Research on clouds from Lidar measurements

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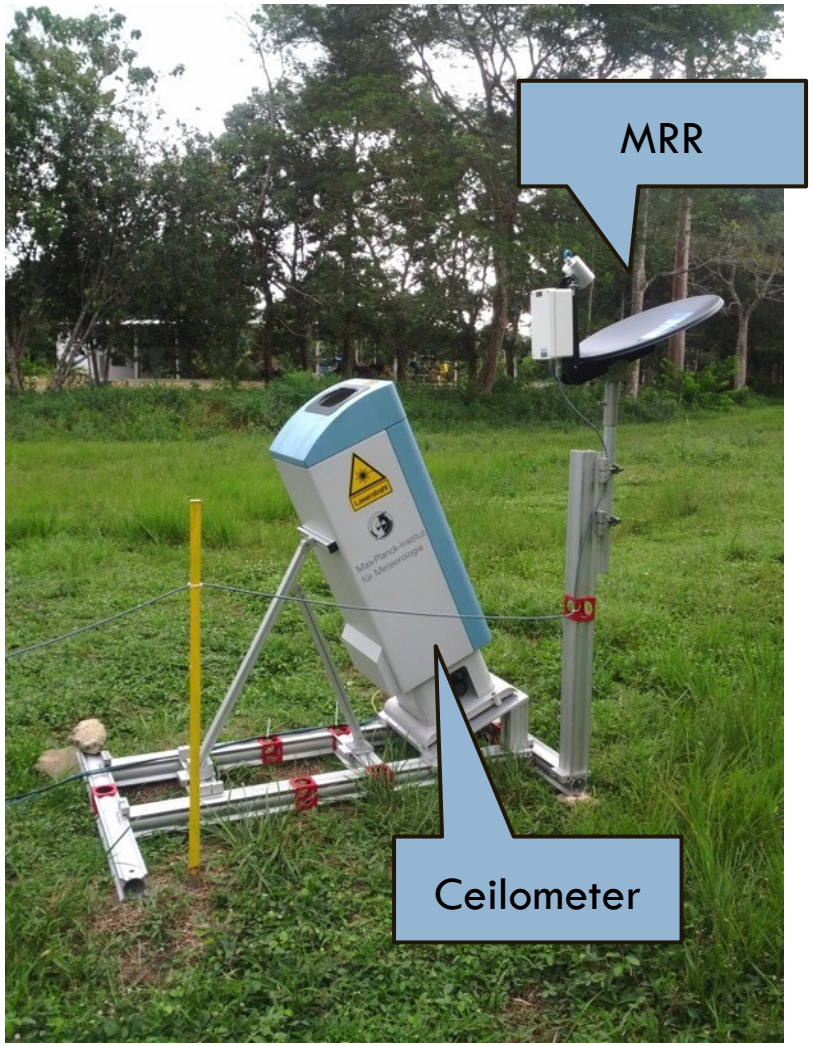
ATTO Workshop

