Coupled Ocean-Atmosphere variability of the SAMS

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VAMOS, Petropolis, Brazil,
5th June 2012

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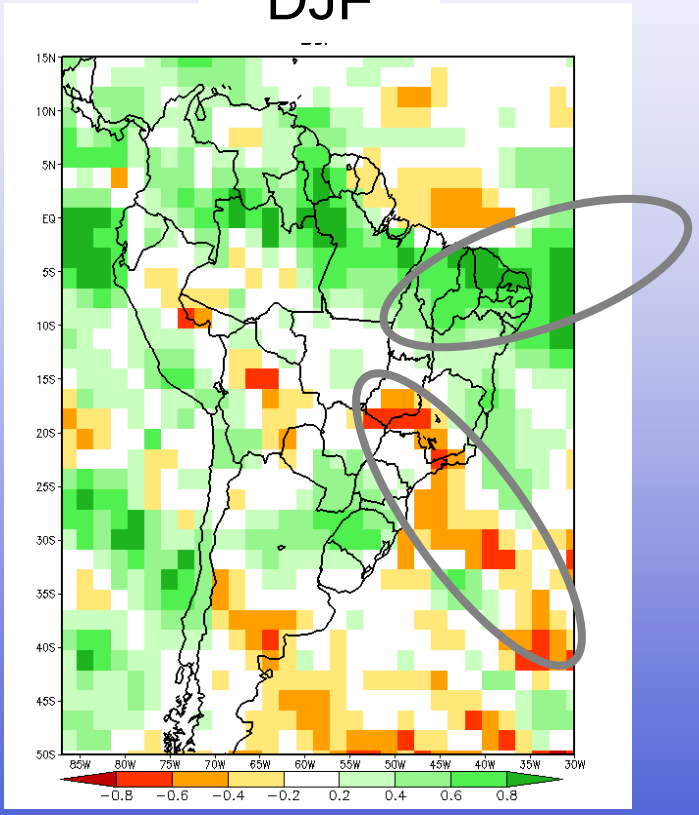
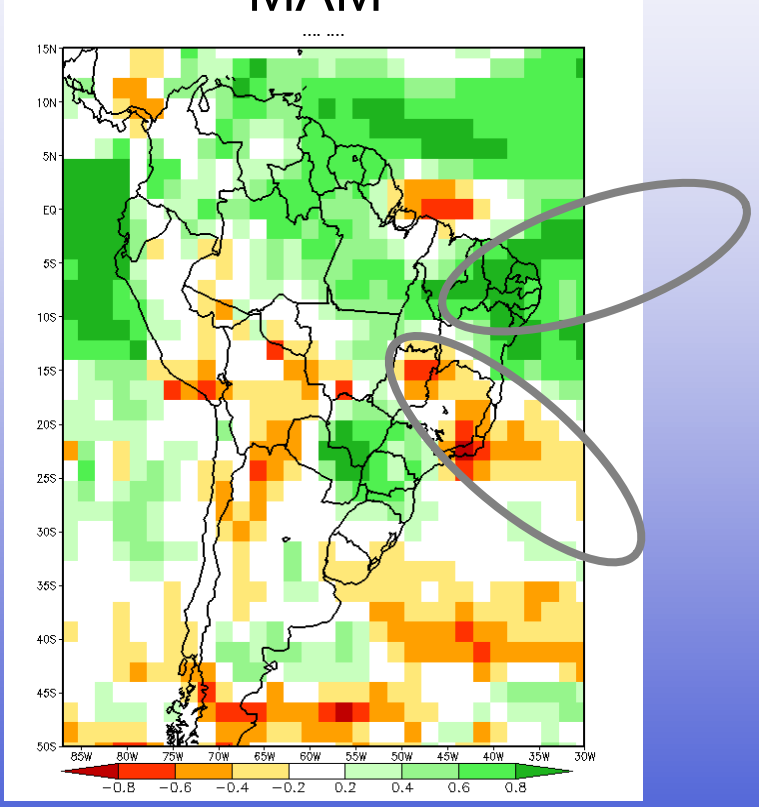
Seasonal Precipitation Anomaly Correlation

CPTEC AGCM simulation and CAMS precip.

