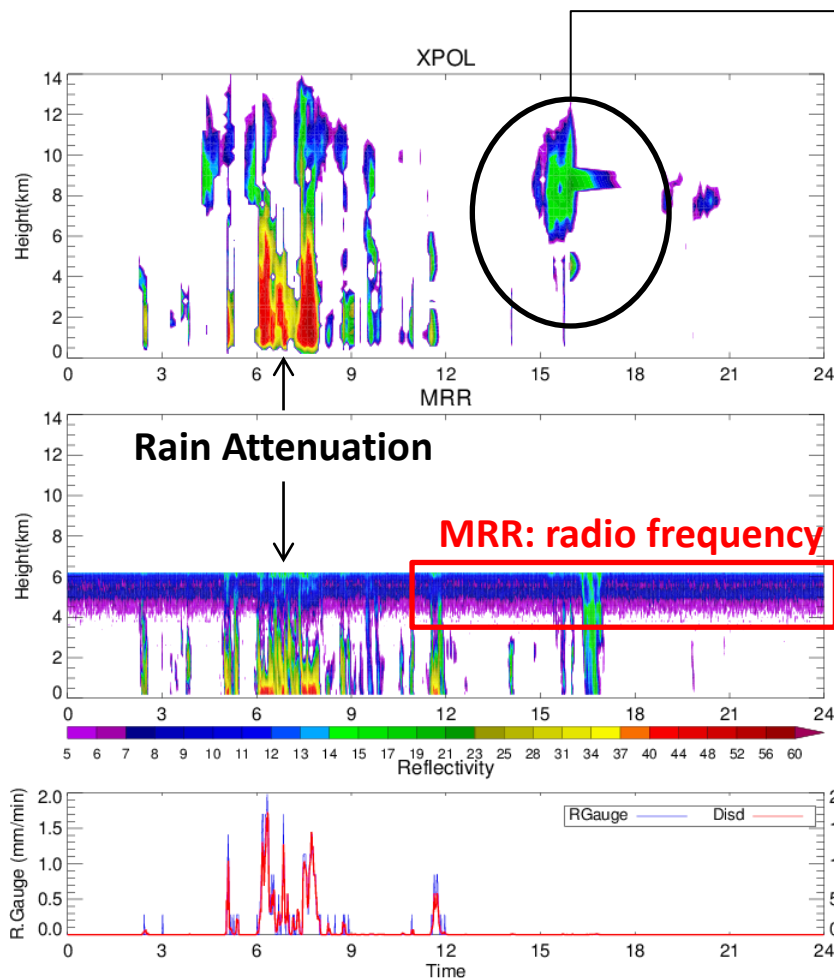
Integrated Liquid Water (mm)

Tab. 2 Site	Stat	Rainy			
		MRR		XPOL	
		ILW _R ($H_{LCL} - H_{0°C-1km}$)		VIL	
		General		Mixed	Glaciated
Fortaleza/CE	Mean	0.24	0.58	0.09	0.02
	Std	0.41	1.43	0.17	0.03
Belem/PA	Mean	0.29	0.44	0.12	0.09
	Std	0.44	0.80	0.29	0.17
Alcântara/MA	Mean	-	0.47	0.06	0.01
	Std	-	0.73	0.08	0.03
Vale do Paraíba/SP	Mean	0.39	0.38	0.14	0.02
	Std	1.26	0.83	0.54	0.06

