Performance Evaluation of Precipitation Retrievals over South-Eastern South America considering different climatic regions

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October 2010. 5th IPWG. Hamburg. Germany

Overview

- Objective and Motivation
- Methodology
- Results
- Conclusions and Future Steps

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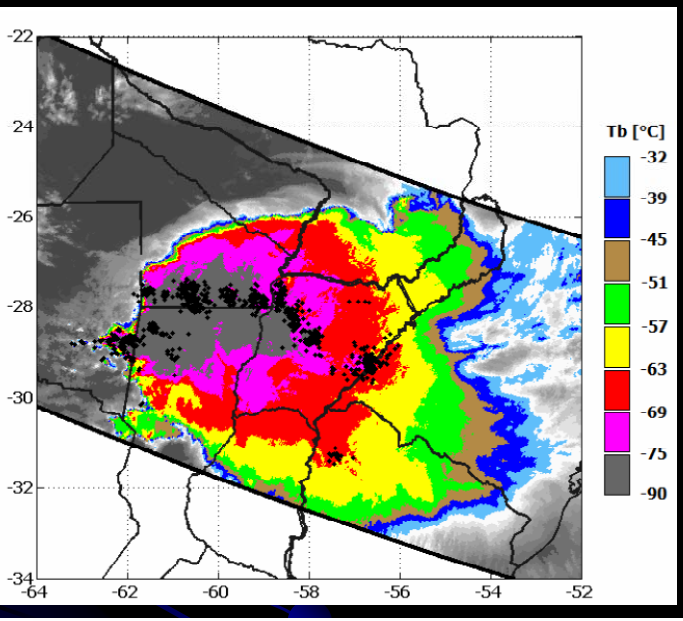
Objective

Evaluate the performance of the gauge-blended precipitation retrievals and satellite-based retrievals on networks with high spatial resolution over south-eastern South America.

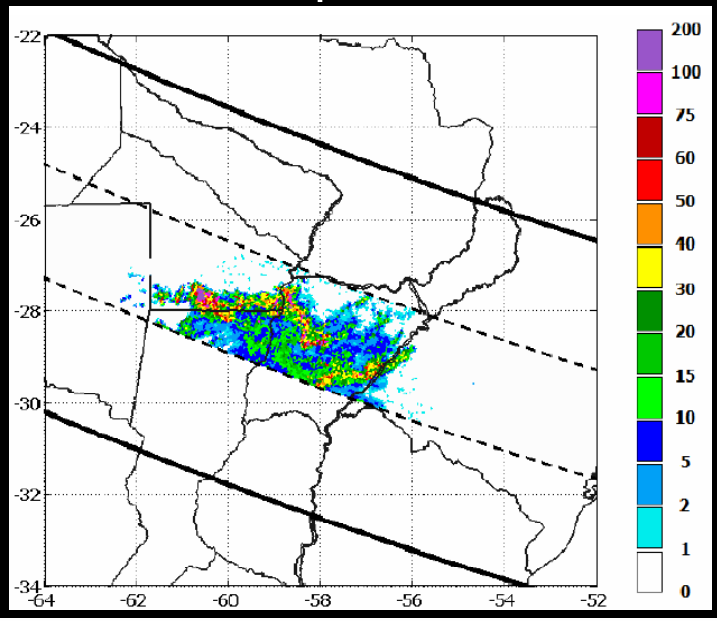
Motivation: Why should we care about the performance of the QPE over SE South America?

Most extreme MCS in TRMM sample over SA – 20 Dec 2003 8:24 Z

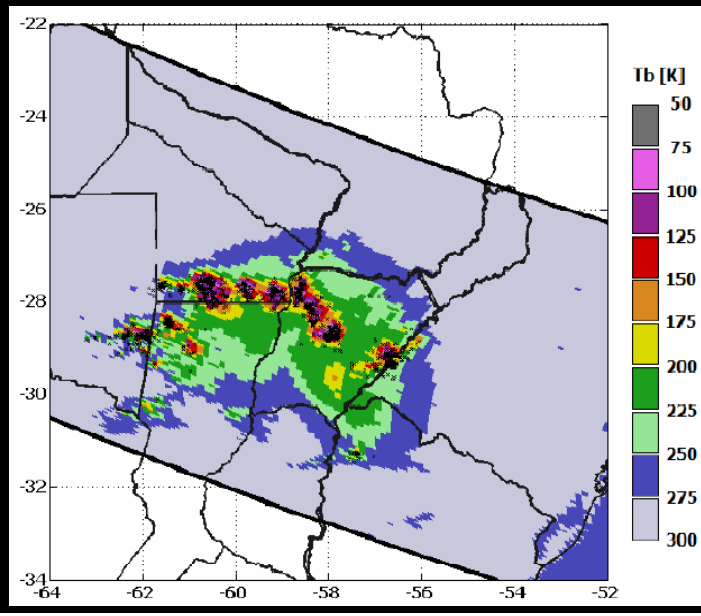
IR and LIS

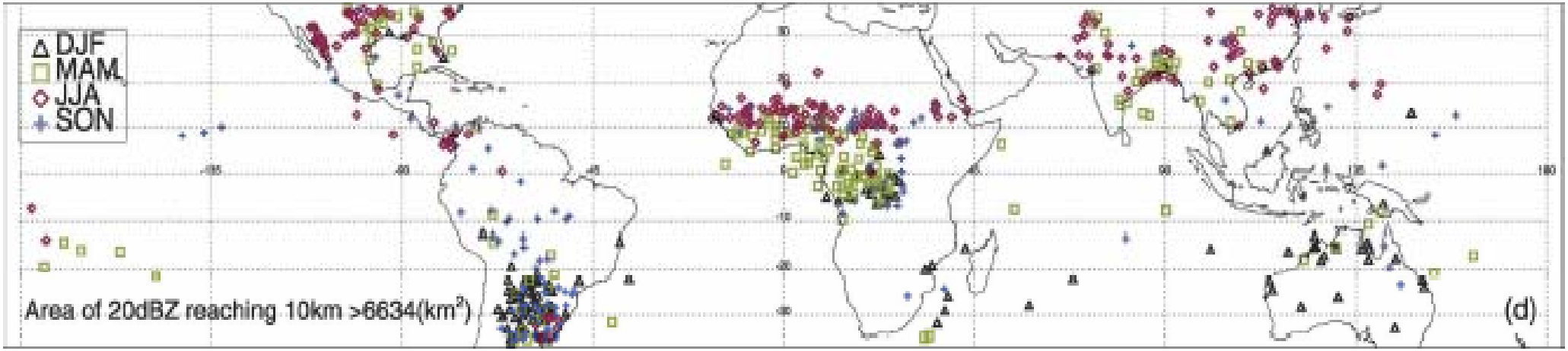


2A25 Precipitation mm h^{-1}



85 GHz PCT





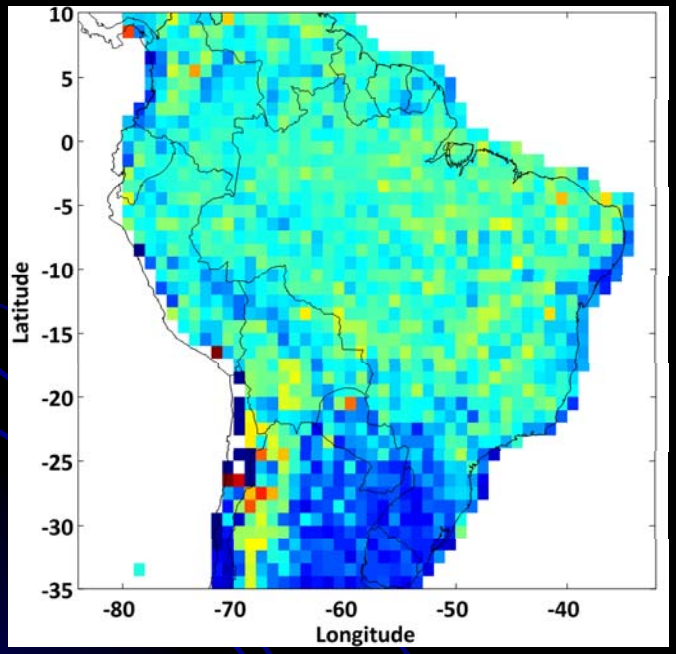
Liu and Zipser 2007

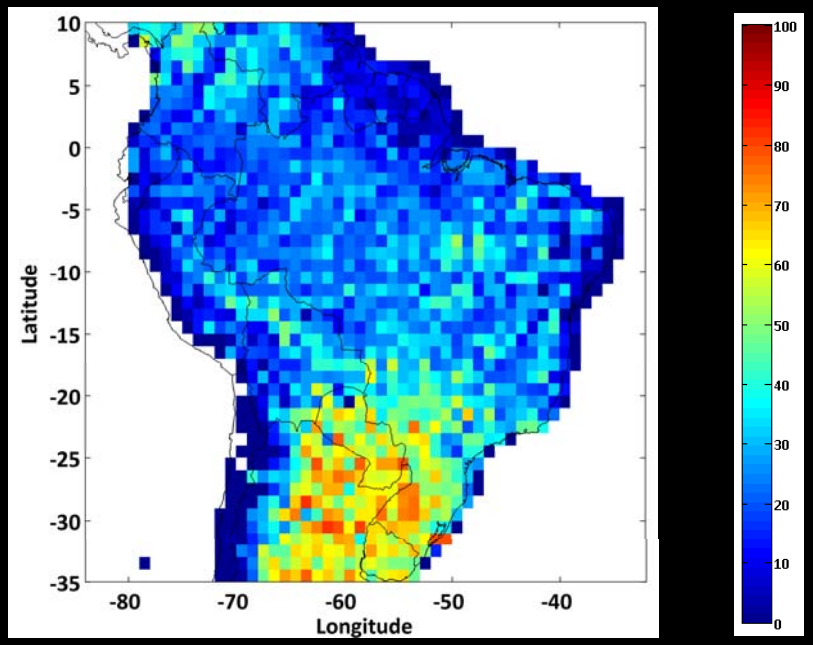
Motivation: Why should we care about the performance of the QPE over SE South America?

% Precipitation explainded by

Area < 2000km²
40dBZ top < 6km
Small and shallow systems

Area > 2000km²
40dBZ top >= 6km
Large and deep systems





from Vidal at al 2010, Liu et al 2008, Liu and Zipser 2007 Zipser et 2006, Nesbitt and Zipser 2003, among others

Overview

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Metodology:

1) Available overlapping periods for QPE

➔Short Period = July 12, 2009 to Dec 31, 2009

Gauge-Blended retrievals	Satellite Based-retrievals
CoSch (Vila et al 2009)	CMORPH (Joyce et al 2004)
3B42_V6 (Huffman et al 2007)	3B42_RT (Huffman et al 2003)

➔Long Period = Jan 1, 2003 to Dec 31, 2009

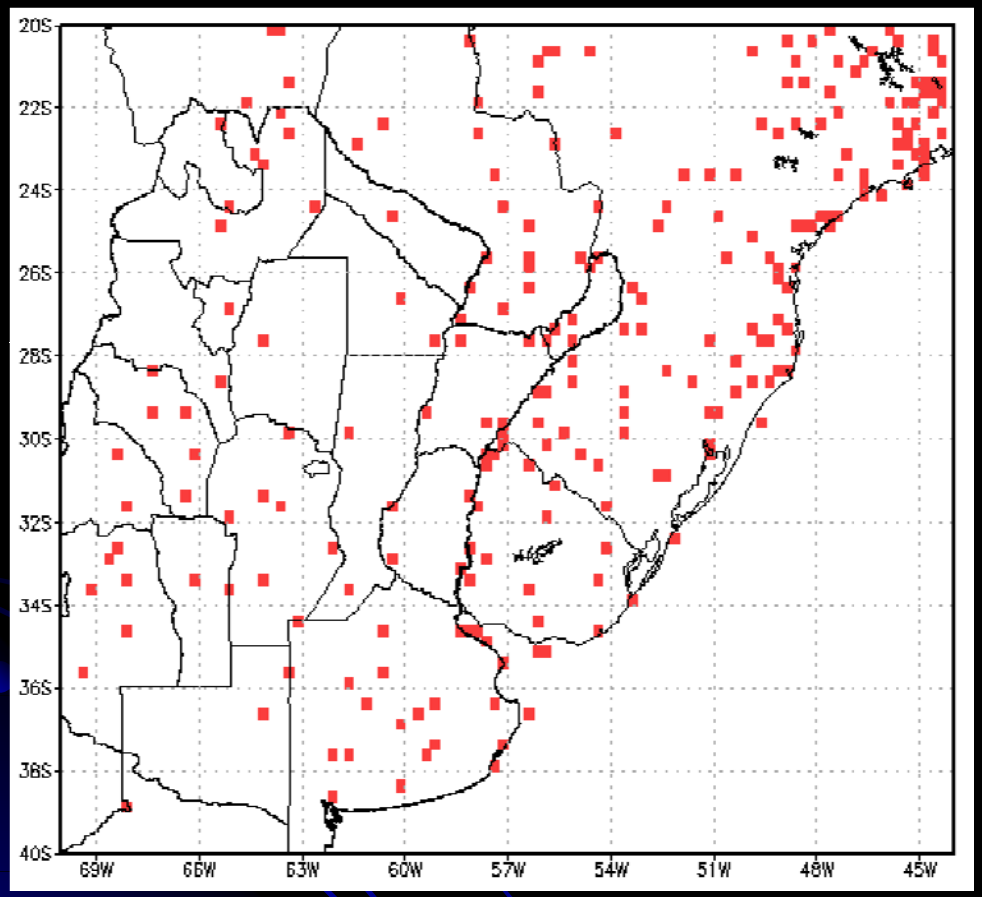
Gauge-Blended retrievals	Satellite based retrievals
3B42_V6	CMORPH