DJF



MAM



Marengo et al. (2002)

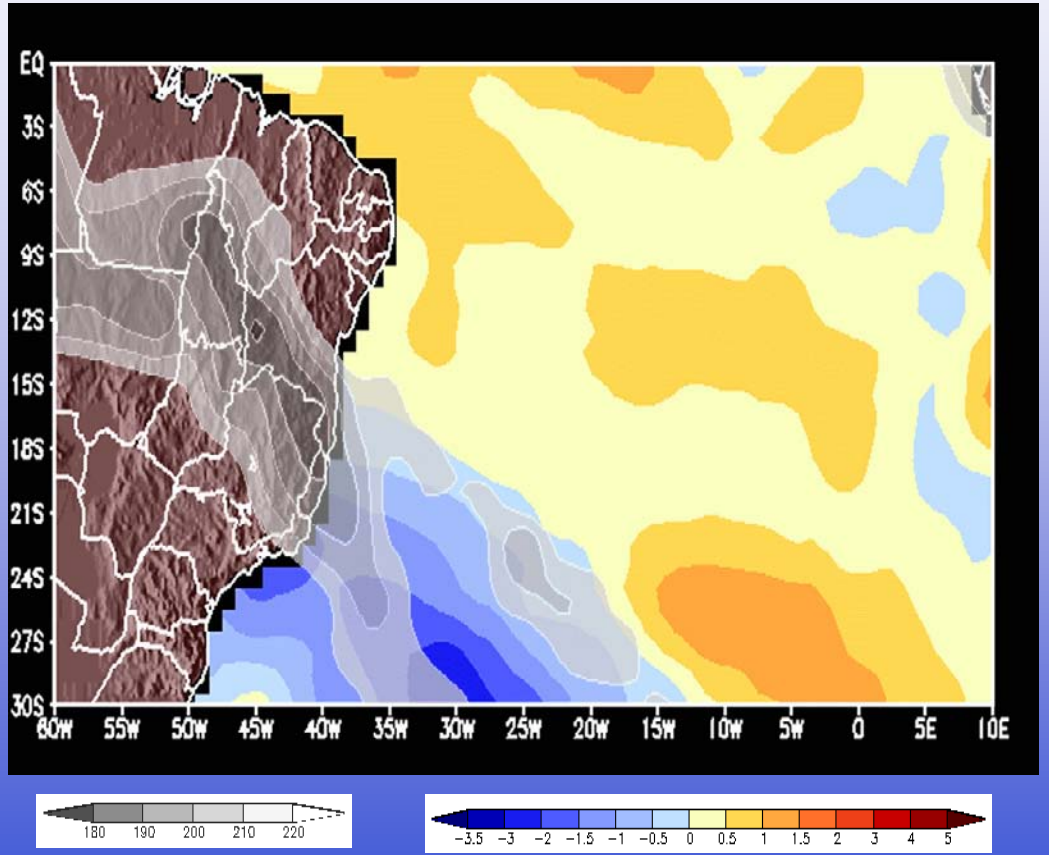
CPTEC AGCM, 50 years, 10 Member Ensemble, Kuo, T062L28, Obs SST

The SACZ 2-tier Quest

South Atlantic Convergence Zone & SSTA

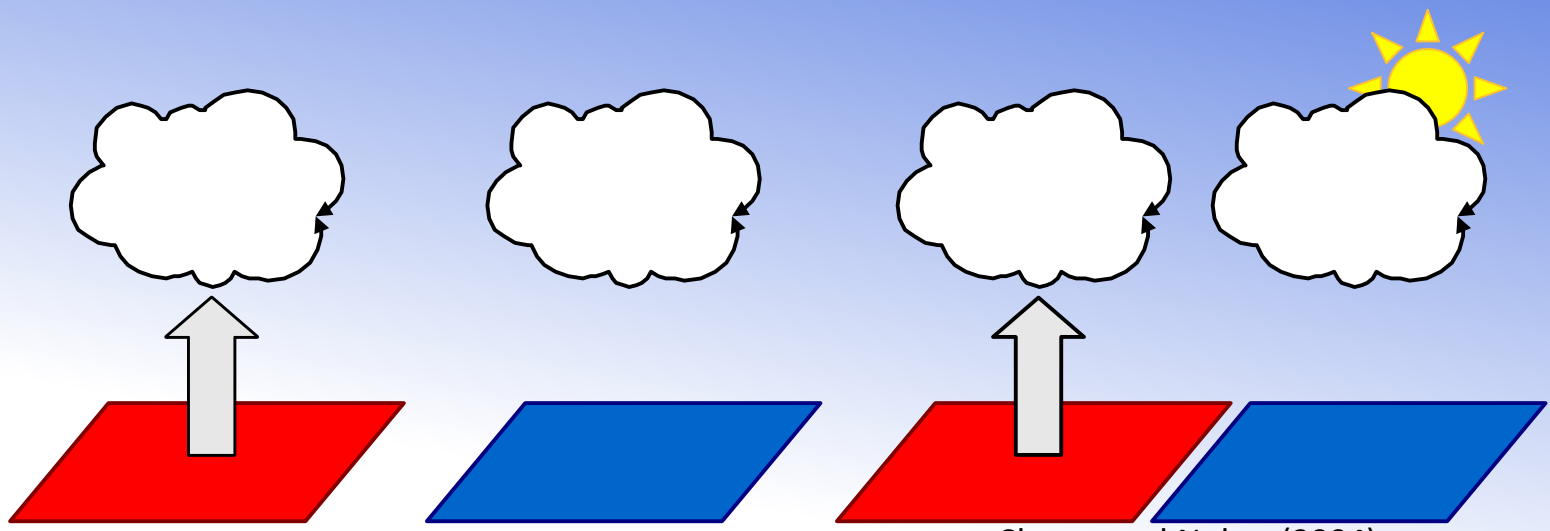
- SACZ formation over cold waters => Atmospheric forcing of underlying SST?

