





# CHUVA Project: Main Goals



**WORKING GROUP-1:** CHARACTERISTICS OF THE PRECIPITATING SYSTEMS AS FUNCTION OF THE REGION AND LIFE STAGE (Luiz Machado)

**WORKING GROUP-2:** PRECIPITATION ESTIMATION – DEVELOPMENT AND VALIDATION ALGORITHM (Daniel Vila)

**WORKING GROUP-3:** ELETRIFICATION PROCESS: MOVING FROM CLOUDS TO THUNDERSTORMS (Carlos Morales)

**WORKING GROUP-4:** CHARACTERISTICS OF THE BOUNDARY LAYER FOR DIFFERENT CLOUD PROCESSES AND PRECIPITATION REGIMES (Gilberto Fisch)

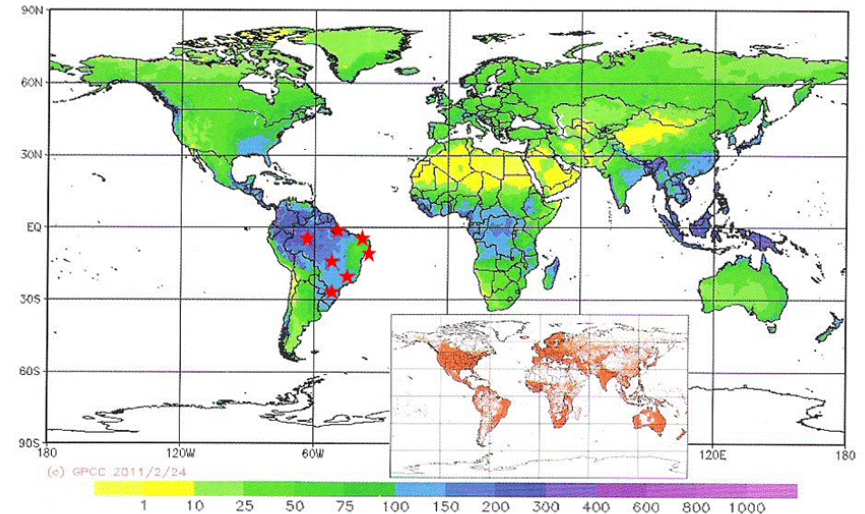
**WORKING GROUP-5:** MODEL IMPROVEMENTS AND VALIDATION, WITH FOCUS IN CLOUD MICROPHYSICS AND AEROSOL INTERACTIONS, FOR SATELLITE PRECIPITATION ESTIMATES IN BRAZIL (Maria Assunção Dias)



# CHUVA Field Campaign Schedule



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEZ
2010			Alcantara									
2011			Fortaleza	Fortaleza		Belem	Belem				Vale do Paraíba	Vale do Paraíba
2012	Vale do Paraíba	Vale do Paraíba	Vale do Paraíba								Santa Maria	Santa Maria
2013			São Paulo	São Paulo	São Paulo	São Paulo	São Paulo	São Paulo	São Paulo			
2014		Manaus	Manaus	Manaus				Manaus	Manaus	Manaus		



Plot of the annual precipitation in mm/month derived from the 12 monthly gridded GPCC climatologies. Underlying station locations are shown in the inset map.





# Experiment

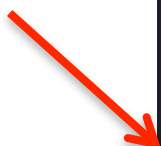


Short Campaign - several over the year – The way to improve rainfall records by selecting rainfall season of each region.





Access to Dataset



The screenshot displays the CHUVA PROJECT website interface. On the left is a navigation sidebar with the following menu items: Home, Presentations at GPM, Chuva Project on Media, Data, Staff, Experiment, GPM Brazil, News History, Schedule, Institutions, Location of Instruments, Mission, Papers, Dual Polarization Radar, and Annual Report. A red arrow points from the text 'Access to Dataset' to the 'Data' menu item.

The main content area features a 'Data Requests' form with the following fields:

- Experiment: Alcantara
- Instrument: --
- Level: --
- Start Date: [calendar icon]
- Product: --
- Type of Instrument: --
- Type of Data: --
- Site: --
- Final Date: [calendar icon]

A 'Search' button is located at the bottom right of the form.

Below the form, there is a 'Term of use' section with a text box containing the following text: *Ao utilizar os dados do chuva, por favor citar a referência Projeto CHUVA FAPESP 2009/15235-8 e enviar uma cópia do seu artigo para chuvaproject@cptec.inpe.br.*

The 'Data Access' section contains two options:

- Application: Represented by an icon of a hand holding a globe.
- FTP: Represented by a button with the text 'ftp://'.

The top right of the page shows a user login area with 'Welcome, luiz.machado' and a 'LOGOUT' button.



CHUVA Portal: <http://chuvaproject.cptec.inpe.br/portal/en/>



Annual Report

Chuva Project on Media

Data

Dual Polarization Radar

Experiments

GPM Brazil

Institutions

Mission

History

Papers

Presentations

Schedule

Staff

The Chuva Project

Videos

Workshops and Courses

Project Supported By

**FAPESP**

Project 2009/15235-8

Latest News

### First Scientific Chuva Workshop

May 24<sup>th</sup> and 25<sup>th</sup>

The Workshop will be held after two years of experiments, aiming to present all available data, they are organized and integrate the research groups.

Read More!

Experiments

COMPLETED!

ALCANTARA - MA

COMPLETED!

FORTALEZA - CE

COMPLETED!

BELEM - PA

COMPLETED!

VALE DO PARAÍSO - SP

IN PREPARATION!

SANTA MARIA - RS

BRASILIA - DF

MANAUS - AM

Chuva Project

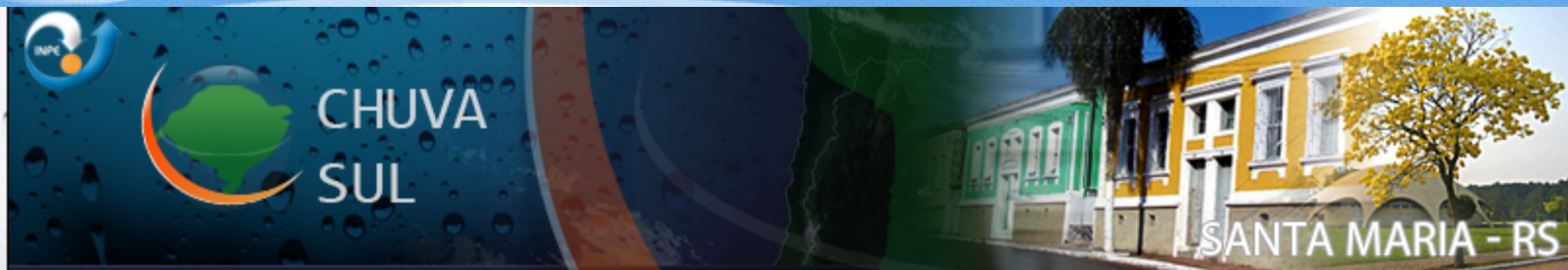
The physical processes inside clouds are one of the most unknown components of weather and climate systems. A description of cloud processes through the use of standard meteorological parameters in numerical models has to be strongly improved to accurately describe the characteristics of hydrometeors, latent heating profiles, radiative balance, air

Field Campaign and SOS System





# CHUVA SUL



Centro Regional  
Sul de Pesquisas  
Espaciais



Home



E-mail

Portal Chuva Project

Relatório de Coleta

Fotos

Instrumentos

Localização dos Sítios

Estratégias de Medidas

Participantes

Boletim Meteorológico

Curso

SOS - Chuva Sul

Quicklook

## ÚLTIMAS DO CHUVA SUL



### Chuva Sul

O experimento CHUVA-SUL será realizado nos meses de Novembro a Dezembro de 2012. A sede do experimento será na cidade de Santa Maria/RS no campus da UFSM, nas instalações na Unidade regional Sul do INPE. O CHUVA-SUL é um experimento financiado pela FAPESP, coordenado pelo INPE pelo Dr. Luiz Augusto T. Machado e localmente pelo Professor Ernani Nascimento da UFSM, especialista em previsão de imediata e tornados. Além dos professores e alunos da UFSM o experimento terá uma participação ativa da UFPEL, da Universidade de Buenos Aires, pesquisadores dos EUA e França e como em todos os outros a coordenação de e subprojetos da USP e IAE.





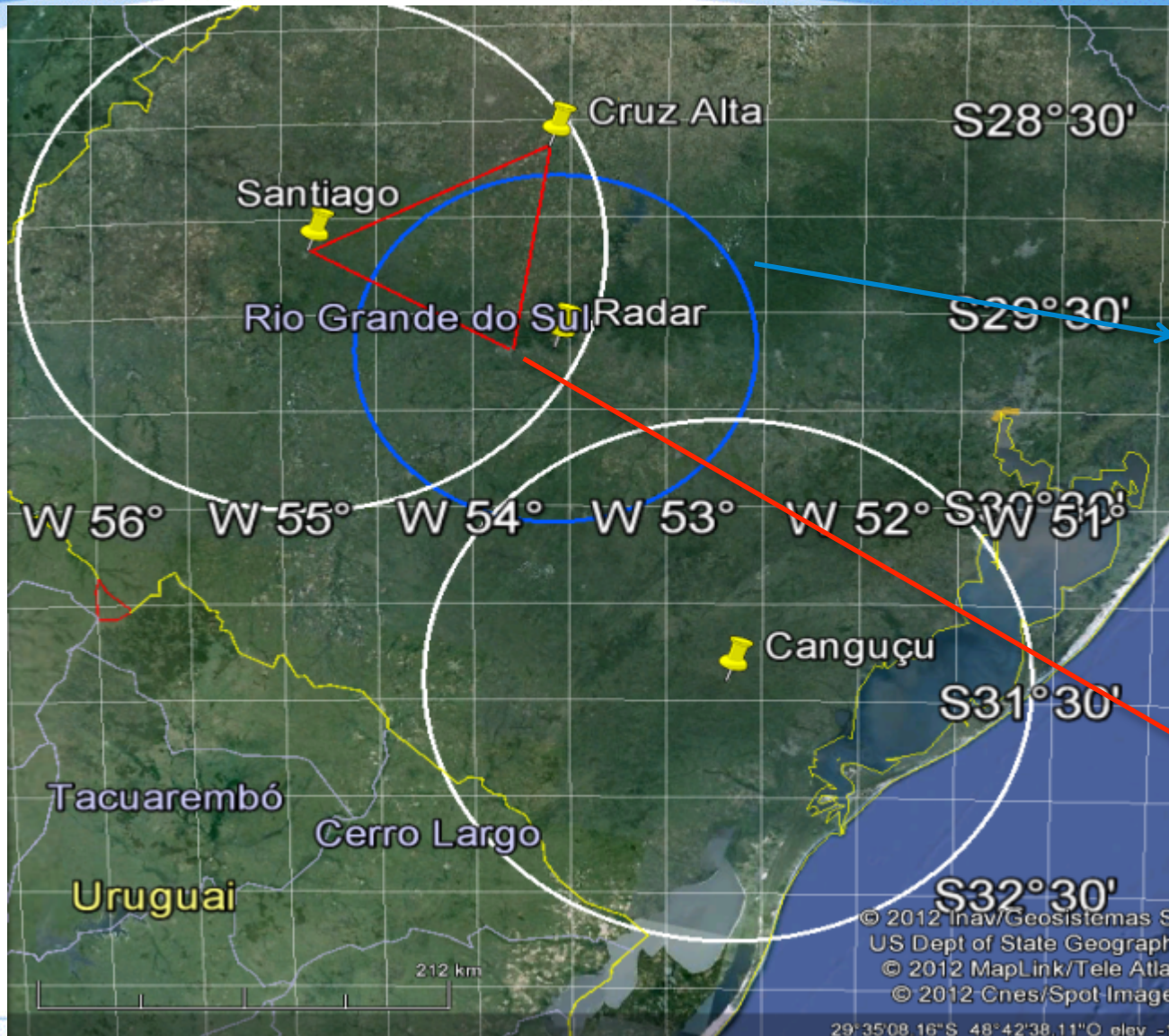
## Instrument Container in Santa Maria







# Radars and Radiossondes



Unfortunately X band had problems , only two S band

Radiosonde

# CHUVA-Lightning Mapping Campaign: CHUVA-GLM Vale do Paraíba



## • Goals:

- Besides CHUVA main goals (*precipitation measurements*) ...
- Contribute to **GOES-R GLM** and **MTG LI** activities by collecting total lightning data under MSG coverage:

### 1) Lightning Location Systems intercomparisons:

- Understand the differences between ground based LLS in respect to TRMM LIS;
- Generate GLM and LI proxy data.

### 2) Develop multi-sensor and multi-platform algorithms:

- satellite QPE;
- nowcasting of severe weather.







