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**Role of the global oceans
and land-atmosphere
interaction on summertime
interdecadal rainfall variability
over Southeastern South America**

or

Has rainfall over SESA potential predictability
on interdecadal time scales?

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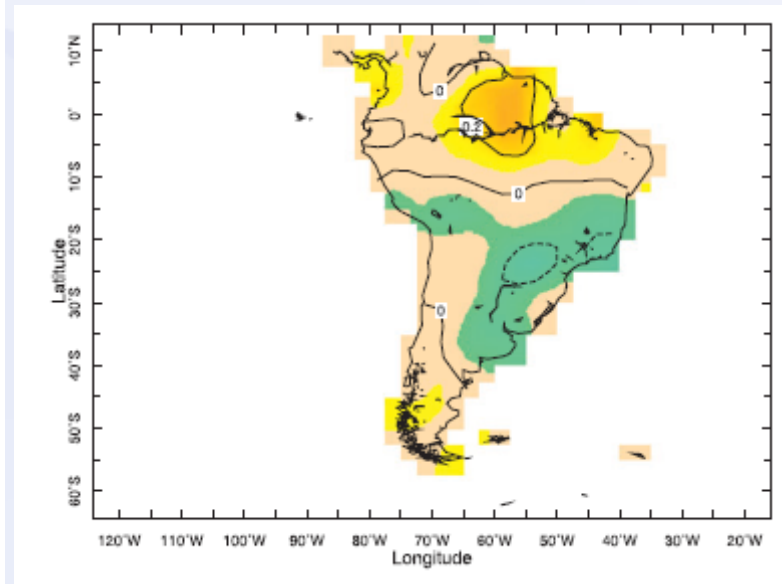
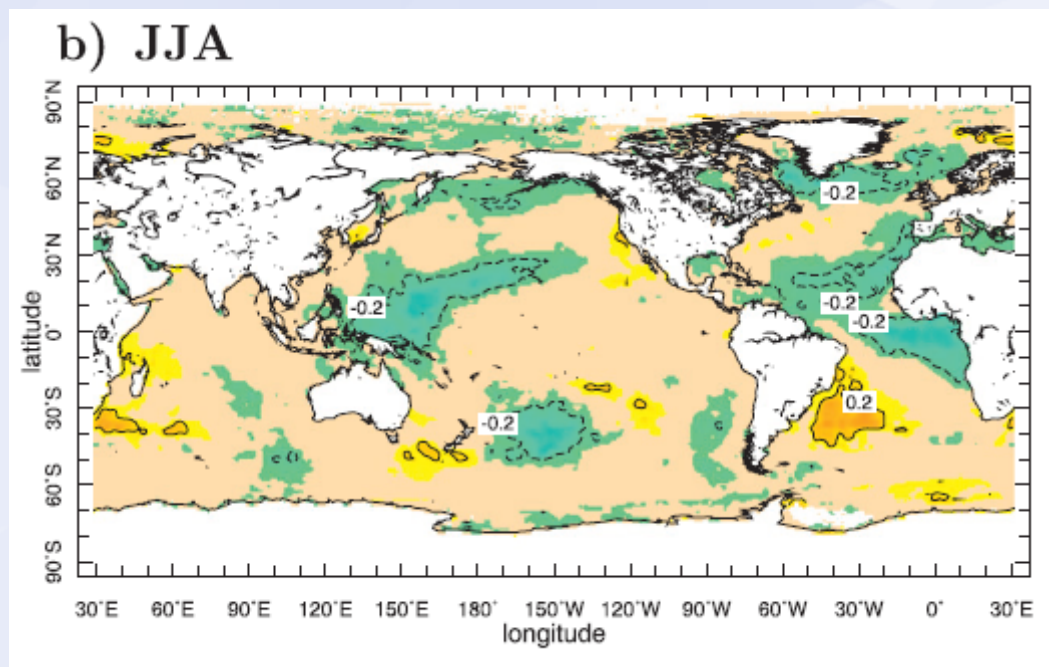
Motivation

- Southeastern South America is strongly influenced by ENSO on interannual time scales (million references...).
- On interdecadal time scales the story is not as well understood
 - Kayano and Andreoli (2007) – PDO affects ENSO teleconnection (constructive/destructive interference)
 - Barreiro (2010) – rainfall predictability changes in 1970s due to changes in ENSO particularly in fall.

- Seager et al (2010) – Atlantic Multidecadal Oscillation plays dominant role.