- Robertson and Mechoso (2000)
- Barreiro et al (2002)
- Chaves and Nobre (2004)
- De Almeida et al (2007)
- Nobre et al (2012)



OLR SSTA

The dynamics of the SACZ



Hidrostatic

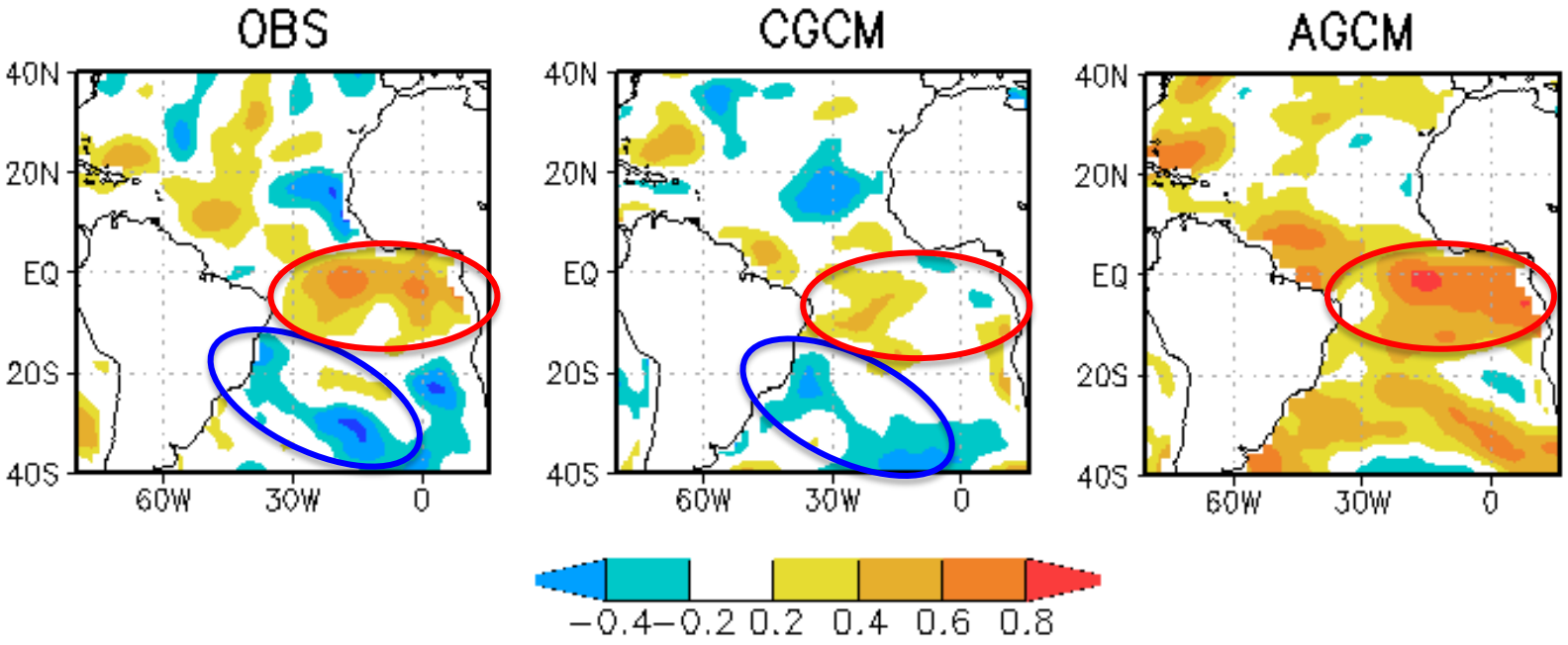
Robertson & Mechoso (2000)
Barreiro et al (2002)

Chaves and Nobre (2004)
De Almeida & al (2007)
Nobre et al. (2012)

