



Centro de Previsão de
Tempo e Estudos Climáticos

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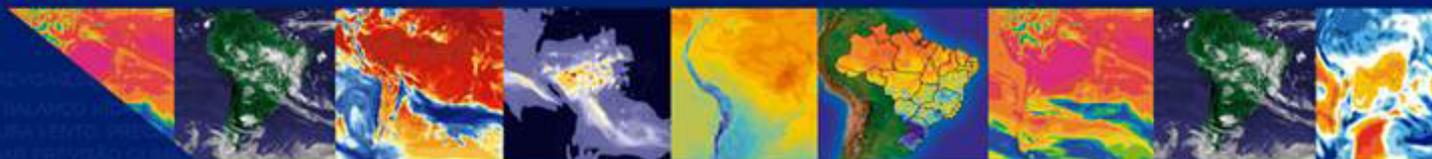
Brazilian Ground Validation Activities for GPM: Understanding the Physical Processes of Intense Precipitation Events

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Carvalho, Rayana Araujo, Lia Martins



2017 PMM Science Team Meeting

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INOVAÇÕES E COMUNICAÇÕES





Rationale and Activities

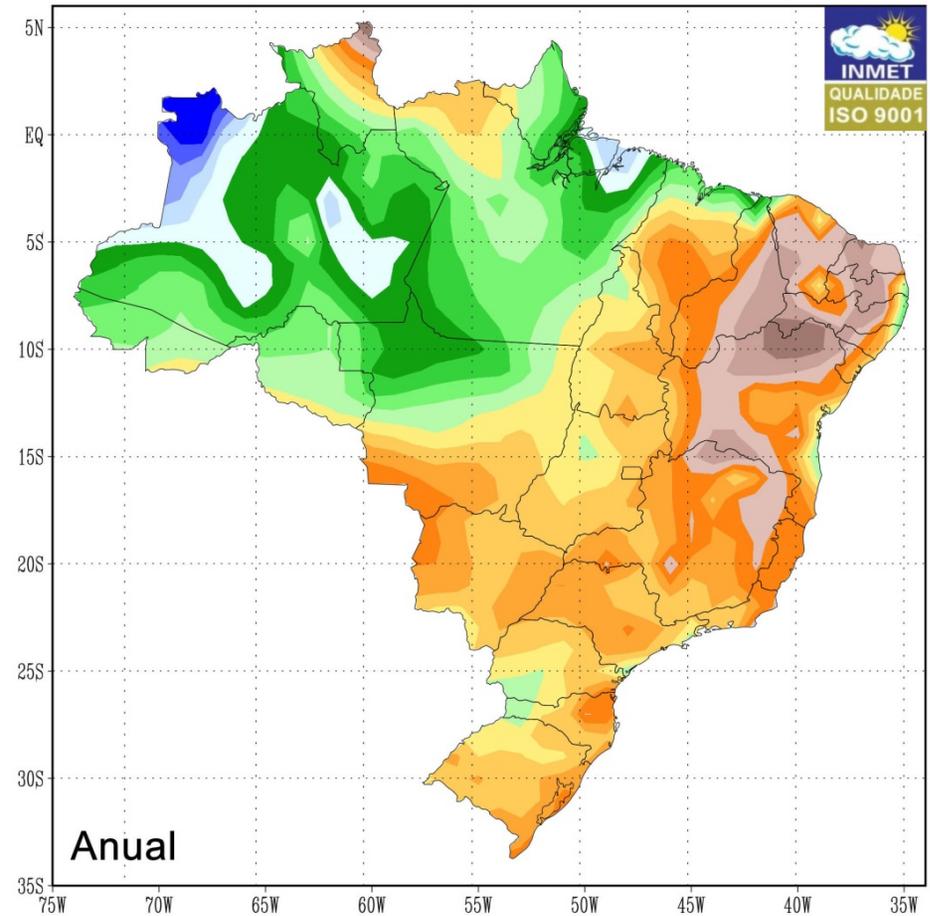
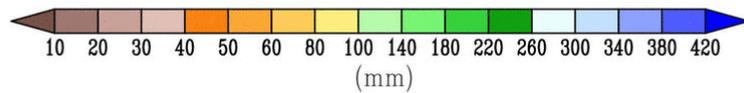
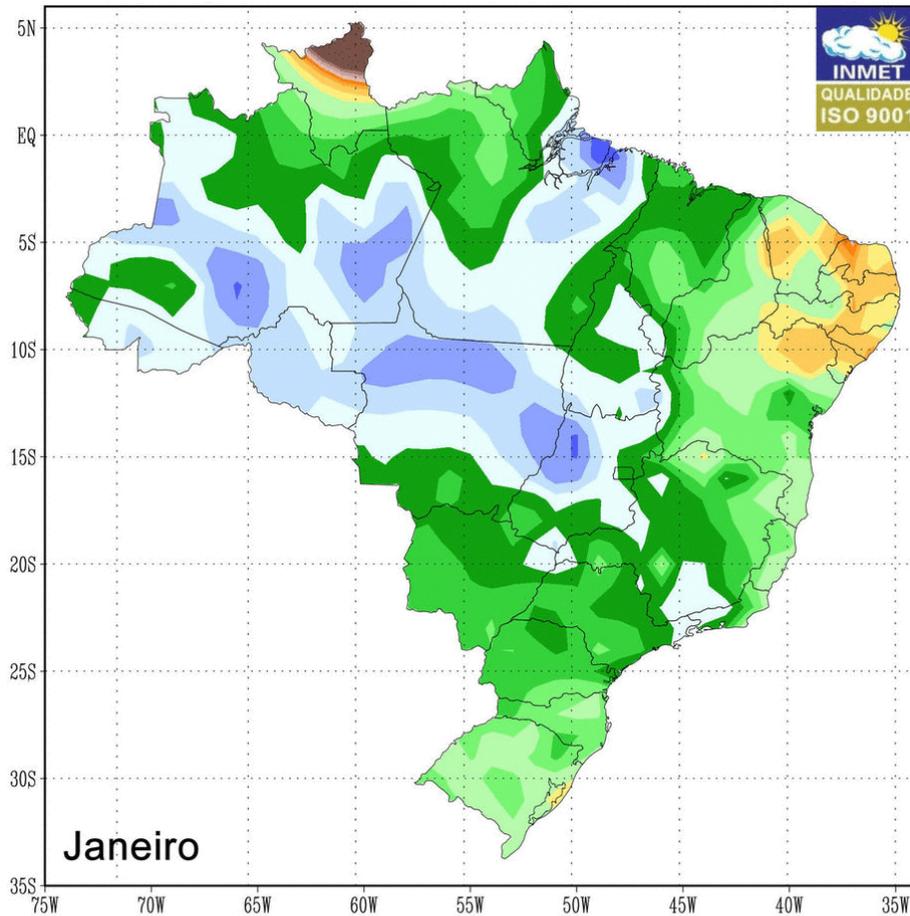
The main objective of this proposal is to understand the evolution of microphysical properties of clouds when modify to become intense precipitation events and predict these changes based on conceptual models and provide ground precipitation datasets supporting physical and direct validation of satellite-based GPM precipitation retrieval algorithms.

- Develop a ground-based precipitation dataset (radar, gauges, disdrometers, radiometer, etc.) to support GPM direct and physical based ground validation activities.
- Adapt and improve tracking tools to understand the evolution of microphysical properties of clouds.
- Study the occurrence of lightning and how this electric activity is linked with severe weather.
- Develop different conceptual models of storm evolution according MCS characteristics (stratiform, shallow and deep convection) using different remote sensing techniques (radar, satellite, lightning, etc.).