QPEs are accumulated over 24 hours at 12Z

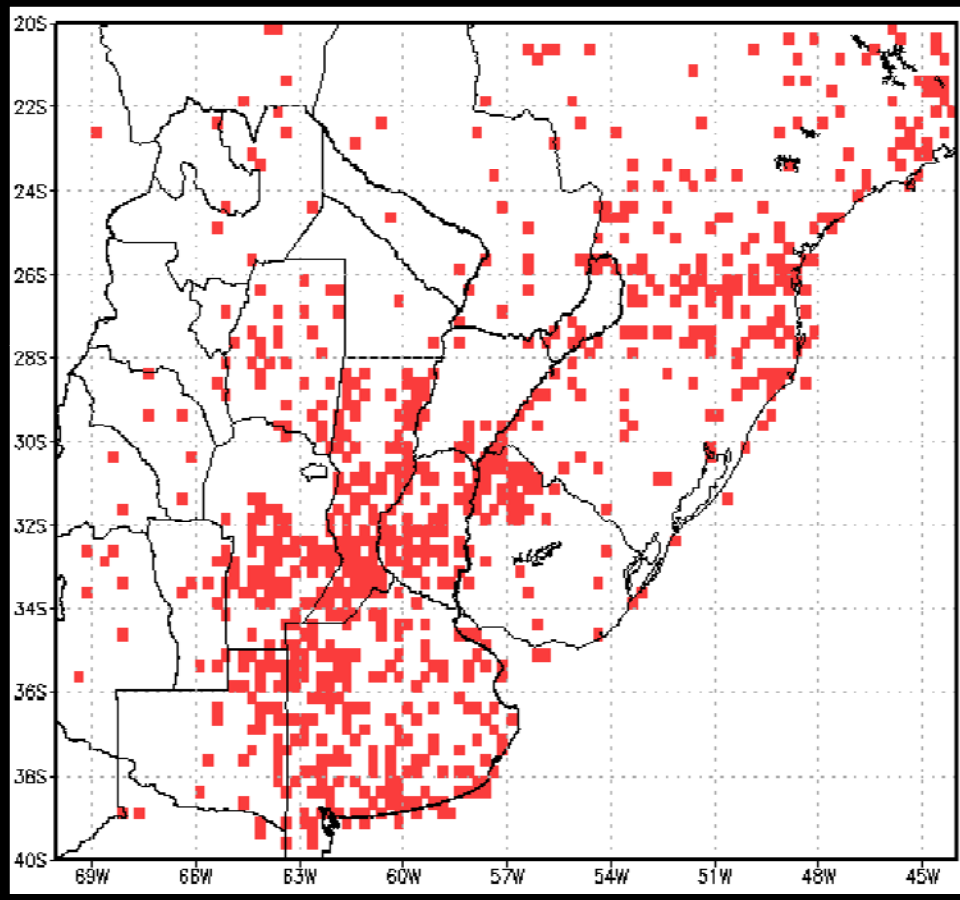
Metodology:

2) Interpolate precipitation observations to a common grid of 0.25º considering more than 2560 stations not available on GTS (number of stations depends on the day).

Operative Network available on GTS e.g. 2010, Jul 21



122 stations in Argentina and Uruguay
150 Brazil
12 Paraguay
5 Bolivia



1141 stations in Argentina and Uruguay
1253 Brazil
12 Paraguay
5 Bolivia

Metodology:

3) Evaluation of QPE performance considering different statistics:

RMSE, BIAS, BIAS SCORE, ETS, FAR, POD_{rain}

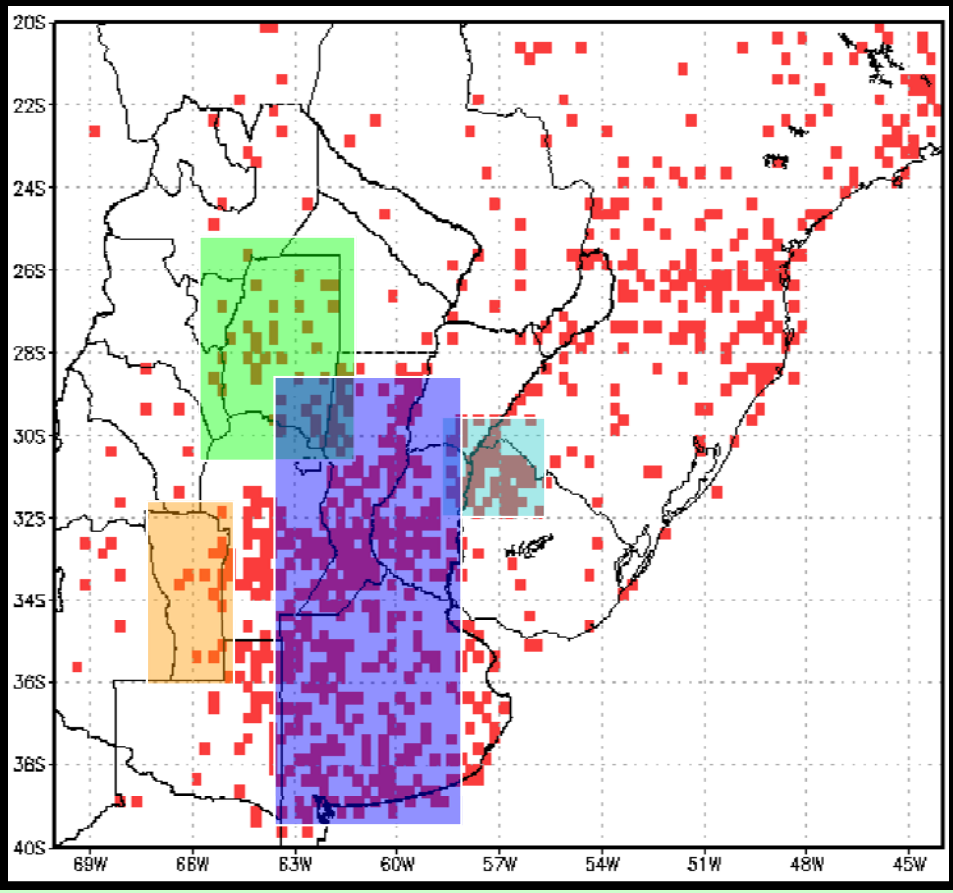
- over the whole sample
- particular areas associated with dense networks and climatic regions

BA= (39.25-28.75S 64-57.75W)

SE=(30-25S 65-61.5W)

SG=(32.25-30S 58.5-55.75W)

SL=(36-31S 68-64W)



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  - **Short Period Analysis**
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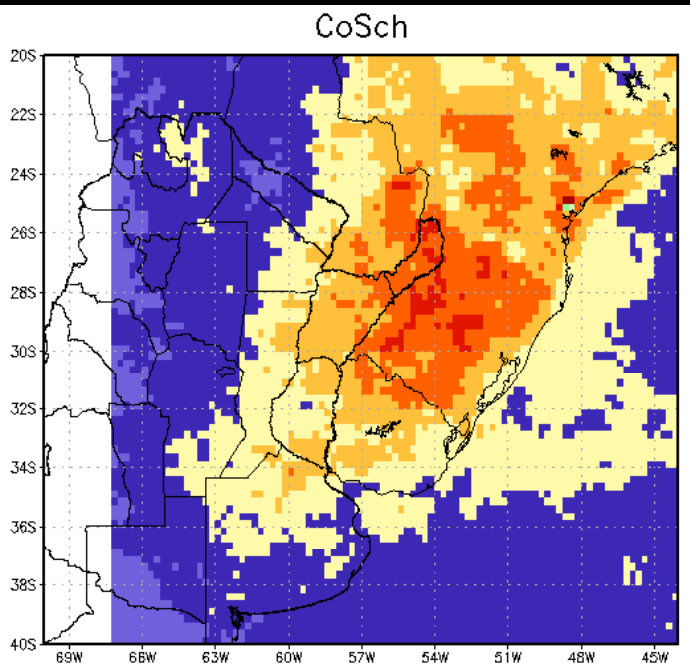
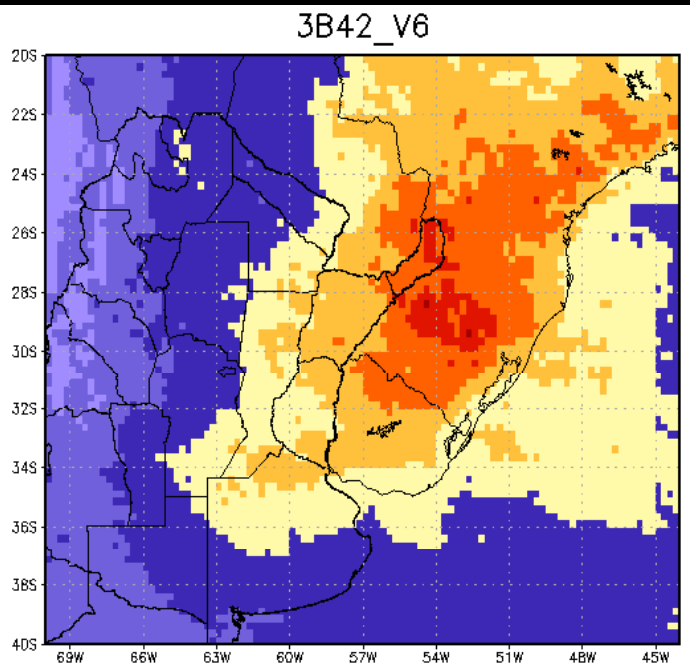
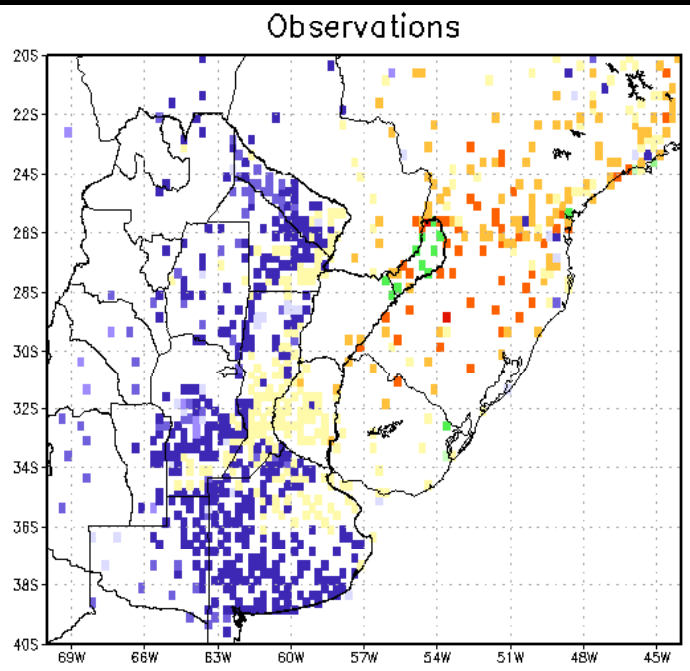
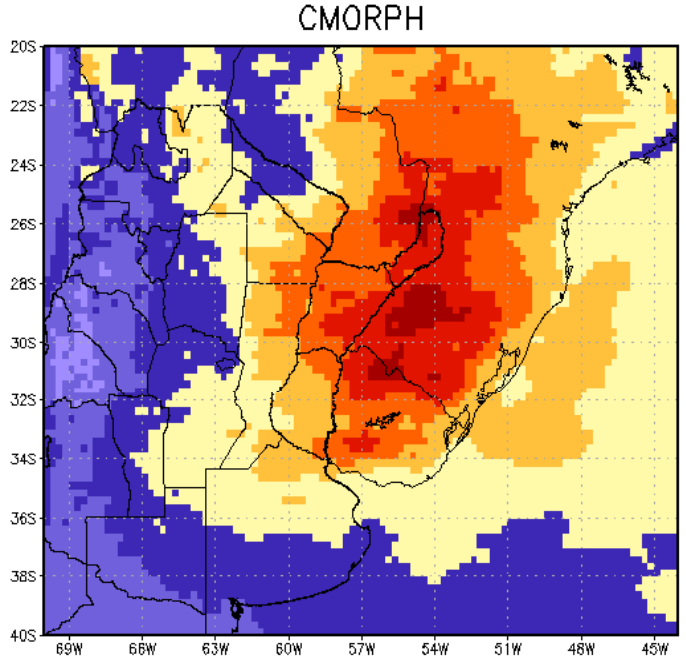
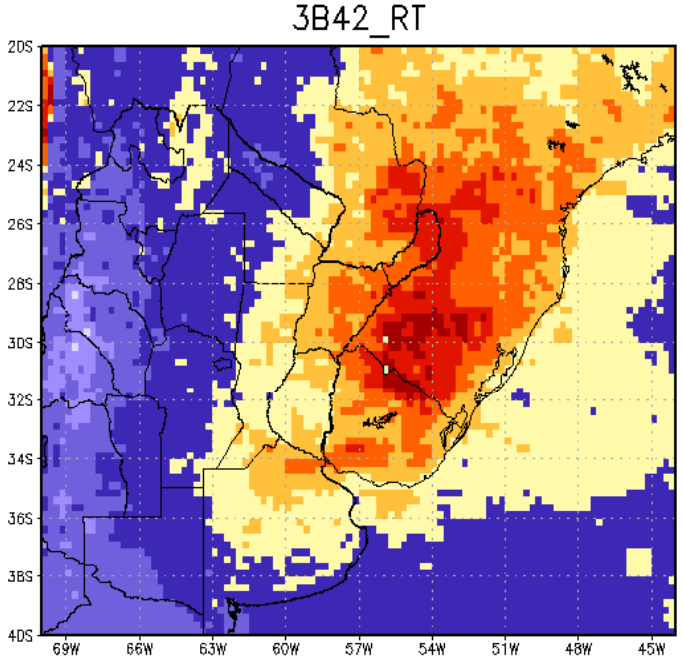
Precipitation Mean mm/day *July 2009 – Dec 2009*