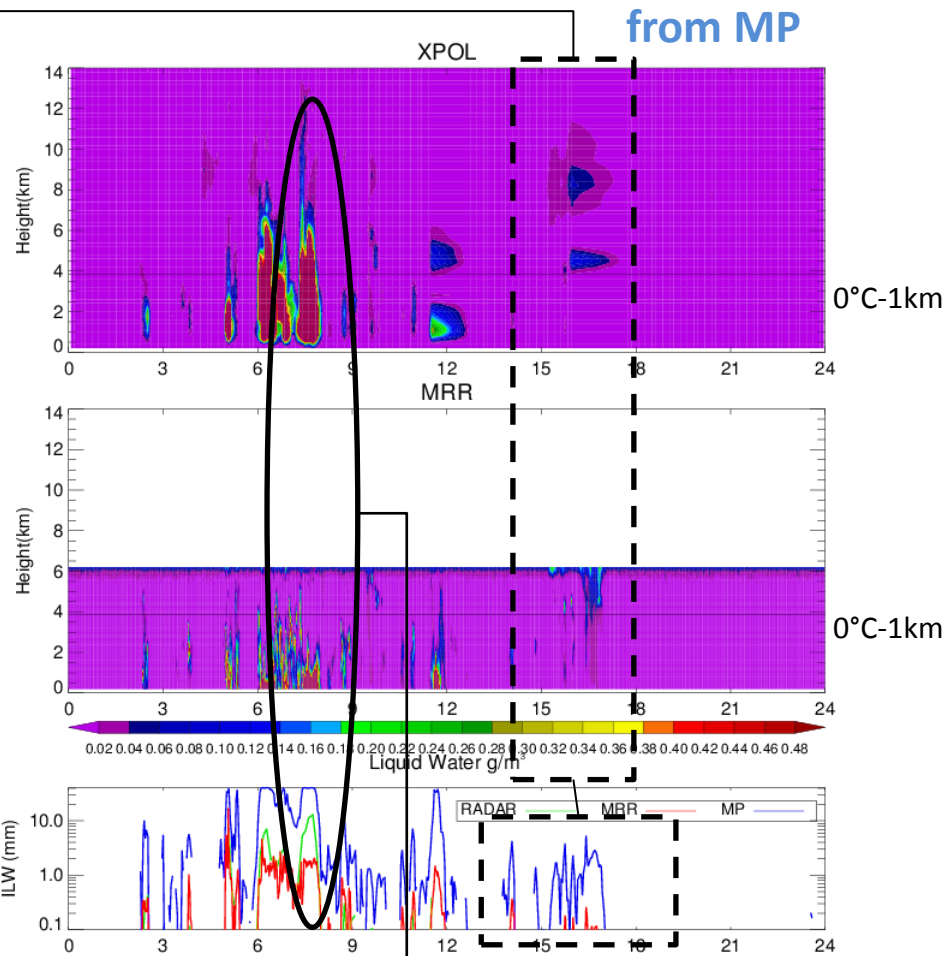


XPOL versus MRR and MP raindrop effect

Convective Rain (6 to 8hr)