Manaus, Brazil - October 05th 2017

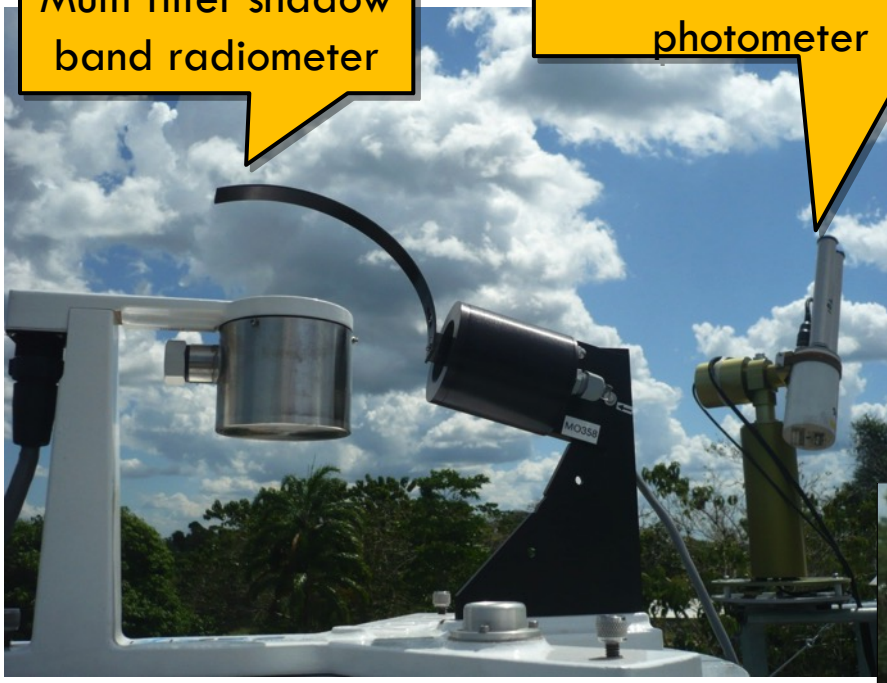
Embrapa Site – km30 AM-010

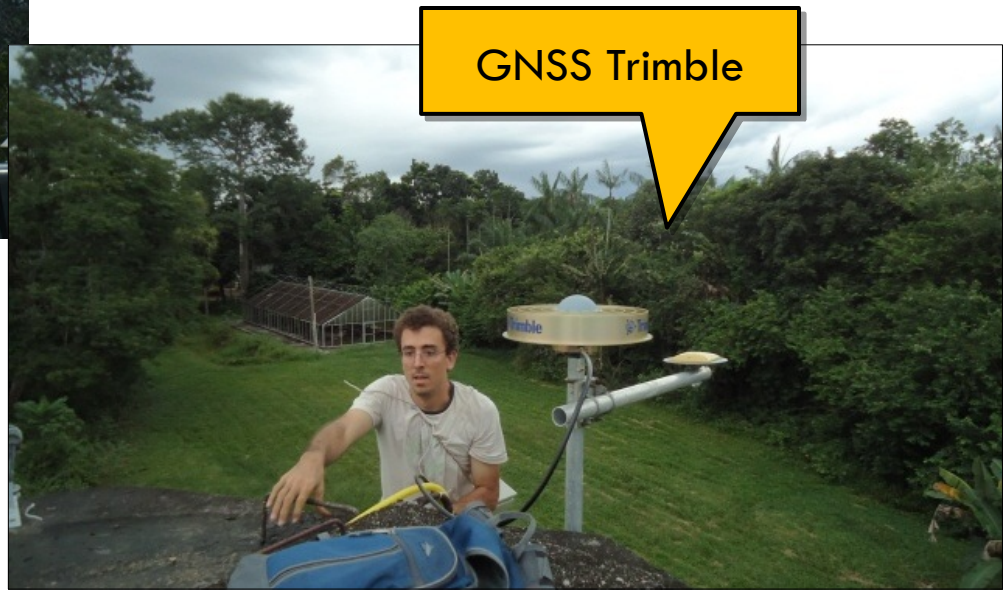
Embrapa Site - Closeup

Ceilometer, MRR and Lidar

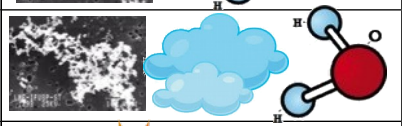
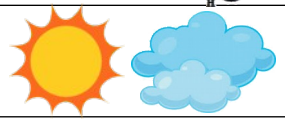
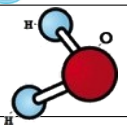


AERONET, MFR and GNSS





Instruments starting in 2011/2012

Instrument	Measurement	
Sunphotometer (AERONET) CE318 / Cimel	Column integrated aerosol properties	
UV Raman Lidar LR 102-U-D400 / Raymetrics	Vertical profile of aerosols (day/night) Water vapor (night)	
Multi-filter Rotating Shadowband Radiometer MFR-7 / Yesinc	Direct and diffuse solar irradiance Cloud optical depth; PWV; Ozone;	
Ceilometer CHM15k / Jenoptik	Profile of clouds and aerosols	
GNSS Receiver NetR8 GNSS / Trimble	Column water vapor	
Disdrometer LPM V2.5x STD / Thies	Rain drops diameter and speed distribution;	
Vertical pointing Rain Radar (MRR) 24 Ghz Micro Rain Radar (MRR) / Metek	Profile of rain drops diameter distribution	
Automatic Weather Station (AWS)	P, T, RH, Wind	

Would should we bring to ATTO?

Instrument	Measurement	
~~**Sunphotometer (AERONET)**~~ ~~CE318 / Cimel~~	~~Column integrated aerosol properties~~	ATTO has it
UV Raman Lidar LR 102-U-D400 / Raymetrics	Vertical profile of aerosols (day/night) Water vapor (night)	