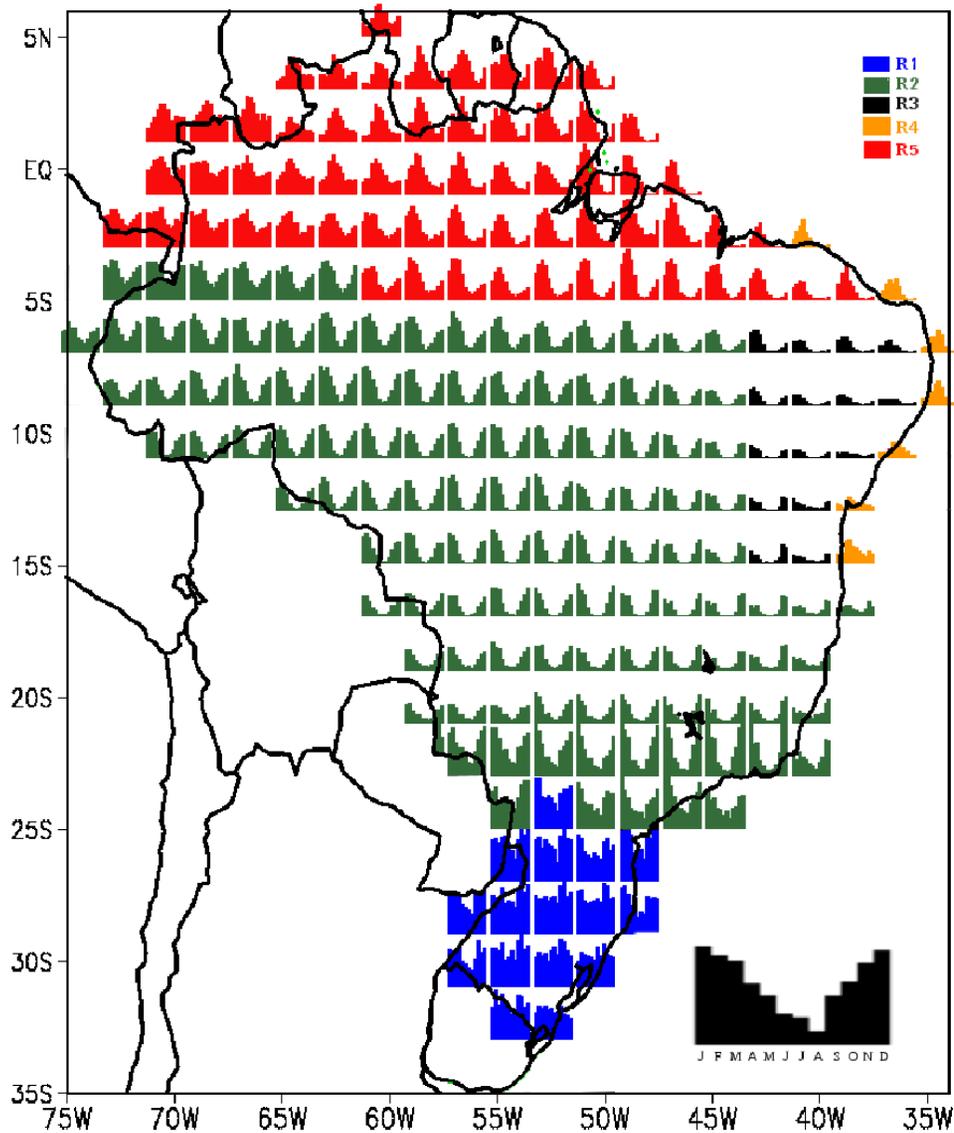


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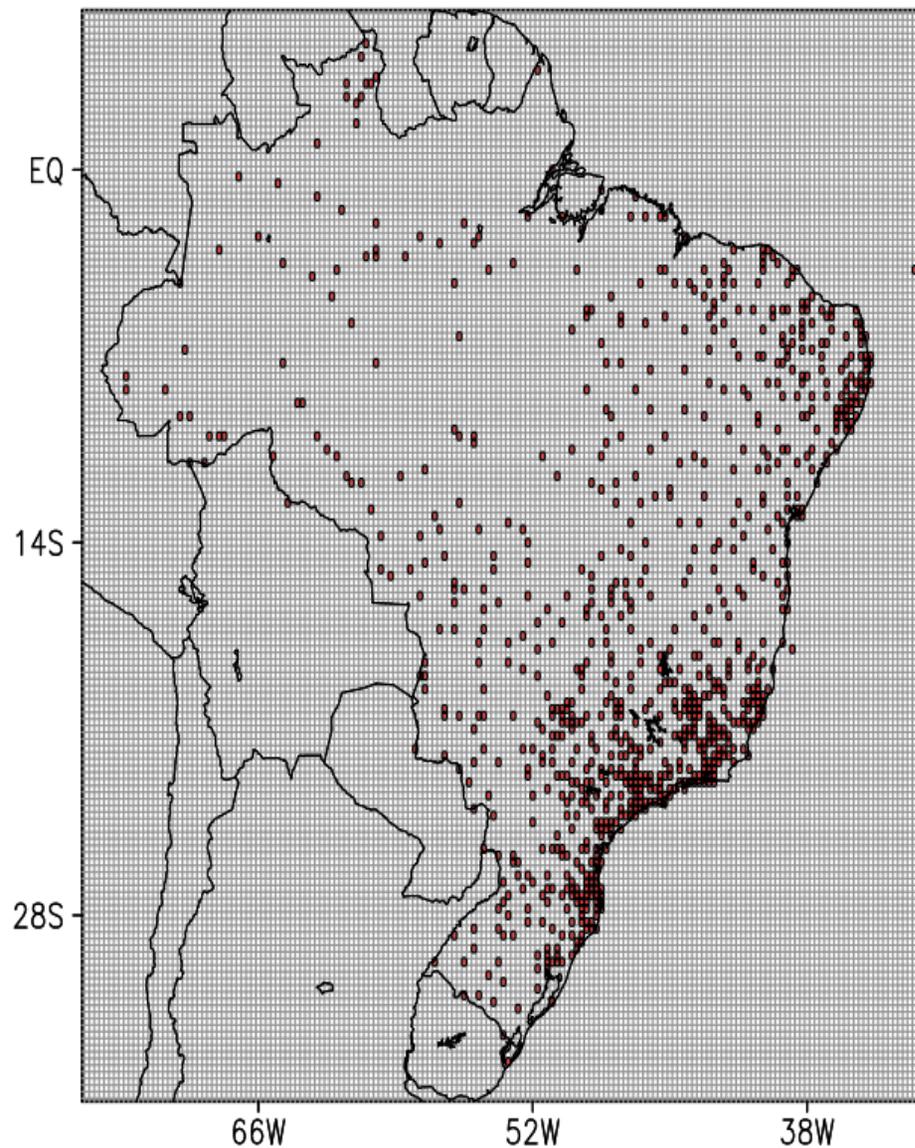
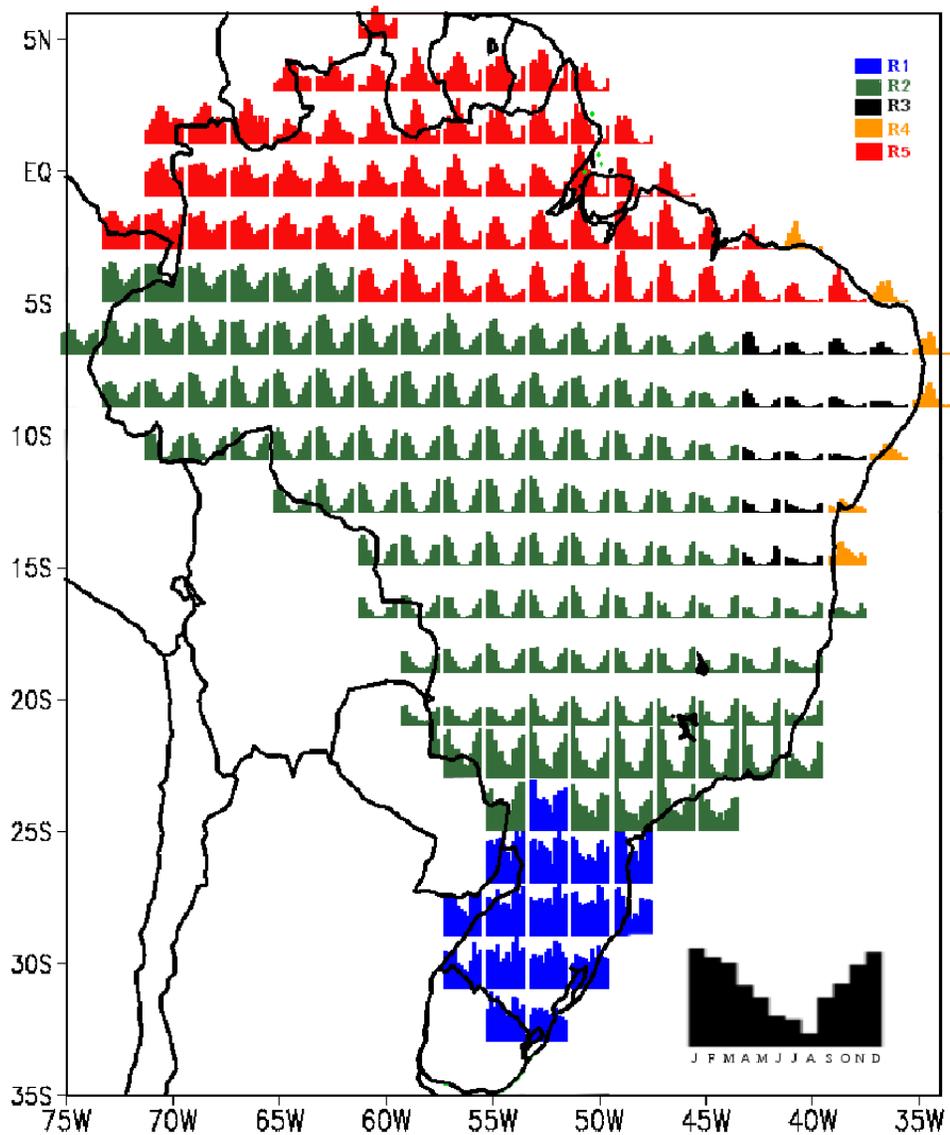
Rainfall Regimes in South America



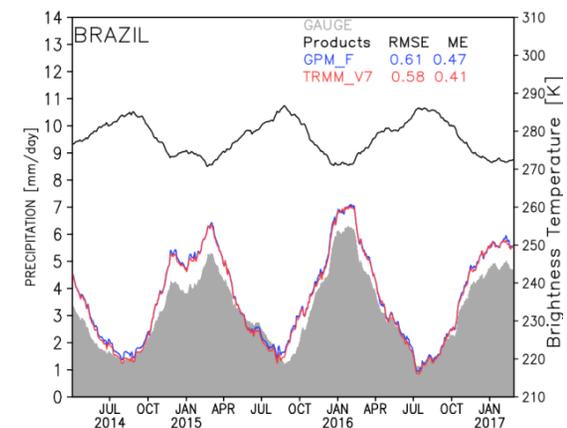
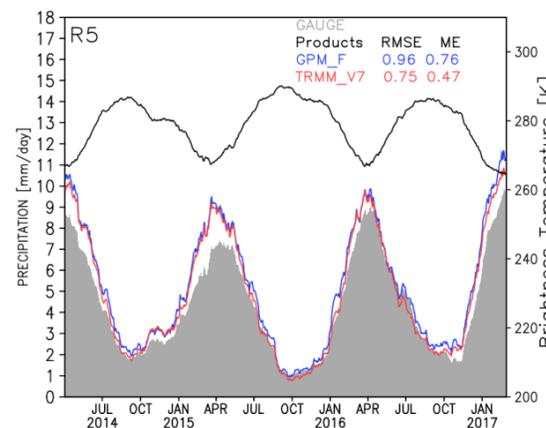
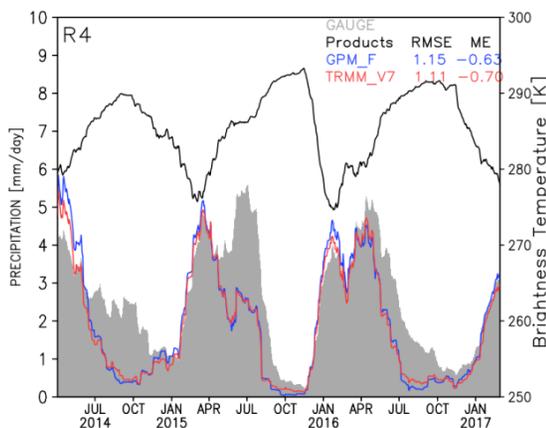
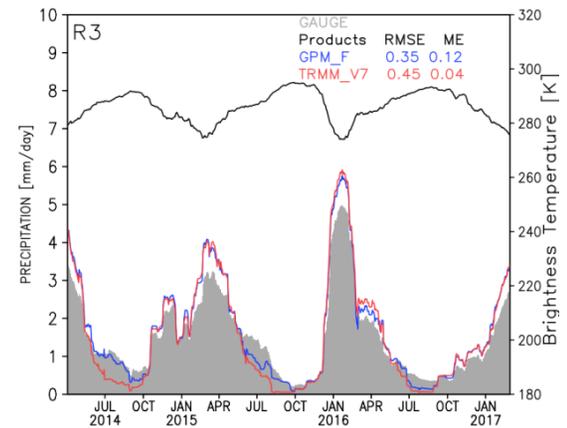
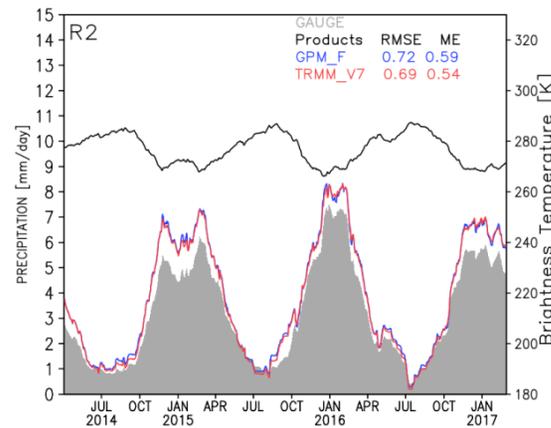
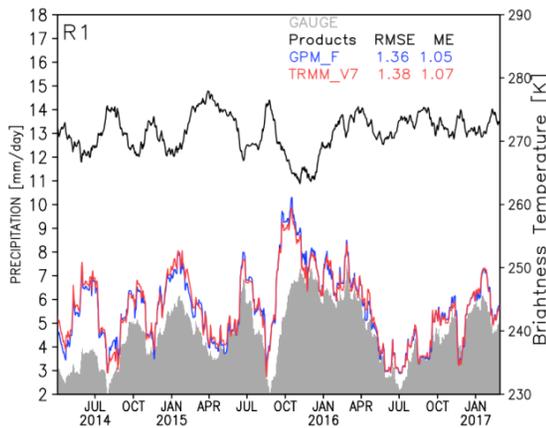
Rationale and Activities