# CHUVA-Lightning Mapping Campaign: CHUVA-GLM Vale do Paraíba



## Deployed total lightning networks :

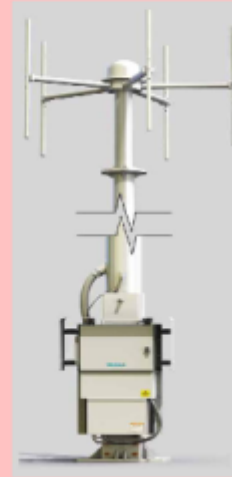
12 LMA sites  
(VHF)



7 LINET sites  
(VLF-LF)



5 TLS200 sites  
(LF-VHF)



7 EN sites  
(ELF-LF)



## Operational networks :

- RINDAT (LF)
- STARNET (VLF)
- WWLLN (VLF)
- GLD360 (VLF)
- ATDnet (VLF)
- BrasilDAT (ELF-LF)

## 6 High Speed Video Cameras



## 8 Field-Mills



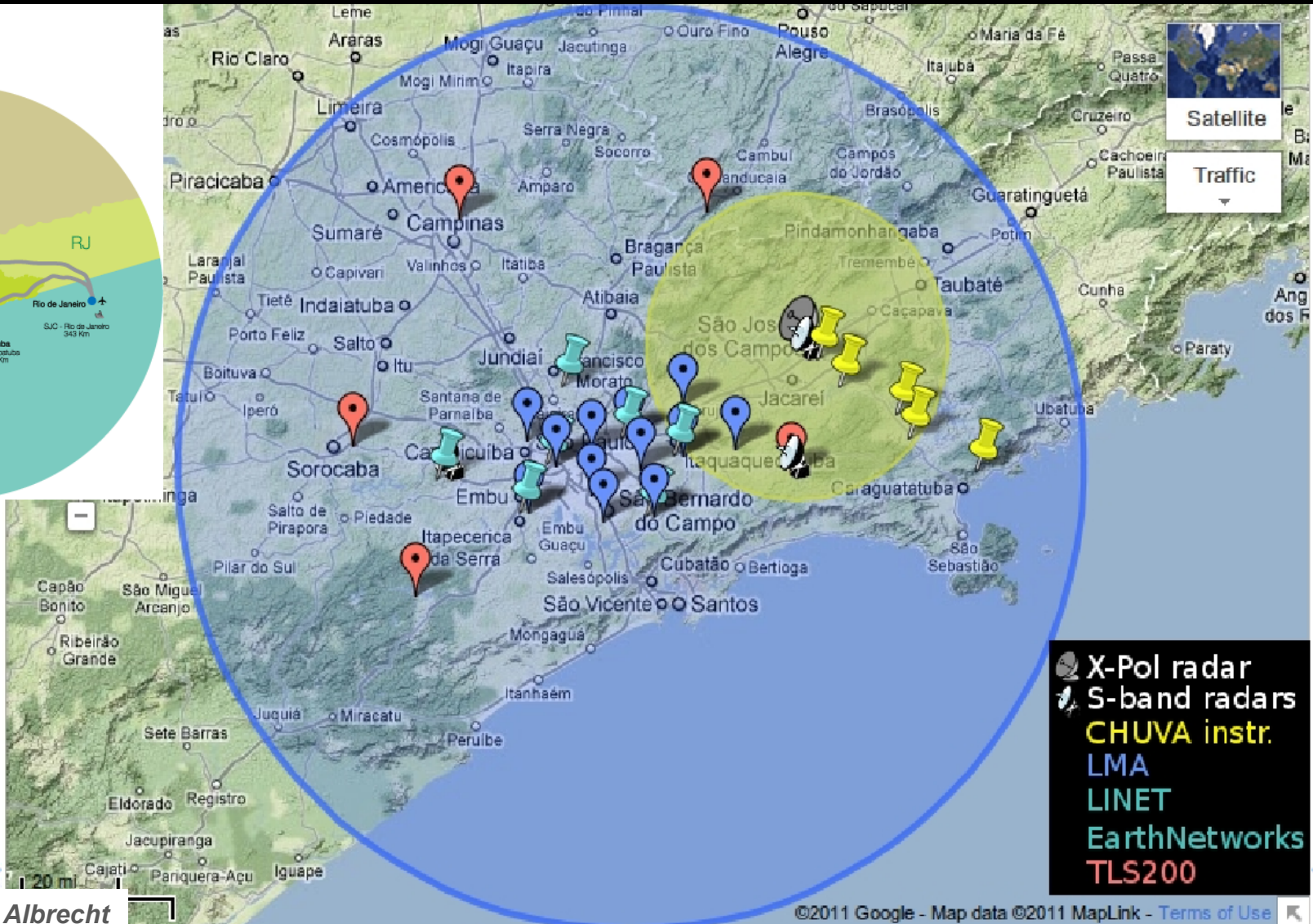
## Satellite Observations :

- GOES-12
- MSG
- TRMM





# CHUVA-Lightning Mapping Campaign: CHUVA-GLM Vale do Paraíba







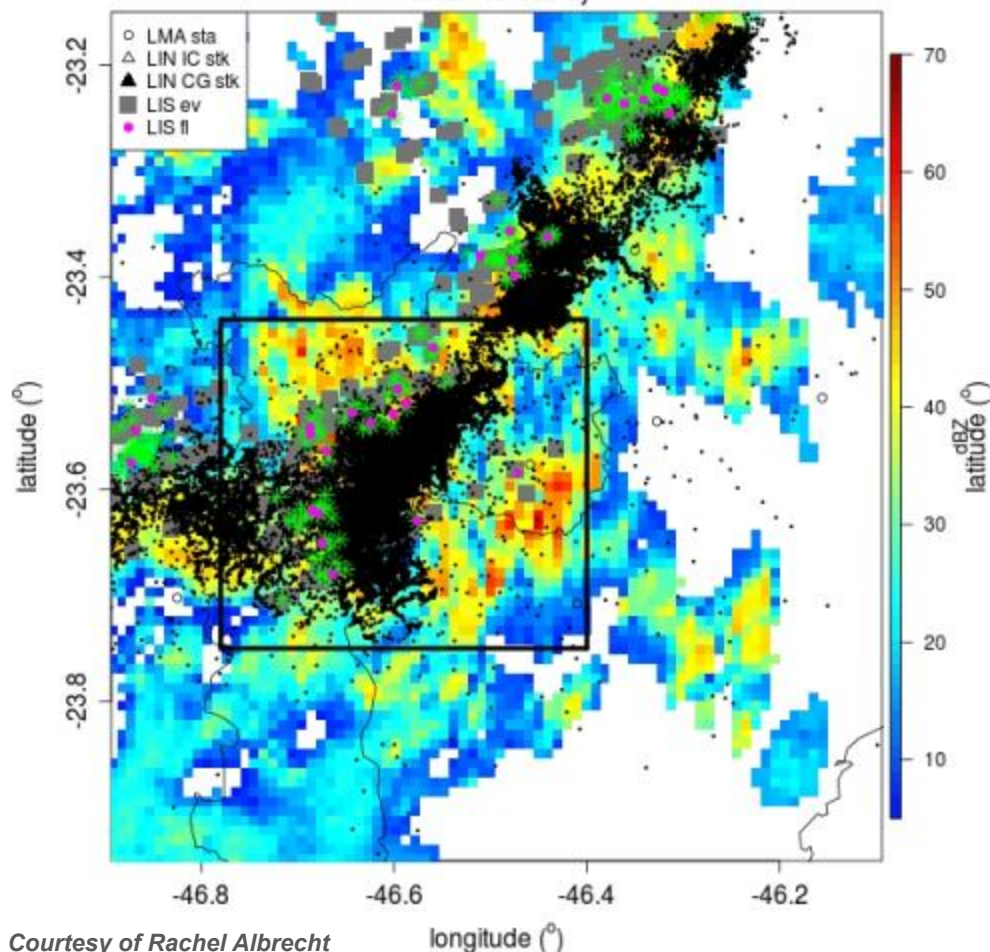
# CHUVA-Lightning Mapping Campaign: CHUVA-GLM Vale do Paraíba



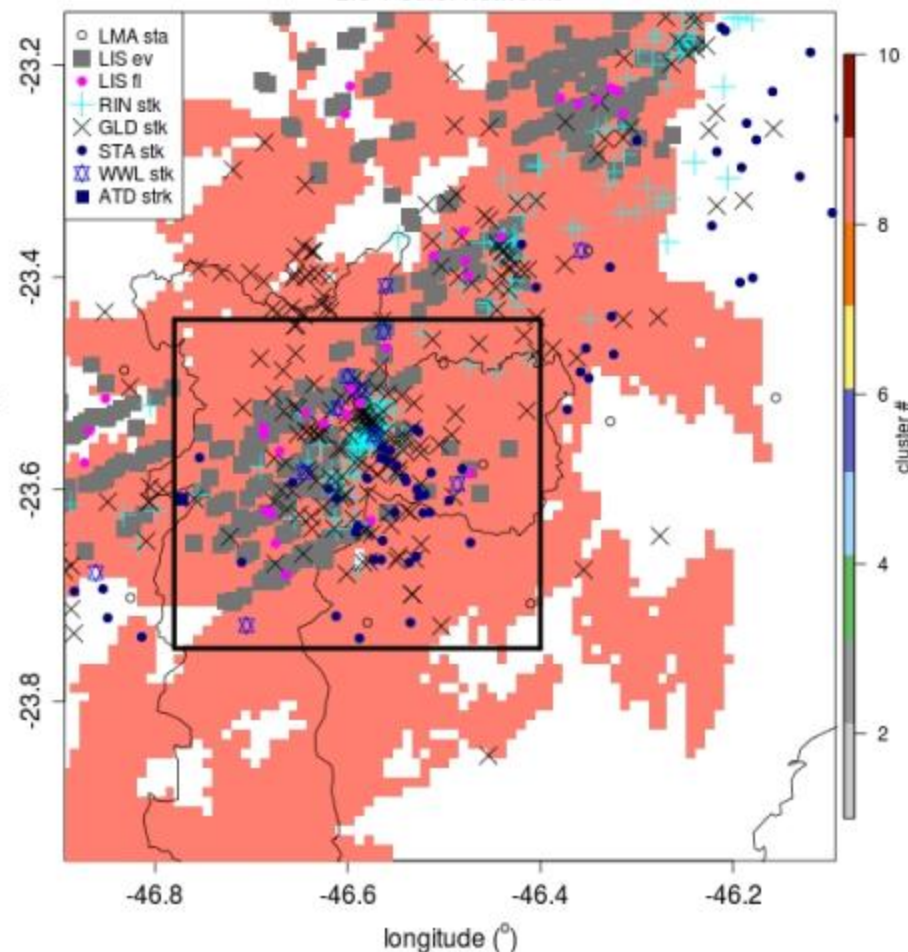
**TRMM LIS overpass: 2012-02-10 case (~100 seconds)**

TRMM LIS orbit #81108 (2012-02-10 19:00UTC) - Radar time: 1900UTC (SR)

Radar Reflectivity



LIS + other networks



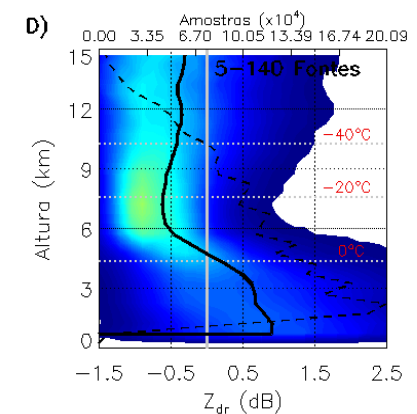
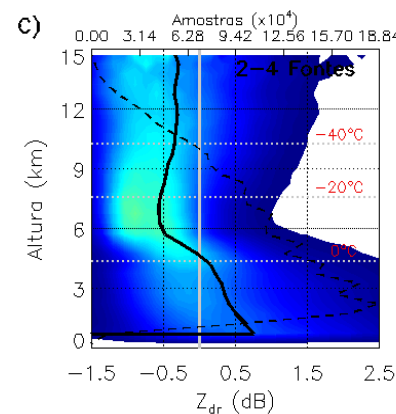
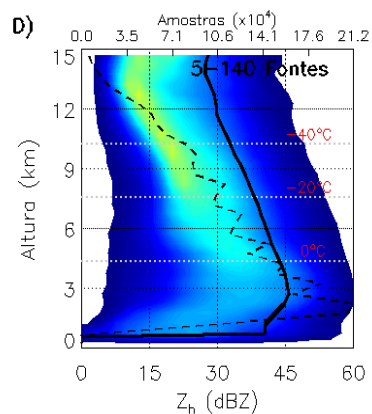
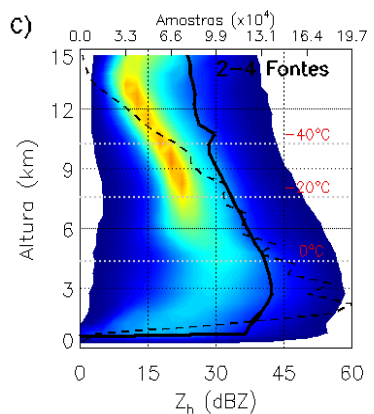
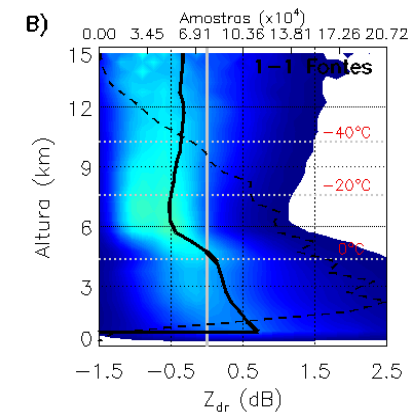
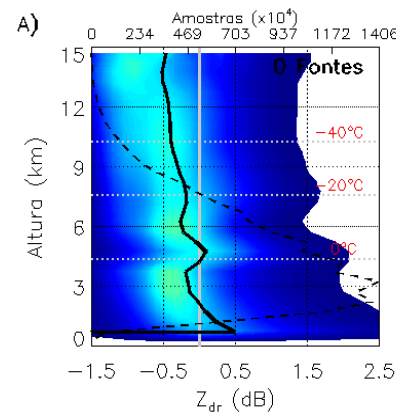
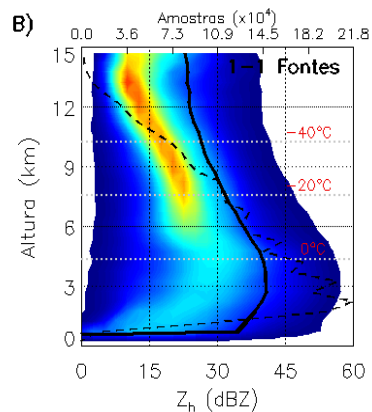
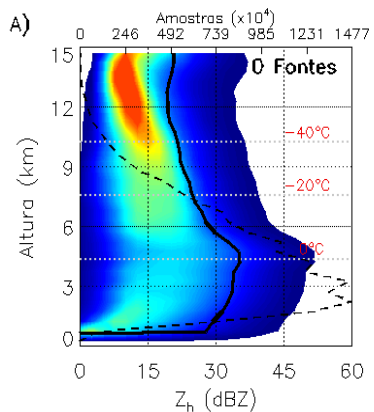