Multi-filter Rotating Shadowband Radiometer MFR-7 / Yesinc	Direct and diffuse solar irradiance Cloud optical depth; PWV; Ozone;	
Ceilometer CHM15k / Jenoptik	Profile of clouds and aerosols	would be
GNSS Receiver NetR8 GNSS / Trimble	Column water vapor	novelty
Disdrometer LPM V2.5x STD / Thies	Rain drops diameter and speed distribution;	
Vertical pointing Rain Radar (MRR) 24 Ghz Micro Rain Radar (MRR) / Metek	Profile of rain drops diameter distribution	
~~**Automatic Weather Station (AWS)**~~	~~P, T, RH, Wind~~	ATTO has it

Cooperation
(maintenance <=> operation <=> science)

Instrument	Possible Teams Cooperating	
~~**Sunphotometer (AERONET)**~~ ~~CE318 / Cimel~~	~~Column integrated aerosol properties~~	ATTO has it
UV Raman Lidar LR 102-U-D400 / Raymetrics	IF-USP + Tropos Ansman	would be novelty
Multi-filter Rotating Shadowband Radiometer MFR-7 / Yesinc	IF-USP + IAG-USP Yamasoe	
Ceilometer CHM15k / Jenoptik	IF-USP + Tropos Ansman	
GNSS Receiver NetR8 GNSS / Trimble	IF-USP + INPE + UNAM + UW Machado, Adams, Serra	
Disdrometer LPM V2.5x STD / Thies	INPE + IAG-USP + IF-USP Machado, Albrecht	
Vertical pointing Rain Radar (MRR) 24 Ghz Micro Rain Radar (MRR) / Metek	INPE + IAG-USP + IF-USP Machado, Albrecht	
~~**Automatic Weather Station (AWS)**~~	~~P, T, RH, Wind~~	ATTO has it

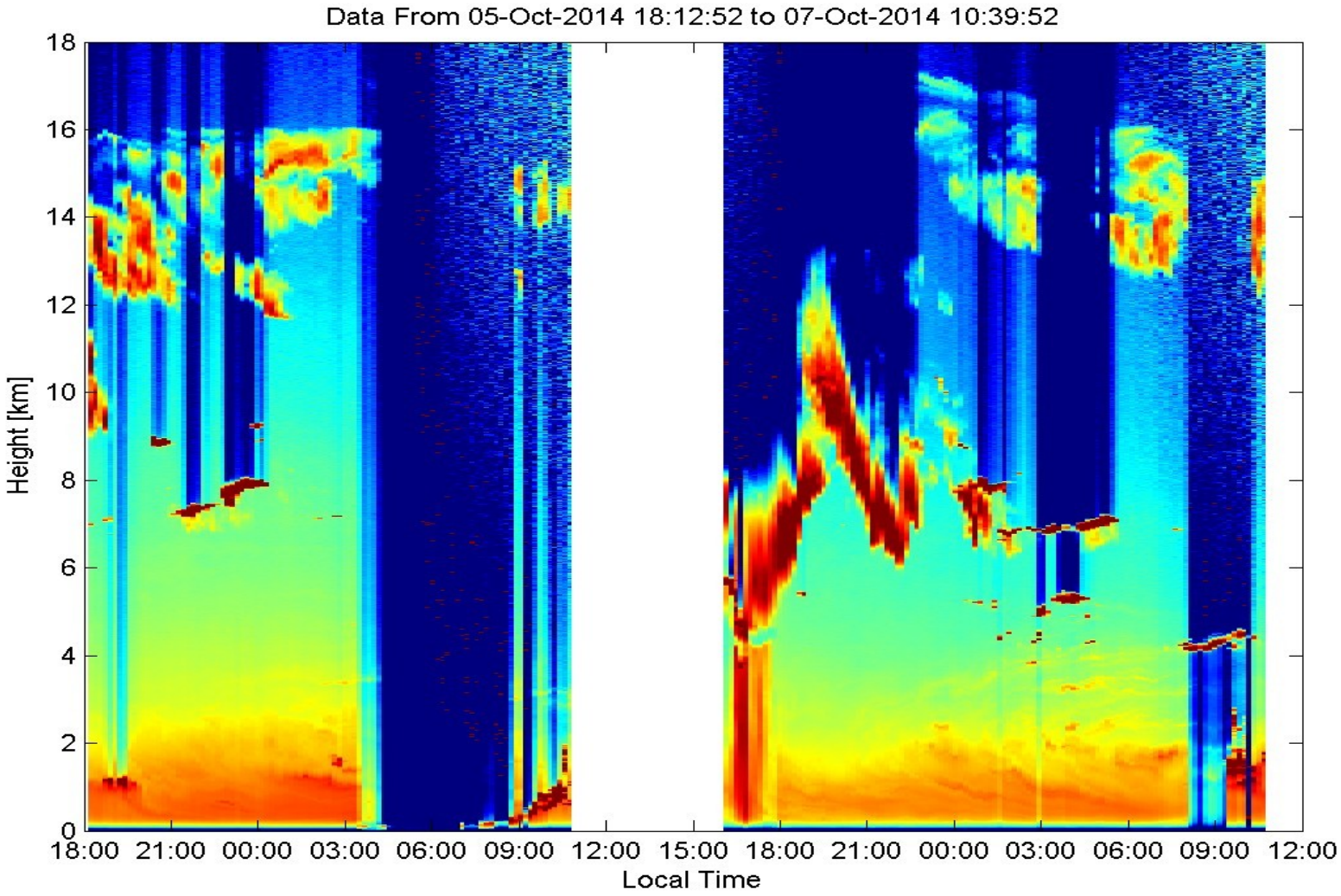
Cooperation
(maintenance <=> operation <=> science)