Rationale and Activities

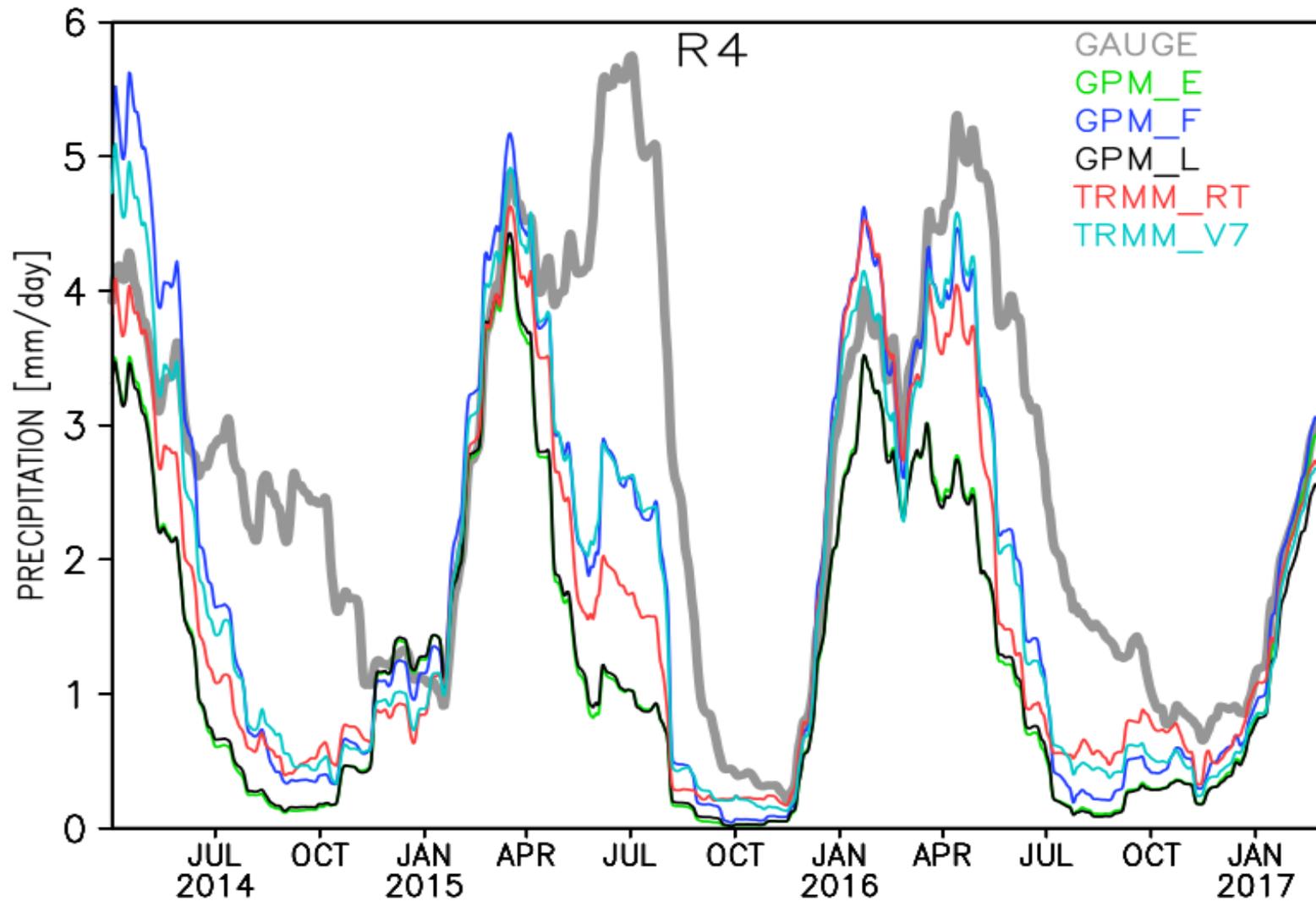


Rainfall Regimes in South America



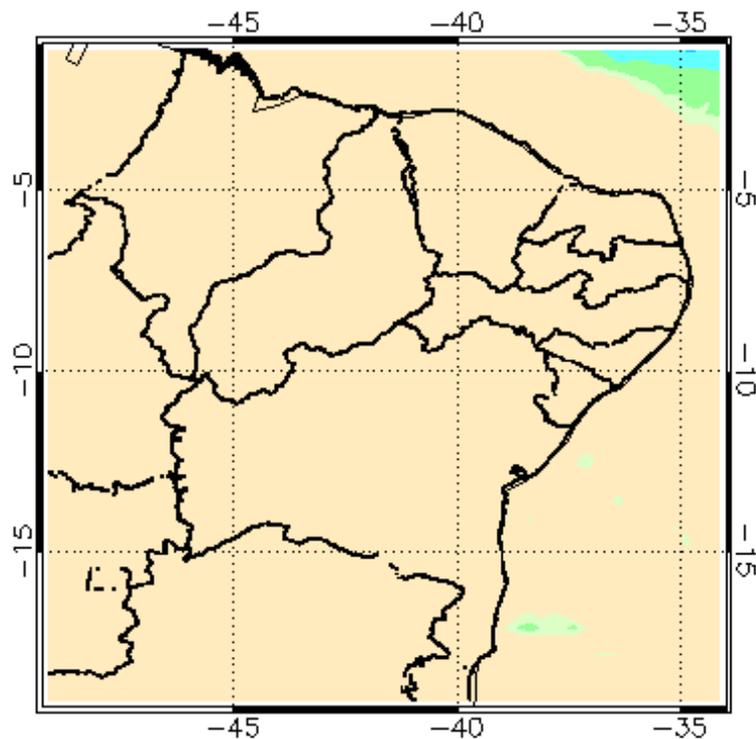
Temporal evolution of the daily averages of different precipitation products: GPM_F (blue), TRMM_V7 (red) and brightness temperature of the GOES-13 (Geostationary Operational Environmental Satellite) [K] for the regions R1 (a), R2 (b), R3 (c), R4 (d), R5 (e) and Brazil (f).

Results: Northeast

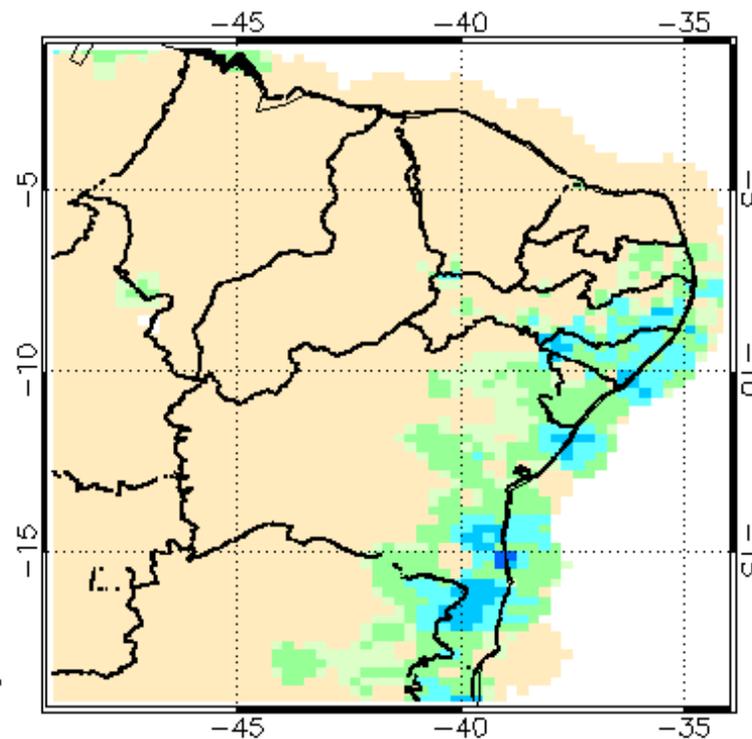
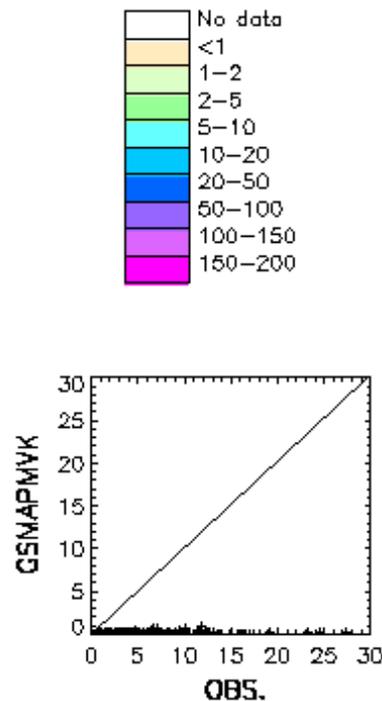


Results: Northeast

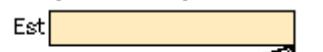
GSMAPMVK estimates for 20160731



Daily gauge analysis (land only) for 20160731



Daily fraction by occurrence



Daily fraction of total rain



Rainfall accumulation by amount

GSMAPMVK

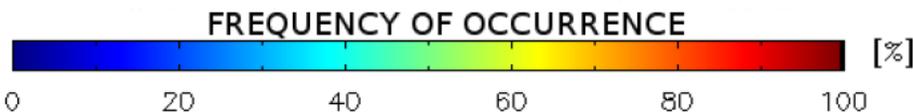
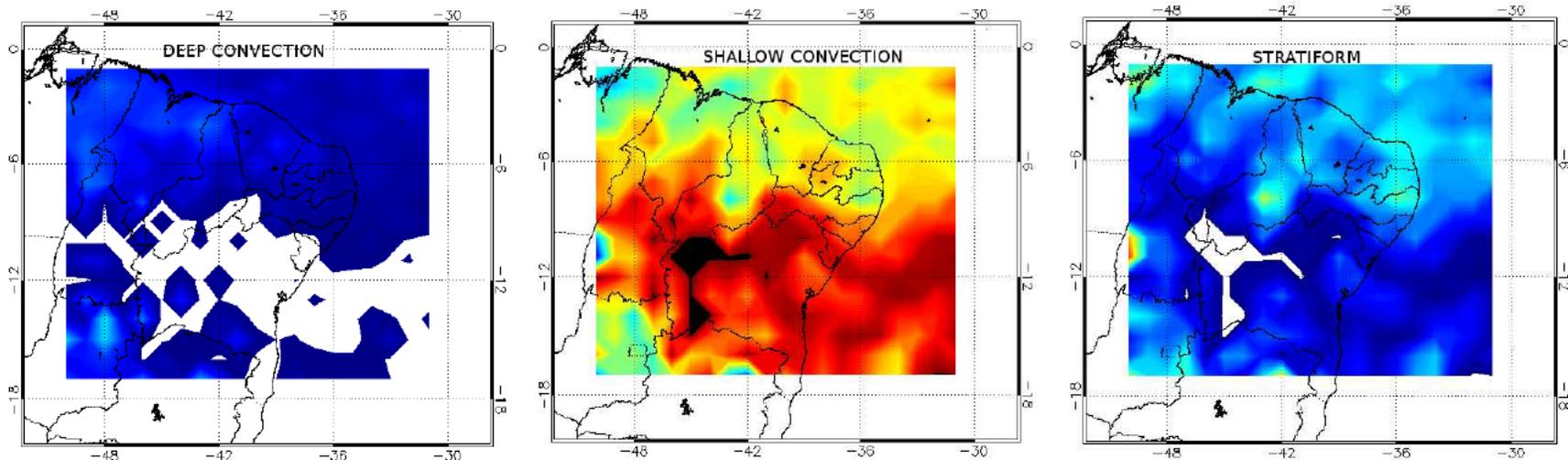
	<1	≥1
<1	1653	0
≥1	474	0