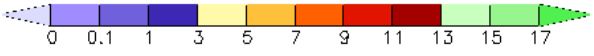








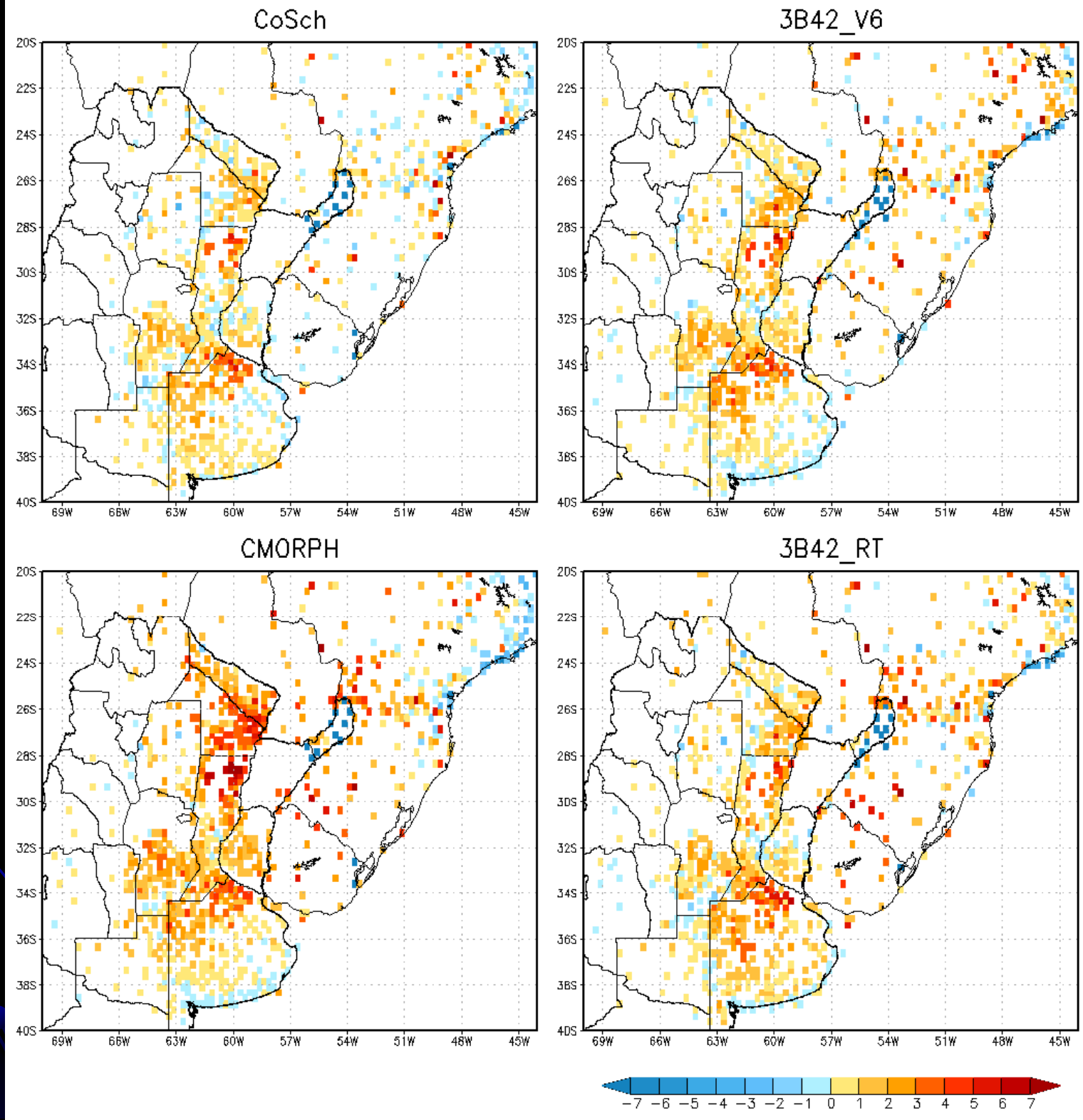




Bias

Estimated – Obs

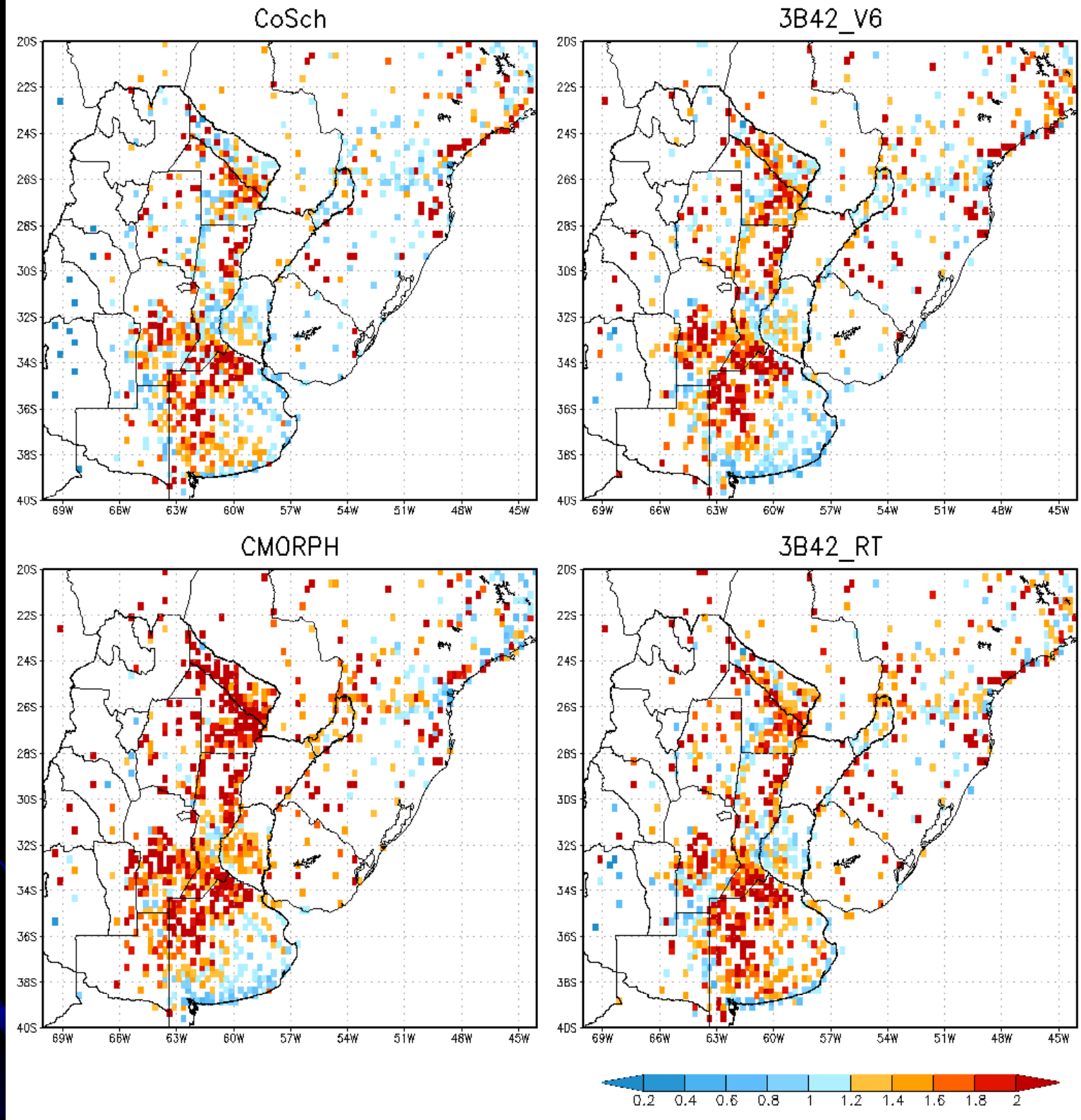
July 2009 – Dec 2009



Porcentual Error

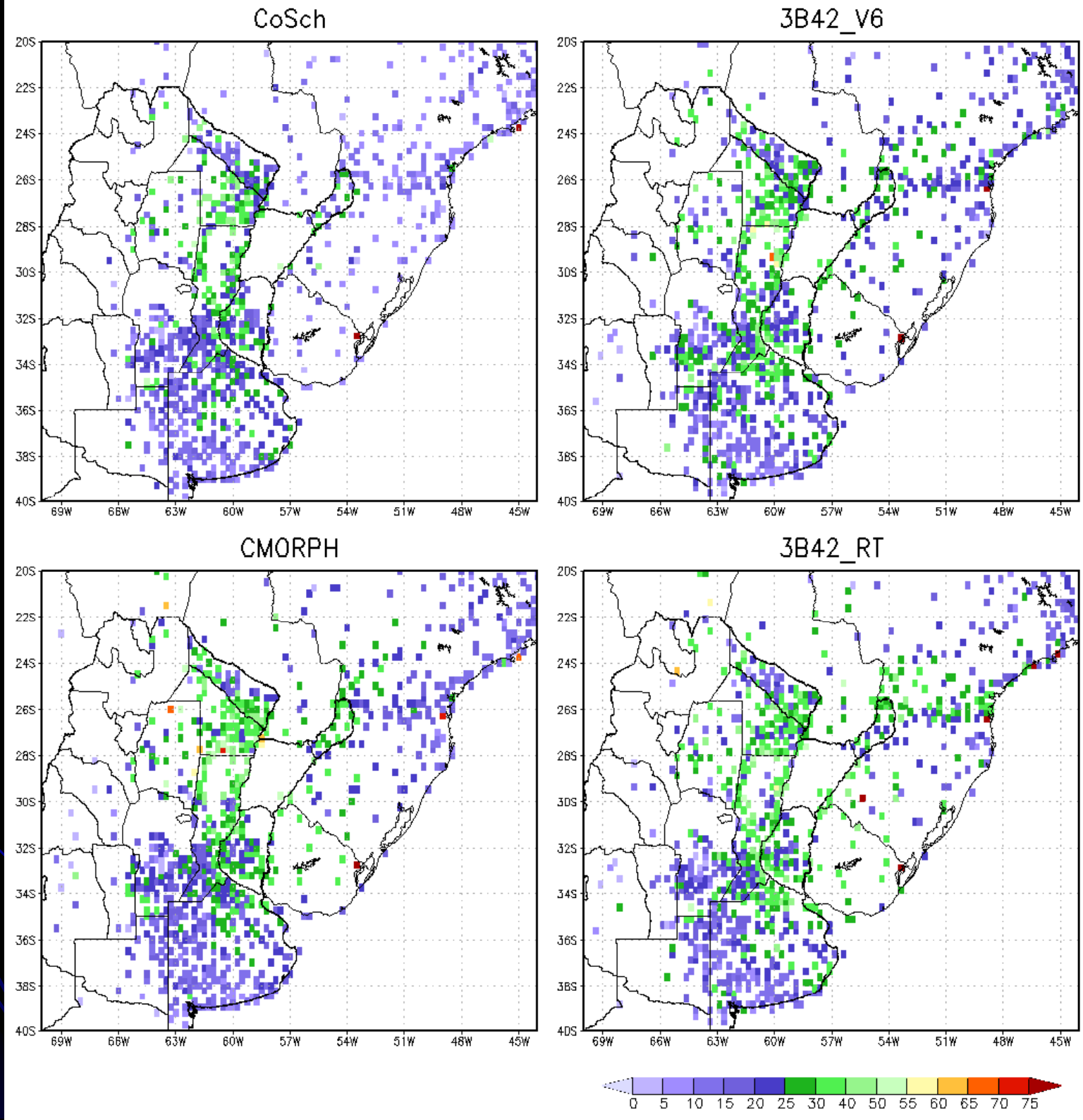
rainy days

July 2009 – Dec 2009

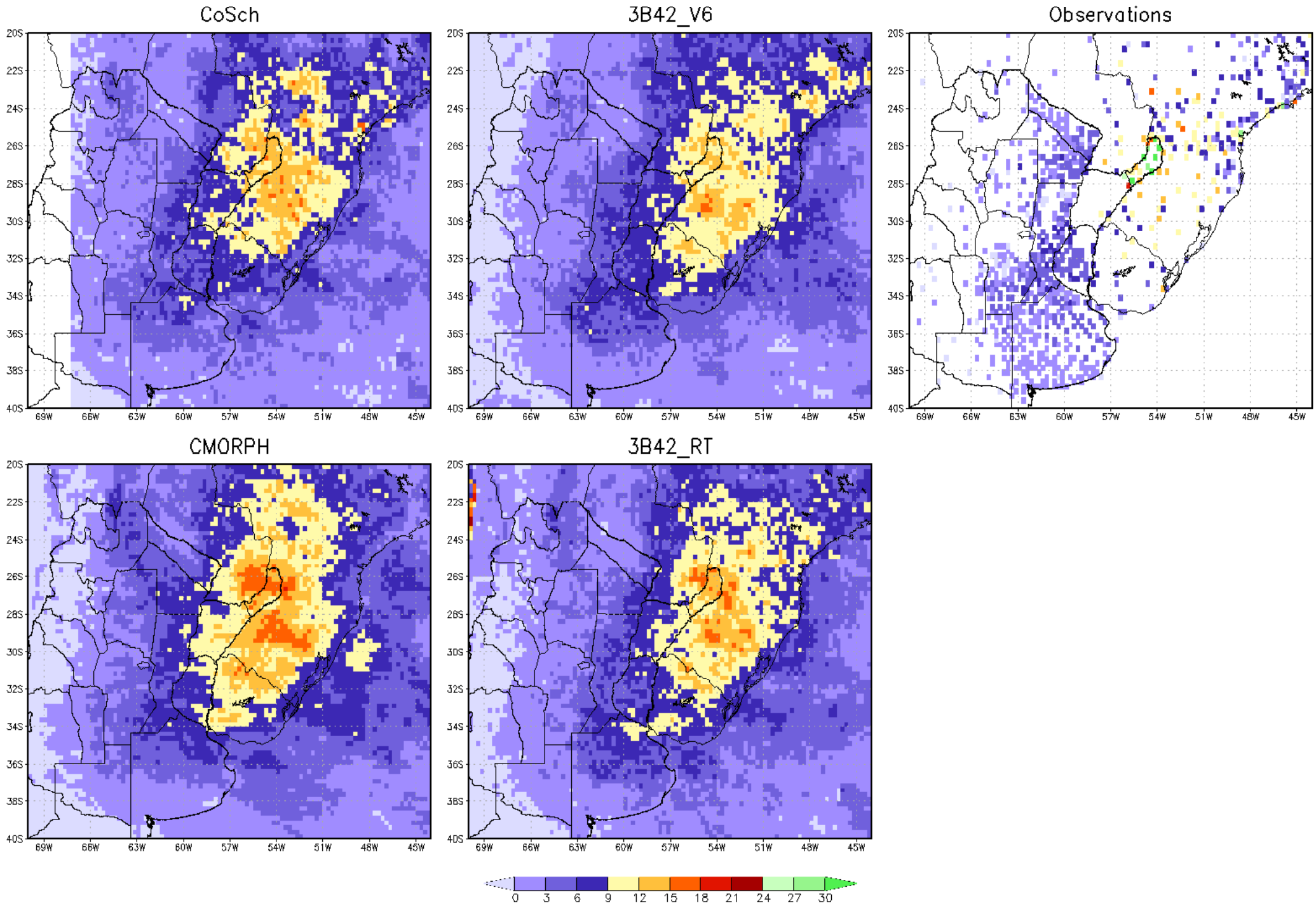


RMSE

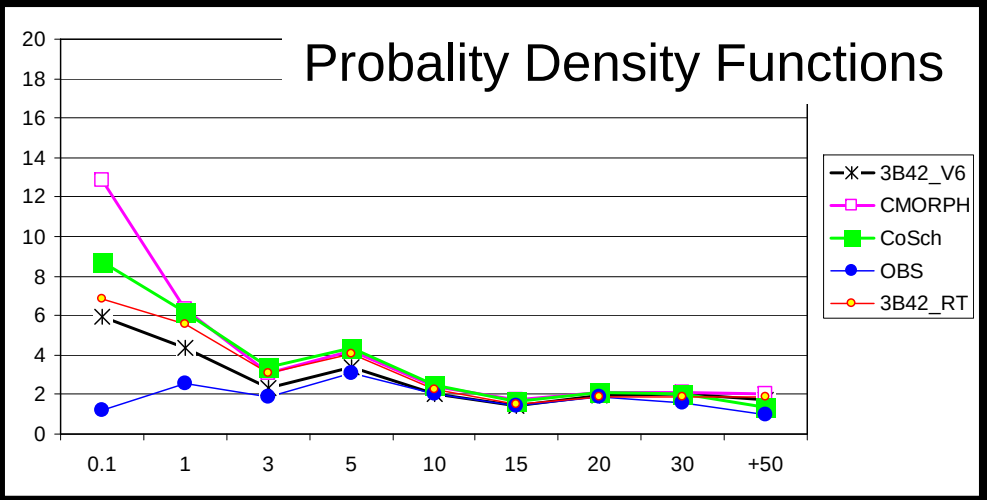
July 2009 – Dec 2009

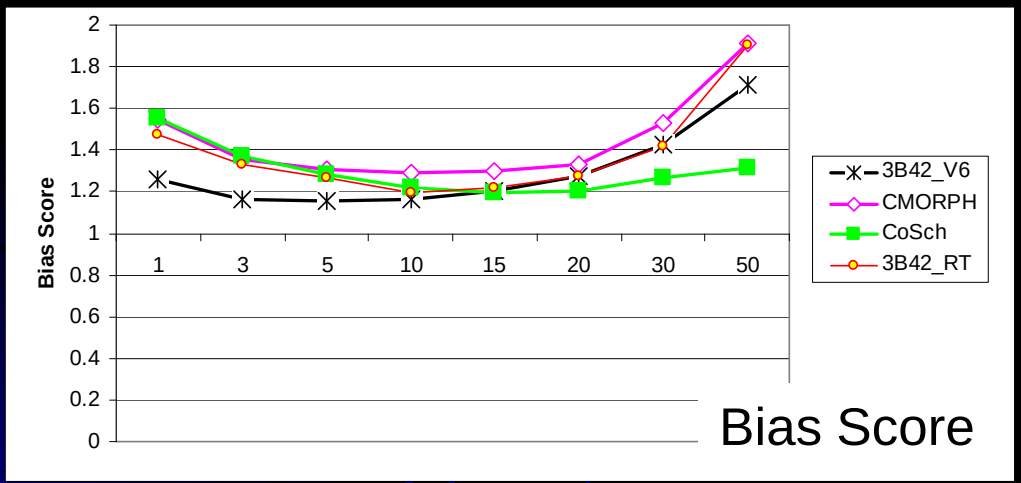