# Avaliar o impacto da estrutura e microfísica das tempestades na eletrificação e características dos relâmpagos



## RESULTADOS: CFADS



Distribuição desloca-se para maiores valores de dBZ

Distribuição desloca-se para valores de ZDR negativo e para ~7

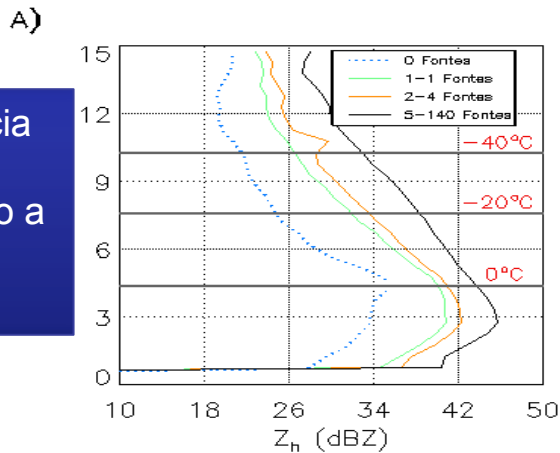


# Avaliar o impacto da estrutura e microfísica das tempestades na eletrificação e características dos relâmpagos

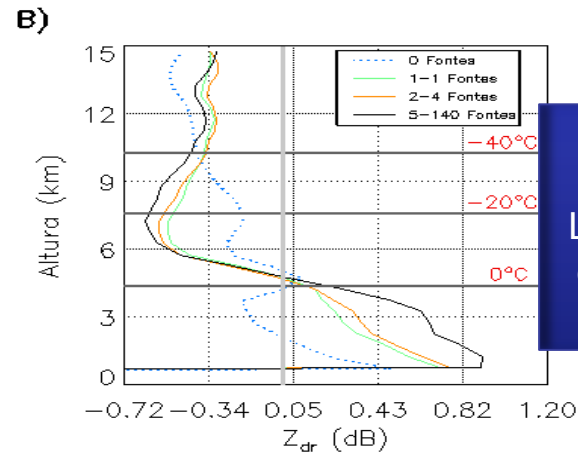


## RESULTADOS: Perfil Vertical

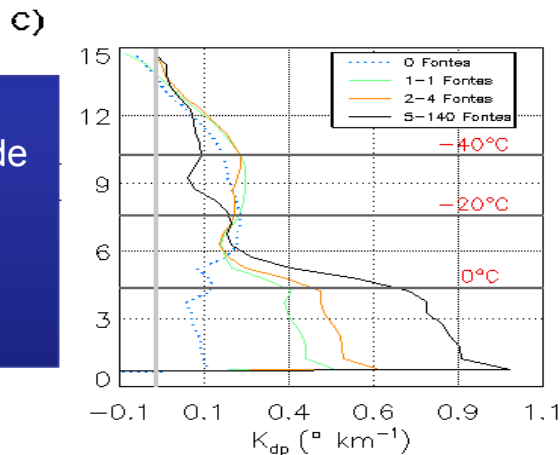
DBZ: Ocorrência de LMAs associado a perfis mais convectivos



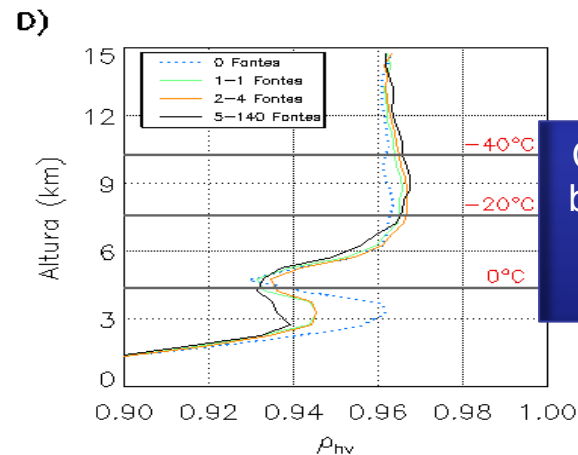
ZDR: Alta ocorrência de LMAs associado a gelo com formato vertical



KDP: Predominância de hidrometeoros oblatos na alta ocorrência de LMAs



CORR: Diferença bem a intensidade elétrica na fase líquida

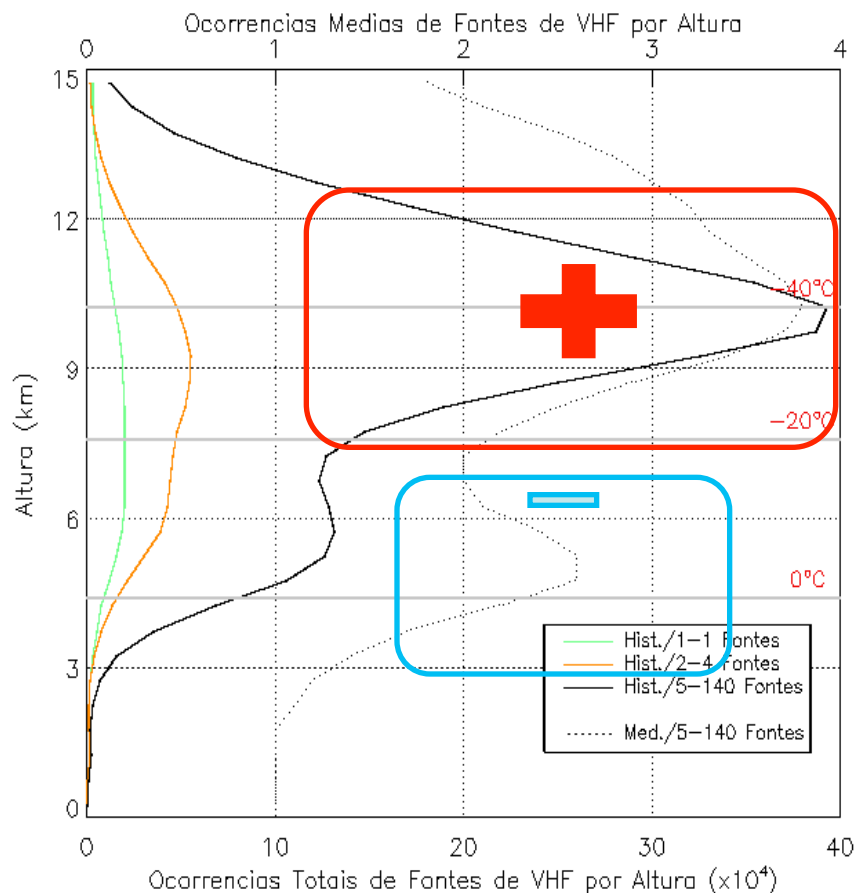




# Avaliar o impacto da estrutura e microfísica das tempestades na eletrificação e características dos relâmpagos



## RESULTADOS: Próximos Passos



CENTRO DE  
CARGAS  
ELÉTRICAS  
NEGATIVO

Avaliar as diferenças dos centros negativo e positivo das nuvens em termos das propriedades dos hidrometeoros

CENTRO DE  
CARGAS  
ELÉTRICAS  
POSITIVO





# Profiles and Integration of Cloud and Rain Liquid Water over Brazil using Passive and Active Ground Sensors

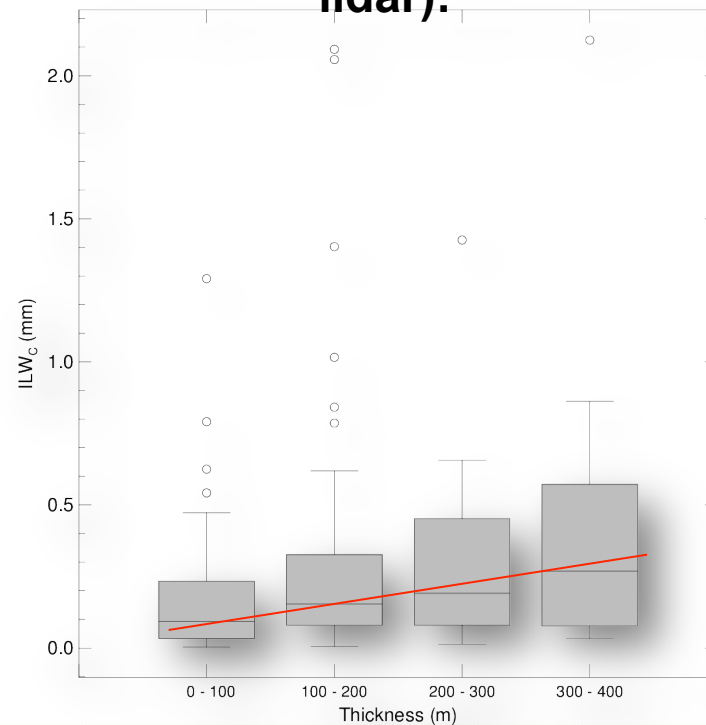
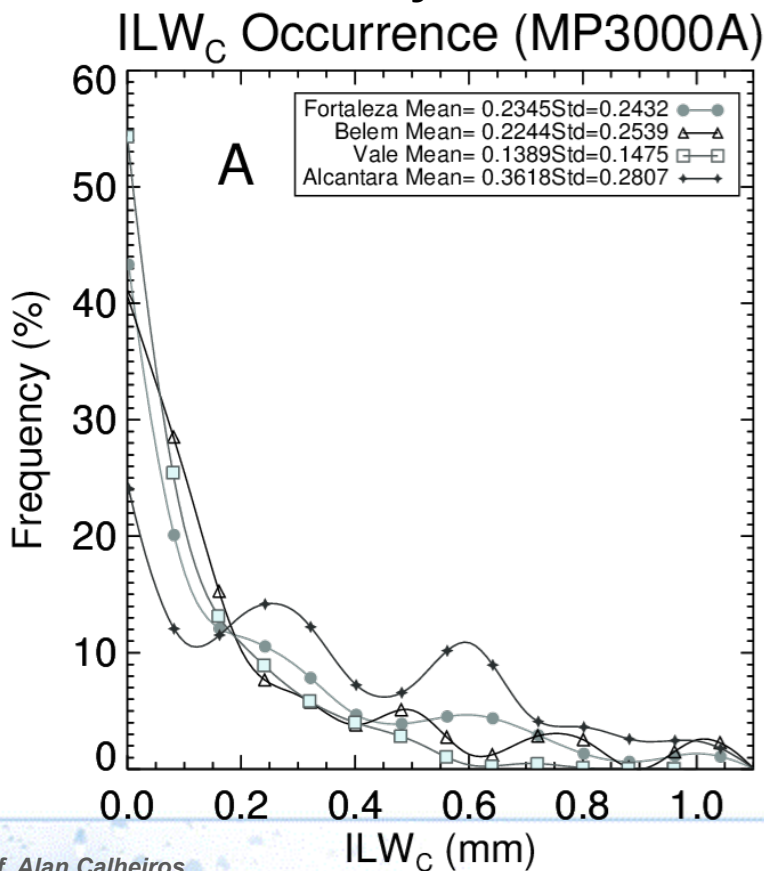