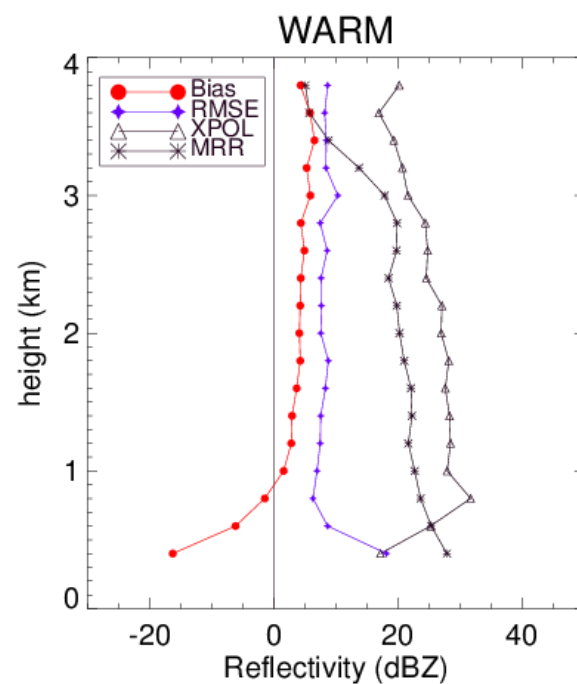
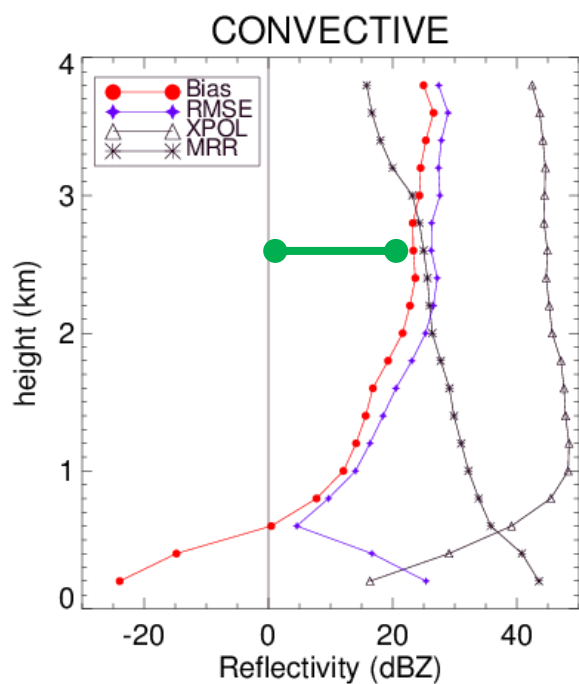
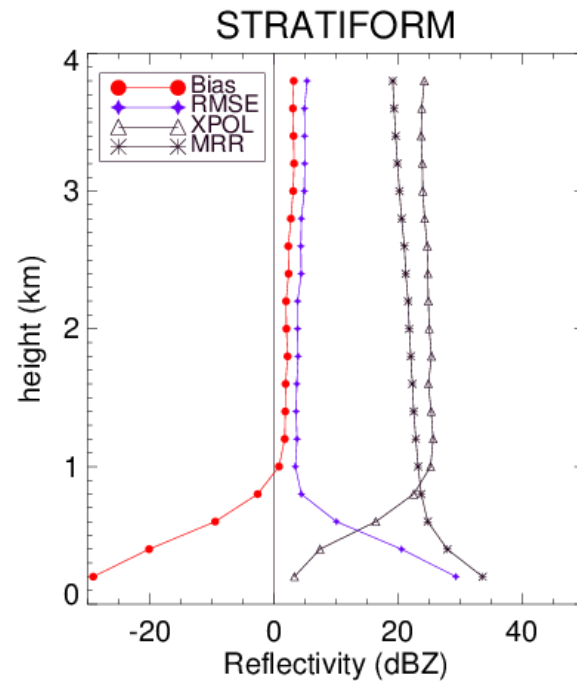
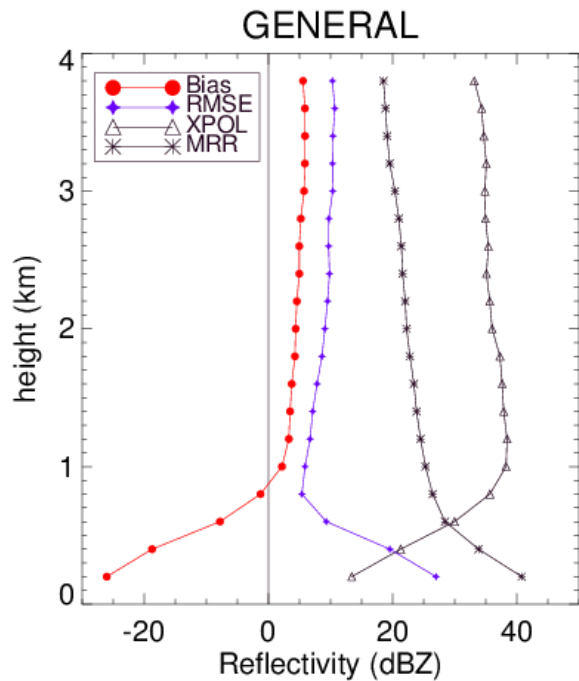