Instrument	Possible Teams Cooperating	Data per Day
~~**Sunphotometer (AERONET)**~~ ~~CE318 / Cimel~~	~~Column integrated aerosol properties~~	
UV Raman Lidar LR 102-U-D400 / Raymetrics	IF-USP + Tropos Ansman	810 Mb
Multi-filter Rotating Shadowband Radiometer MFR-7 / Yesinc	IF-USP + IAG-USP Yamasoe	0.4 Mb
Ceilometer CHM15k / Jenoptik	IF-USP + Tropos Ansman	25 Mb
GNSS Receiver NetR8 GNSS / Trimble	IF-USP + INPE + UNAM + UW Machado, Adams, Serra	6 Mb
Disdrometer LPM V2.5x STD / Thies	INPE + IAG-USP + IF-USP Machado, Albrecht	4 Mb
Vertical pointing Rain Radar (MRR) 24 Ghz Micro Rain Radar (MRR) / Metek	INPE + IAG-USP + IF-USP Machado, Albrecht	132 Mb
~~**Automatic Weather Station (AWS)**~~	~~P, T, RH, Wind~~	

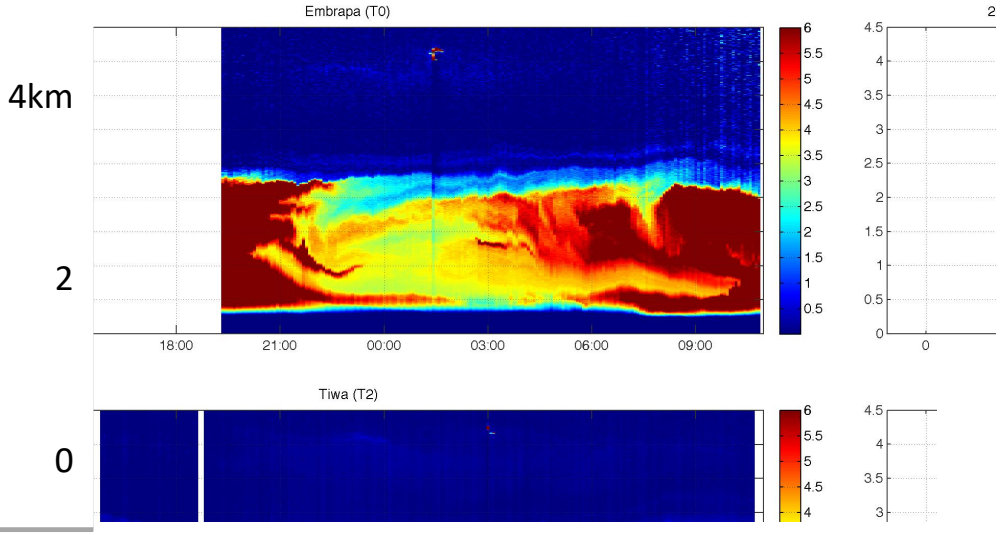
When? At some point in 2018…

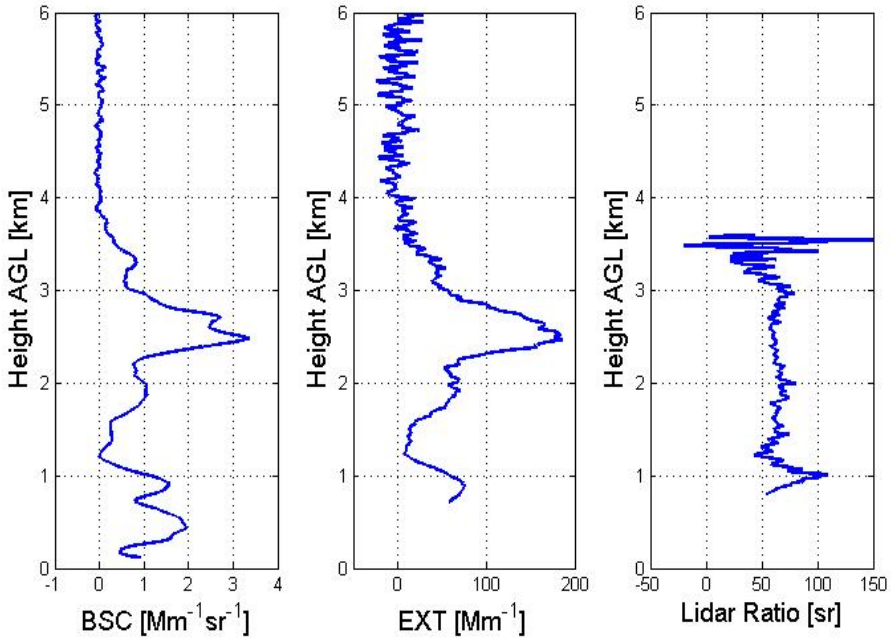
- Of course we will need to discuss the available infrastructure: space, power, internet, routine maintenance and download, etc.