Verification statistics for 20160731 n=2127 Verif. grid=0.25° Units=mm/d

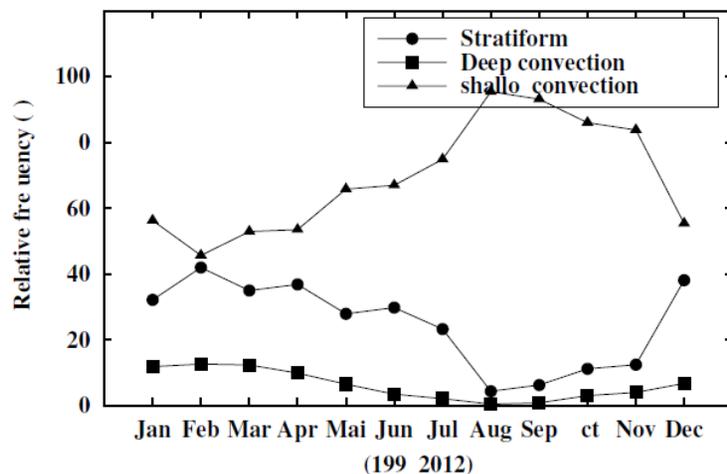
	Observed	GSMAPMVK
# gridpoints raining	474	0
Average rain	1.0	0.0
Conditional rain	4.6	-999.0
Rain volume (mm*km ² *10 ⁹)	1.6	0.0
Maximum rain	27.3	0.8

Mean abs error = 1.0
RMS error = 2.8
Correlation coeff = 0.352
Frequency bias = 0.000
Probability of detection = 0.000
False alarm ratio = -NaN
Hansen & Kuipers score = 0.000
Equitable threat score = 0.000

Results: Northeast

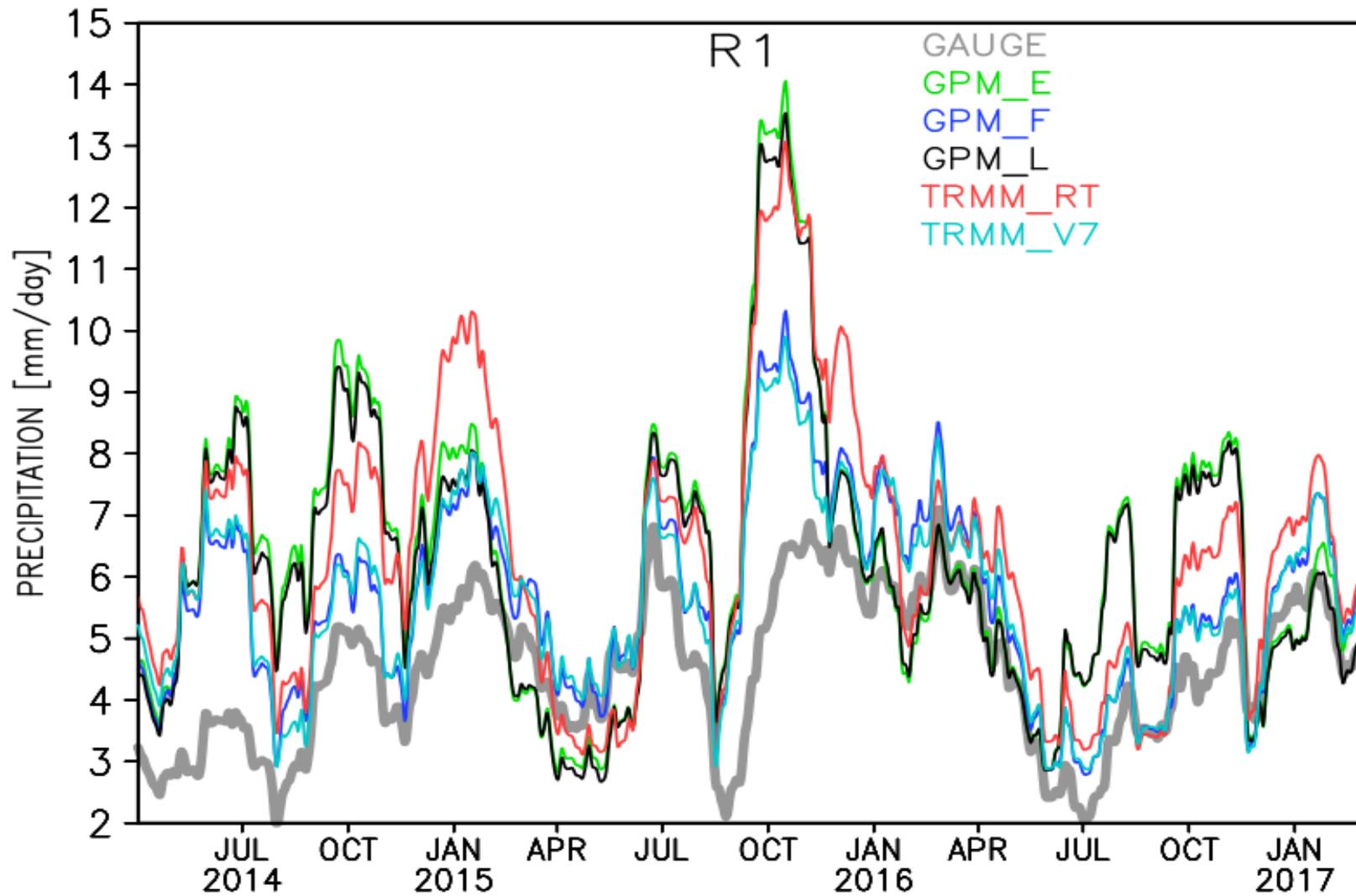


Frequency of precipitating clouds A3(eastern)



... The results obtained, it was observed that the eastern region NEB is basically composed of shallow convective clouds that are relatively warm low clouds but causing representative accumulated at the end of the rainy season. Explained by the fact that generally the winds are perpendicular to the coast and carry a lot of ocean moisture to the continent. Contributing to the formation of clouds that do not become deep but have a high efficiency of precipitation...

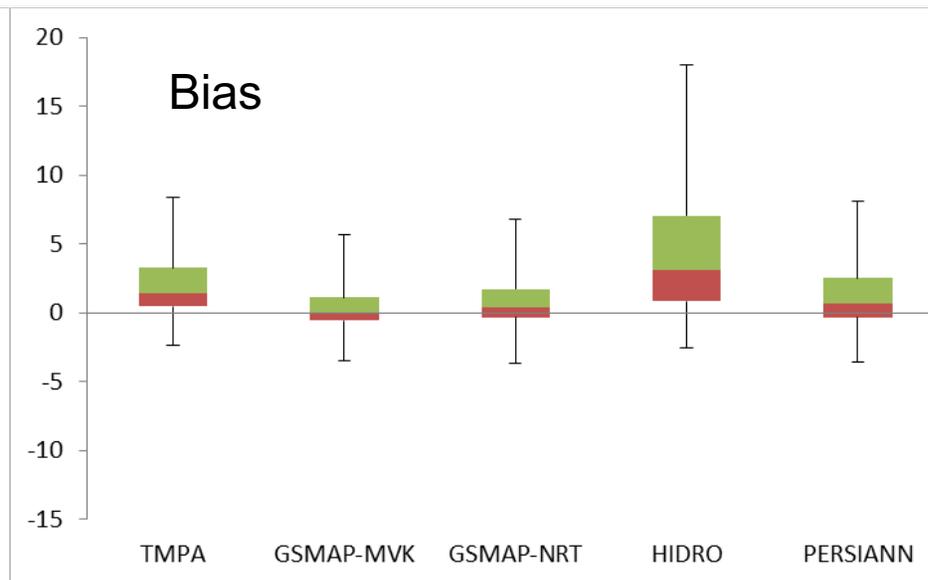
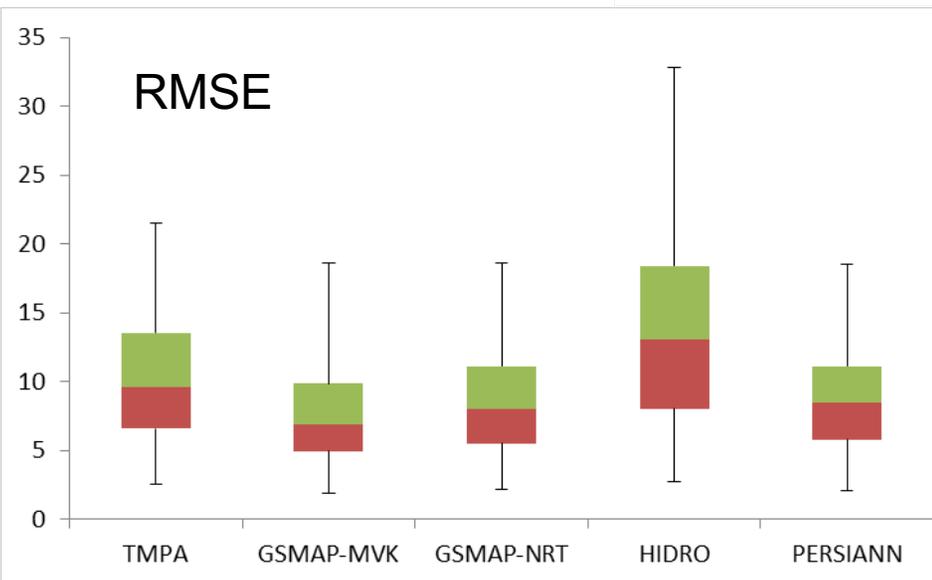
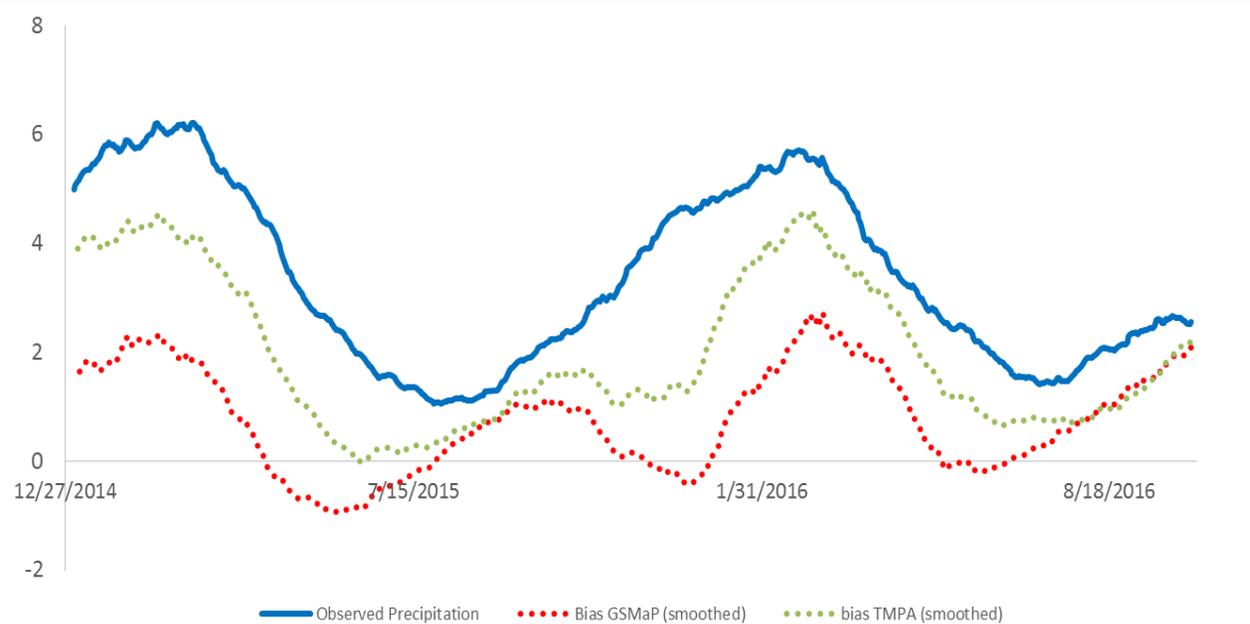
Results: North