## No rainy events

### INTEGRATED (mm):

1. By Sites:

2. By Cloud Thickness (from lidar):





# Profiles and Integration of Cloud and Rain Liquid Water over Brazil using Passive and Active Ground Sensors

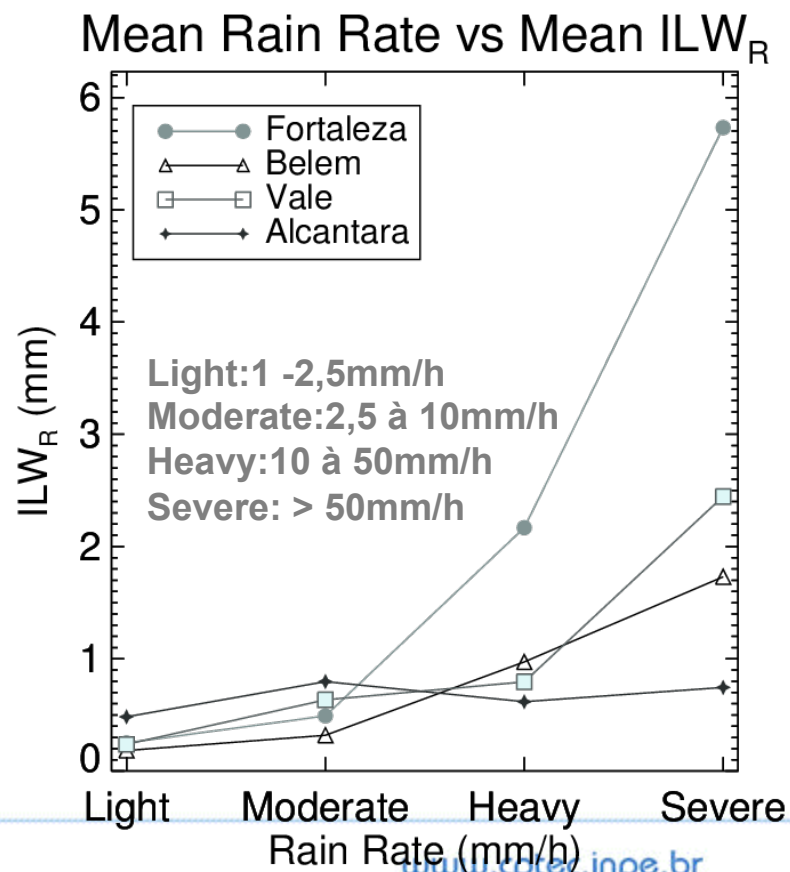
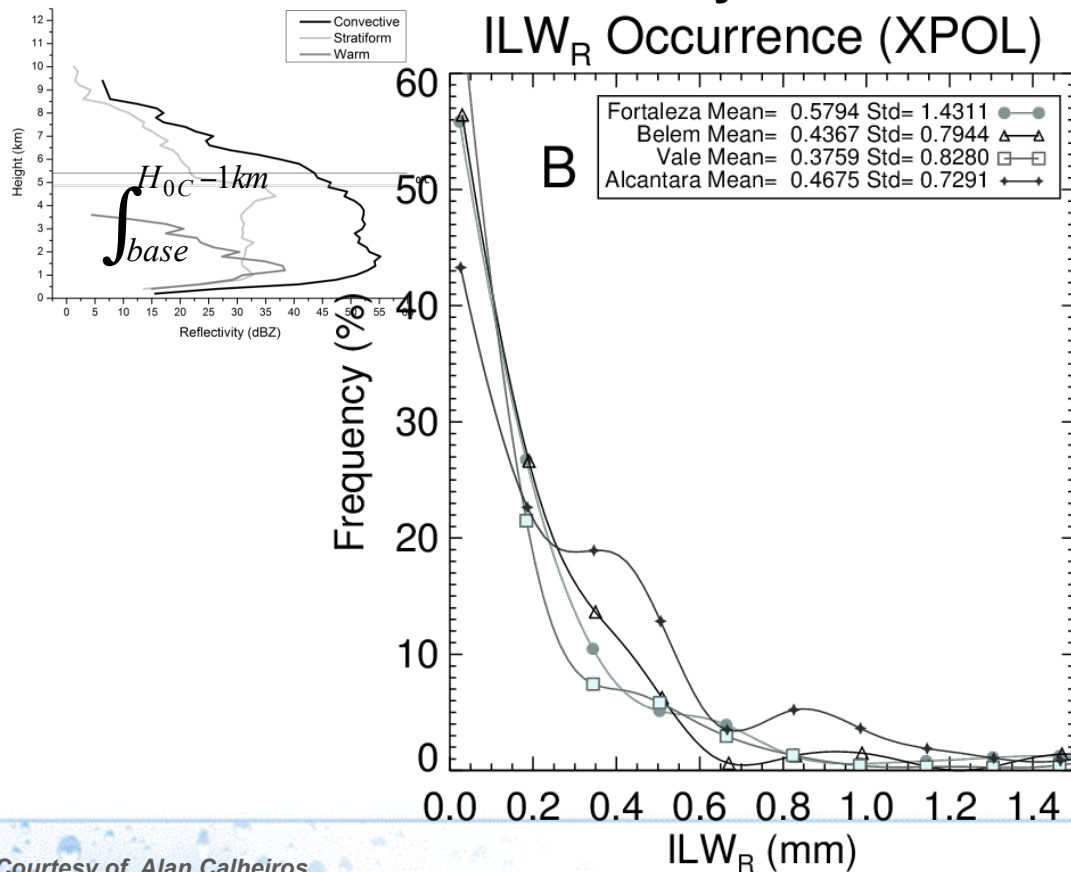


## Rainy events

### INTEGRATED (mm):

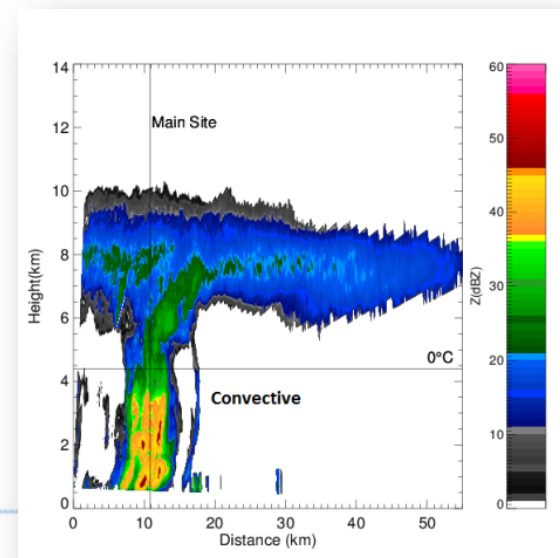
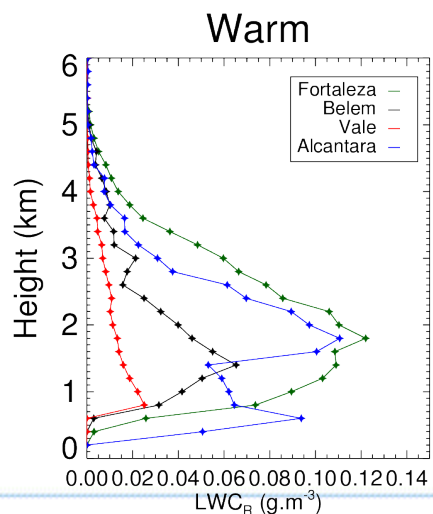
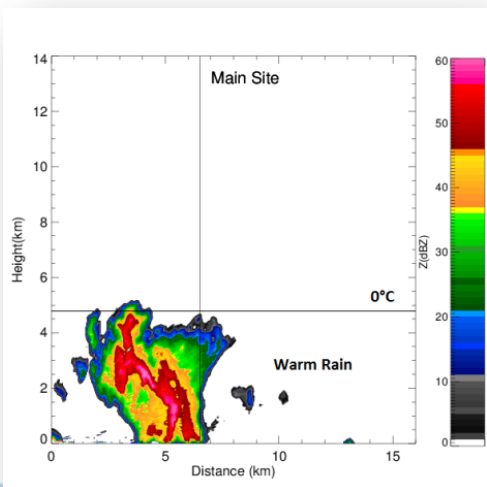
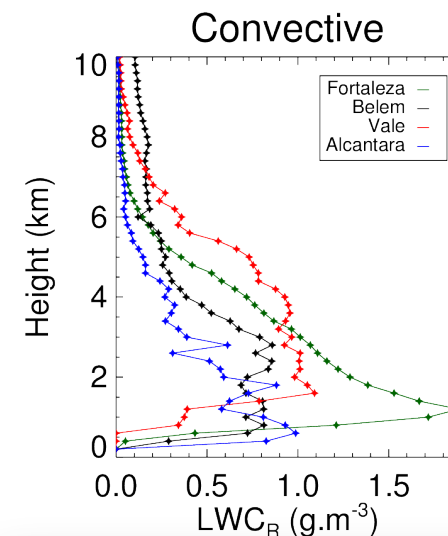
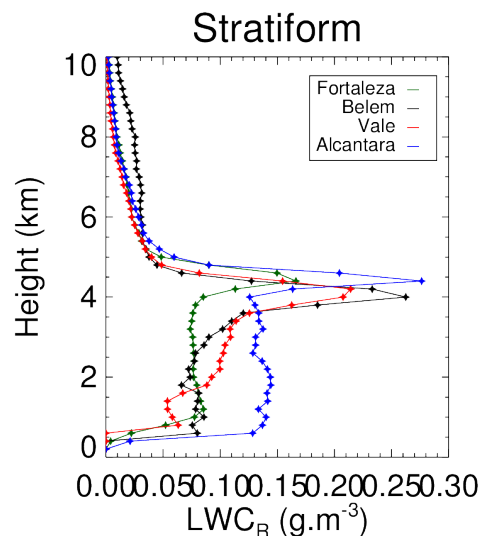
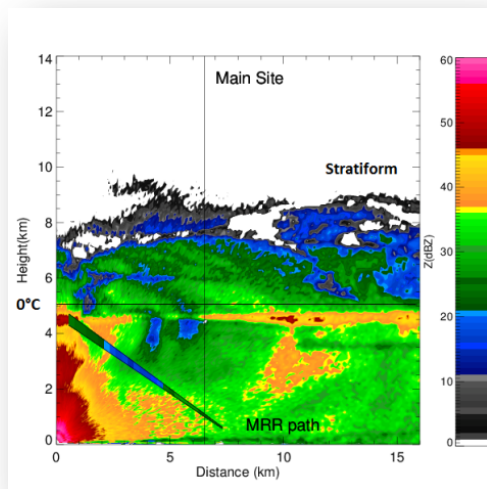
→ 4. By Site:

→ 5. By Rain Intensity:





## Rainy events: Mean LWC profiles (XPOL)



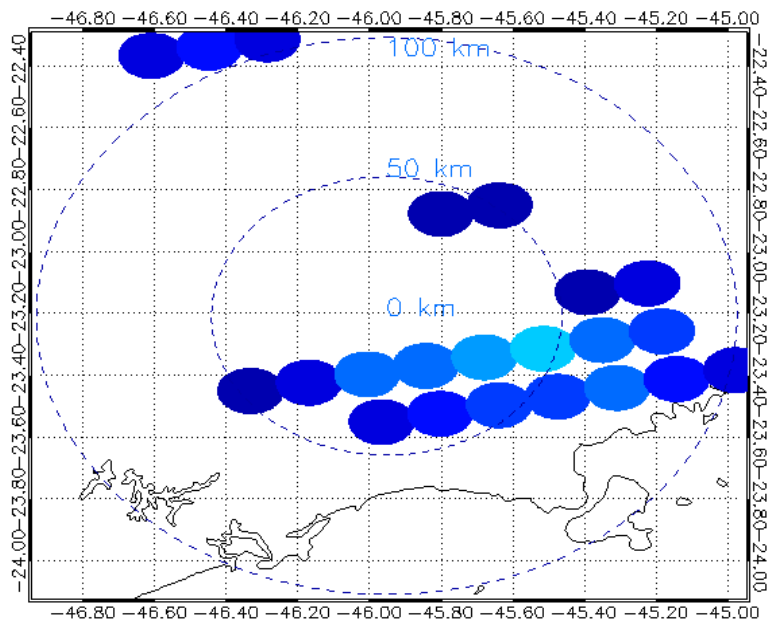


# Ice Water Path Study Using Passive Microwave Sensors During the Cloud Life Cycle

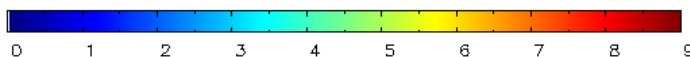


- ESTUDO DE CASO PARA O DIA 08/01/2012 SOBRE SJC às 16:45UTC

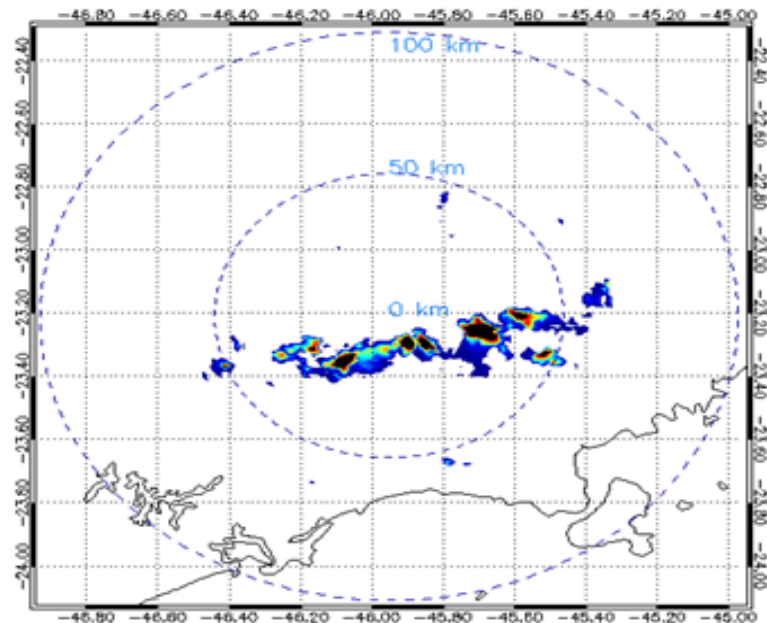
### IWP



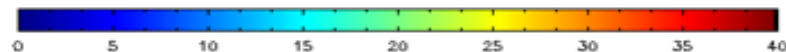
ICE WATER PATH [ $\text{Kg}/\text{m}^2$ ] - Dia: 08-01-2012 Horário: 16:49 UTC