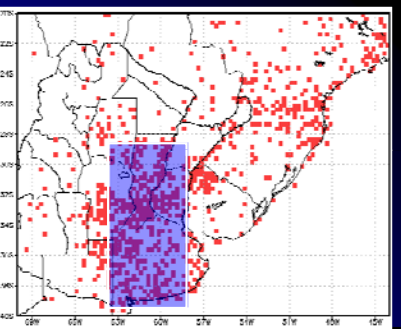
Frequency Precip >= 25 mm/day *July 2009 – Dec 2009*

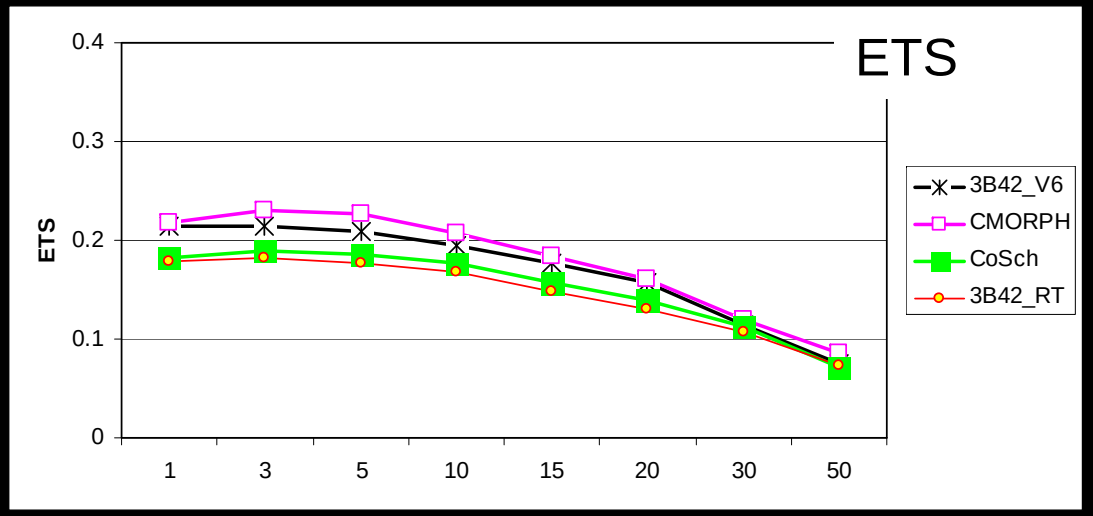


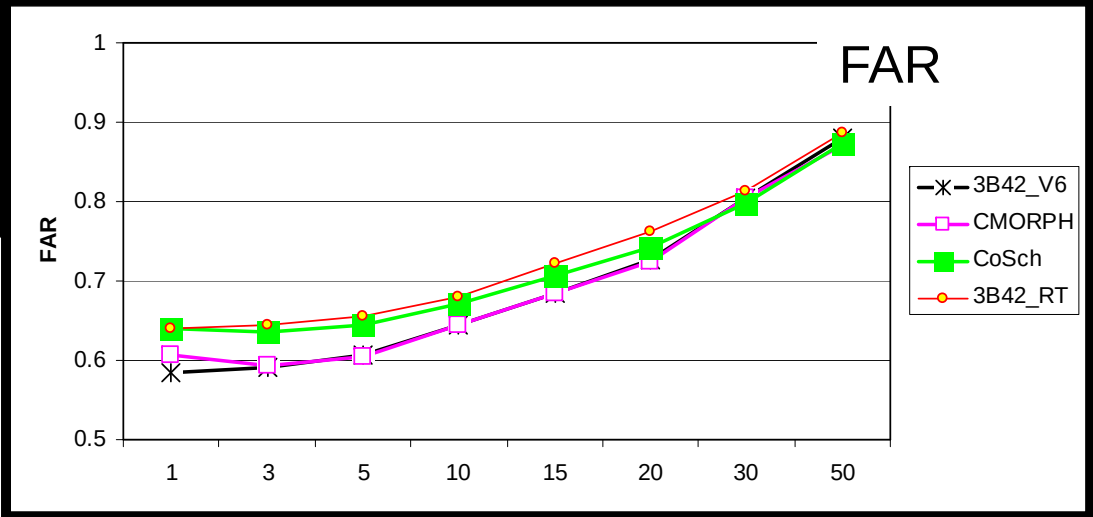
BA Region
July to Dec 2009

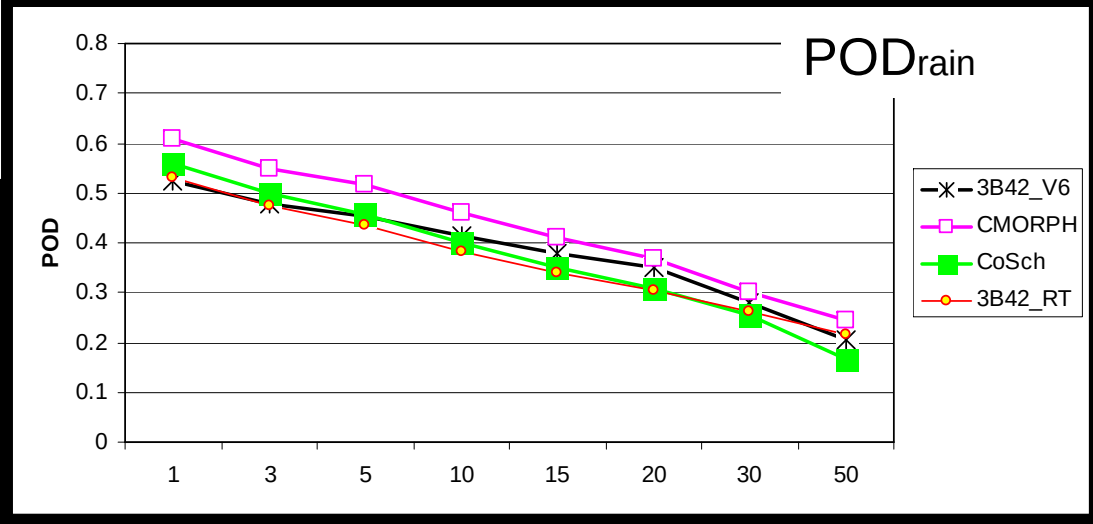












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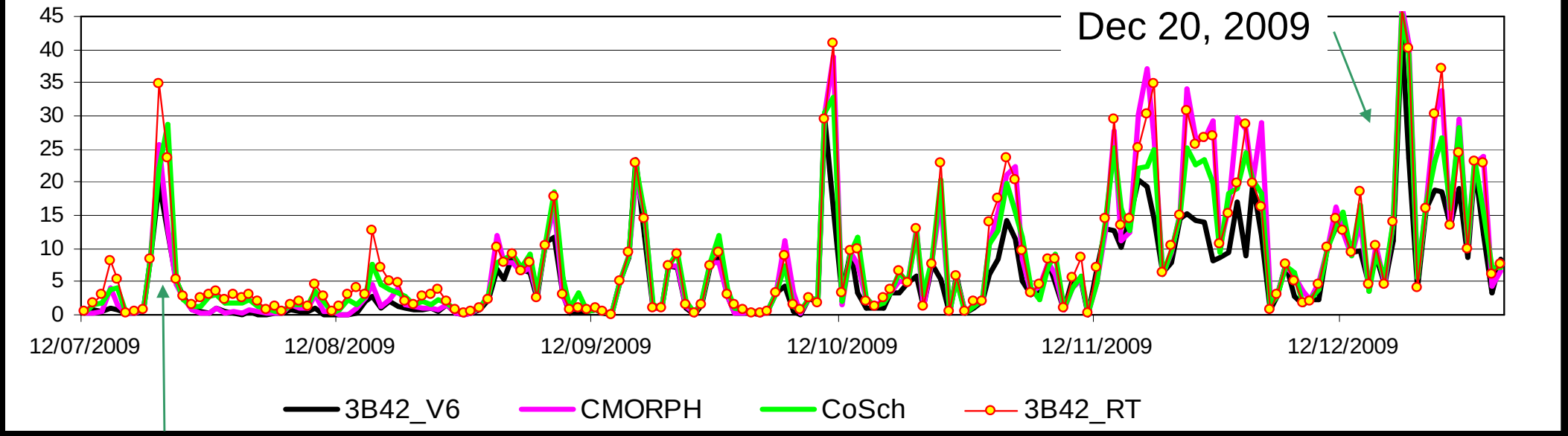
Extreme RMSE Events in the short sample