SST- => SACZ+

SST+ → SACZ+ → SST-

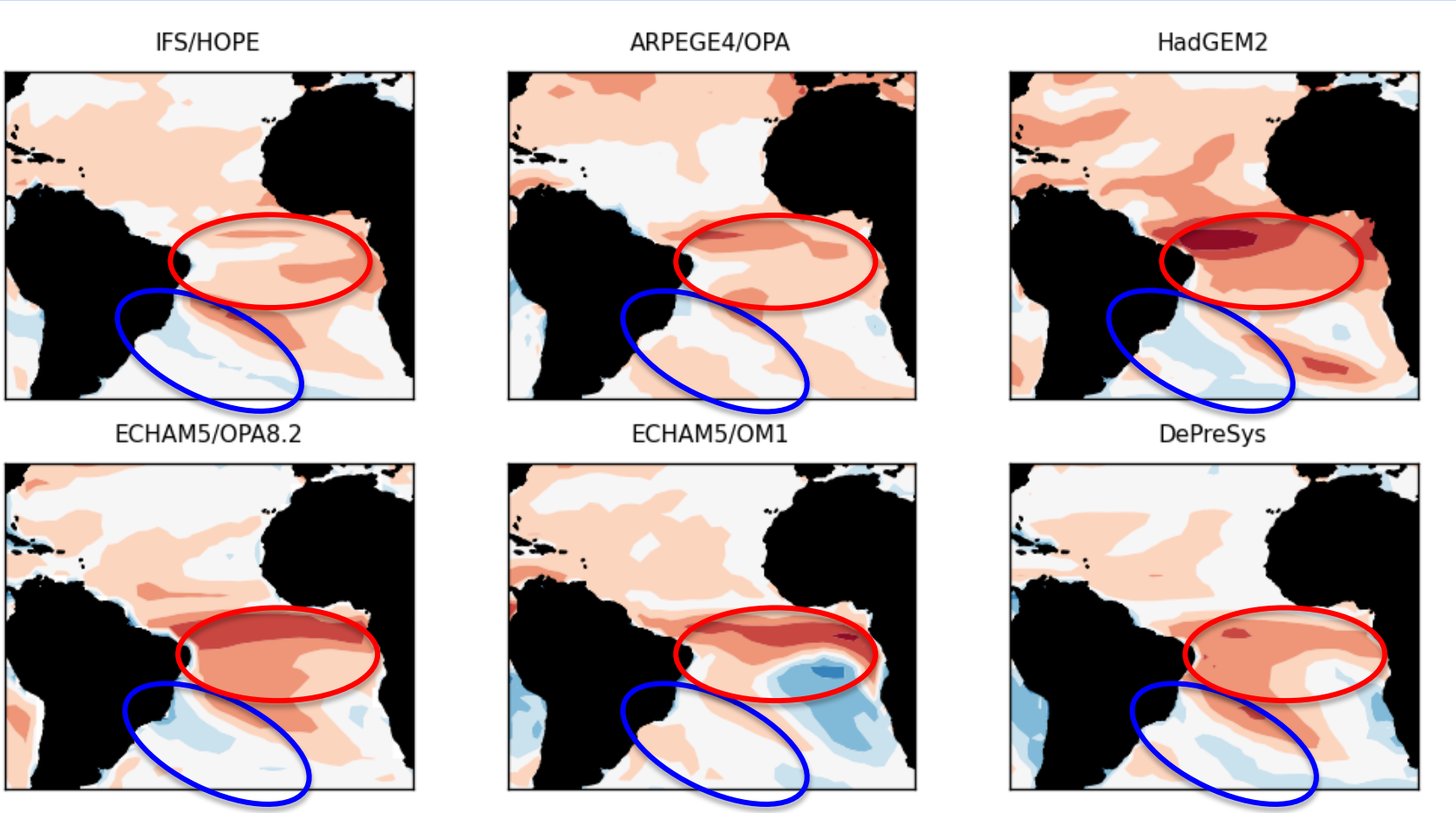
Rainfall – SST
Anomaly Correlations