Lidar Profiles

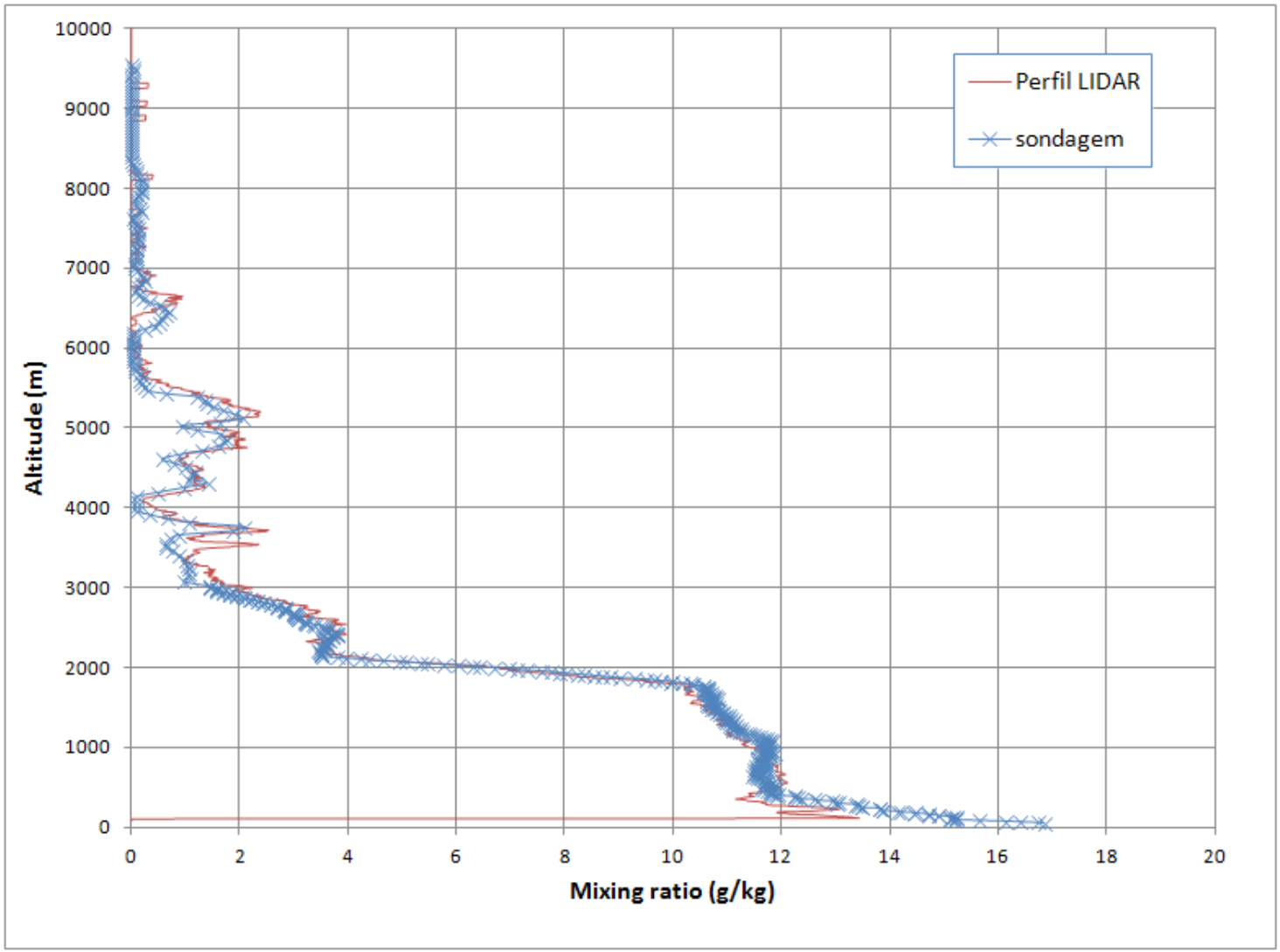


Lidar Profiles: Aerosols

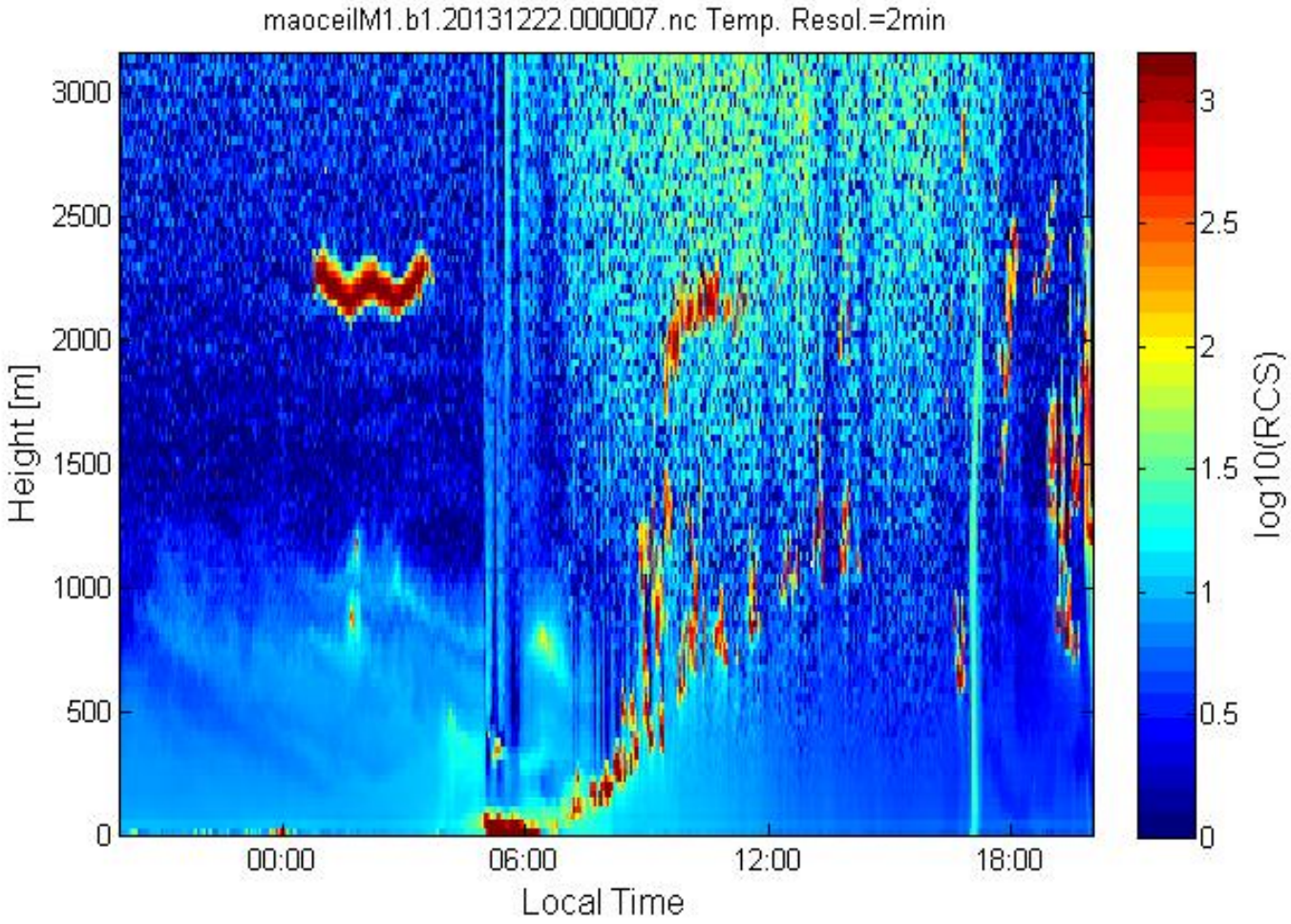




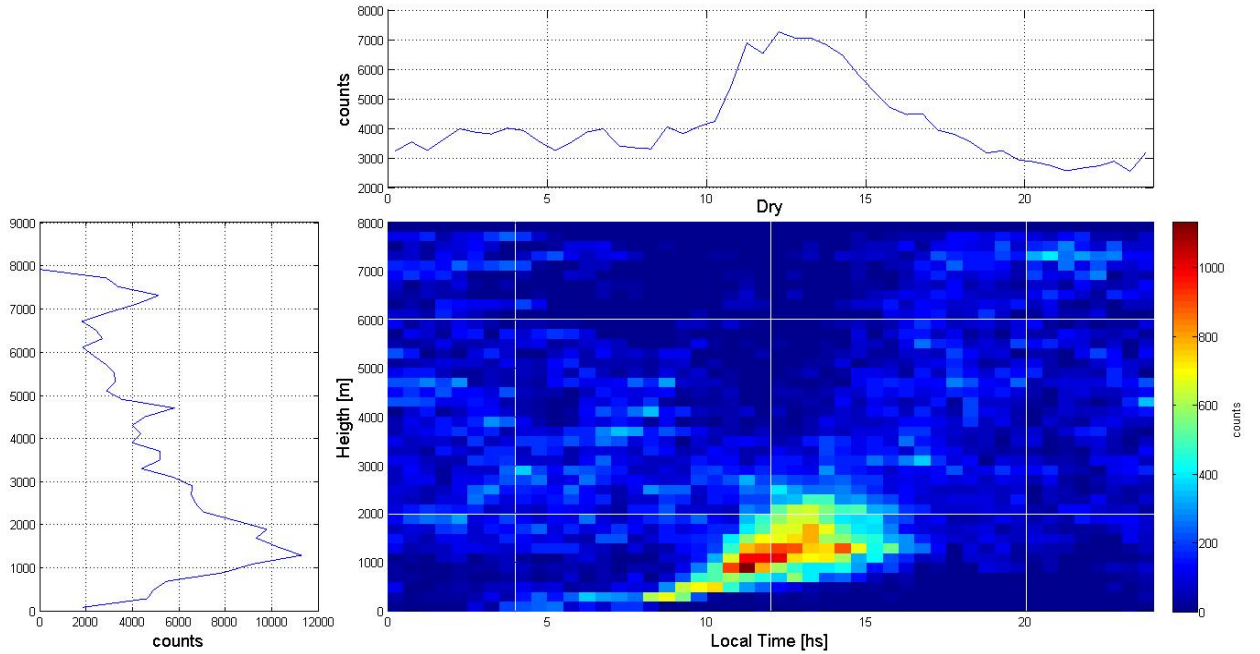
Lidar Profiles: Water Vapor (night)