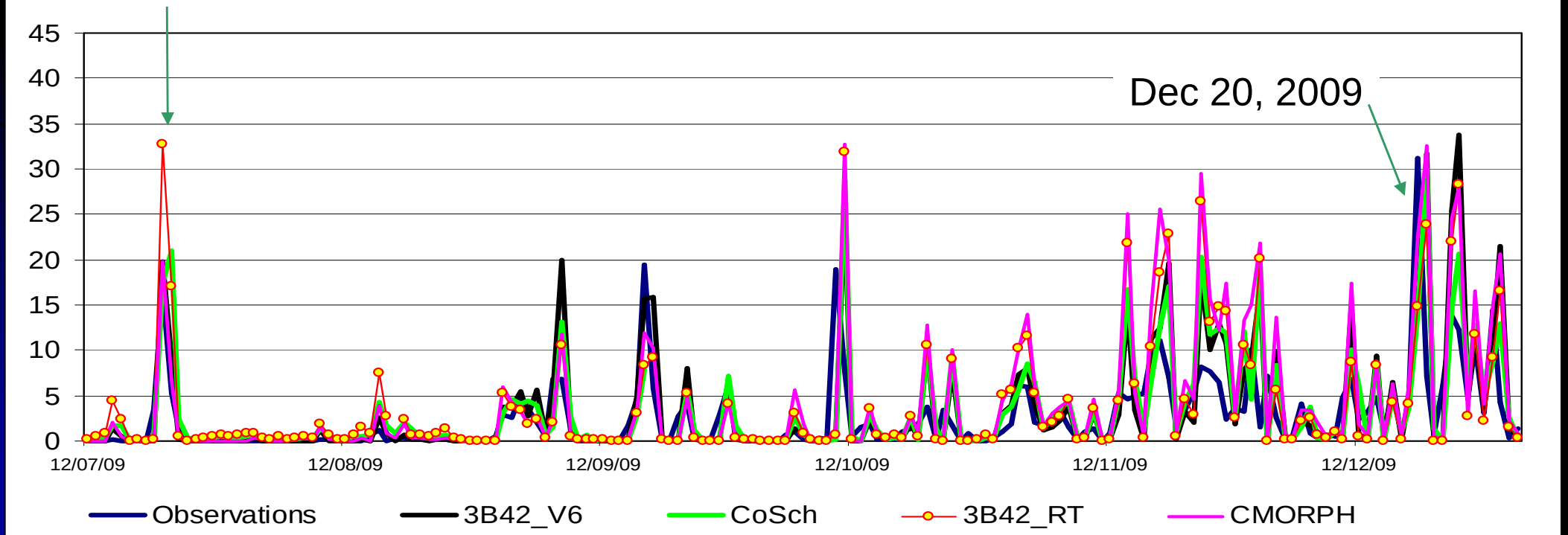
- Conclusions and Future Steps

Root Mean Square over BA box



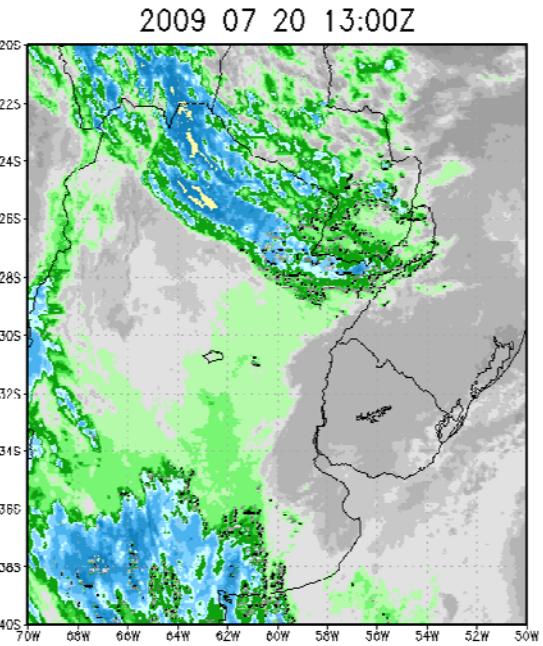
Jul 21, 2009

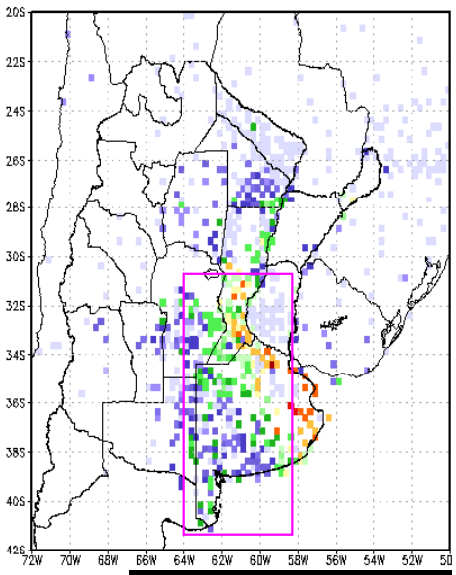
Precipitation average over BA box

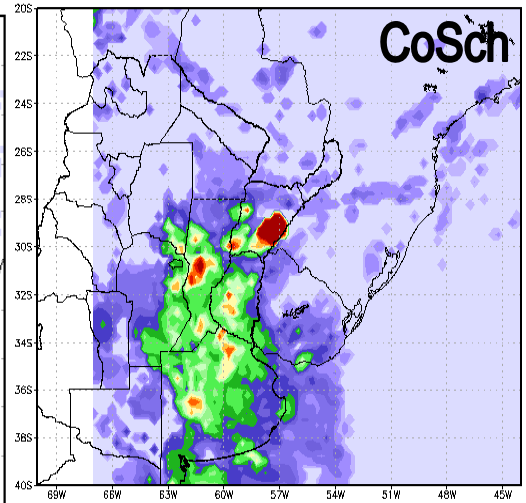


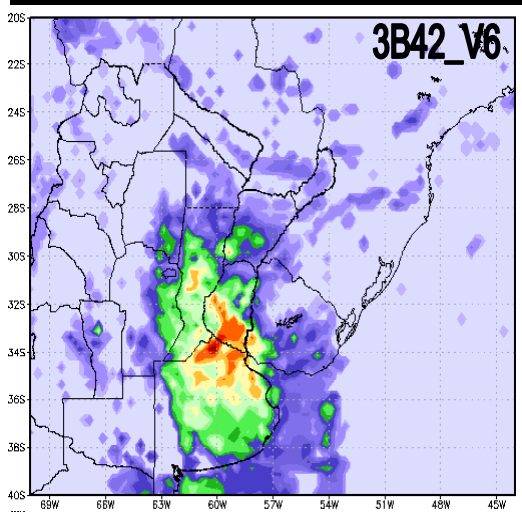
Extreme RMSE Cases

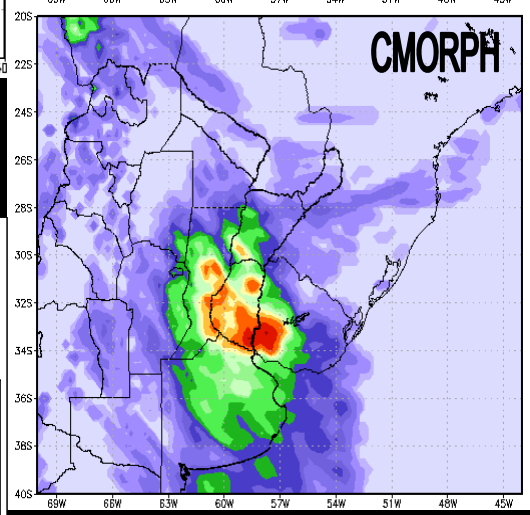
July 21, 2009 12UTC Winter Case - associated with a cold front and a MCSs development

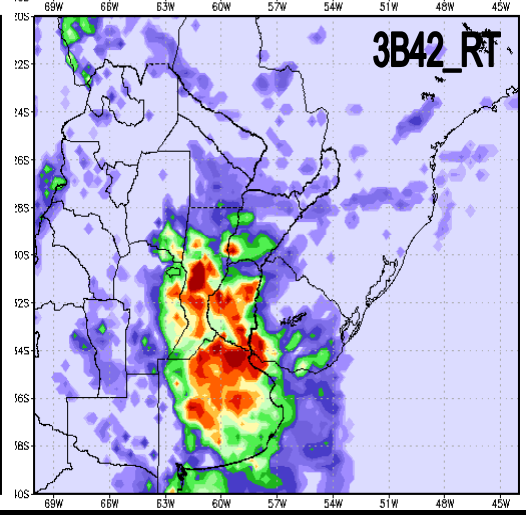


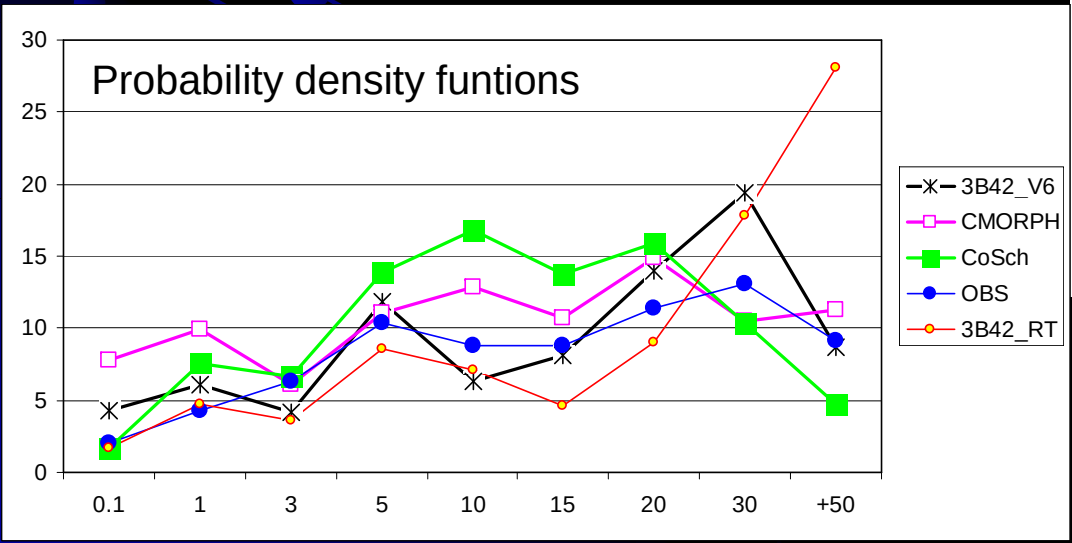








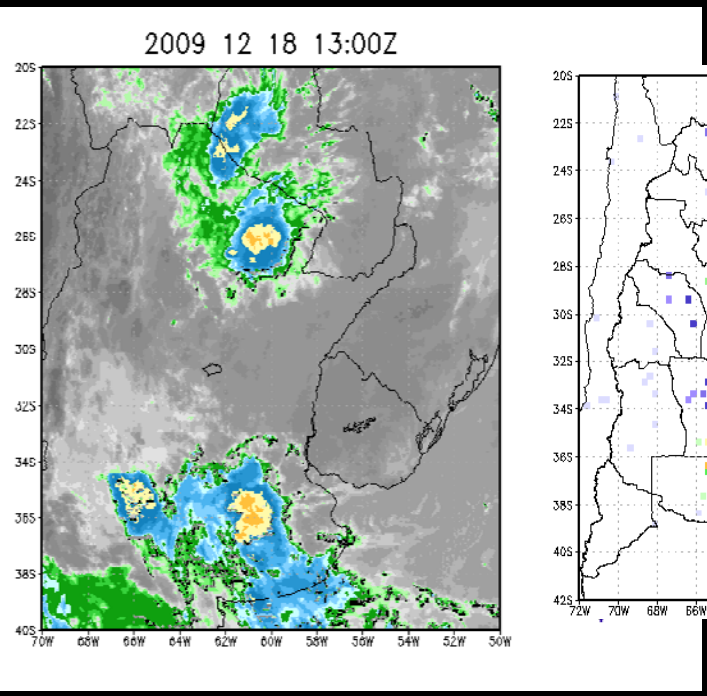


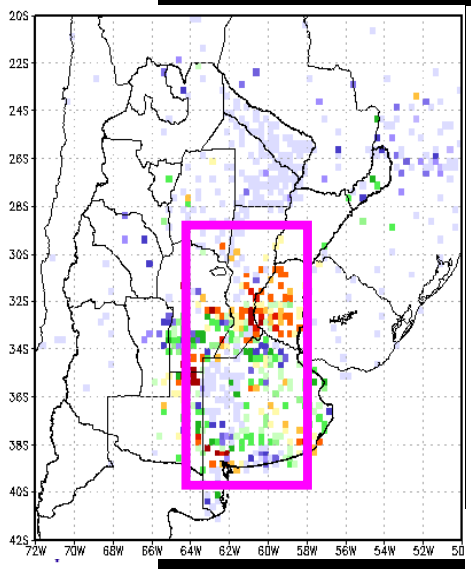


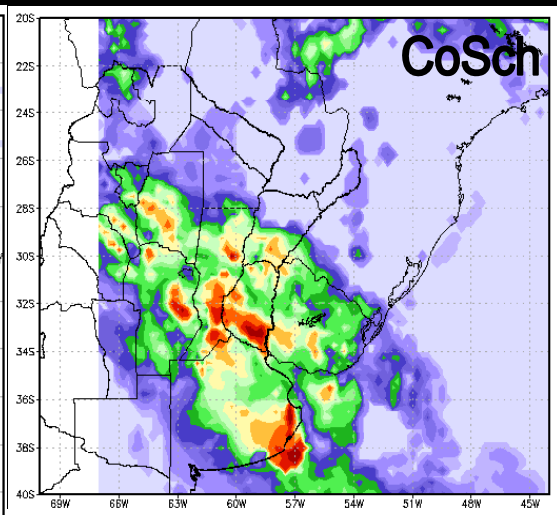
	3B42_V6	CMORPH	CoSch	3B42_RT
RMSE	23.1412	25.6727	22.1927	34.7932
BIAS	5.4664	3.6482	0.7434	18.0495
COR	0.3638	0.1873	0.215	0.4363