20 years, 10 member ensemble CGCM & tween AGCM runs

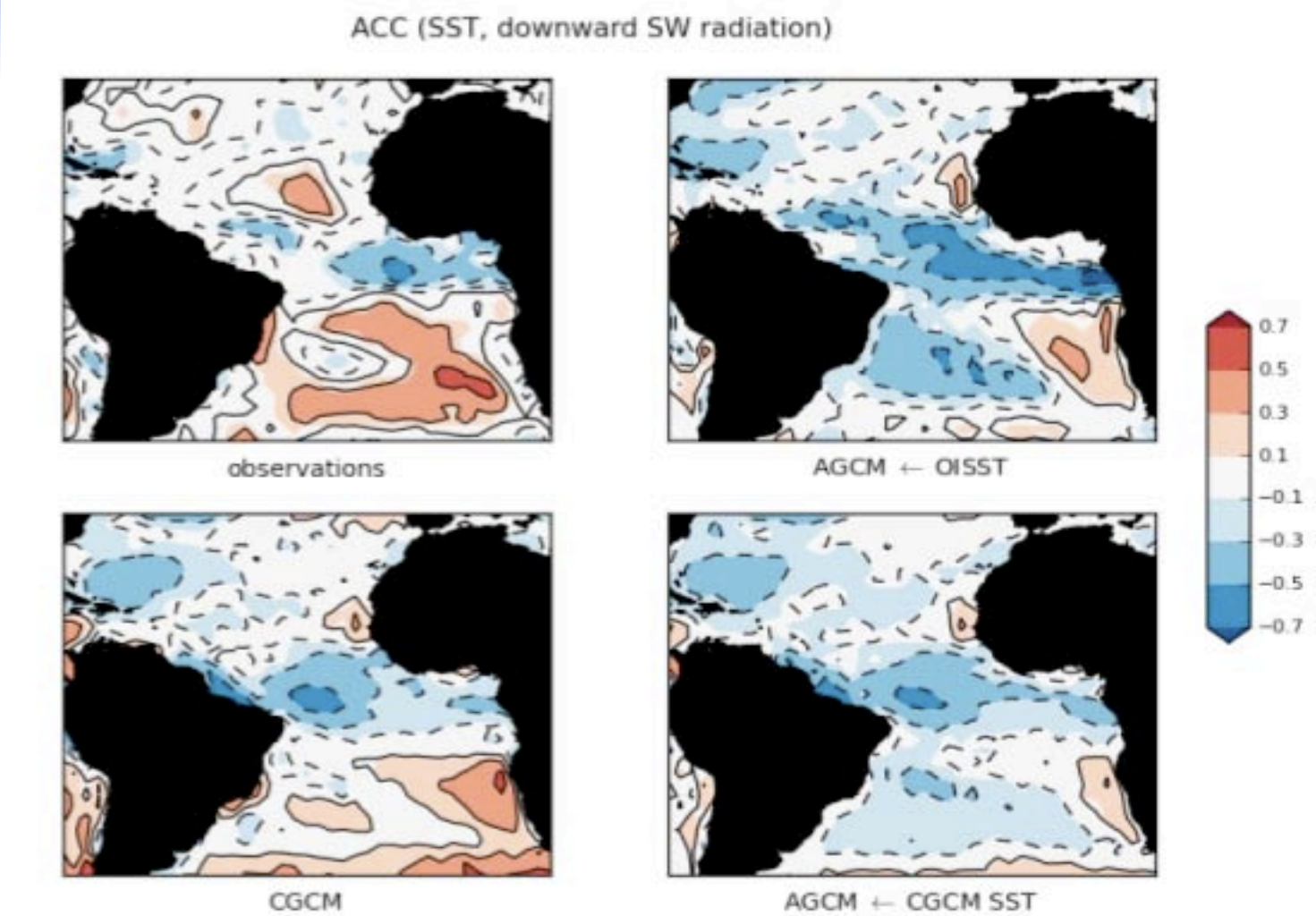
Nobre et al. (2012, in press)