### RRx



Precipitação Instantânea RADAR [ $\text{mm}/\text{h}$ ] - Dia: 08-01-2012 Horário: 1648 UTC

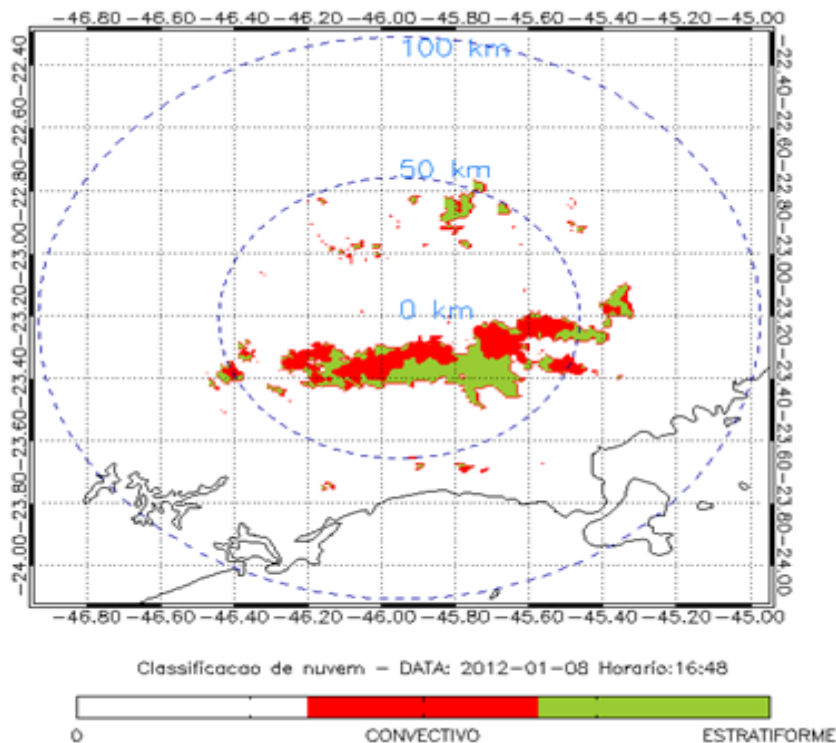




# Ice Water Path Study Using Passive Microwave Sensors During the Cloud Life Cycle

- ESTUDO DE CASO PARA O DIA 08/01/2012 SOBRE SJG às 16:45UTC

## Classificação de Nuvens



## Imagem GOES-12

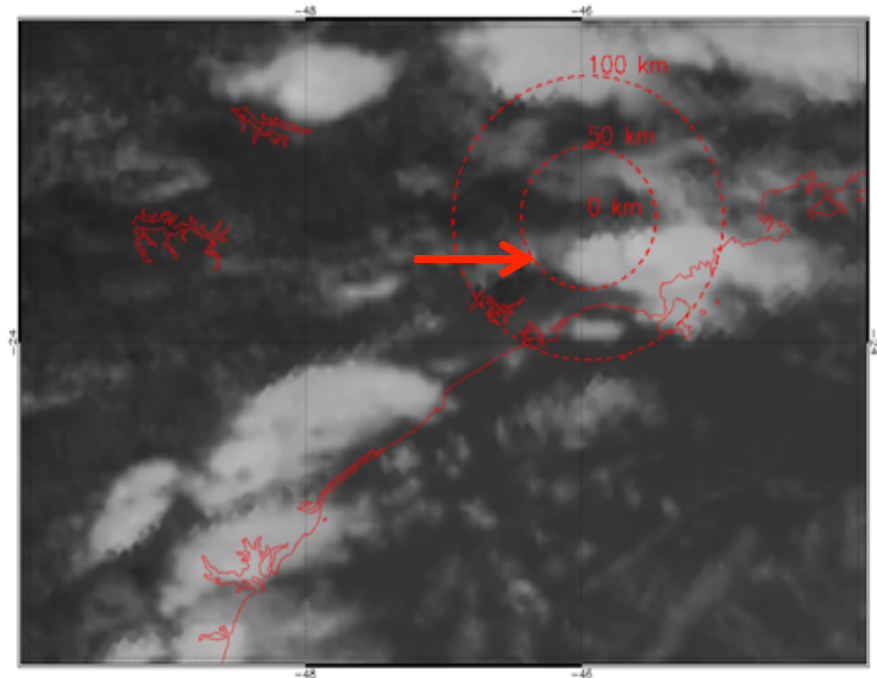
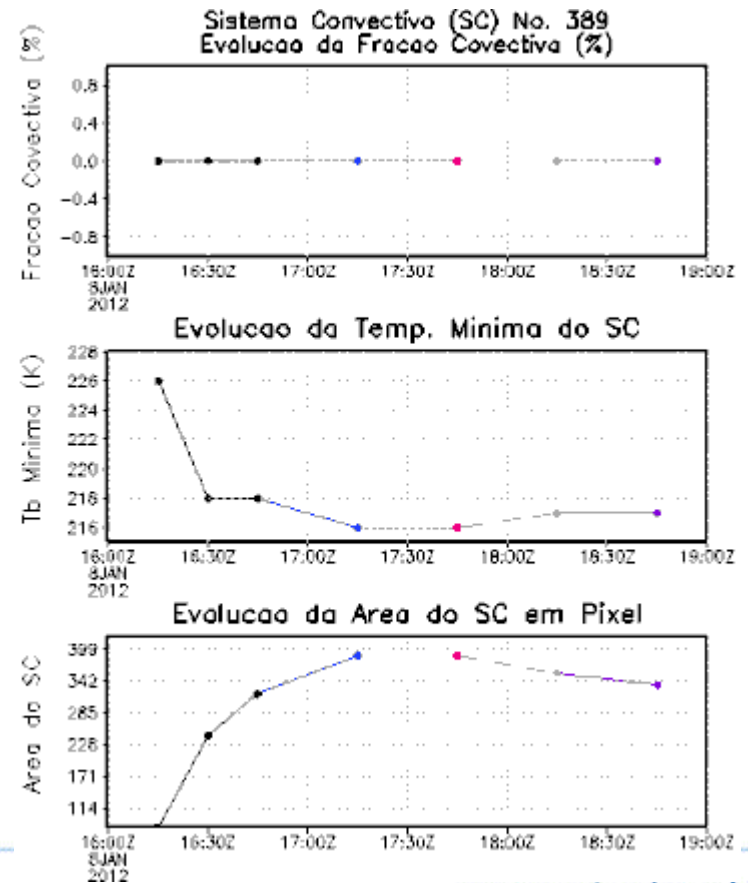
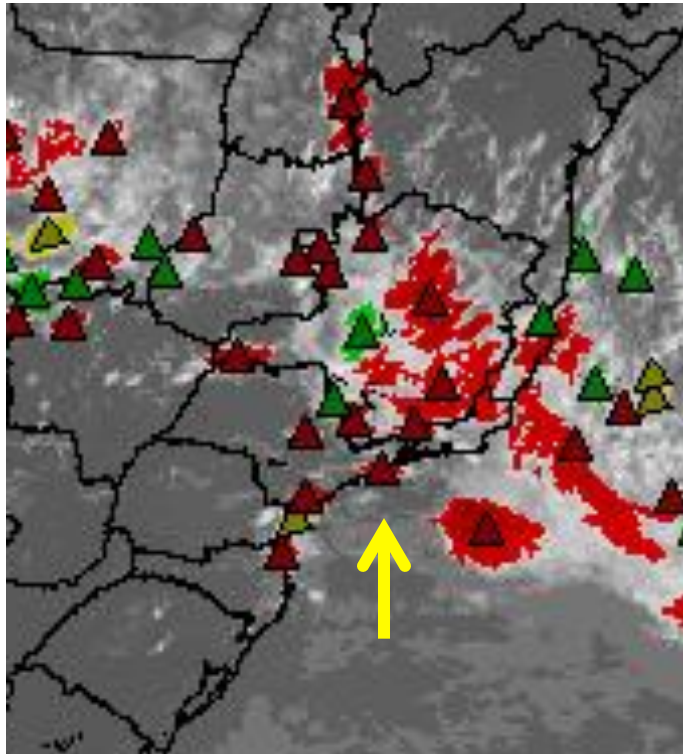


Imagem GOES(10.7um)- Data: 08/01/2012 Horário: 16:45 UTC

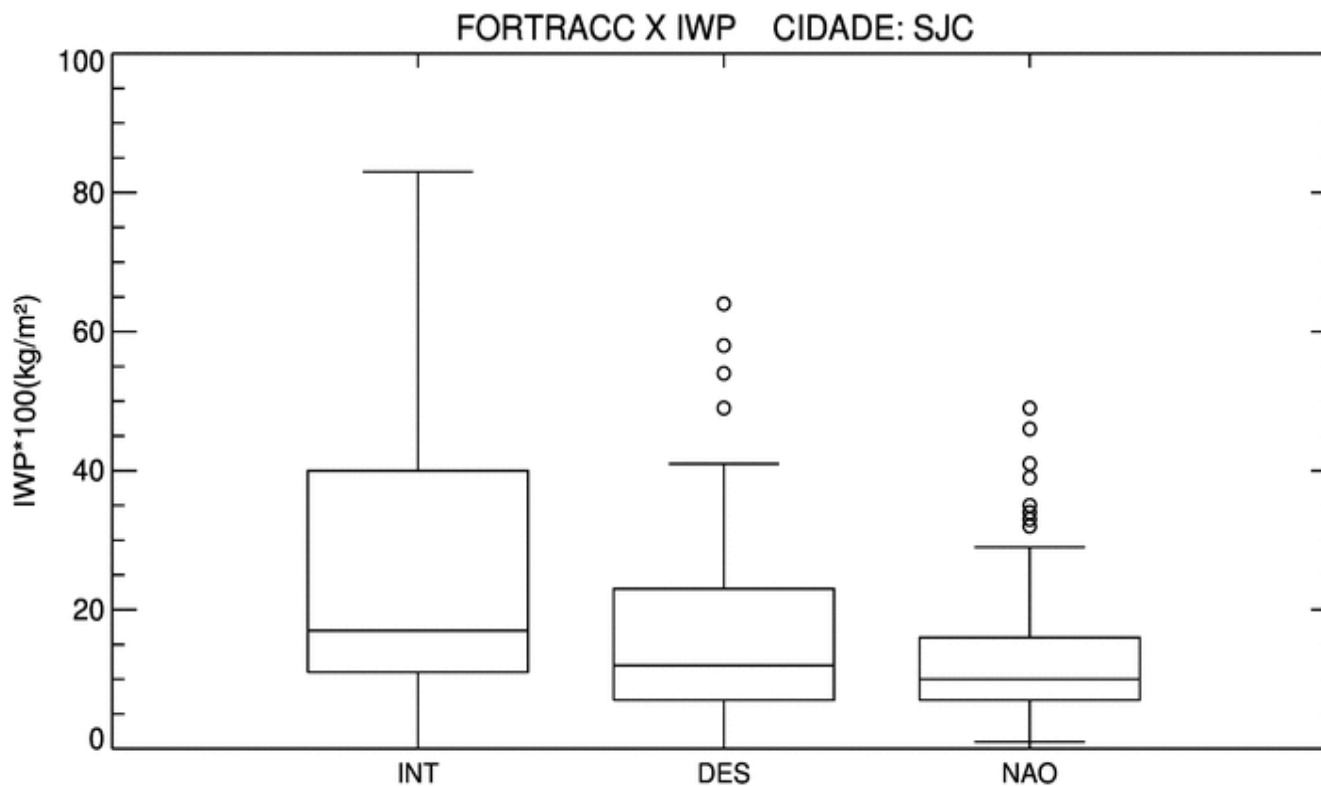
- ESTUDO DE CASO PARA O DIA 08/01/2012 SOBRE SJC às 16:45UTC