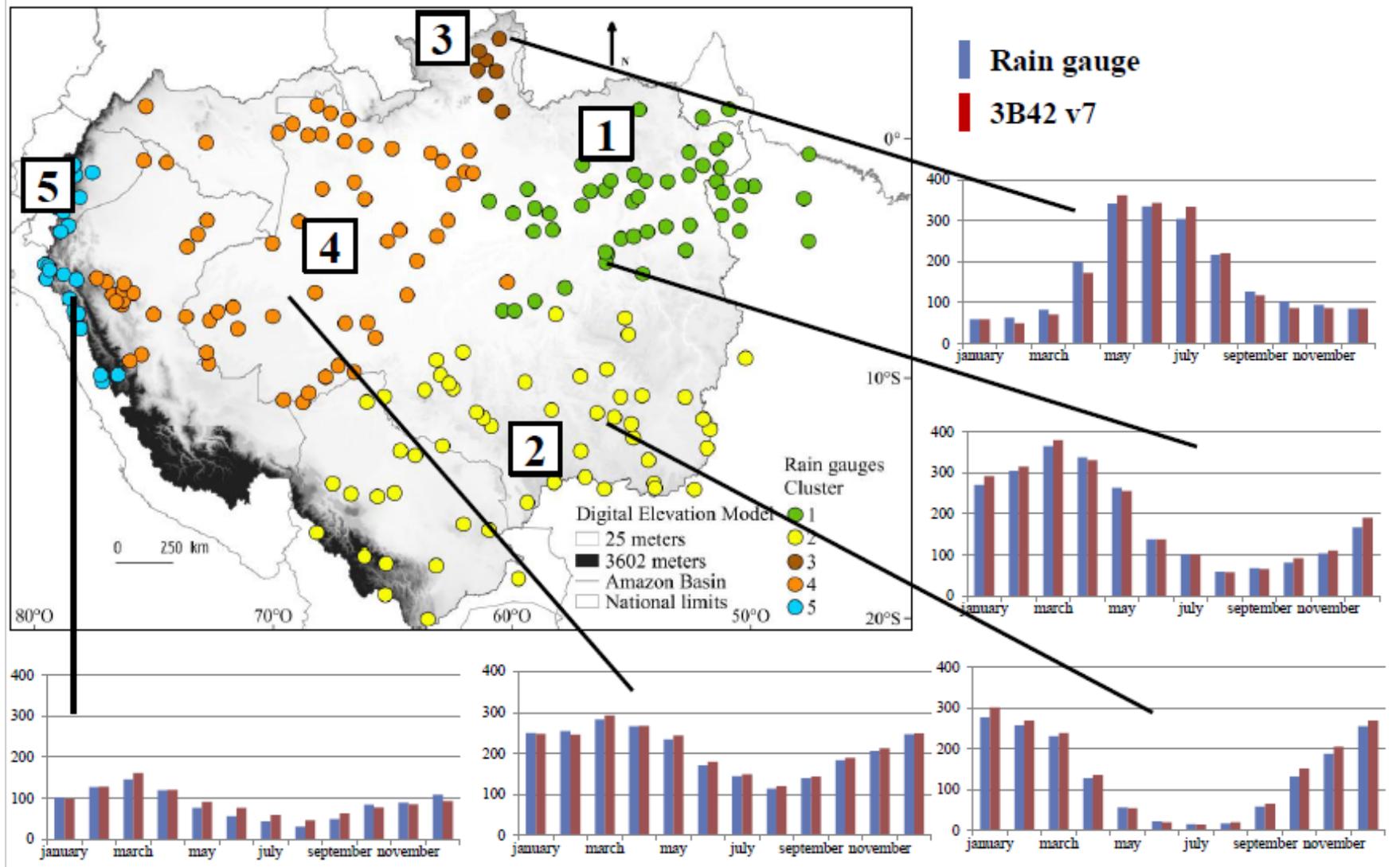


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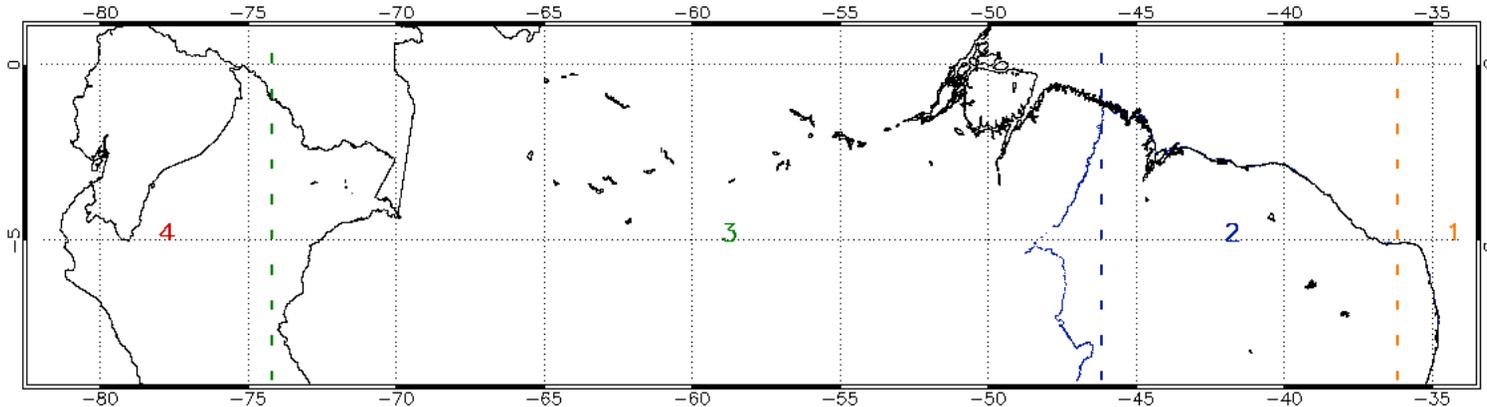
Results: North



Results: North



Results: North



- Match GPROF and KuPR (parallax correction);
- Compare KuPR profile with CRM profile and to estimate IWC and LWC;
- Select the near points;
- Calculate the average value using the grid 0.5 degree;

Area: Area1 Number pixels = 46

Max IWP_DPR	0.763000	Max IWP_GPROF	1.65750
Max LWP_DPR	1.17960	Max LWP_GPROF	1.45300
Max RR_DPR	9.59390	Max RR_GPROF	5.48860

Area: Area2 Number pixels = 189

Max IWP_DPR	0.593300	Max IWP_GPROF	1.32880
Max LWP_DPR	1.26660	Max LWP_GPROF	1.32780
Max RR_DPR	7.94870	Max RR_GPROF	5.15340

Area: Area3 Number pixels = 570

Max IWP_DPR	4.02800	Max IWP_GPROF	3.19110
Max LWP_DPR	3.70080	Max LWP_GPROF	3.20330
Max RR_DPR	32.1430	Max RR_GPROF	9.59030