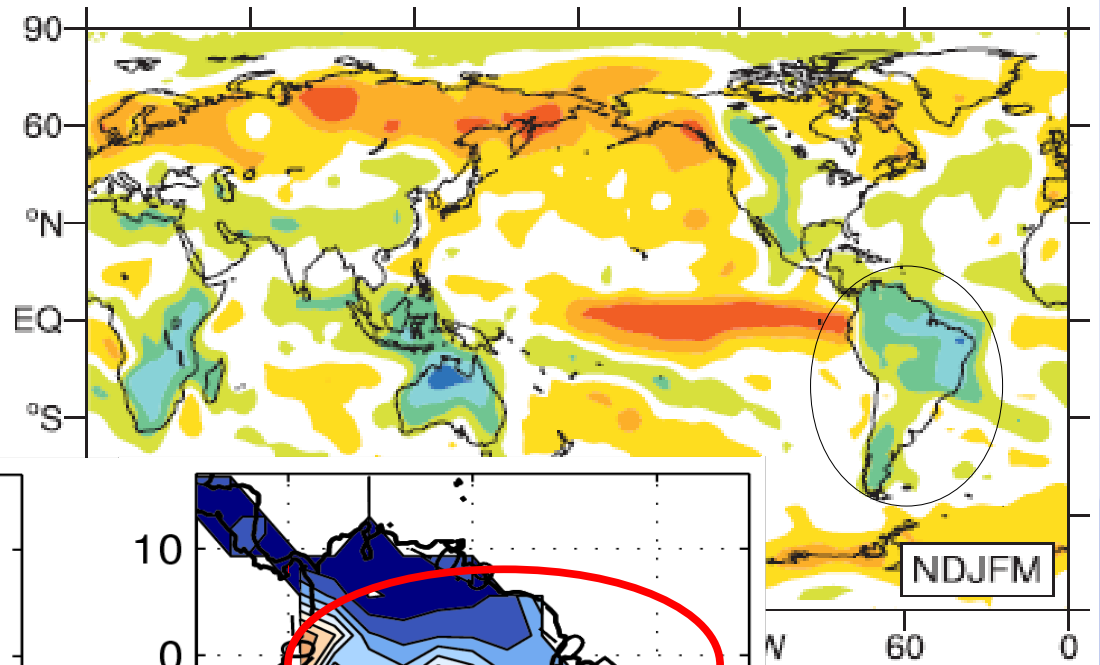
Equatorial SST < 0 promote wet conditions over SESA (particularly during winter).

Observed rainfall trend in SESA partly due to AMO.