## Classificação FORTRACC





- ANÁLISE IWP

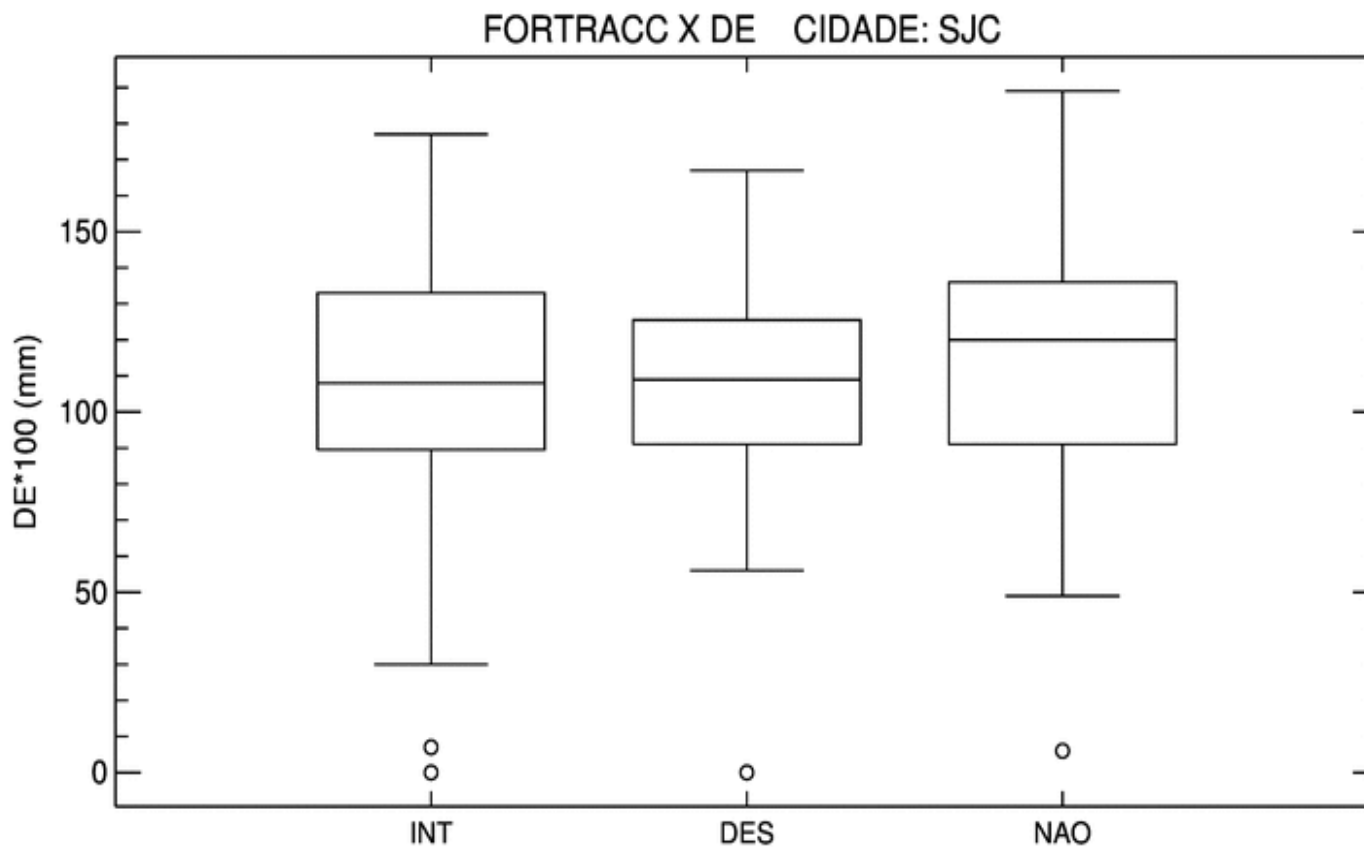




# Ice Water Path Study Using Passive Microwave Sensors During the Cloud Life Cycle

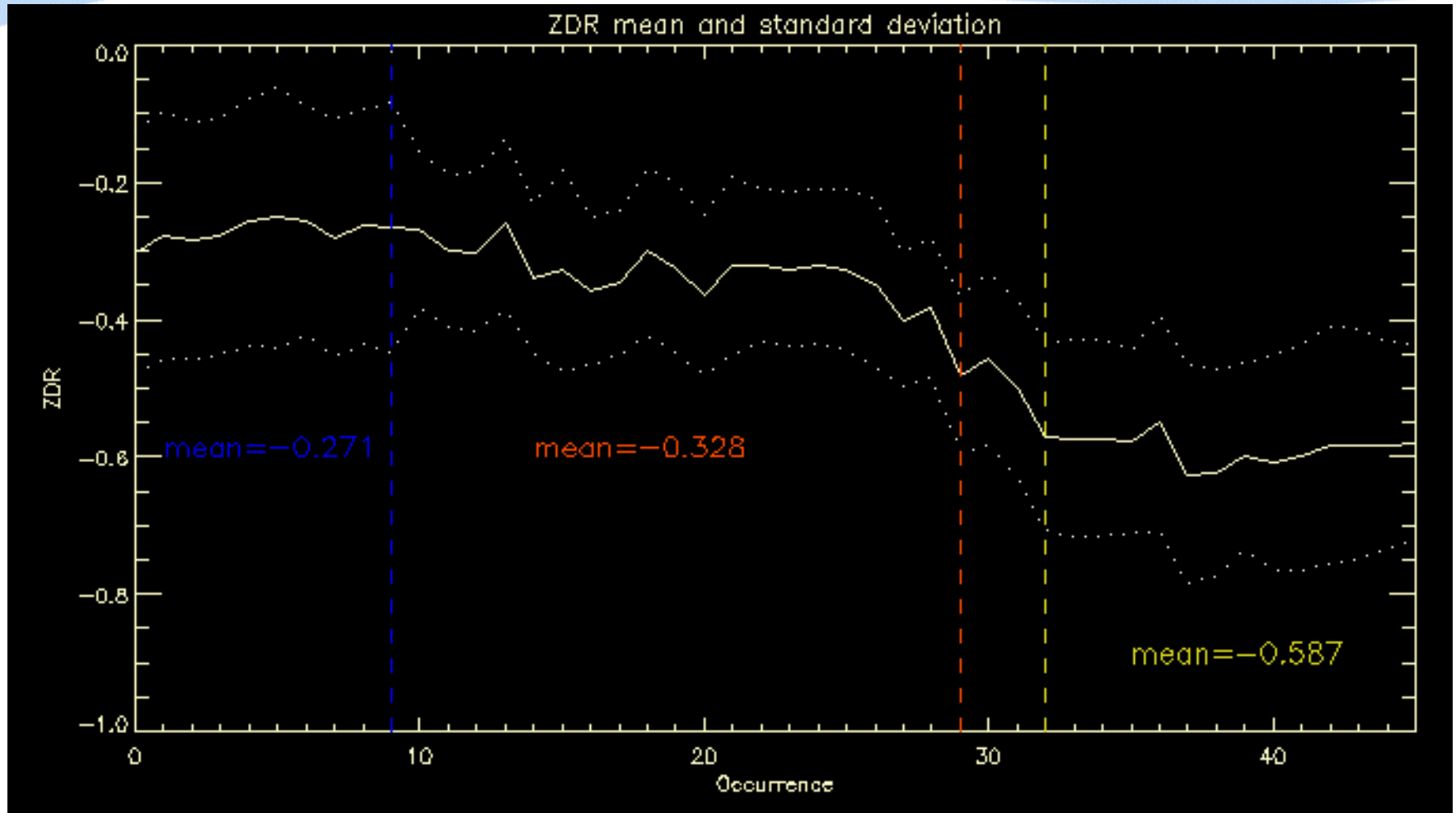


## •ANÁLISE De





# Determinação do Viés do Zdr e seu Impacto na Classificação de Hidrometeoros



Viés médio do Zdr → há uma nítida degradação do sinal

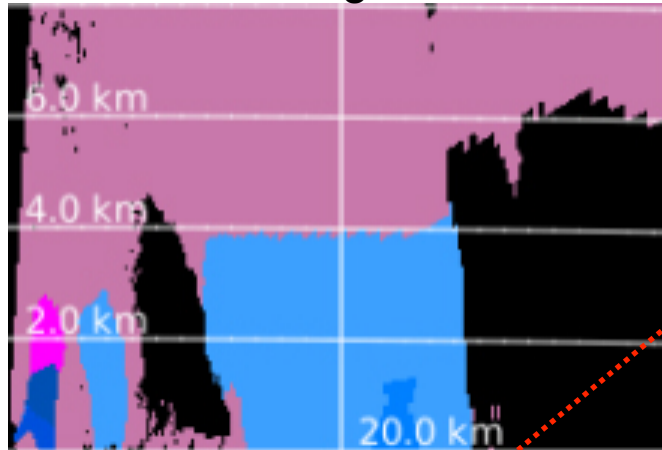
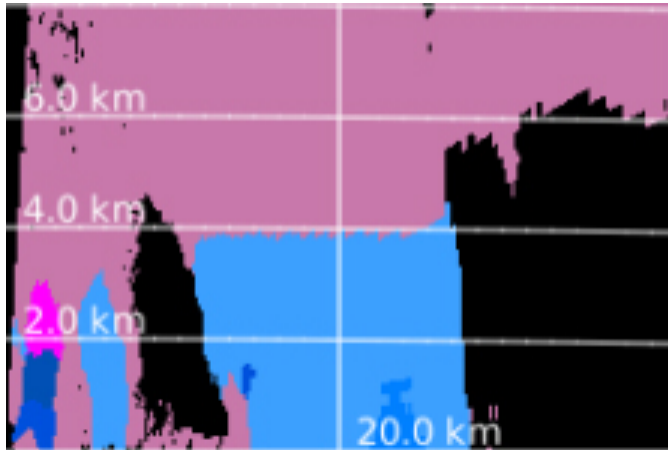


# RHI em 122° - NEXRAD - Warm



17/02/2012-18:16Z

corrigido

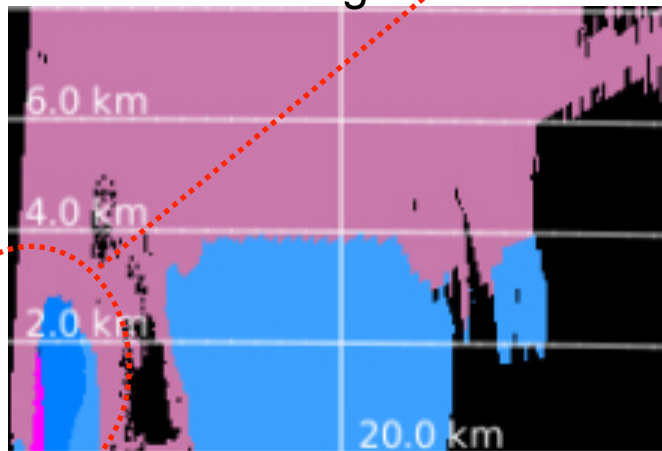
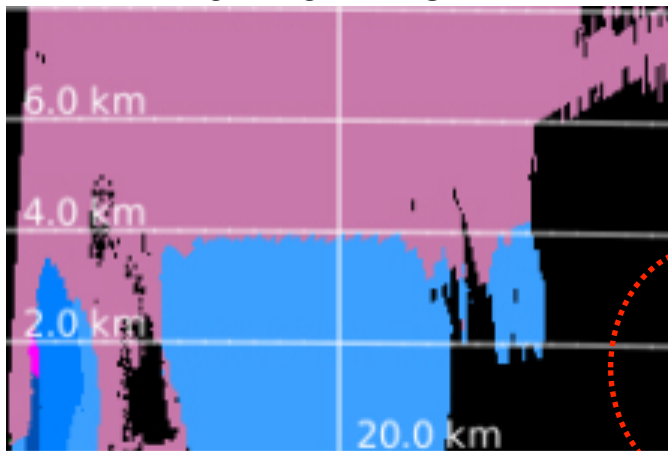


## Classificação de hidrometeoro

- Rain-hail mixture
- Big drops
- Moderate rain
- Biological
- Not classified
- No Data

17/02/2012-18:22Z

corrigido

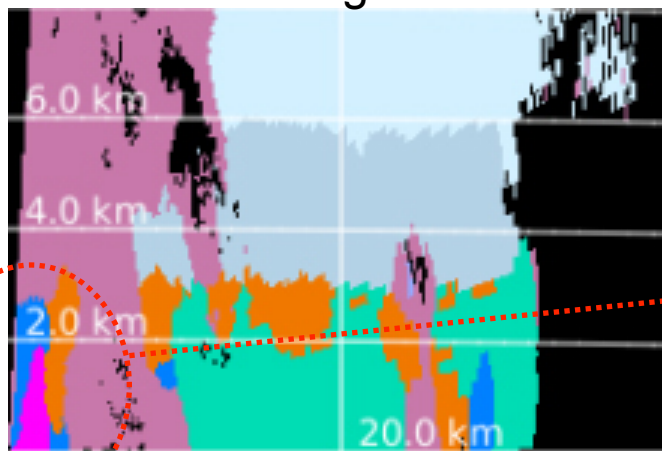
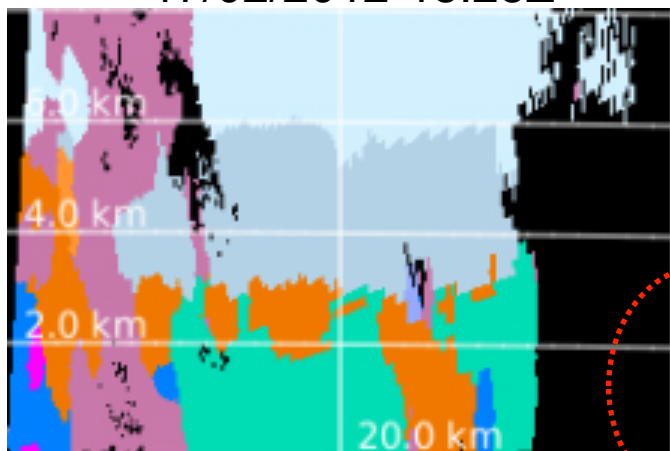