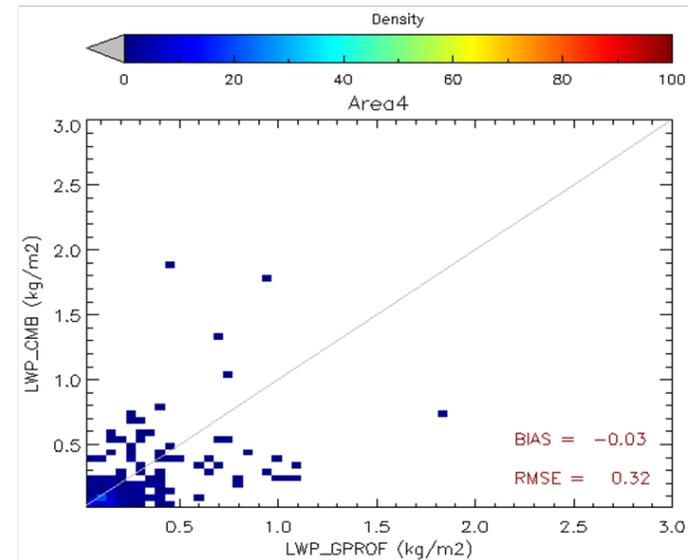
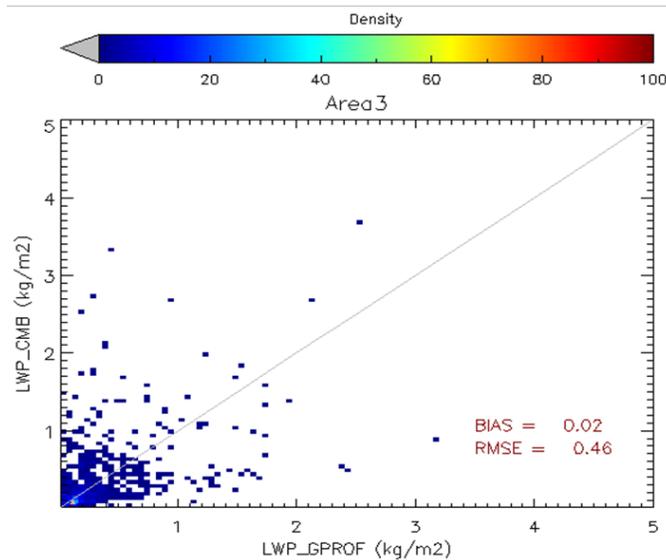
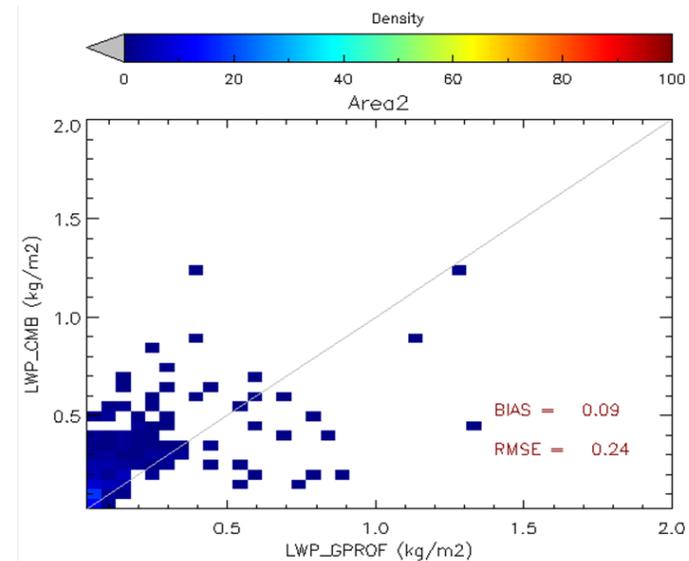
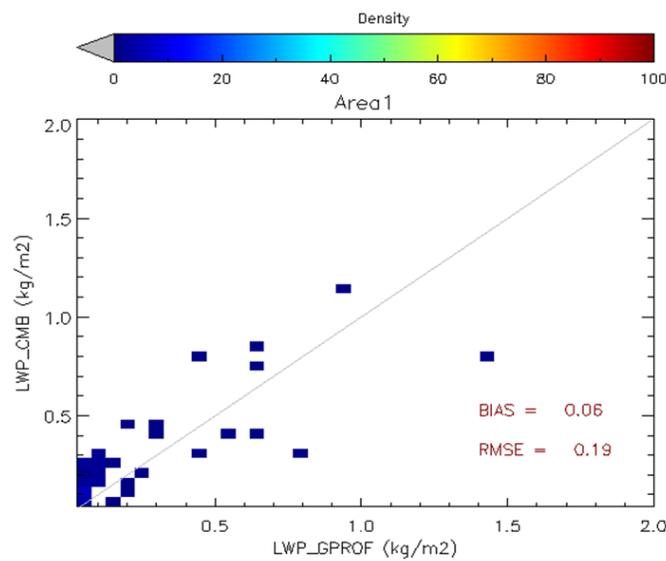
Area: Area4 Number pixels = 193

Max IWP_DPR	1.75820	Max IWP_GPROF	2.53740
Max LWP_DPR	3.29810	Max LWP_GPROF	1.85940
Max RR_DPR	26.7785	Max RR_GPROF	6.70690



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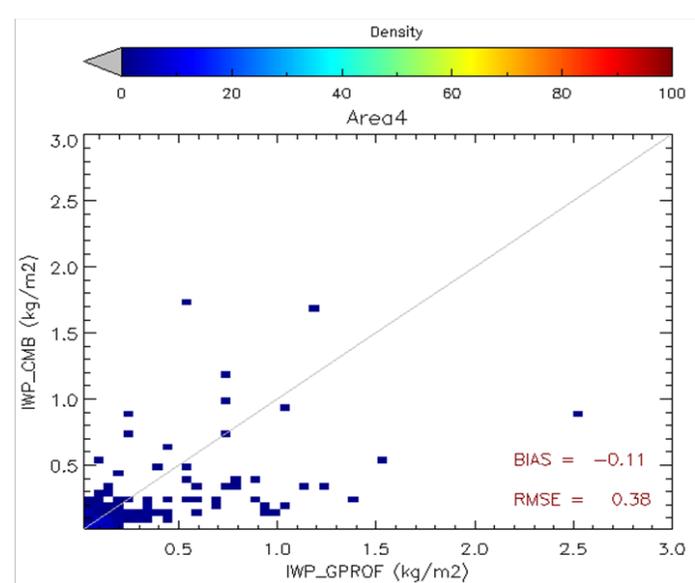
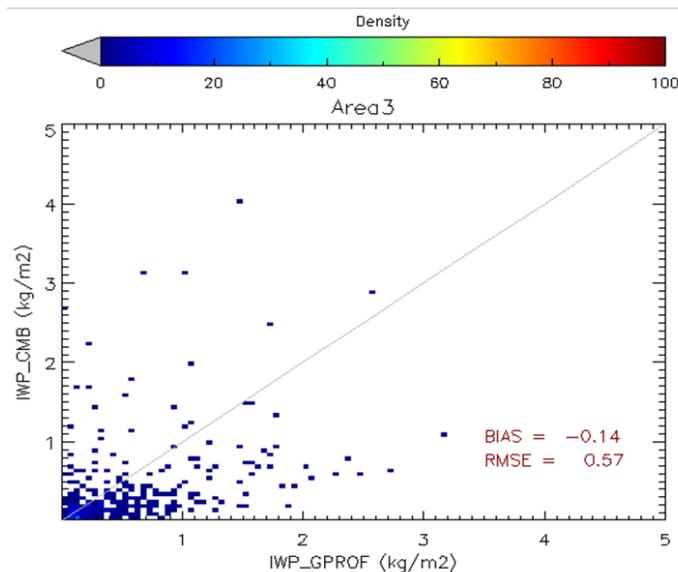
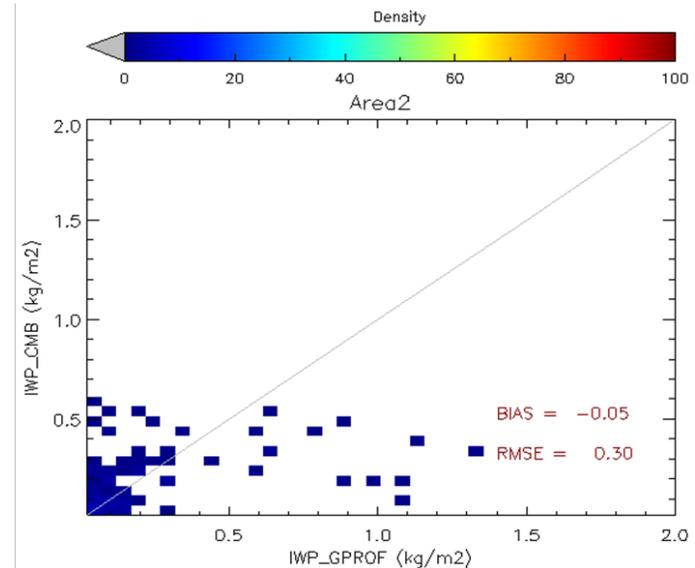
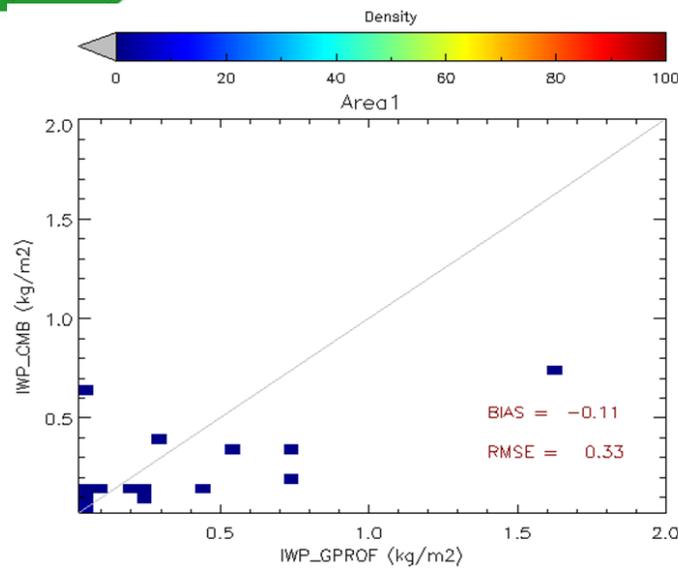
Results: North