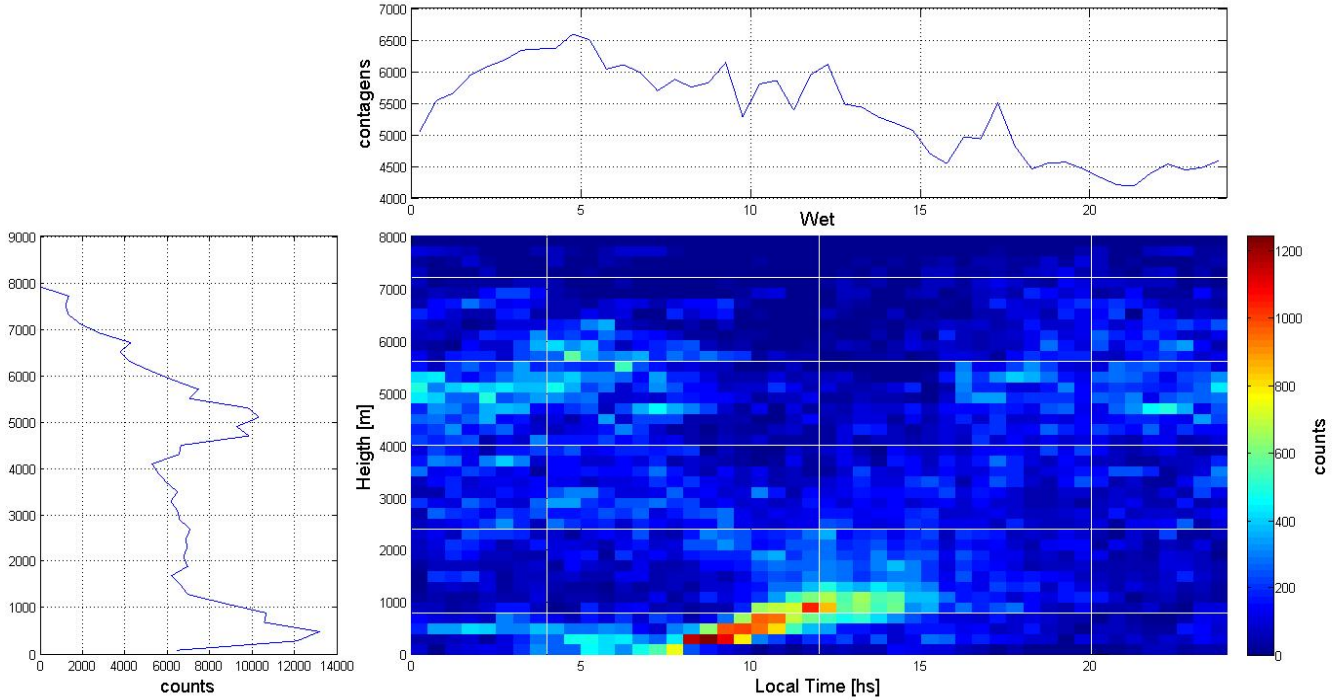


Ceilometer: Low clouds

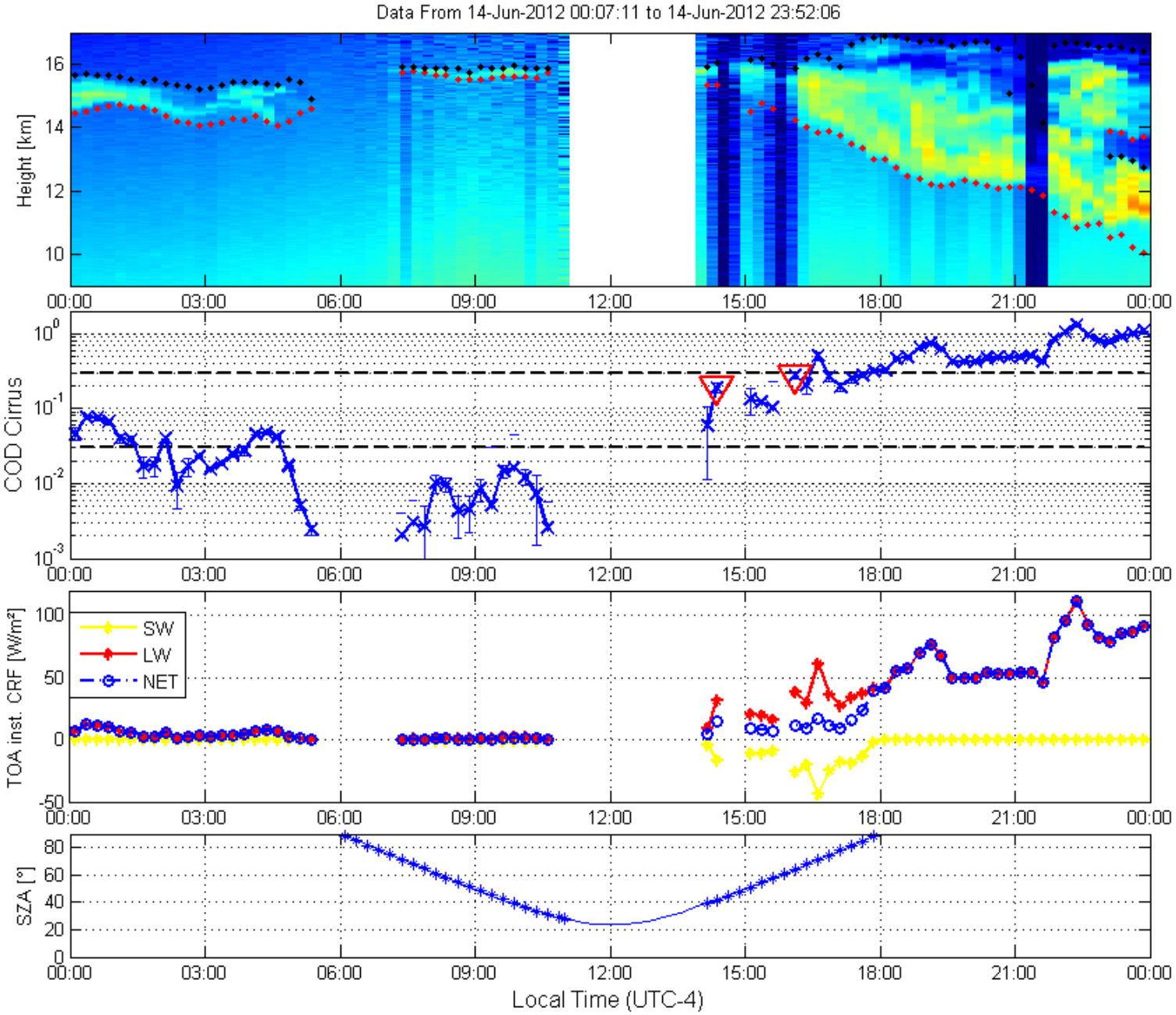


Ceilometer: Cloud Mask

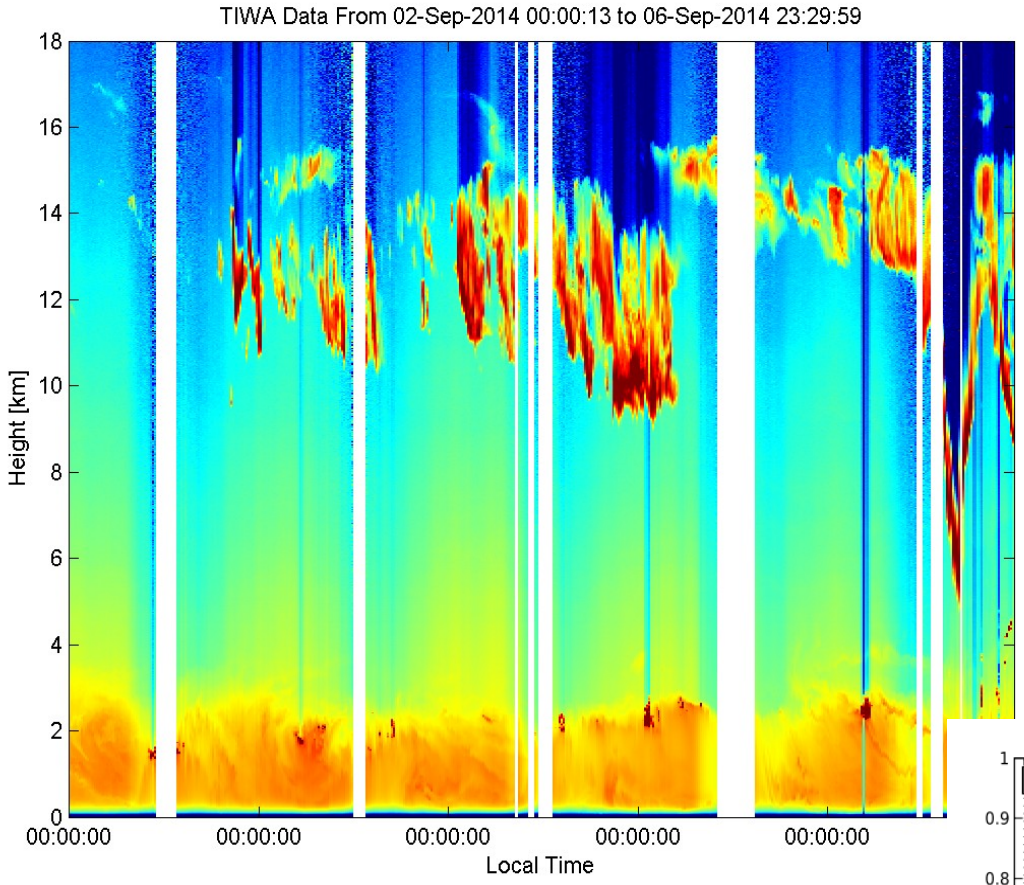




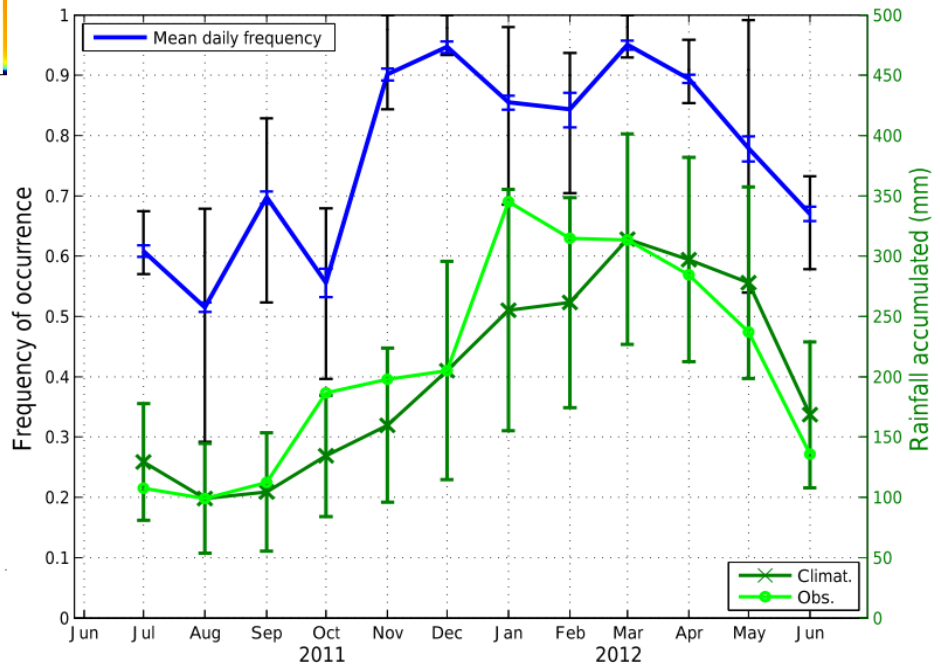
Cirrus Clouds Time Series



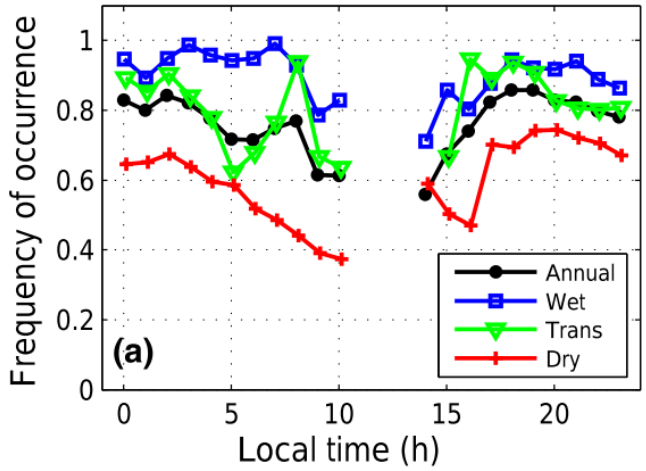