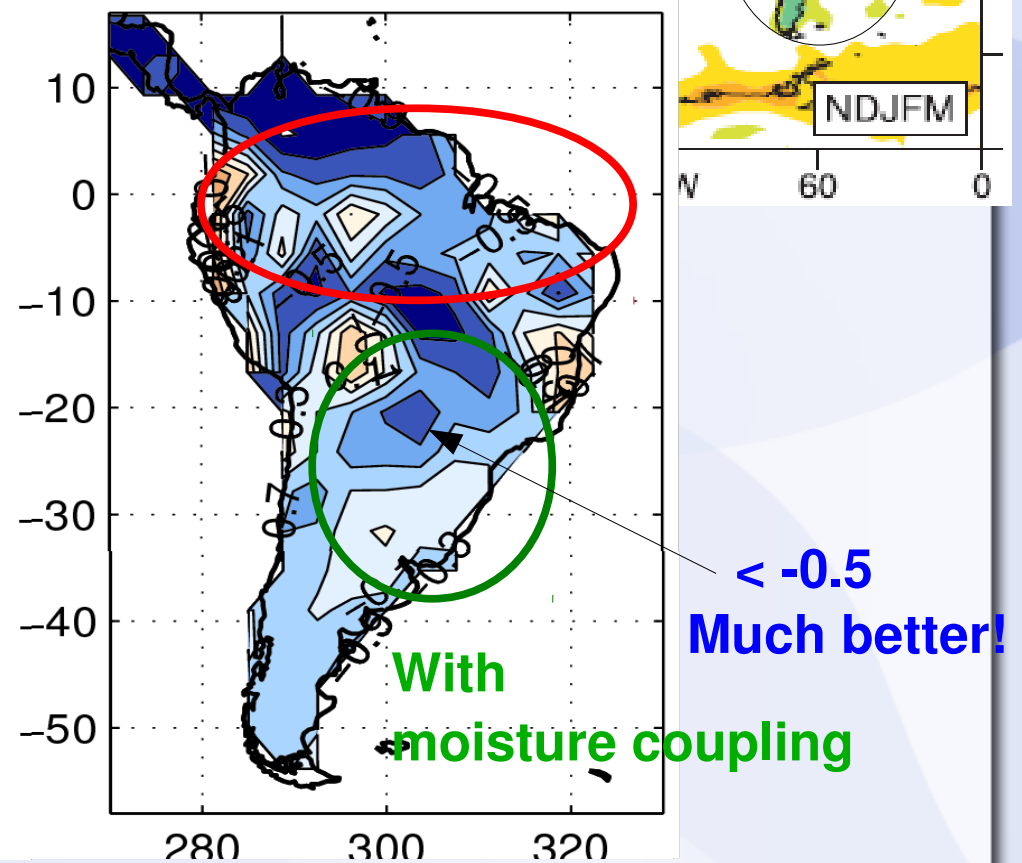
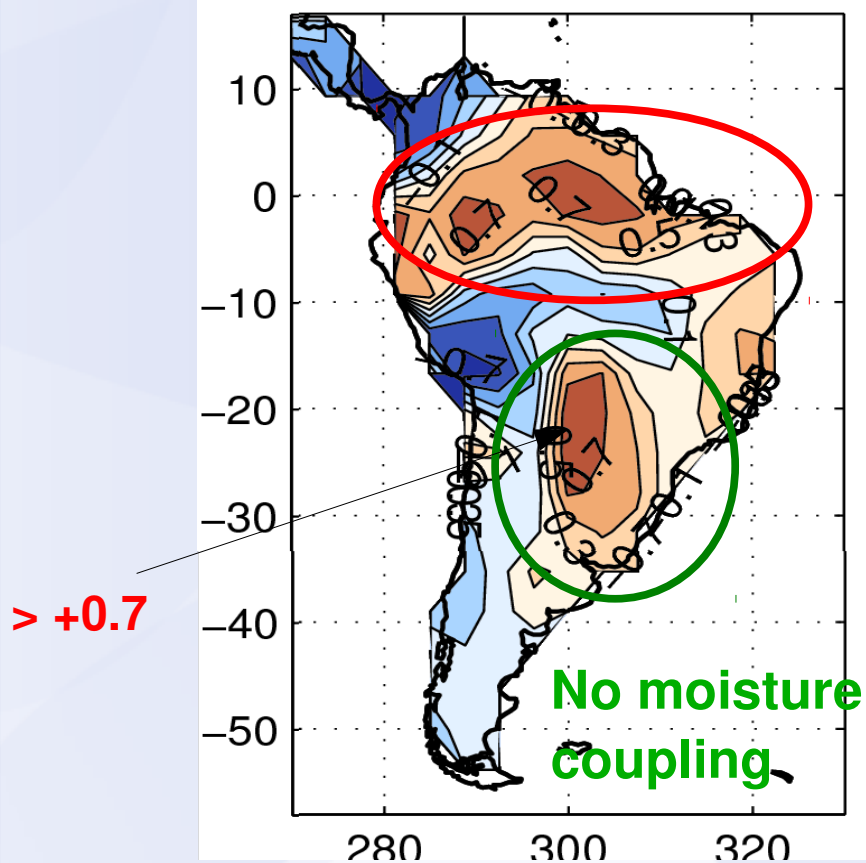