**Zdr viés = -0.58**

# Classificação do MeteoFrance

17/02/2012-18:28Z

corrigido

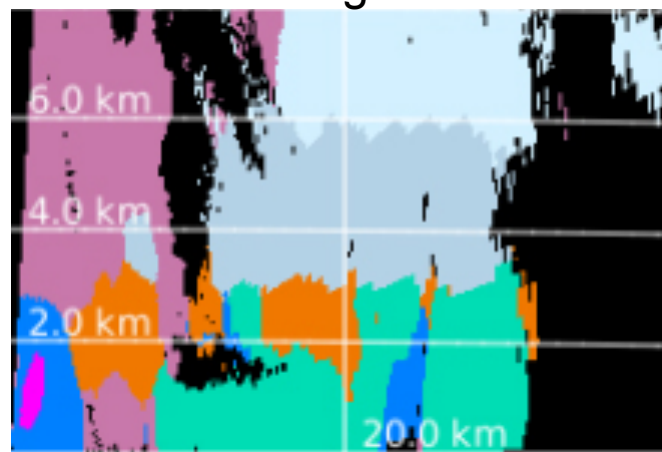
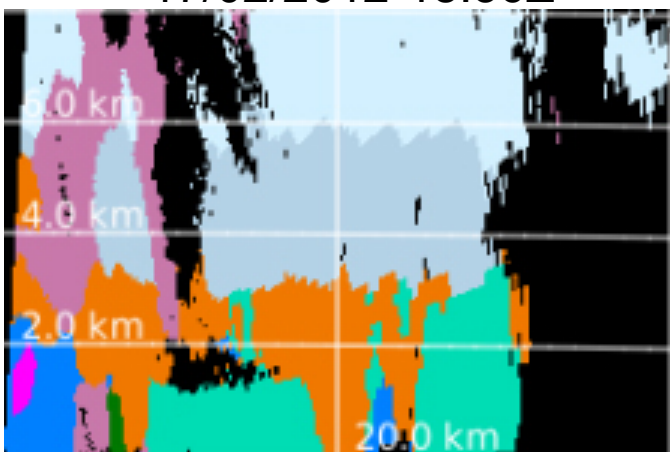


## Classificação de hidrometeoro



17/02/2012-18:36Z

corrigido



**Zdr viés = -0.58**





# CHUVA Project



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEZ
2010			Alcantara									
2011			Fortaleza	Fortaleza		Belem	Belem				Vale do Paraiba	Vale do Paraiba
2012	Vale do Paraiba	Vale do Paraiba	Vale do Paraiba								Santa Maria	Santa Maria
2013			São Paulo	São Paulo	São Paulo	São Paulo	São Paulo	São Paulo	São Paulo			
2014		Manaus	Manaus	Manaus				Manaus	Manaus	Manaus		





# Megacidades 20013



Get directions My places

Collaborate

EDIT

Explore making custom maps in an interactive tutorial.

### CHUVA - MegaCidades

Free Map Tools Radius

Public · 1 views  
Created on Mar 12 · By Rachel ·  
Rate this map · Write a comment

MRR, MP3000, Joss  
Instituto de Física - Pelletron Univ  
Instrumentos: - MicroRain Radar  
Joss-Waldvogel -23.561596, -46  
-46° 44' ...

Radar - EMAE  
Empresa Metropolitana de Águas  
banda-X Doppler de Dupla Polariz  
-46.669970, 761.7 m-23° 42' 0.57

The CHUVA -Mega Cidades-São Paulo Experiment is focused on the behavior of precipitation in a large urban center. The Intensive Observation Period (IOP) will allow to improve nowcasting techniques for severe weather for all seasons





## Instruments

### Billing Dam

- METEOR 50DX Radar – Dual Polarization
- Ott Inc. PARSIVEL Optical Laser Disdrometer,

### Physics Institute - USP (IFUSP)

- Microwave Profiling Radiometer - MP3000
- Joss Waldvogel Acoustic Impact Disdrometer Model RD 80
- Micro Rain Radar (MRR)

### Air Force Base

- Radiosondes – temperature, humidity and wind profiles – 00 and 12 UTC





# Megacidades 20013



Acesso à Informação

BRASIL

MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÃO  
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

CENTRO DE PREVISÃO DE TEMPO E ESTUDOS CLIMÁTICOS



PROJETO  
CHUVA

## SOS Chuva - MegaCidades São Paulo



▼ Radar Banda X - Chuva

Prec. Instantânea

2013-03-17 18:15:00

Prec. 30 min.

Fortracc-Prev. 20min.

Fortracc-Prev. 40min.

Prec. Acum. 1h.

Prec. Acum. 6h.

Prec. Acum. 12h.

Prec. Acum. 24h.

Velocidade Doppler

► São Roque

► Descargas Elétricas

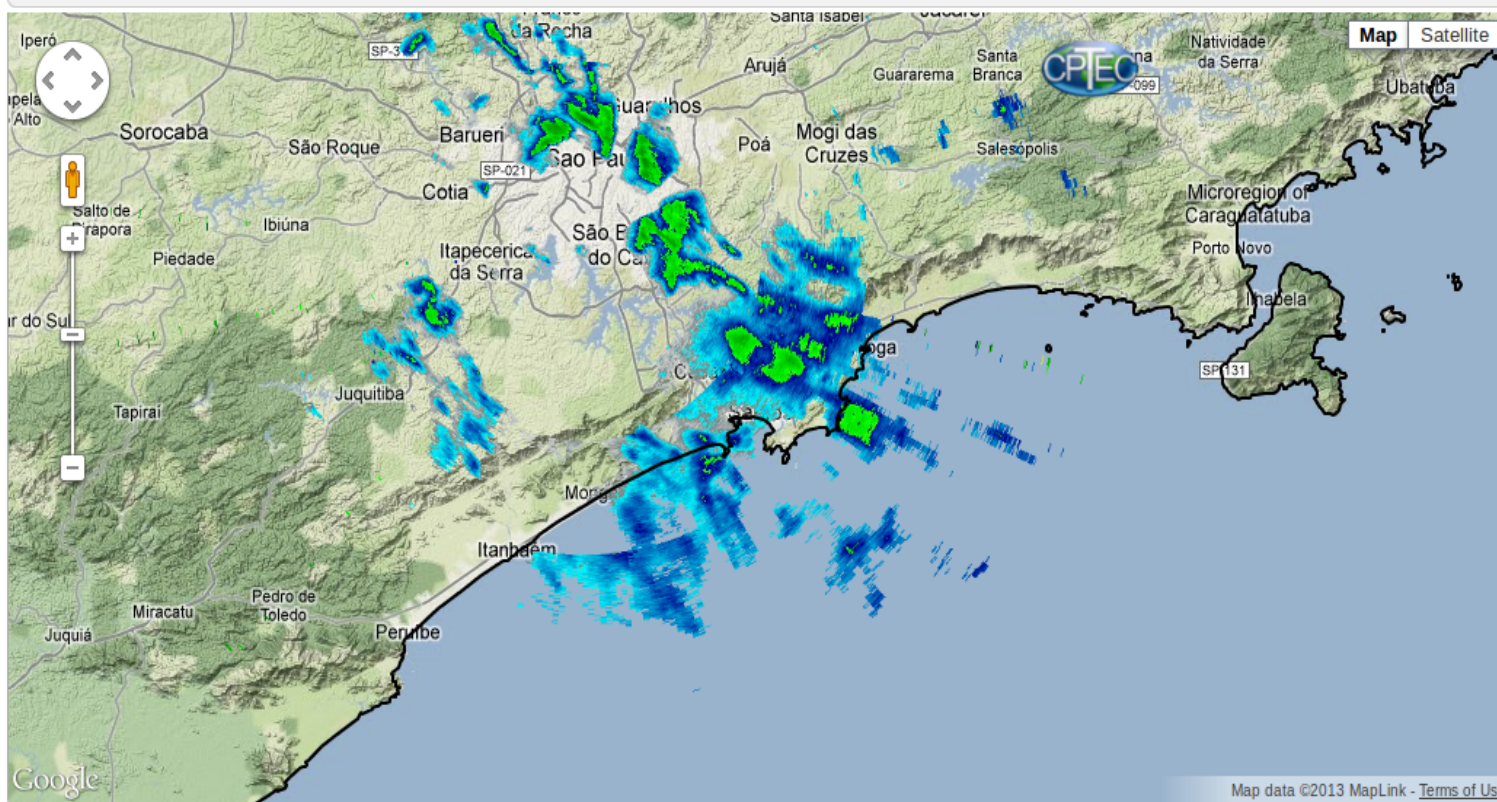
► Satélite

► Camadas

Acumulados por bairros/cidades

Atualização automática  Distância  Acumulados por bairros/cidades

-47.7411, -23.4784



Map data ©2013 MapLink - Terms of Use

**IARA - GoAmazon 2014**

**Activities related to Aerosol, Cloud,  
Precipitation, and Radiation Interactions  
and Dynamics of Convective Cloud Systems  
(ACRIDICON)  
and CHUVA Project**

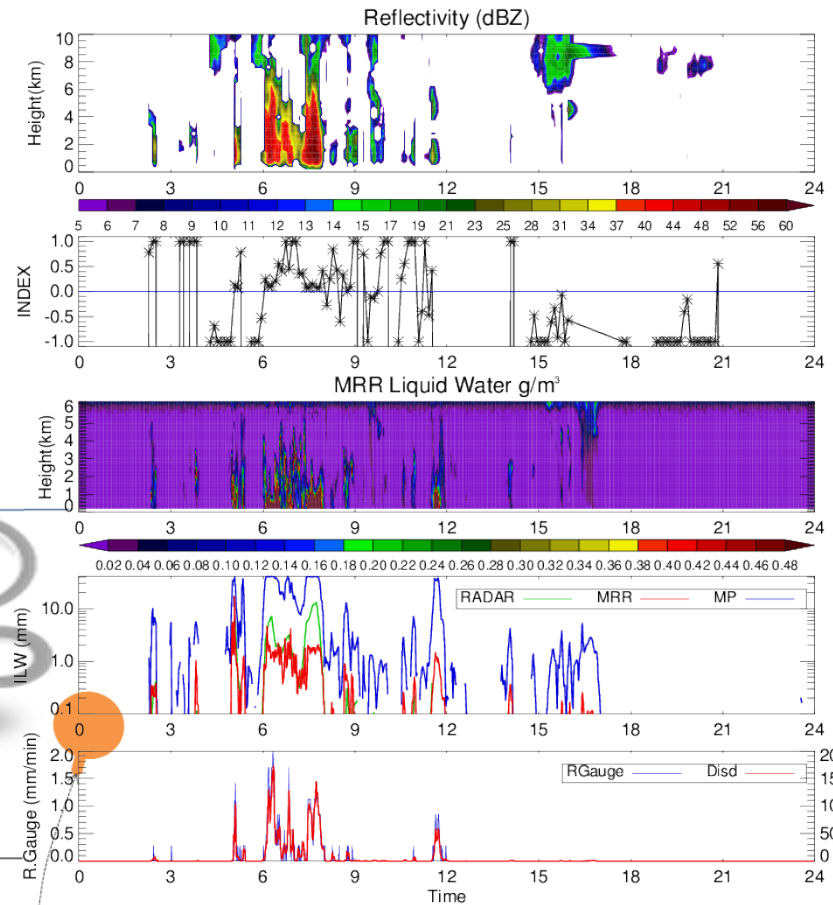
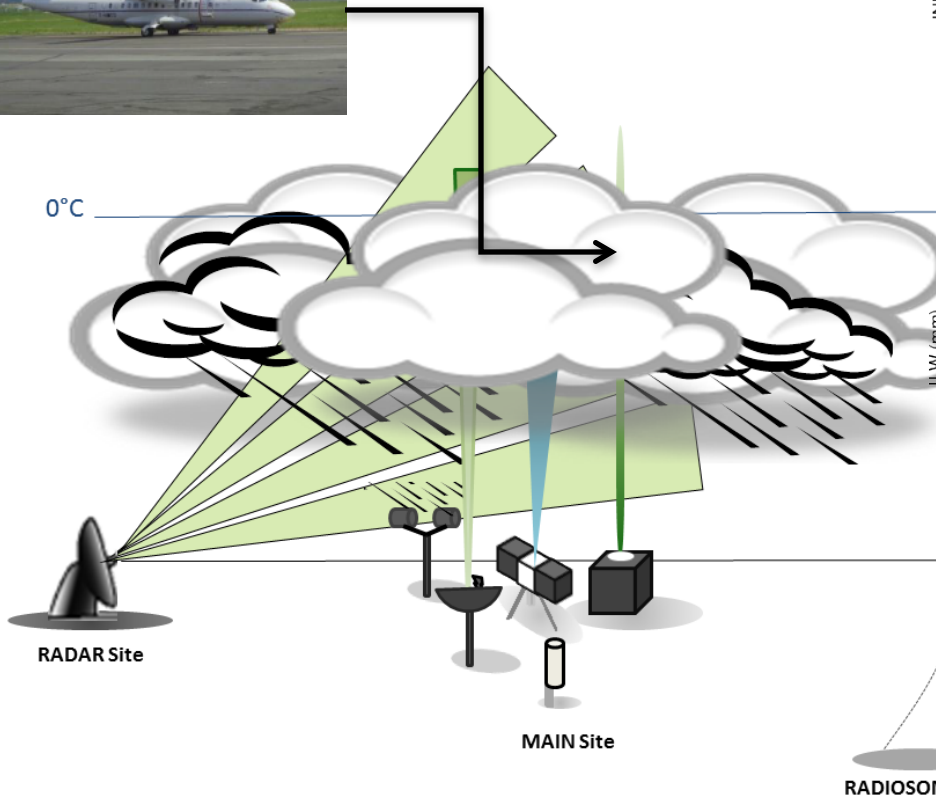
**Luiz.Machado@cptec.inpe.br**