Amazon Forest – A lot of Cirrus

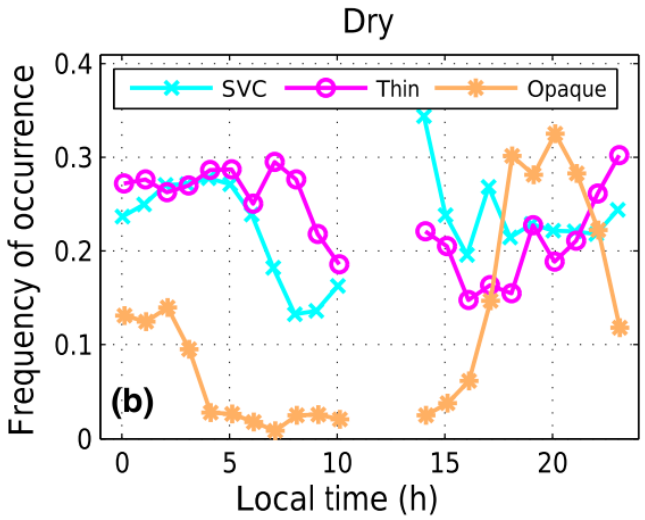


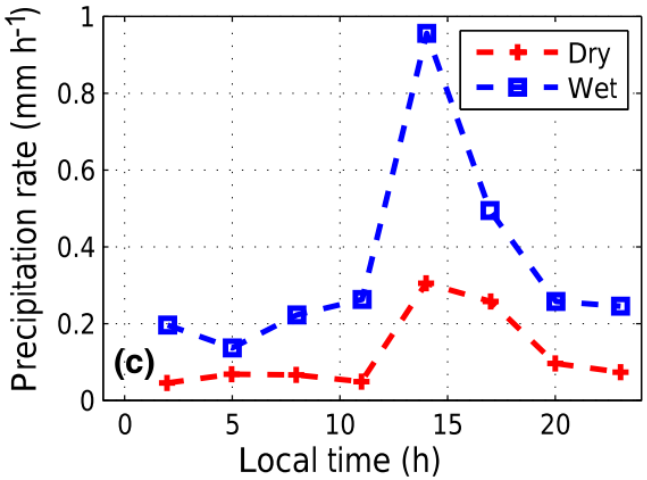
Média: **73,8%**
Dry: 59.2%
Wet: 88.1%

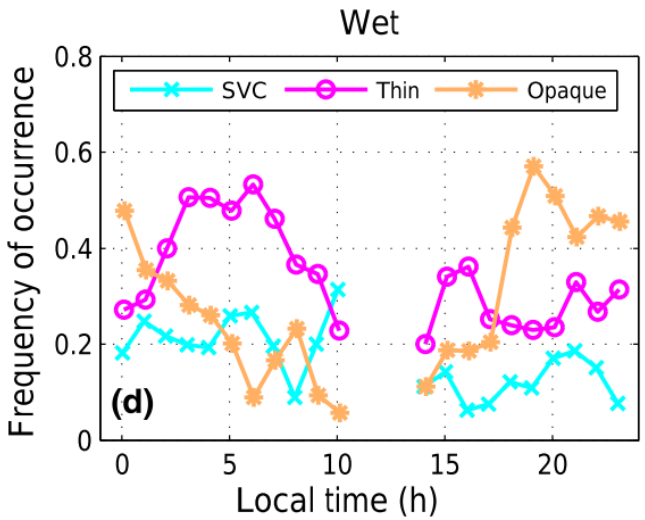


Daily Cicle

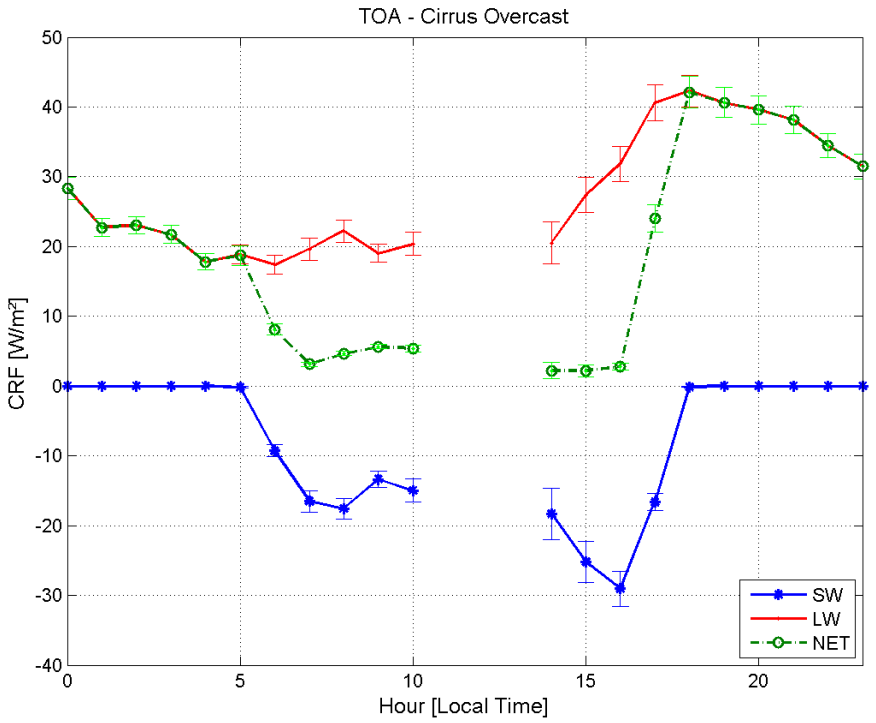

Frequency of occurrence
Local time (h)
(a)
Annual