Ensembles Coupled Forecasts SST-Rainfall Anomaly Correlations



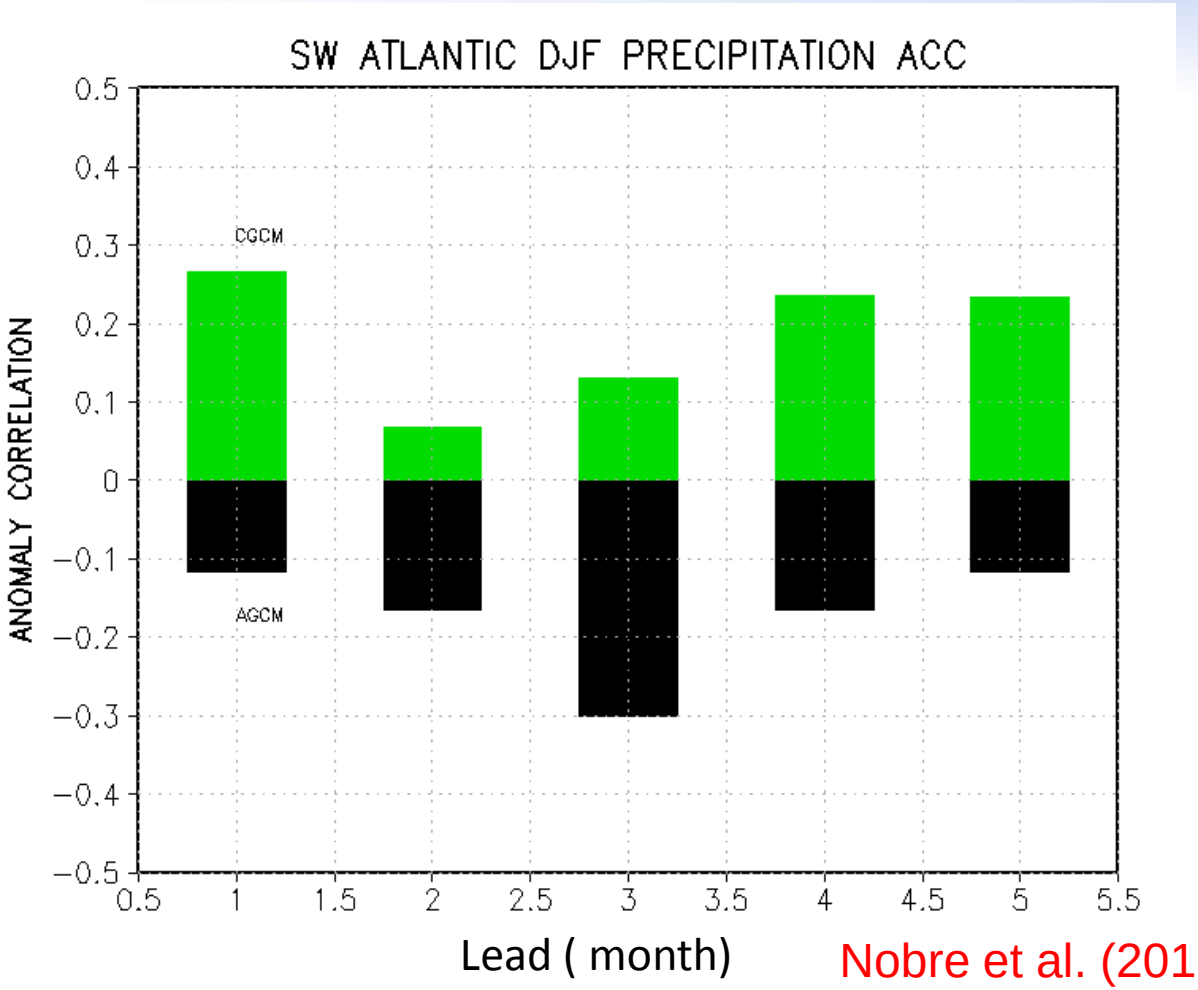
Nobre et al. (2012, in press)

Ensembles Coupled Forecasts SST-SWR Anomaly Correlations



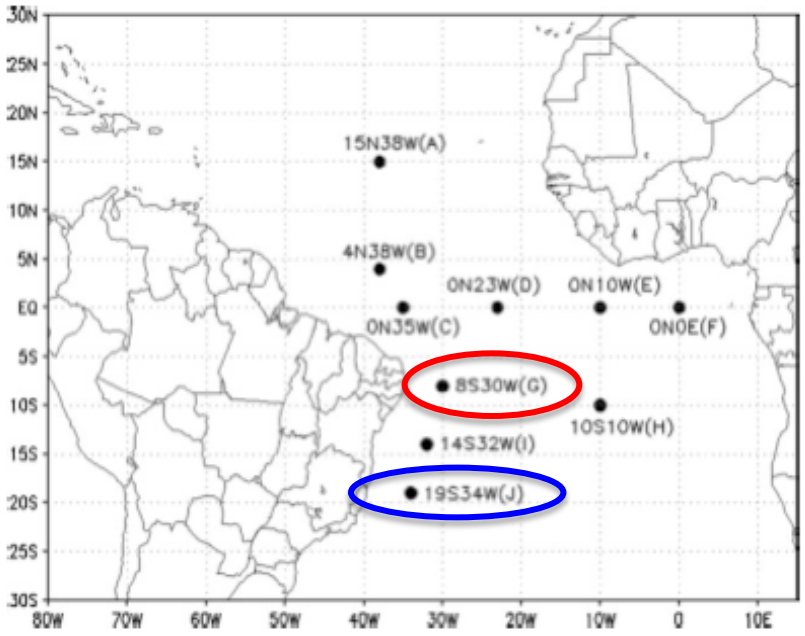
Nobre et al. (2012, in press)

South Atlantic SST Predictability



Nobre et al. (2012, in press)

Validation with PIRATA data



Cross correlation	Buoy at 8 S-30 W	Buoy at 19 S-34 W
SAT.SST	**0.91**	**0.94**
SWR.PREC	**-0.64**	**-0.74**
SAT.SWR	*-0.38*	*0.49*
SST.SWR	-0.18	*0.41*
SAT.PREC	*0.56*	-0.32
SST.PREC	0.33	-0.19

Nobre et al. (2012, in press)

- What about the performance of a nested regional model in the AGCM and CGCM?