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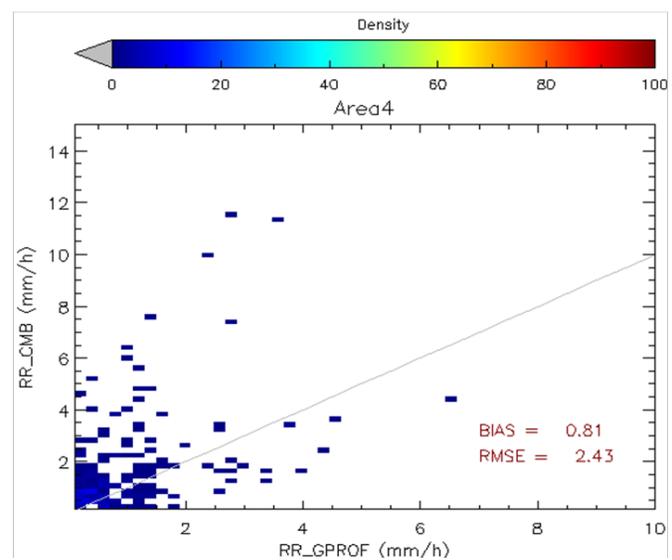
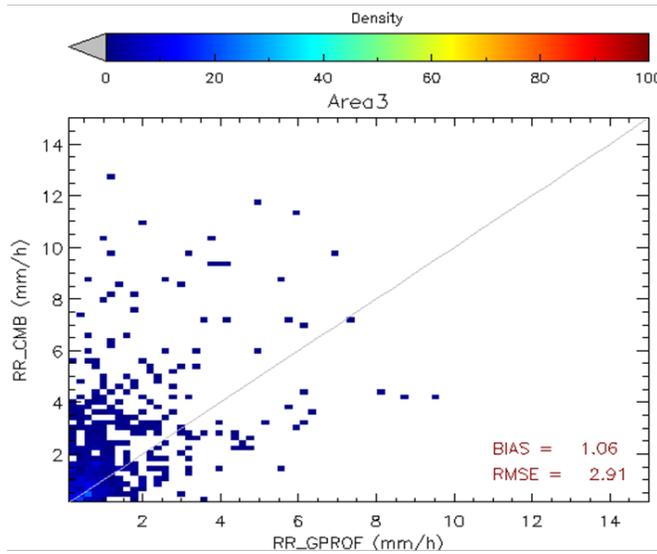
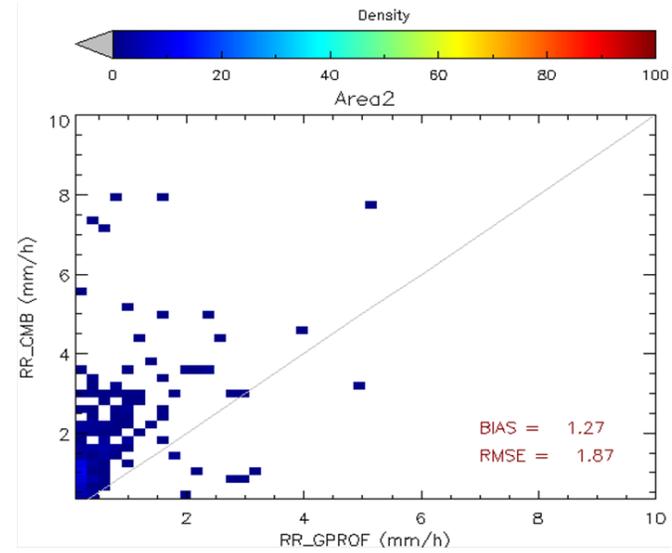
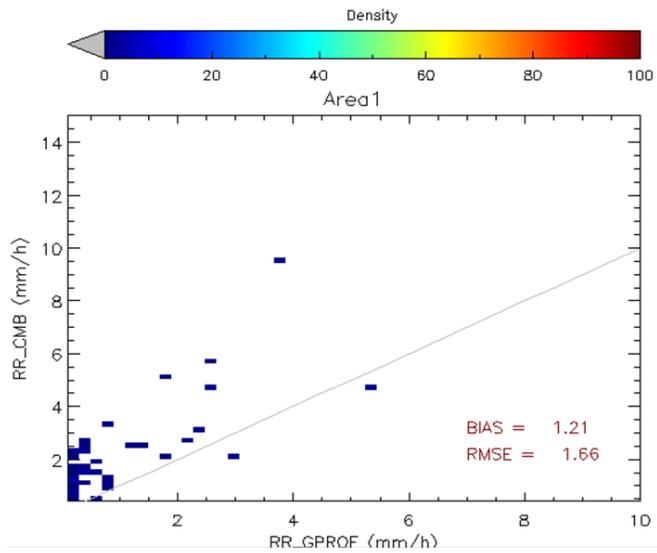
Results: North



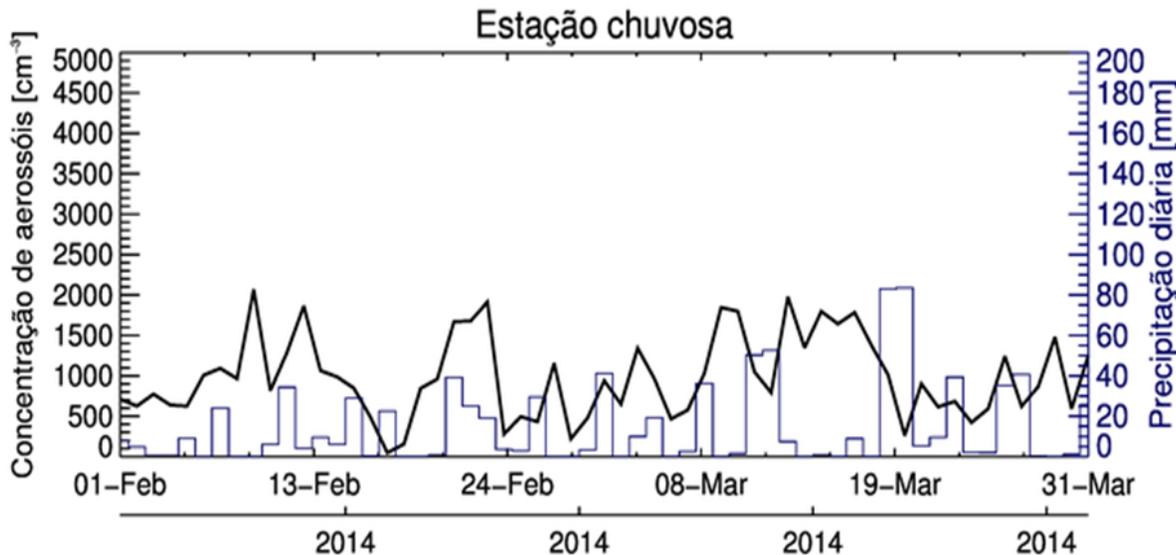


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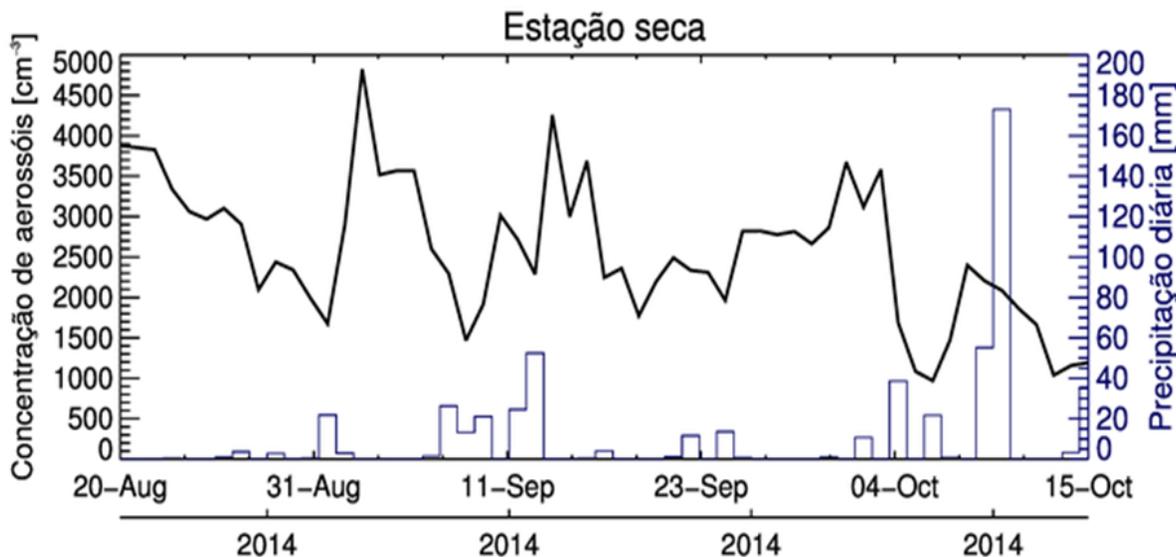
Results: North



Results: North

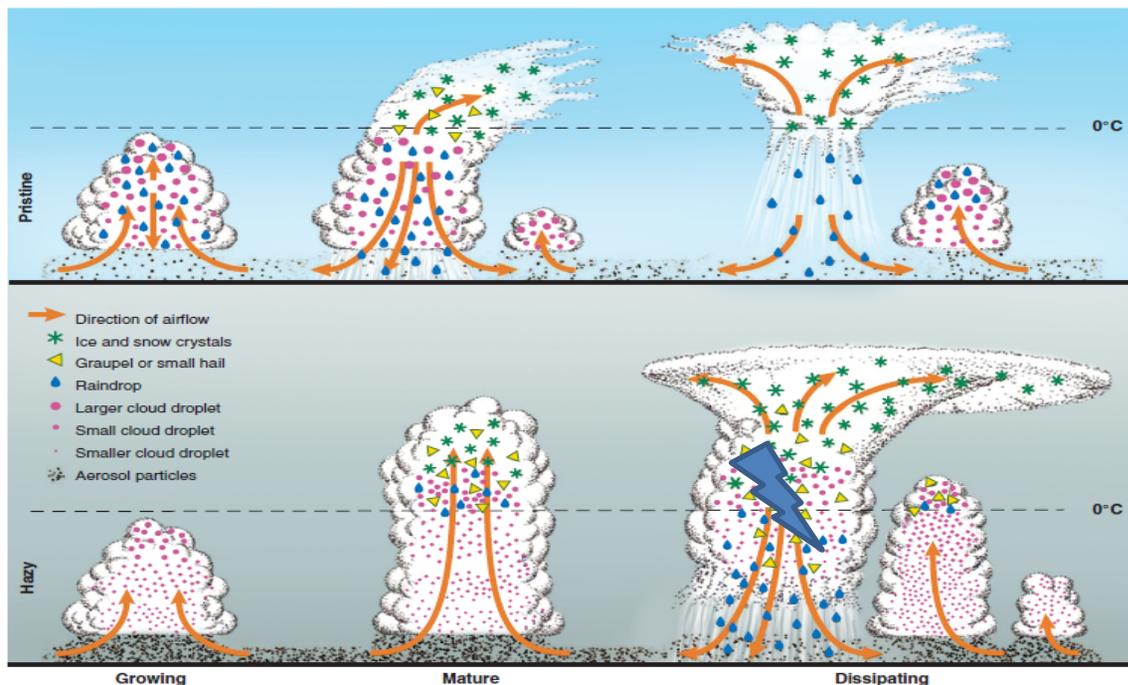


In the rainy season the average daily aerosol concentration is $\sim 980 \text{ cm}^{-3}$, ranging from 100 cm^{-3} to $2,000 \text{ cm}^{-3}$, and precipitation occurs almost every day.