Wet
Trans
Dry

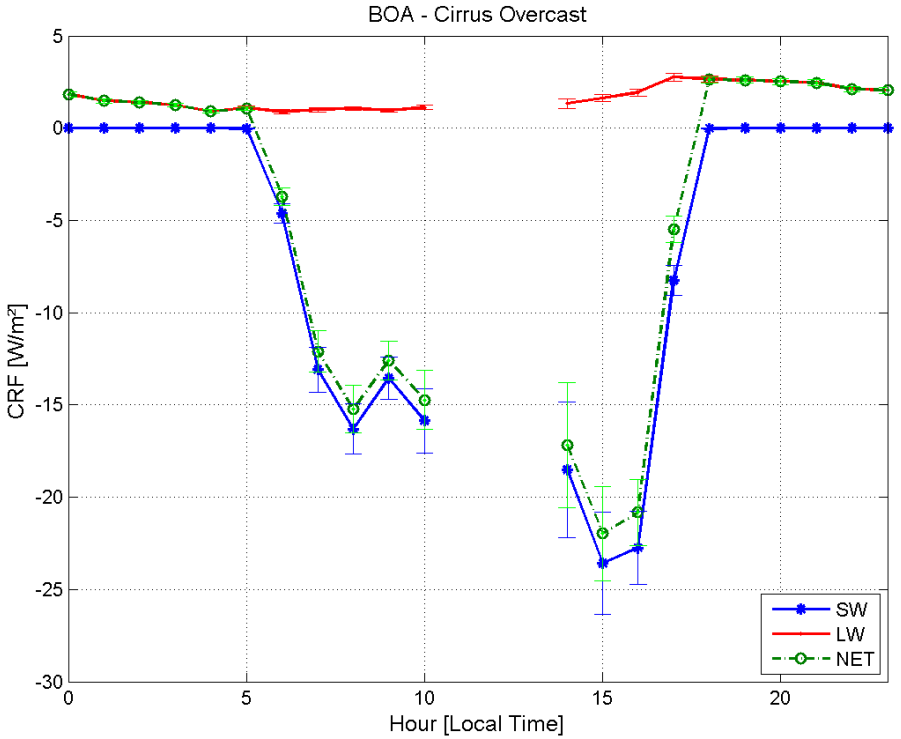

Dry
Frequency of occurrence
Local time (h)
(b)
SVC
Thin
Opaque


Precipitation rate (mm h-1)
Local time (h)
(c)
Dry
Wet


Wet
Frequency of occurrence
Local time (h)
(d)
SVC
Thin
Opaque

Cirrus Radiative Forcing - Daily Cicle





Obrigado!