Land-atmosphere coupling

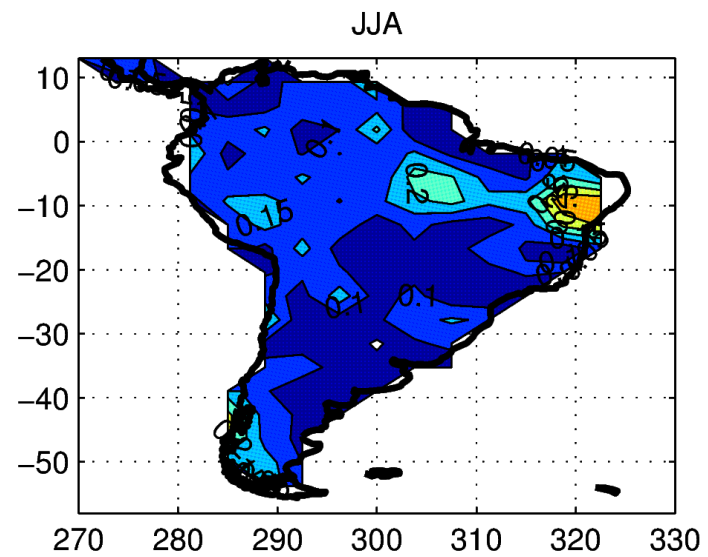
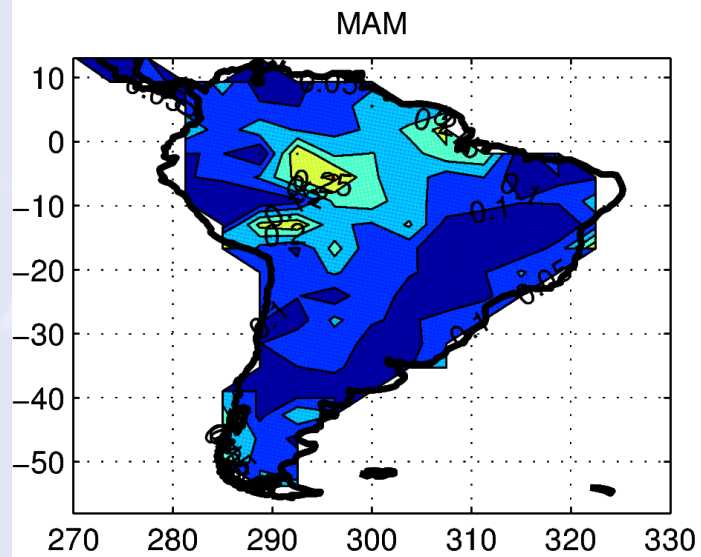
Correlation between Rainfall and SAT in NDJFM
(Trenberth & Shea 2005)



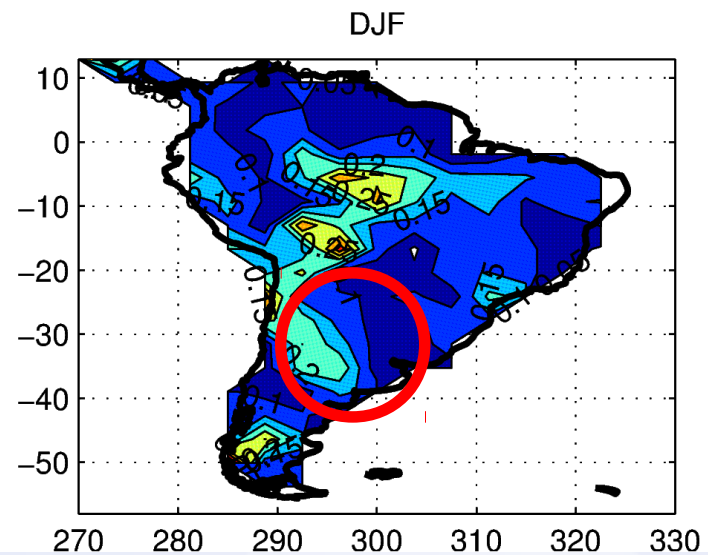
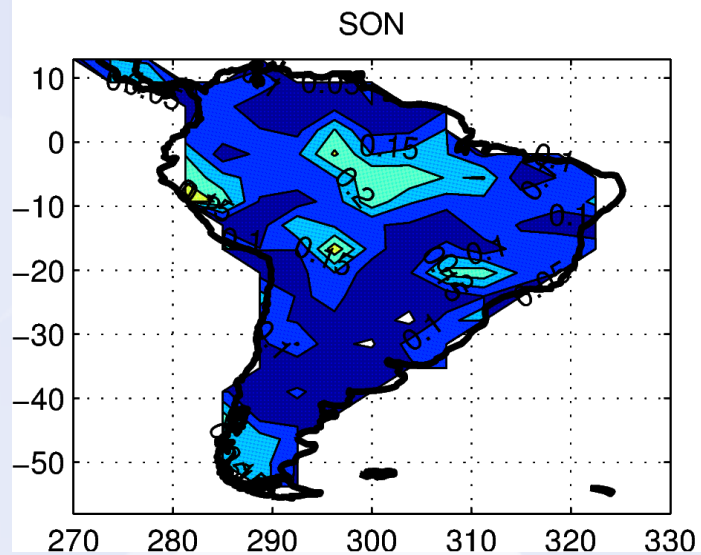
ICTP AGCM