Raindrop effect in ILW retrieval from MP



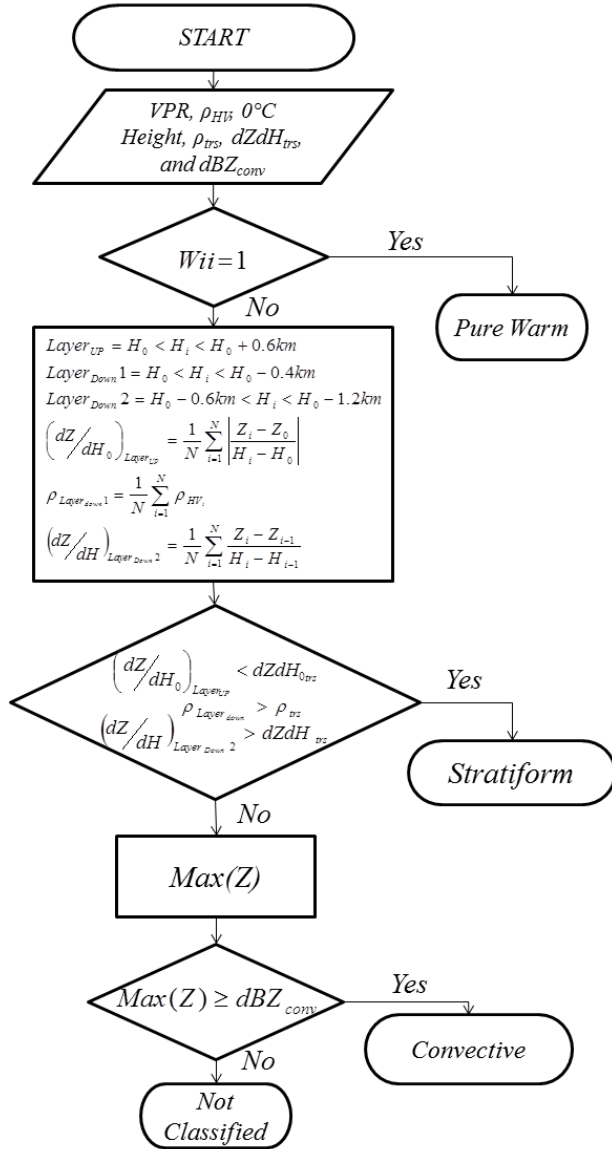
No agreement between the radars

XPOL versus MRR



Rain Liquid Water by rainy system:

Classification

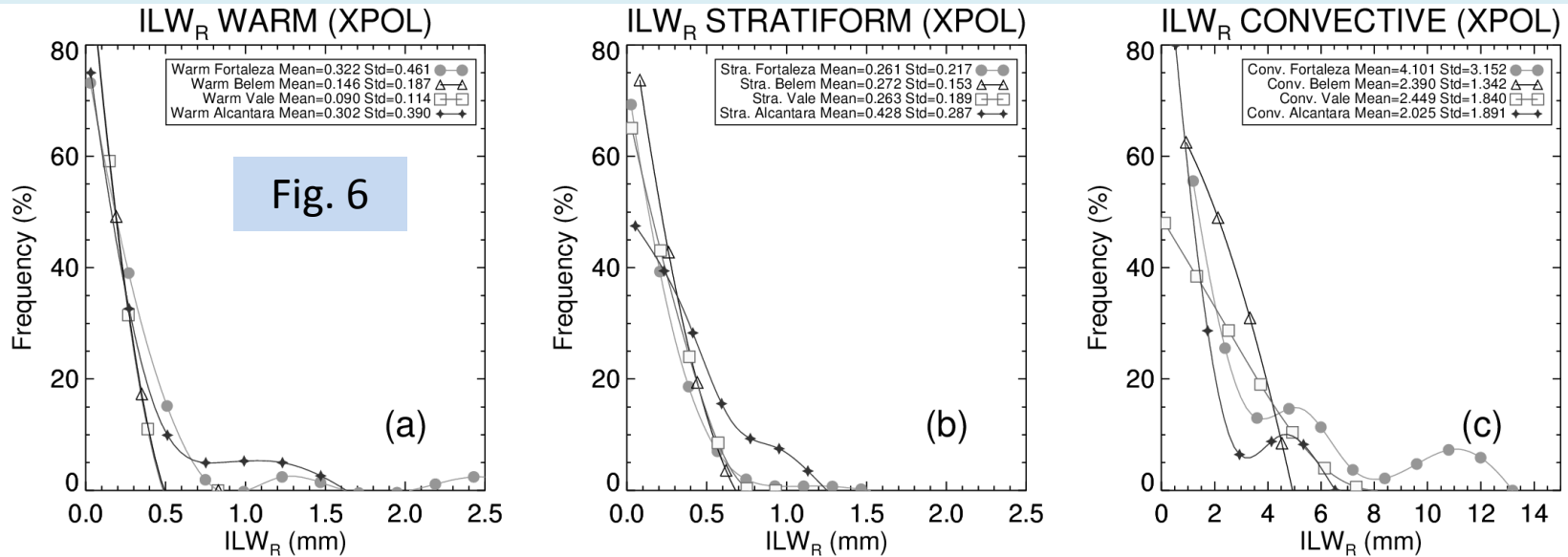


Tab. 3

Site	Fortaleza		Belem		Vale		Alcantara	
Type	%	RR _{Mean}	%	RR _{Mean}	%	RR _{Mean}	%	RR _{Mean}
Stratiform (with BB)	36	1.8	19	1.8	27	2.4	26	3.7
Convective	8	46.2	8	61.6	6	62.5	6	27.5
Warm Pure	12	3.6	25	4.9	14	1.94	19	7.2