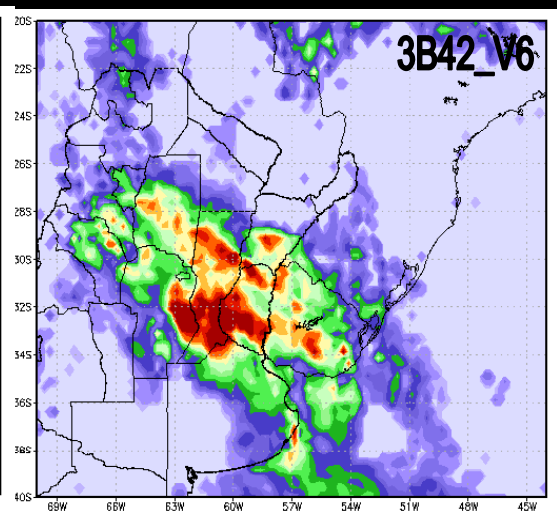
Extreme RMSE Cases

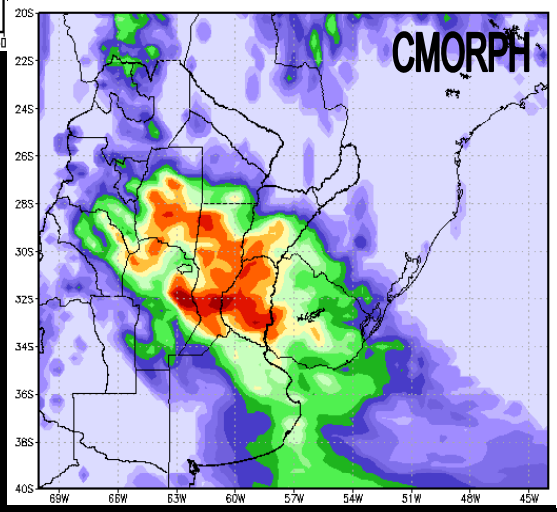
Dec 20, 2009 Squall line event

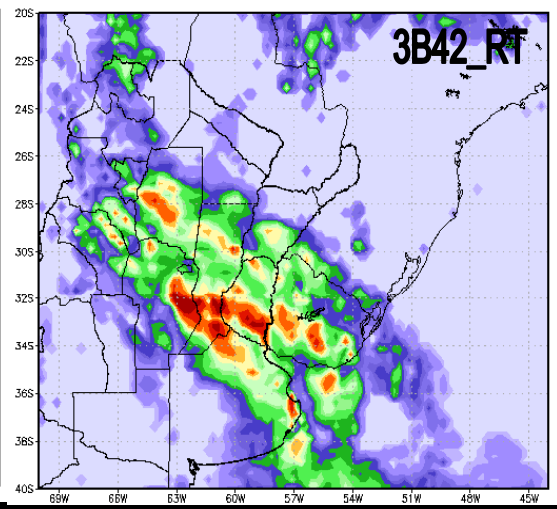


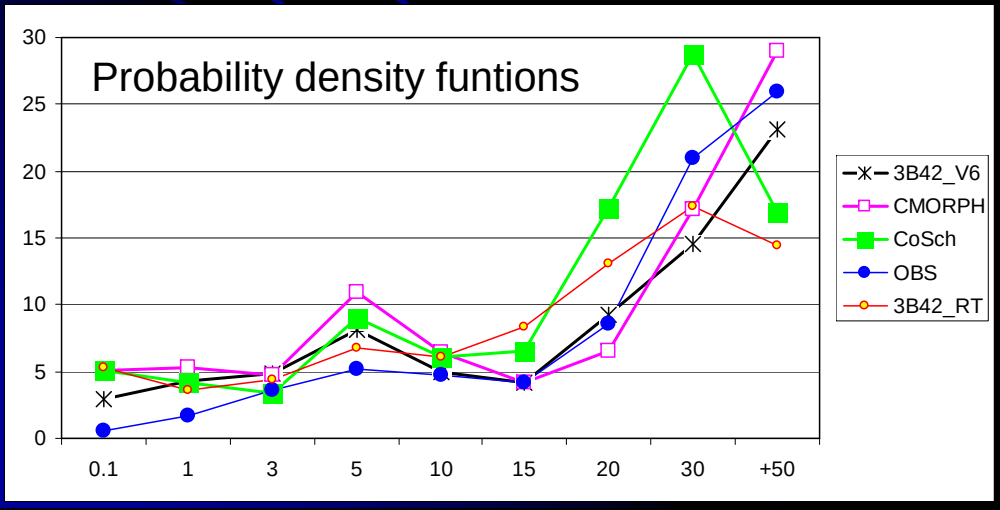












	3B42_V6	CMORPH	CoSch	3B42_RT
RMSE	55.6872	40.8746	39.1726	40.1462
BIAS	27.8592	23.237	23.65	19.3322
COR	0.0806	0.1301	-0.0235	0.0482

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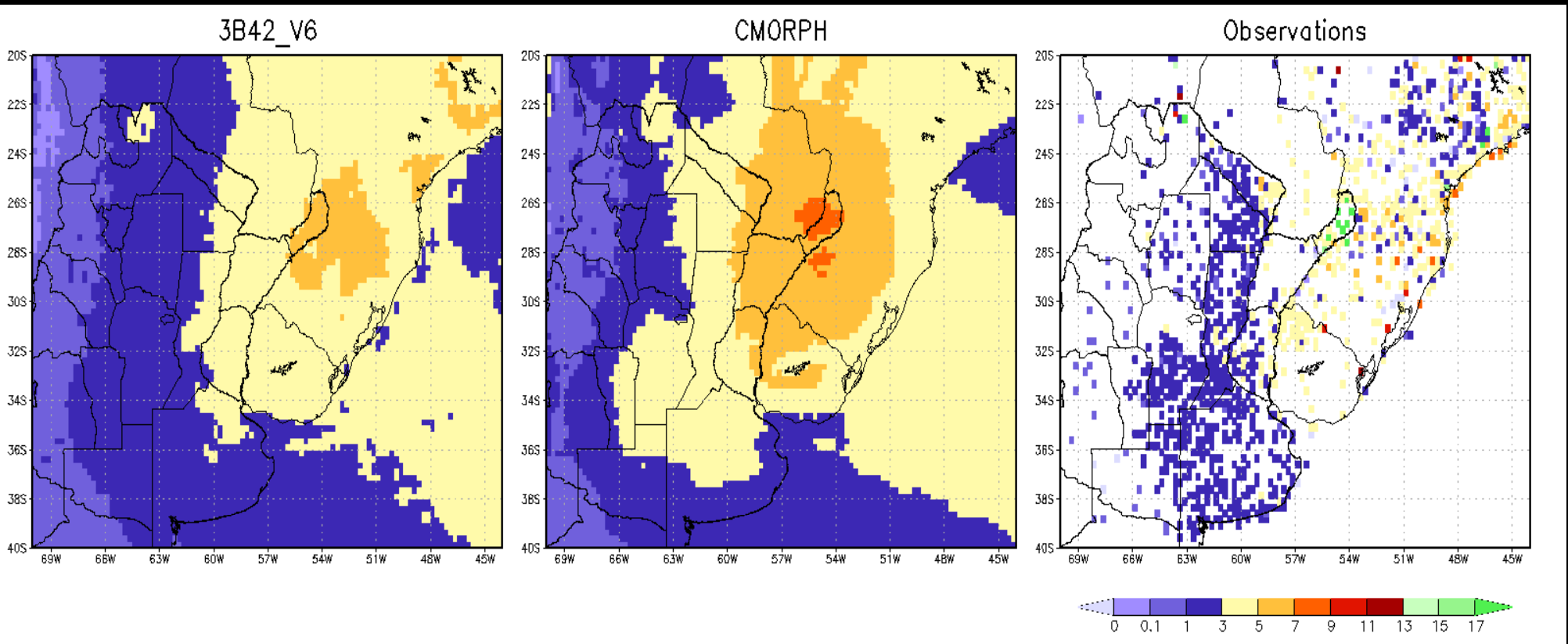
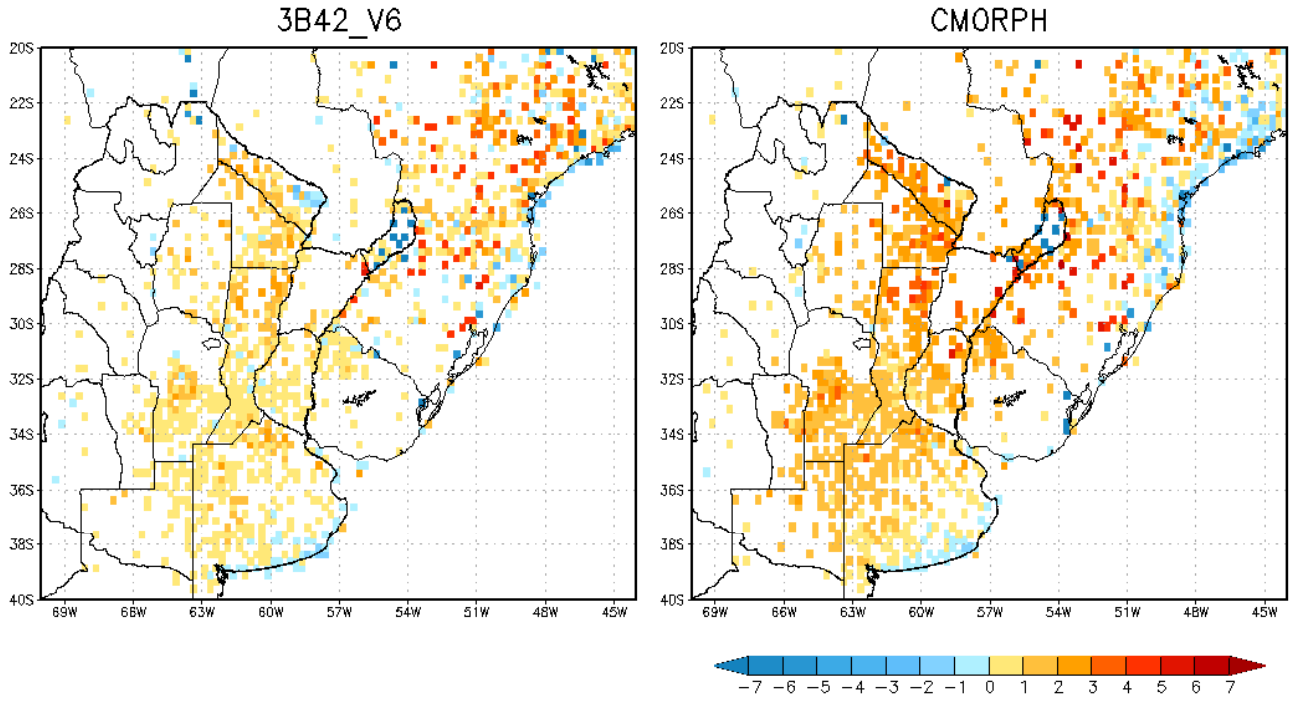
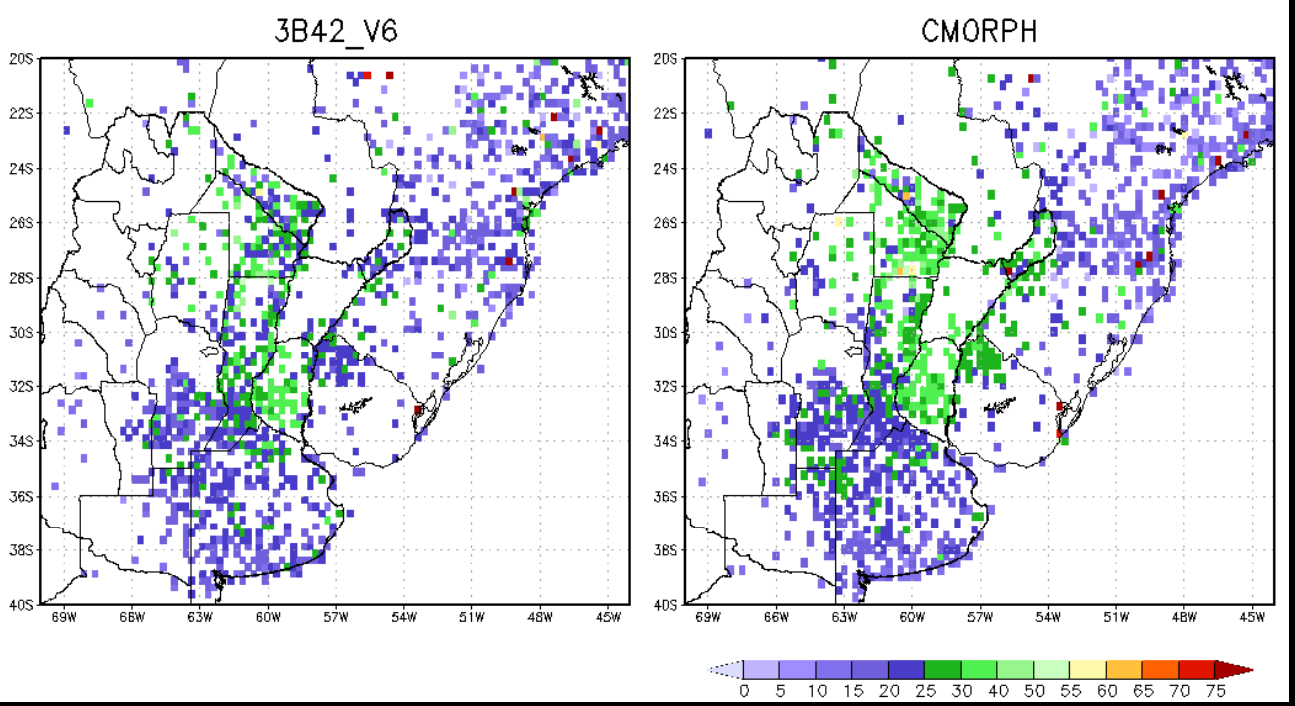