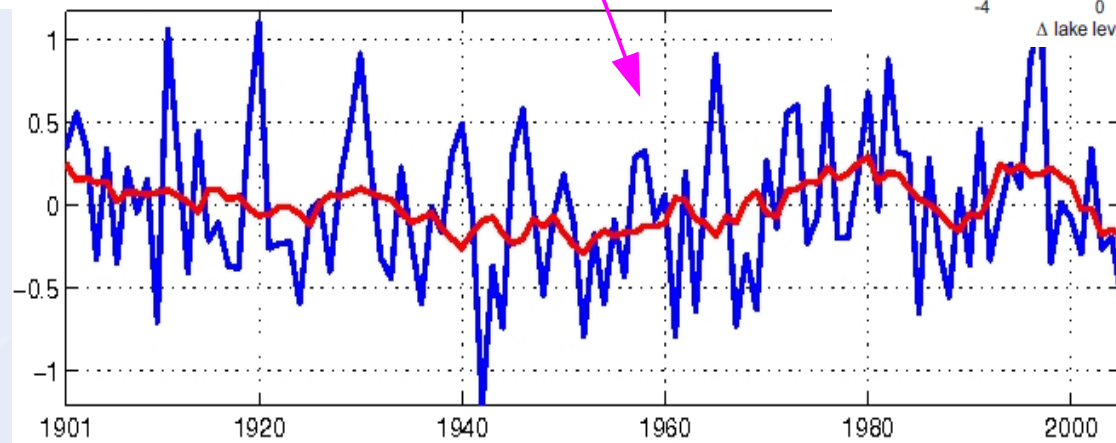
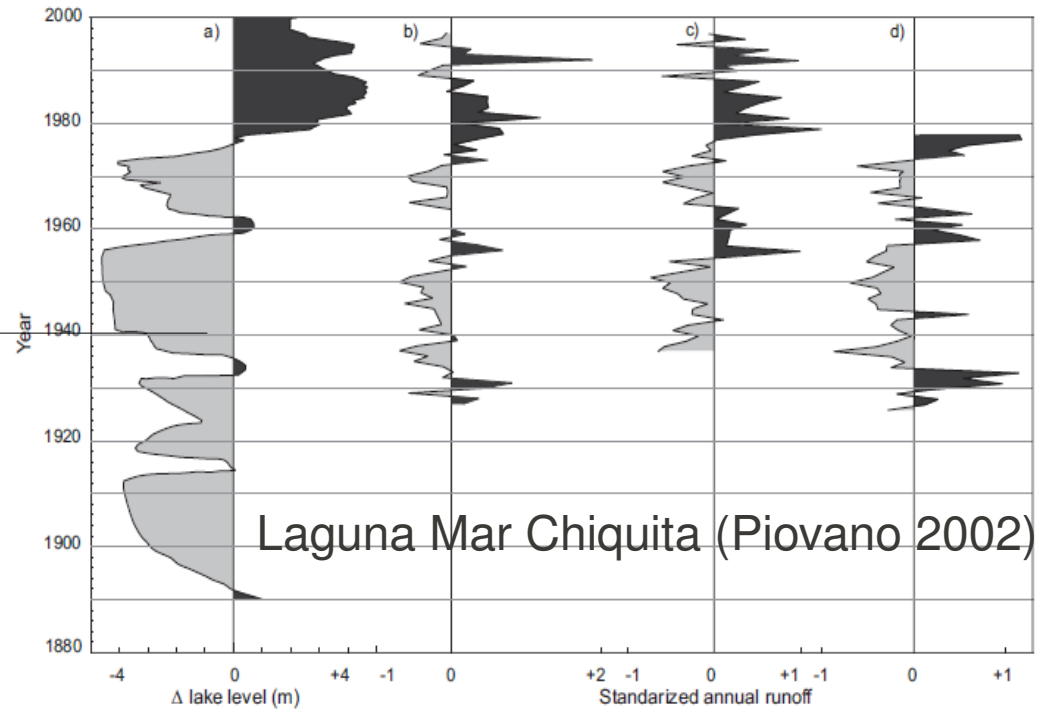
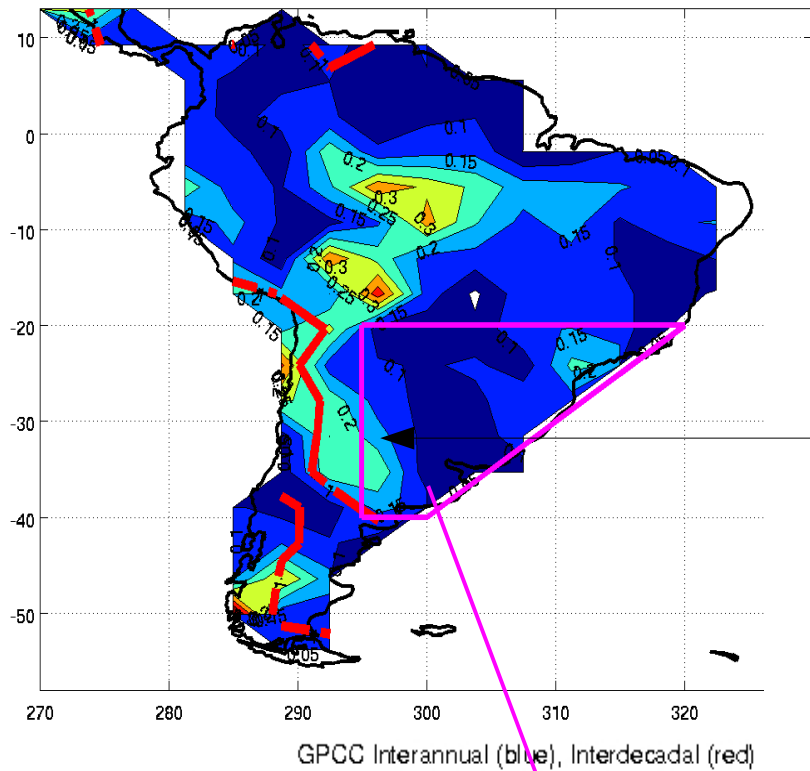
GPCC Interdecadal/Interannual Variance Ratio