High efficiency to Belem and Vale associated to the upper level

Rain Liquid Water by rainy system



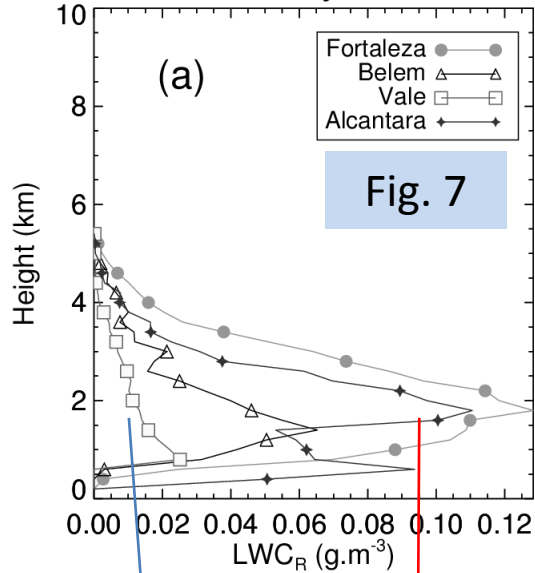
- Warm ~ Stratiform (Except Vale)
- The warm clouds had a greater variability (life cycle)
- Stratiforms were quite similar (Except Alcantara)
- Convective exhibit the higher values

Integrated Liquid Water (mm)

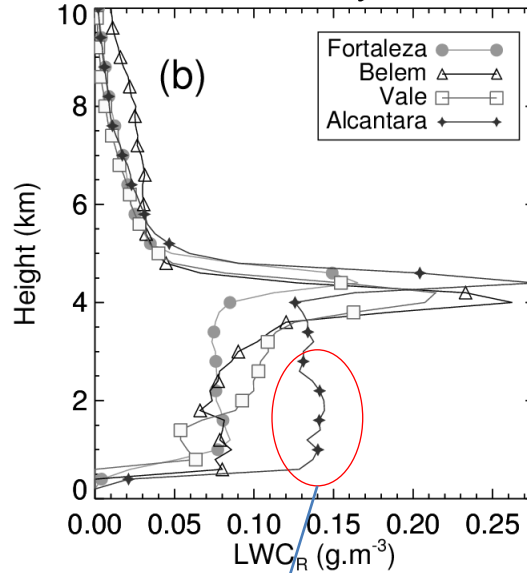
Site	Stat	Rainy		
		XPOL		
		ILW _R (H _{LCL} -H _{0°C-1km})		
		Warm	Stratiform (BB*)	Deep Convection
Fortaleza/CE	Mean	0.32	0.26	4.10
	Std	0.46	0.22	3.15
Belem/PA	Mean	0.15	0.27	2.39
	Std	0.19	0.15	1.34
Alcântara/MA	Mean	0.30	0.43	2.03
	Std	0.39	0.29	1.89
Vale do Paraíba/SP	Mean	0.09	0.26	2.45
	Std	0.11	0.19	1.84

Rain Liquid Water Profiles and Raindrop Size Distribution (Bottom)