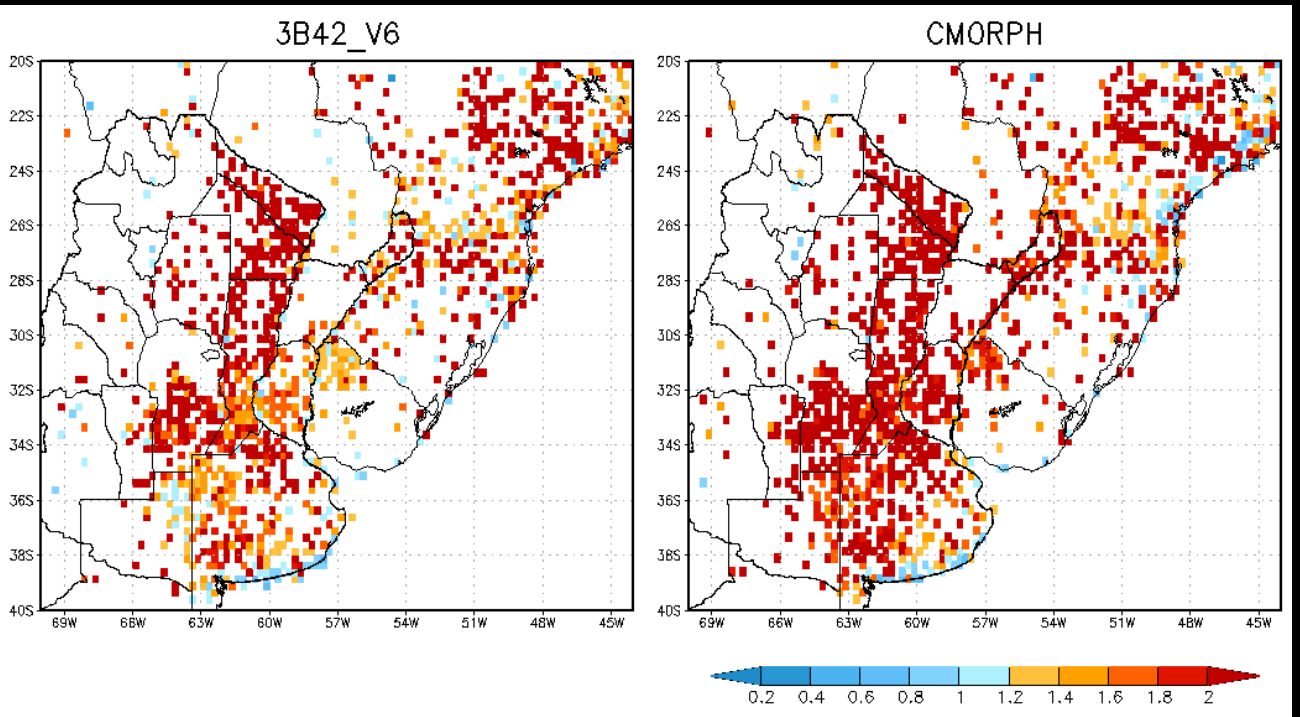


Bias

Jan 2003 – Dec 2009



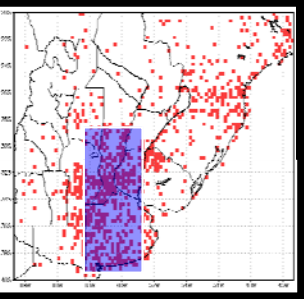
RMSE

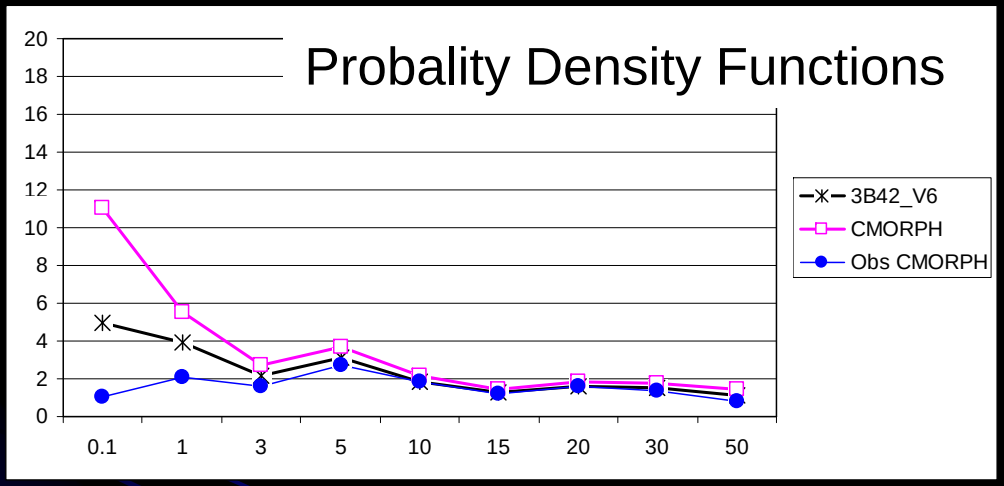


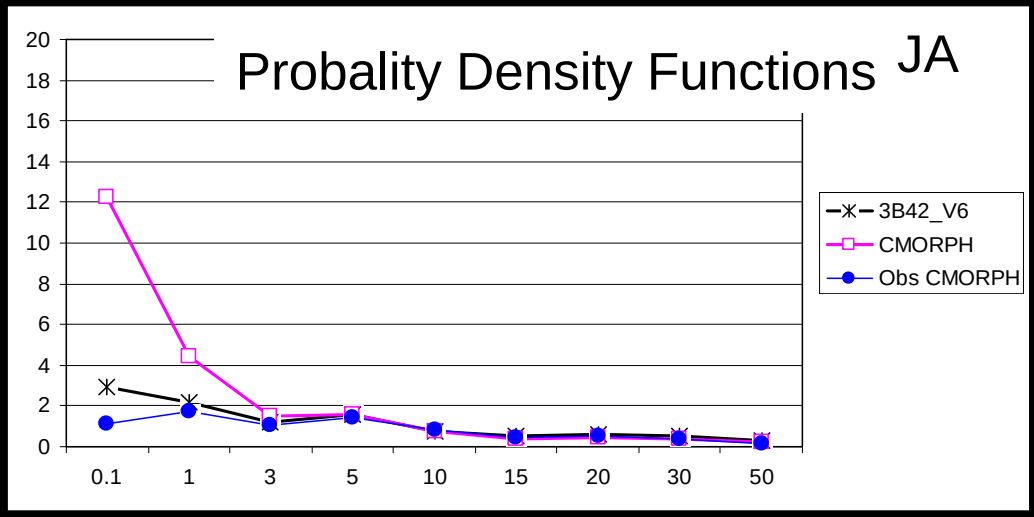
Porcentual Error

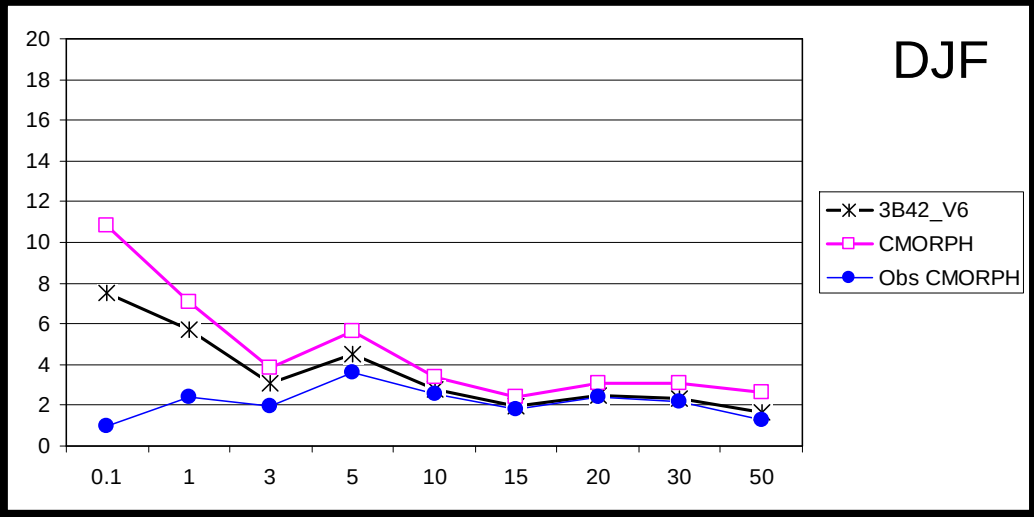
Jan 2003 – Dec 2009

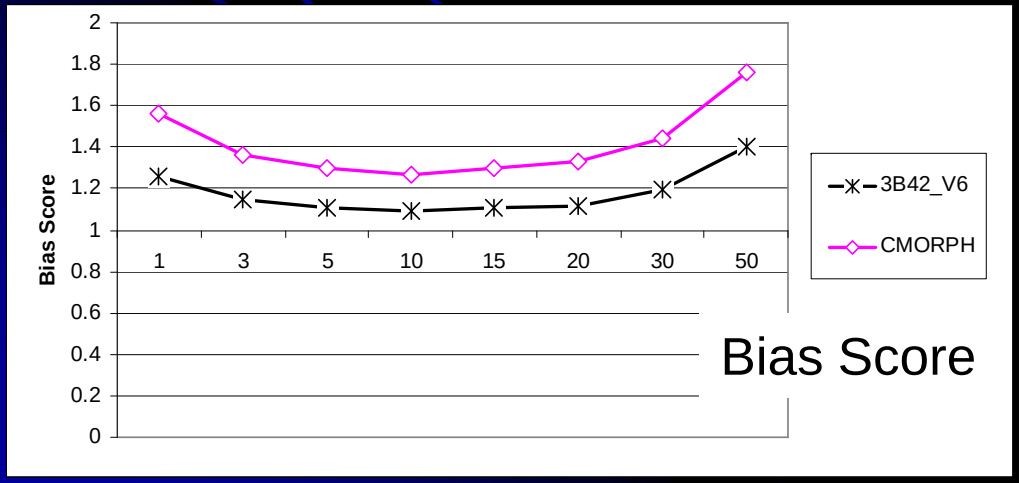
BA Region – Long Period close 500 stations



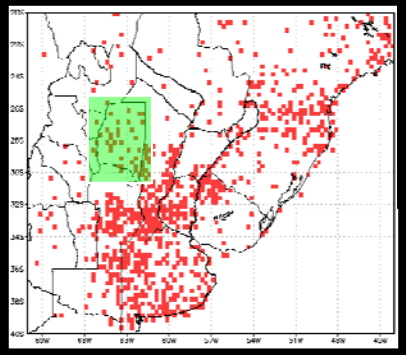


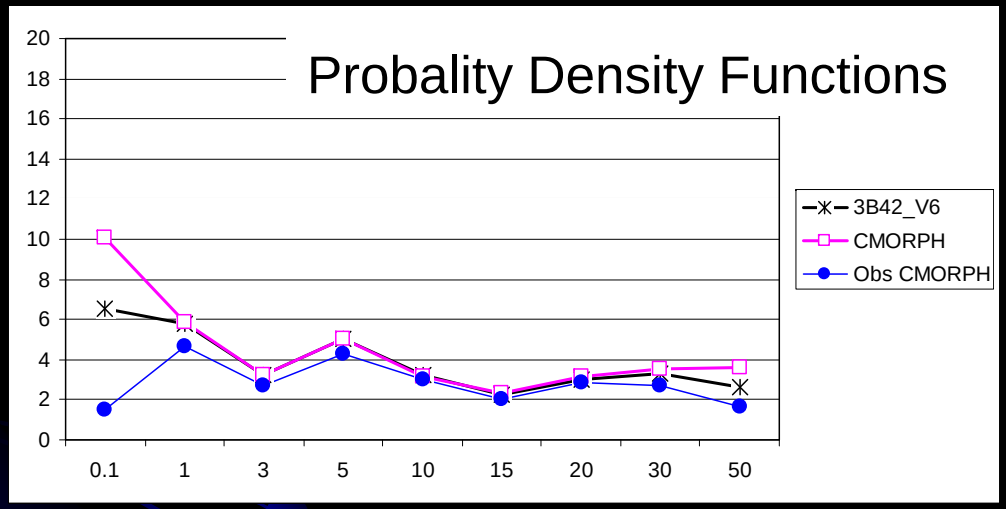


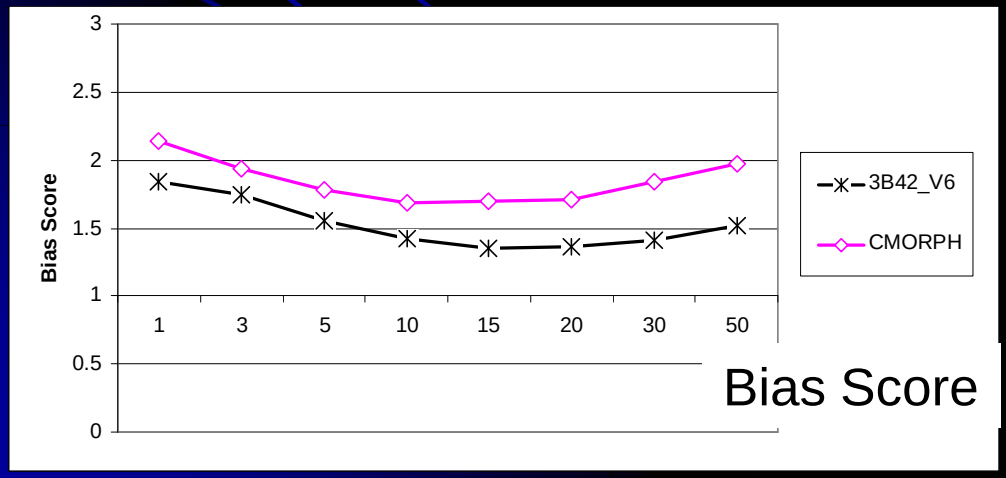




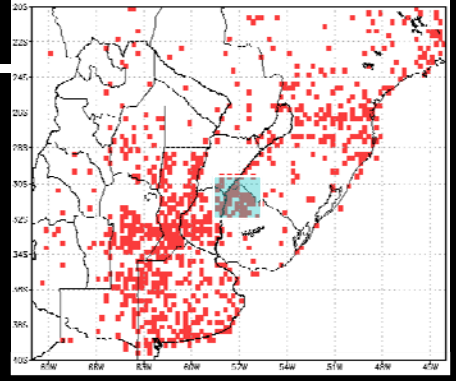
Santiago del Estero – Long Period Dry region 40 stations