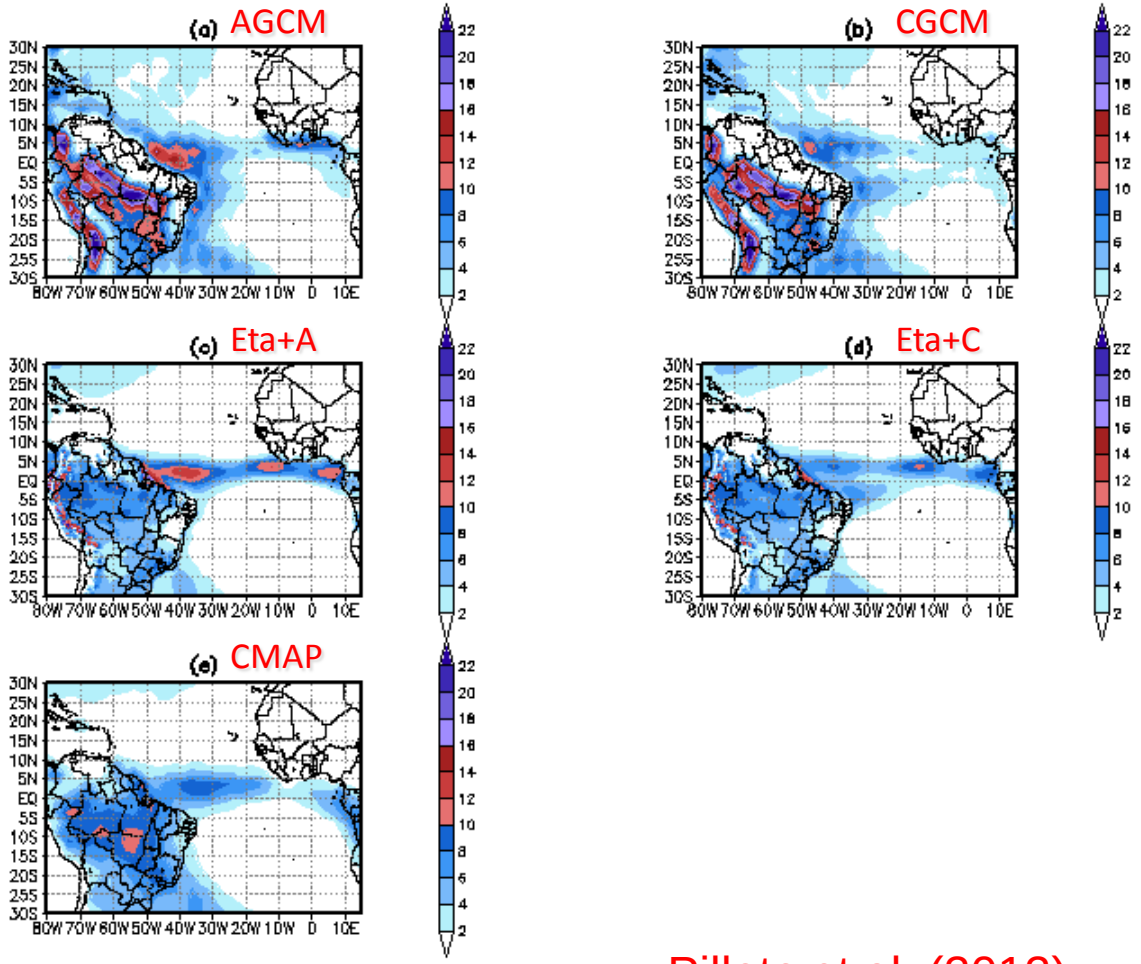
- What are the effects of the model resolution/physics and smaller errors on the lateral boundary conditions provided by the CGCM?