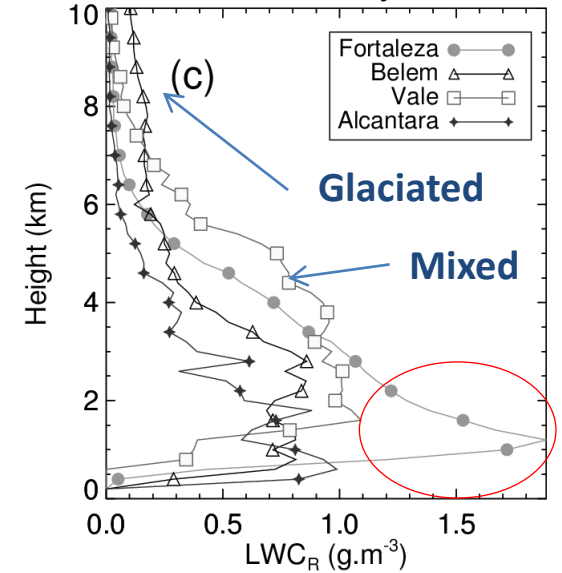
Warm Systems



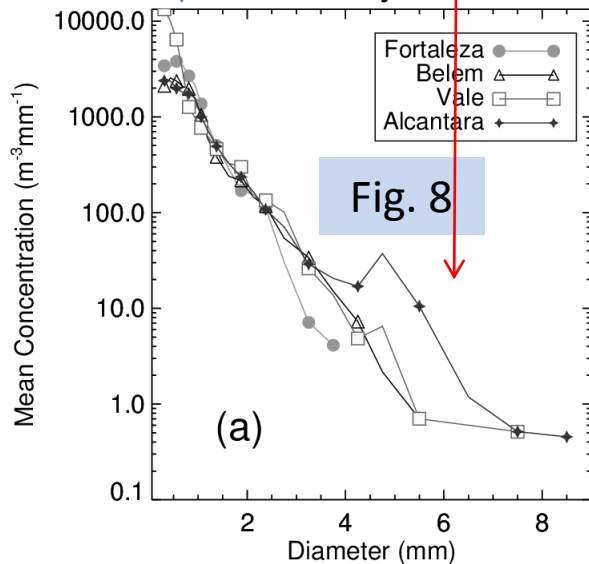
Stratiform Systems



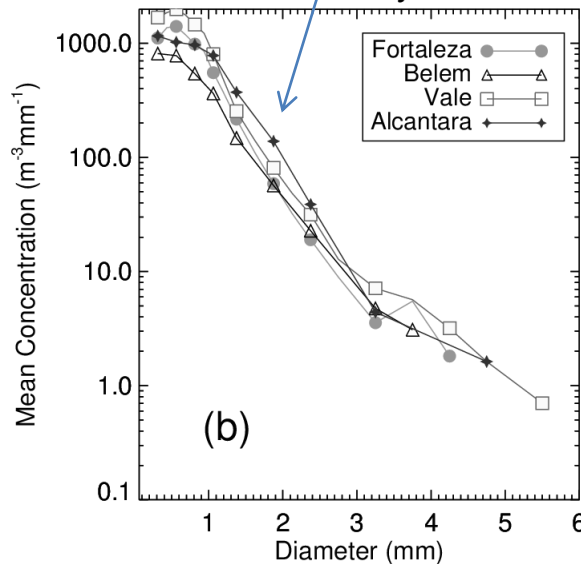
Convective Systems



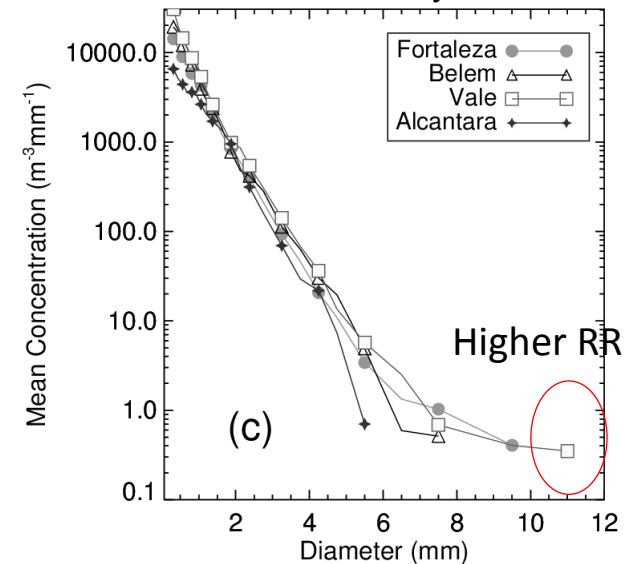
Warm Systems



Stratiform Systems



Convective Systems



Conclusion

- For non-precipitating clouds, the ILW_C values were larger for the sites in Northeast Brazil near the coast than for the other regions.
- For rainy cases, distinct LWC_R profiles and ILW_R were observed for different rain classifications and regions with a distinctive rainfall regime.
- The ILW_R for the convective systems show the highest values, followed by stratiform and warm systems.
- The clouds in the Vale do Paraiba and Belem showed the largest reflectivity in the mixed and glaciated layers, respectively.

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**THANKS FOR YOUR
PATIENCE!!!**