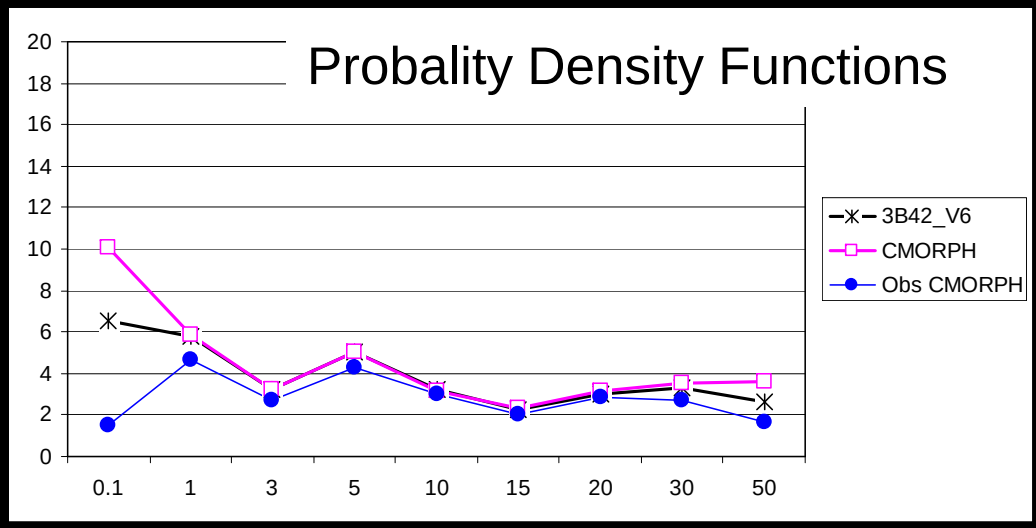


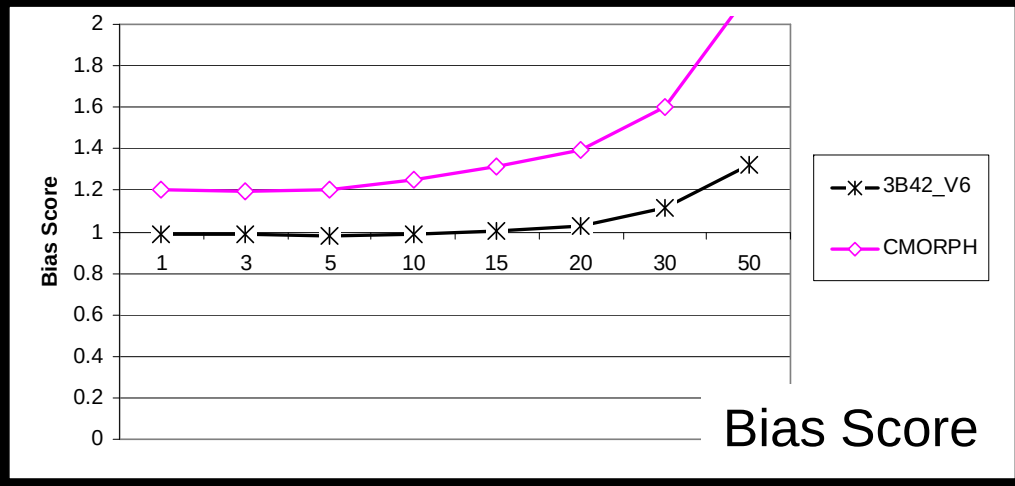




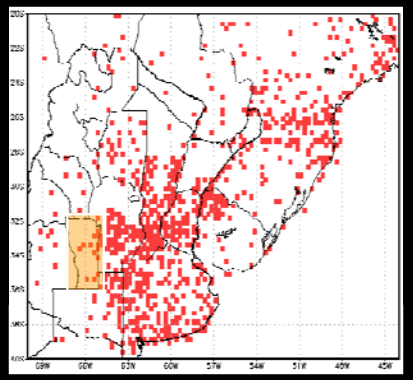
Salto Grande – Long Period 140 stations

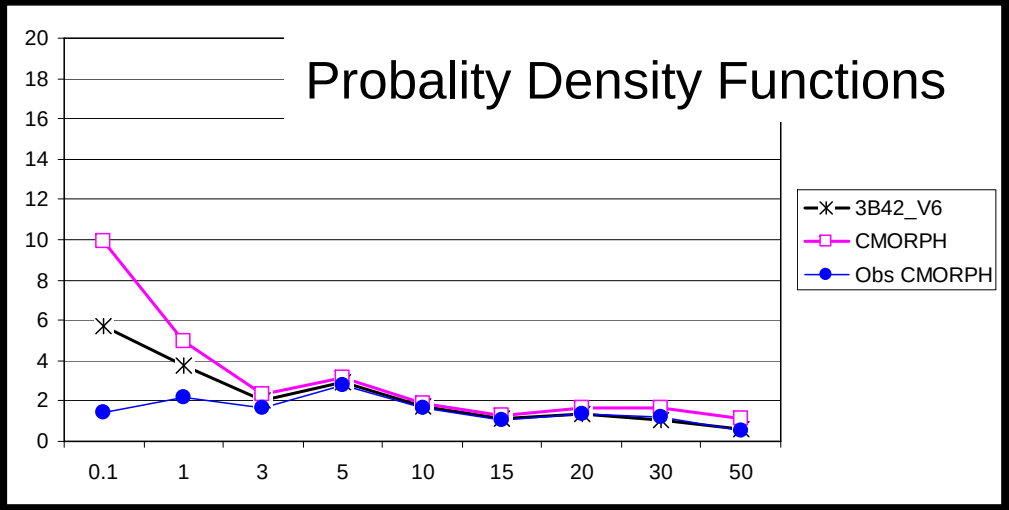


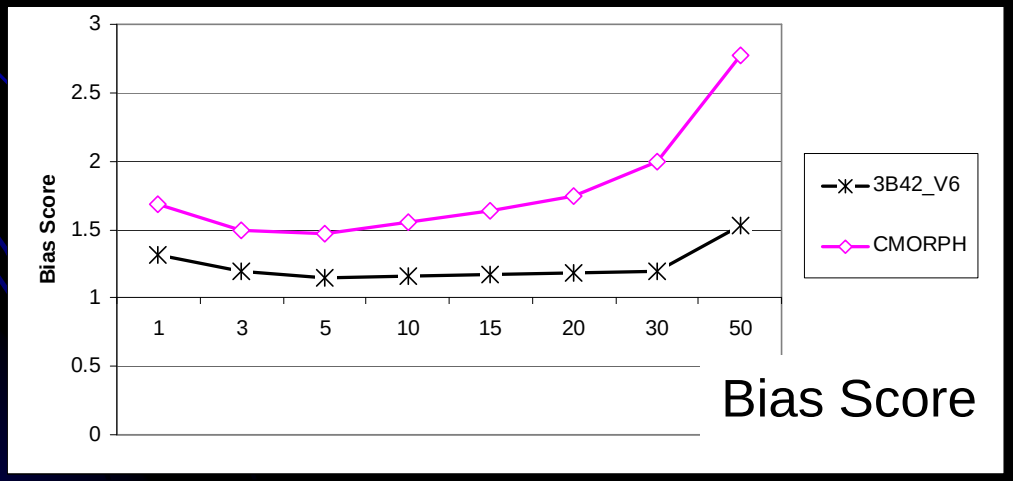




San Luis
Long Period
Dry region
40 stations







Summary

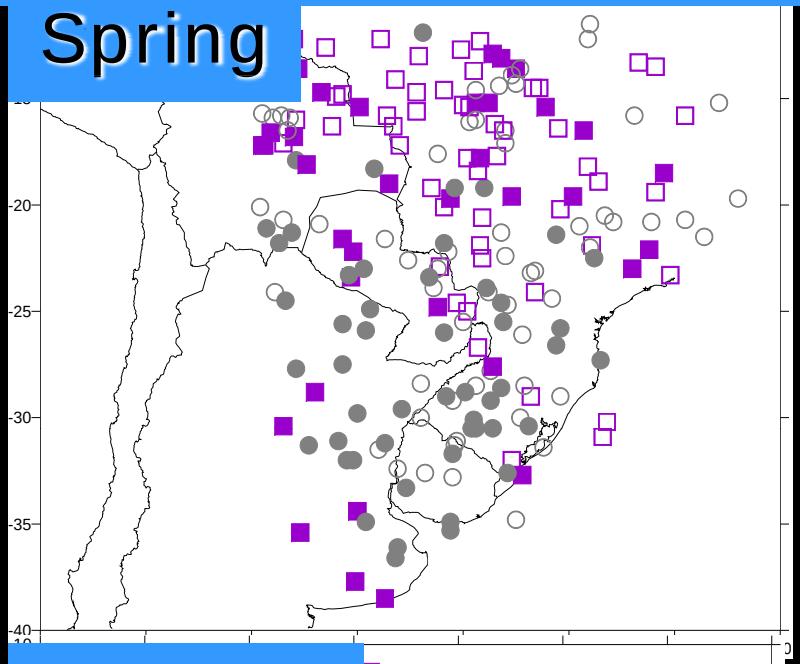
- Overestimation is observed by all QPE techniques. Larger error values can be observed over central section of SESA, associated with the area of maximum extent of MCSs.

- Gauge-blended retrievals show a better performance than pure satellite estimates, showing different behavior during stratiform and convective cases.

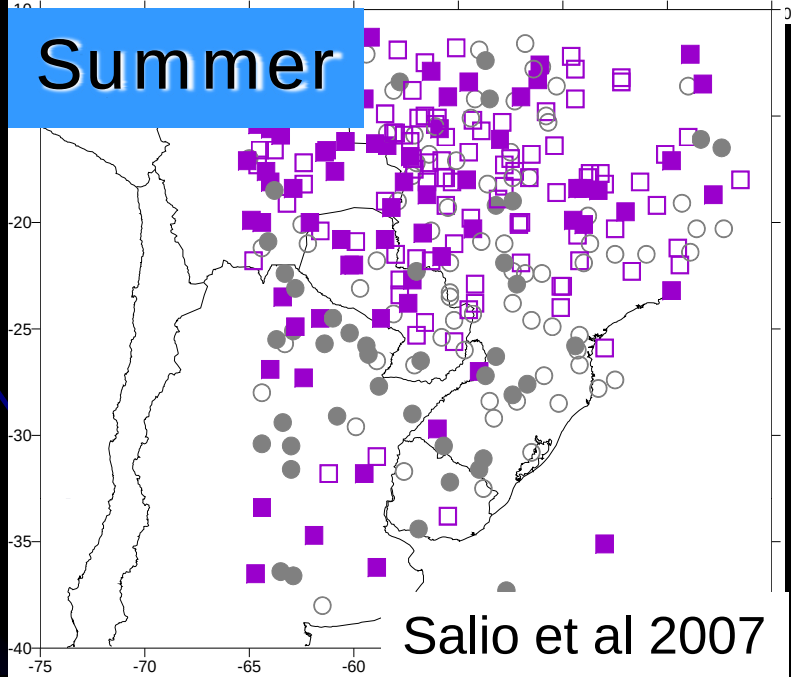
- Gauge-blended retrievals over a network with large number of observations and a long period of time, affected principally by mature stage period of MCSs, shows a perfect fit except for large precipitation rates. But over MCSs initiation area and dry regions, problems are observed over light precipitation events.

MCS Mature stage centroid position from IR data BT lower -55ºC

Spring



Summer



Salio et al 2007

Future Steps

- Include more available networks over the area.
- Evaluate the performance against hourly observations from manual and automatic stations principally over dry and mountain areas.
- Run CoSch for a longer period to evaluate the performance.
- Include level 2 data (2A25 and 2A42) in the evaluation.
- Deploy and participate on CHUVA experiment in Foz do Iguazú, considering this experiment is over the area with really strong MCSs.

CHUVA Project
Lead: Luiz Agusto Toledo Machado

Experiments

Table I : Field Campaign Schedule

	Jan	FEB	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dez
2010			Centro de Lançamento de Alcântara									São Luiz Paraitinga
2011	São Luiz Paraitinga		Fortaleza	Fortaleza		Belém	Belém				Manaus	Manaus
2012				Londrina	Londrina		Santa Maria	Santa Maria		Brasília	Brasília	

New experiment at Foz de Iguazu
From 10-2012 to 1-2013
Joint effort with LPB field activities

Thanks for your attention