In the dry season the average daily aerosol concentration is $\sim 2,400 \text{ cm}^{-3}$, ranging from $1,000 \text{ cm}^{-3}$ to $5,000 \text{ cm}^{-3}$, and precipitation is much less frequent than in the rainy season but it is more intense

Results: North



Rosenfeld, 2008, Science

Fração de CRCs com CG			
CRCs Leve	Chuvoso: 614	Seco: 702	Número de CRCs: 1316
% CG	0.2% (1)	0.4% (3)	0.3% (4)
CRCs Moderada	Chuvoso: 3494	Seco: 2116	Número de CRCs: 5610
% CG	1.5% (52)	2.9% (62)	2.0% (114)
CRCs Forte	Chuvoso: 3516	Seco: 2099	Número de CRCs: 5615
% CG	5.6% (197)	10.3% (216)	7.3% (413)



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SOS-CHUVA campaign

O SOS- CHUVA

(Sistema de Observação e Previsão de Tempo Severo)

<http://sigma-soschuva.cptec.inpe.br/#>



CPTEC

Chuva em Tempo Real

- RADAR BANDA X
- RADAR SÃO ROQUE
- RADAR PICO DO COUTO
- RADARES IPMET

Imagem de Satélite

Raios

Previsão de Raios

Probabilidade de Chuva Intensa

Previsão Modelo WRF

Previsão Modelo BRAMS

Sondagem

Índice de Instabilidade por Satélite

INSTITUIÇÕES PARTICIPANTES

FAPESP

UNESP

USP

UNICAMP

IPMET

IA 70

EM COLABORAÇÃO COM:

SIGMA 2.0

MENU SOS CHUVA

16:38:31 GMT

50 km



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SOS-CHUVA campaign





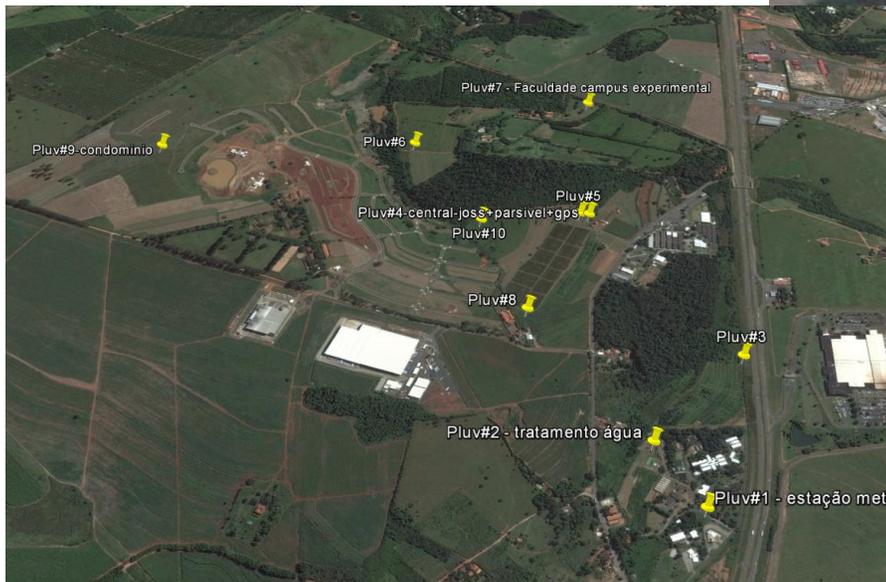
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SOS-CHUVA campaign

Raingauge ESALQ - Piracicaba



Raingauge – EMBRAPA - Jaguariúna





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SOS-CHUVA campaign

Trailer de Química Atmosférica - IFUSP

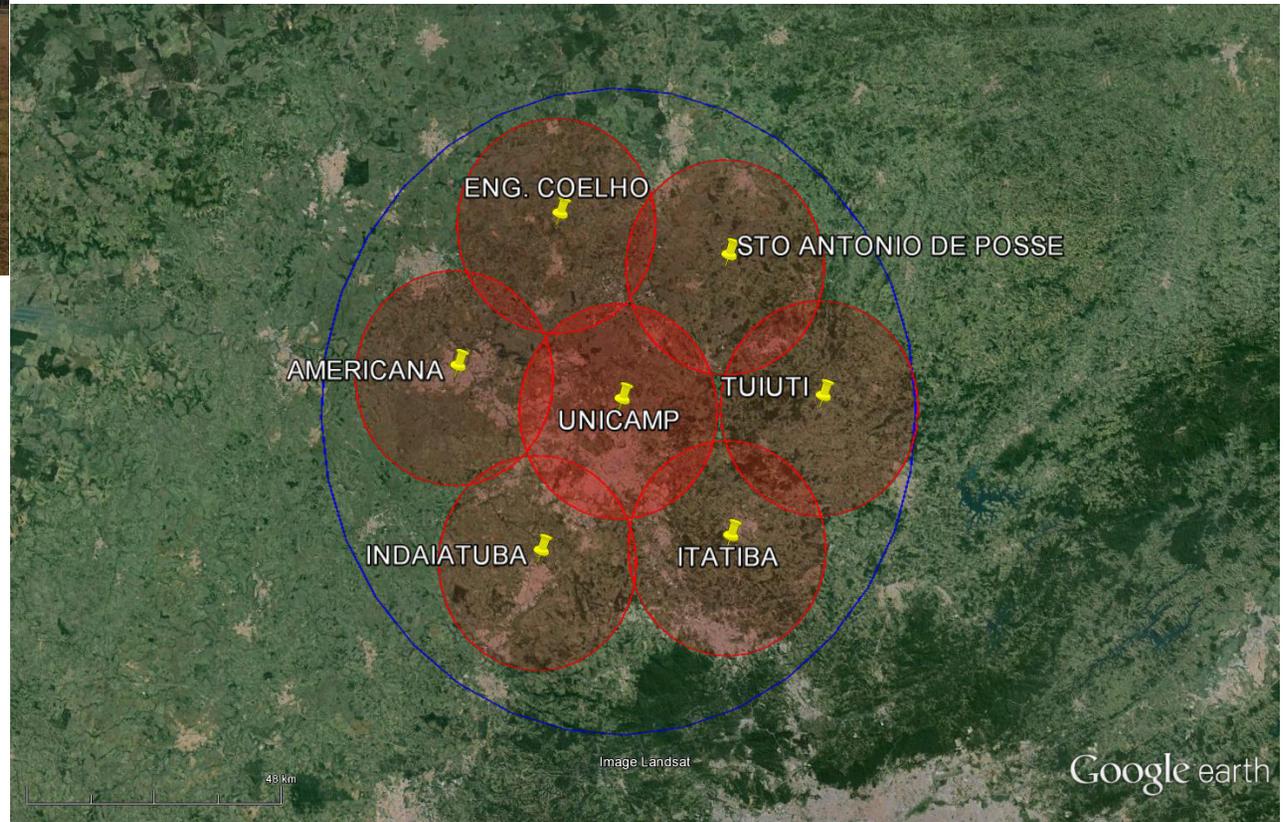
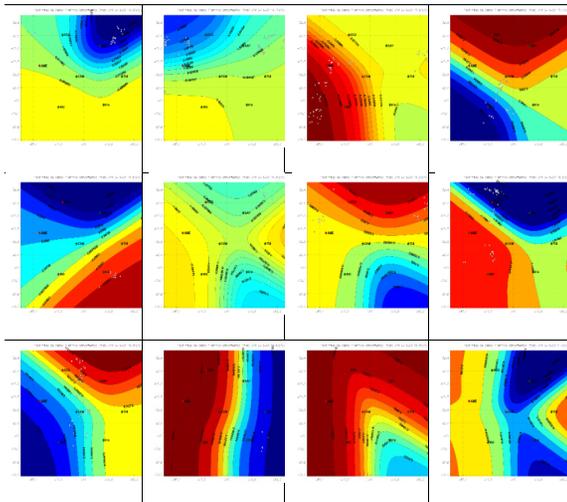




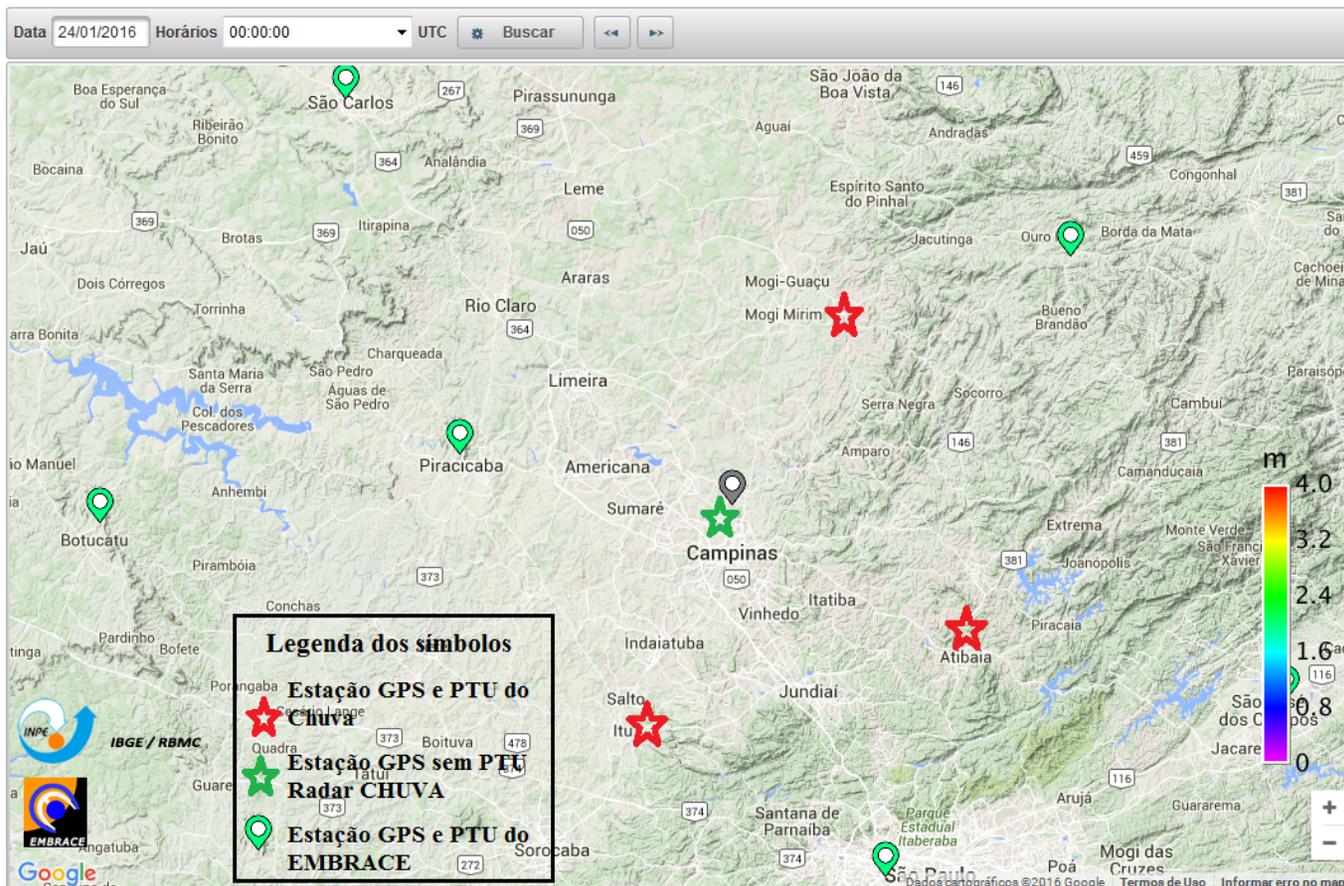
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SOS-CHUVA campaign

Field Mills Network



GPS Network – Assimilation and Nowcasting





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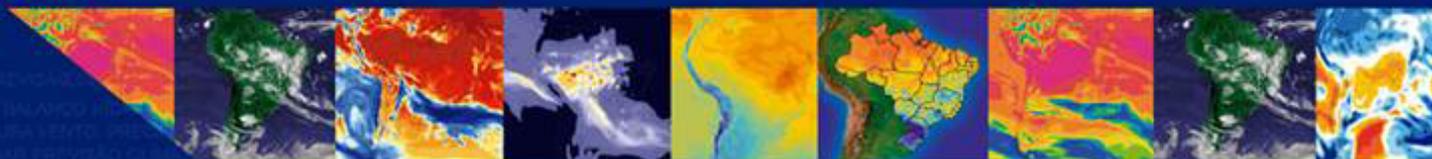
Thank you!

Daniel.vila@inpe.br



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