- **HOW TO DESCRIBE/UNDERSTAND THE COMPLEX INTERACTION BETWEEN AEROSOL AND CLOUDS;**
- **HOW TO IMPROVE MODEL DESCRIPTION OF CLOUD MICROPHYSICS AND AEROSOL INTERACTIONS.**
- **HOW CLOUDS EVOLVE DURING THE LIFE CYCLE FOR DIFFERENT REGIMES (PRESTINE, POLUTTED, ISOLATED, MOUNSSON, FORESTED AND DEFORESTED);**
- **HOW TO HAVE QPE FROM SATELLITE SPECIALY FOR WARM CLOUDS;**
- **WHAT ARE THE MAIN MICROPHYSICAL PROCESS WHEN CLOUDS MOVES TO THUNDERSTORMS ;**
- **HOW BOUNDARY LAYER CONTROL/INFLUENCE THE CLOUD PROCESSES;**





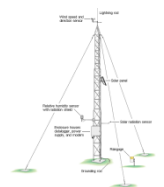
# PROPOSED MEASUREMENTS STRATEGY INSTRUMENT CO-LOCATED





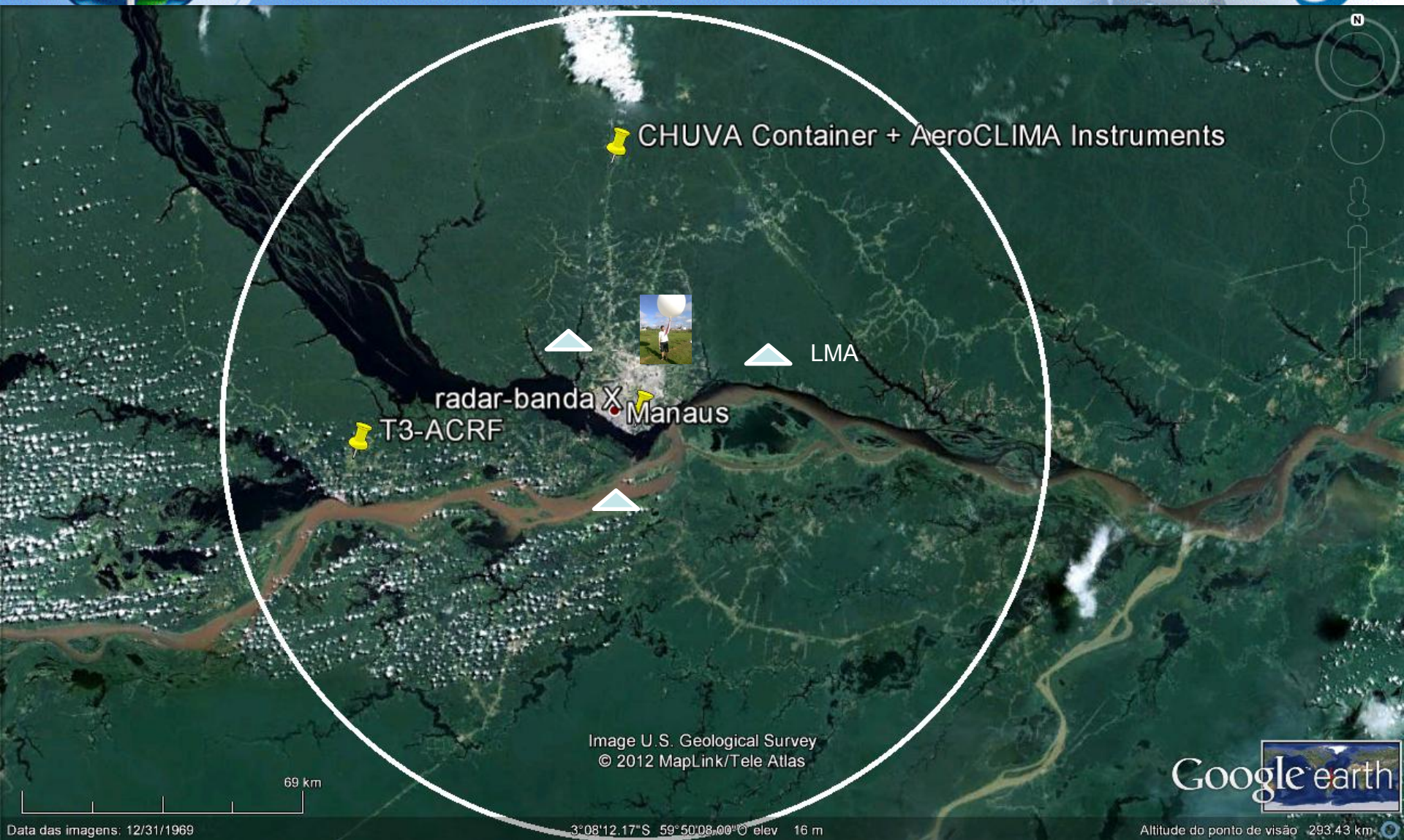
## SELEX METEOR 50DX X-Band DUAL POLARIZATION RADAR

## Multi Instrument Container and Networks



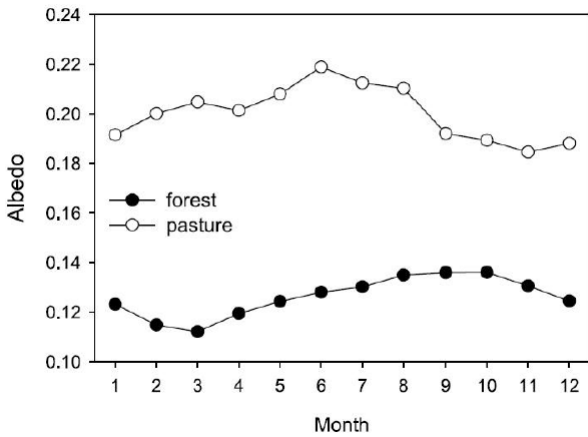


# Proposal Locations





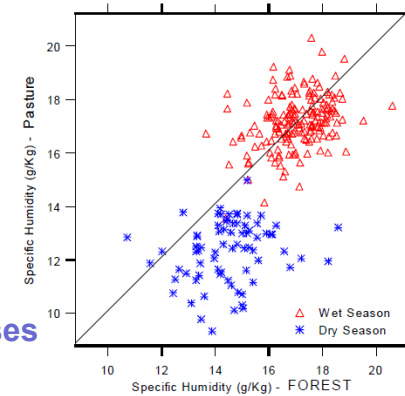
Von Randow et al. , 2004



LocalTime	PASTURE		FOREST	
	DRY	WET	DRY	WET
08	62 ± 31 (10)	94 ± 29 (25)	75 ± 28 (12)	124 ± 50 (16)
11	517 ± 241 (13)	475 ± 99 (26)	267 ± 114 (13)	491 ± 133 (26)
14	1471 ± 479 (13)	775 ± 127 (28)	902 ± 307 (13)	813 ± 128 (19)
17	1641 ± 595 (13)	927 ± 166 (12)	1094 ± 385 (13)	1002 ± 195 (16)

The numbers in brackets represent the number of profiles used to compute the height.

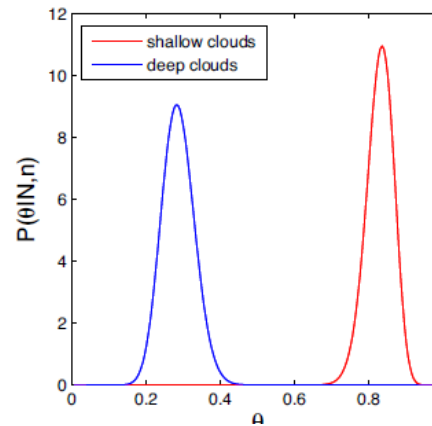
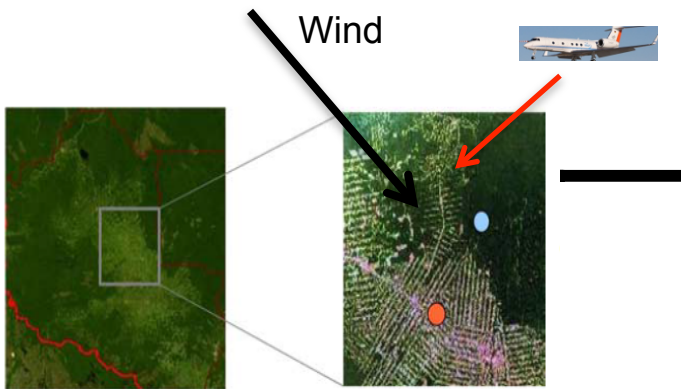
Fisch et al. , 2002



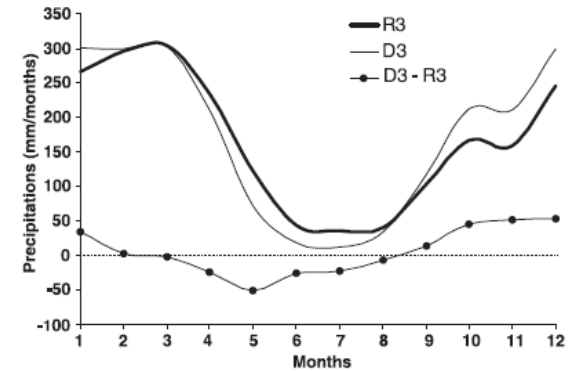
Different Radiative and Thermodynamics processes

W(h), DSD(h) – is there a significant difference

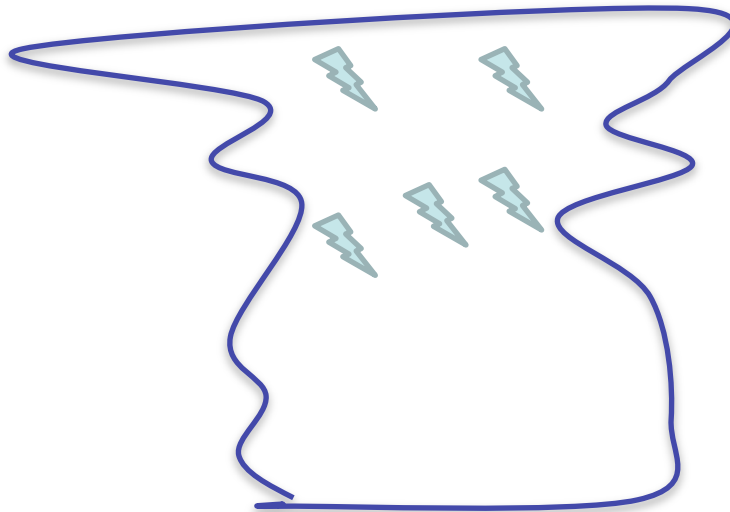
Wang et al. , 2009



Durieux et al. , 2003

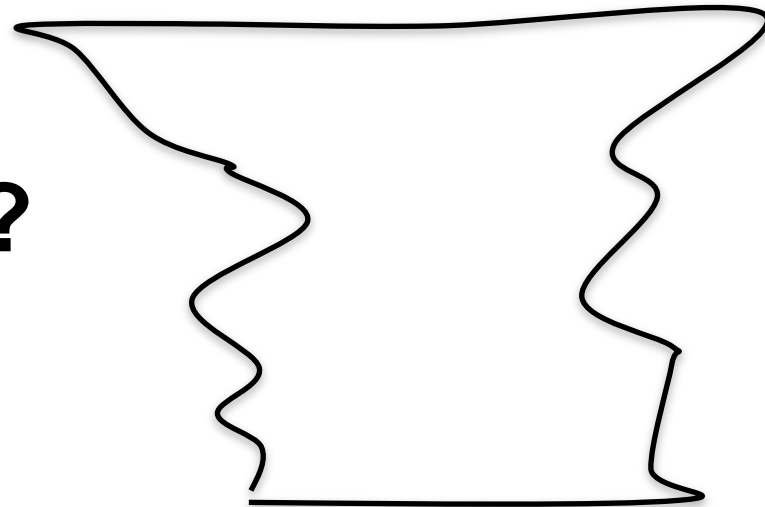


## Updraft/downdraft, ice/water profile, ice type, PSD, aerosol concentration and profiles



Isolated  
Polluted  
Deforested  
**Thunderstorm**

?



Monsoon Type  
Clear air  
Forest  
**Shower**



# CHUVA INTERNATIONAL WORKSHOP

CHUVA  
PROJECT



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[Venue & Format](#)

[Hotel & Travel](#)

[Program](#)

[Committee](#)

## May 08-10, 2013



The objective of this workshop is to promote the interaction among researchers who are directly involved with the project and researchers who make use of the CHUVA database. On the occasion of the First CHUVA International Workshop, after 3 years of campaigns, 5 field experiments (Alcântara, Fortaleza, Belém, Vale do Paraíba e Santa Maria) and the 6th field experiment in the near future (Manaus 2014), we wish to discuss the scientific advances, the data available and foster a greater interaction among different research groups. We will also discuss the next steps of data analysis and the next field experiment.



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# Thank You