Seasonal climate hindcasts with Eta model nested in CPTEC coupled ocean-atmosphere general circulation model

- CPTEC CGCM (version 1; Nobre et al., 2009)
- Eta model (40-km horizontal resolution) nested in the CPTEC CGCM (exp. Eta+C)

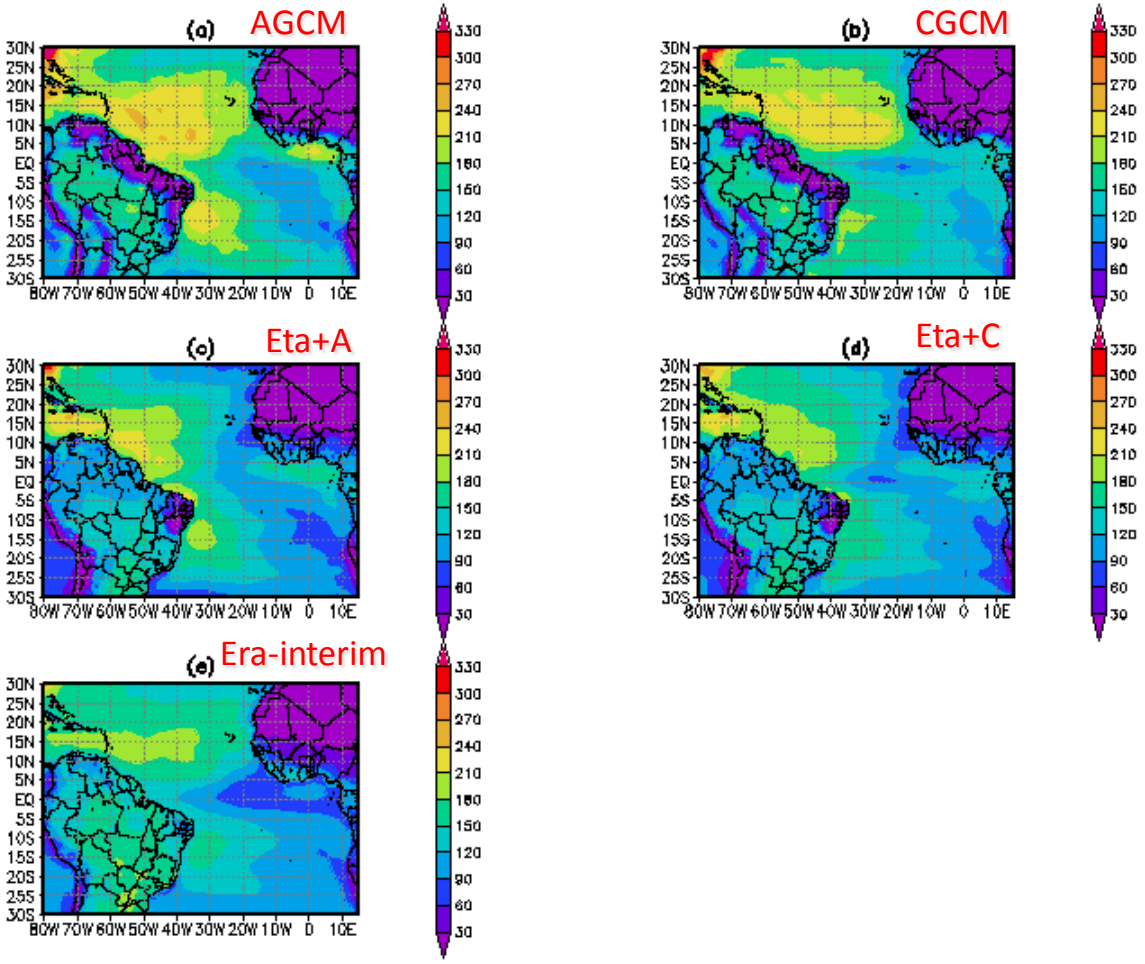
Precipitation (mm/day)
DJF 1997-2006

- Although, the CGCM produced a split in the ITCZ, the CGCM produced the smallest precipitation errors in comparison with AGCM
- The Eta+C also produced a split in the ITCZ, which is probably associated with the cold SST bias produced by CGCM in this area
- The Eta+C showed the best results for precipitation



Pilloto et al. (2012)

Latent heat flux (W/m2)
DJF 1997-2006



- The nested runs improved the latent heat flux hindcasts, in particular the Eta+C, in comparison with the driver global models.
- Over the ocean, the AGCM overestimated the latent heat flux more than the CGCM
- Over the southeastern Atlantic, the latent heat flux from the CGCM is higher than the AGCM, which is probably associated with the warm SST bias of the CGCM in that region

Overall, the Eta+C produced better forecasts than Eta+A forecasts

Why?

- the regional model resolution/physics
- smaller errors on the lateral boundary conditions (large scale circulation) provided by the CGCM

In long term integration of the regional model, the lateral boundary forcing is stronger than the lower boundary forcing as was also found in Chou et al. (2002)

Pilloto et al. (2012)

Conclusions

- Coupled modes between ocean-atmosphere are essential to represent SACZ rainfall over cold waters.
- Although, the CGCM produced a split in the ITCZ, the CGCM produced the smallest precipitation errors in comparison with the AGCM.
- The nested runs improved the latent heat flux and precipitation hindcasts, in particular the one nested in the CGCM.

Thank you