GPCC Variance ratio Interdecadal/Interannual



DJF rainfall variability



**Interdecadal: 9 point
running mean.**

Datasets

- Rainfall:
 - GPCP (1901-2006) $1^\circ \times 1^\circ$
- Sea level pressure
 - 20th century Reanalysis
- ICTP AGCM (1901-2006), T30L8 ($3.875^\circ \times 3.875^\circ$)
 - GOGA: AGCM forced with global historical SST and prescribed soil moisture.
 - GOGA-AL coupled with SLand model (Zeng et al 2000).
 - POGA-AL: AGCM forced with Pacific-only SST with land-atmosphere coupling.
 - 10-member ensembles

Correlation between simulated and observed rainfall in SESA DJF

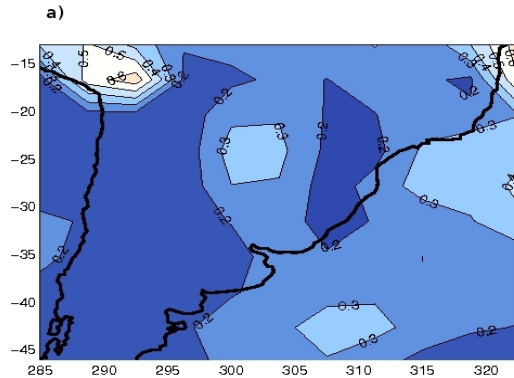
		Interannual		Interannual detrended	
Effect of Pacific	GOGA- AL	0.21	0.26	0.16	0.50
	GOGA	0.07	0.19	-0.35	0.30
	POGA- AL	0.42	0.30	0.74	0.05
		Interdecadal		Interdecadal detrended	

Land-Atmo Interaction

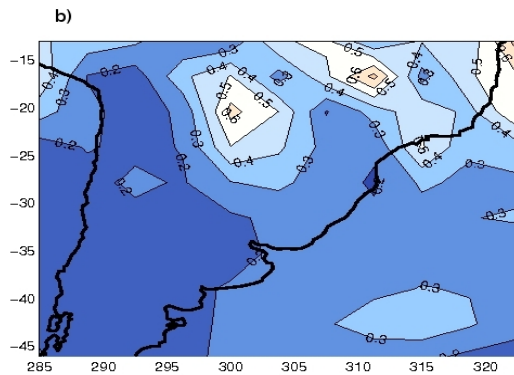
- The linear trend is governed by the Pacific.
- The interdecadal variability dominated by the global oceans with land-atmosphere interaction playing a role

Signal/noise Variance of Ensemble Interannual

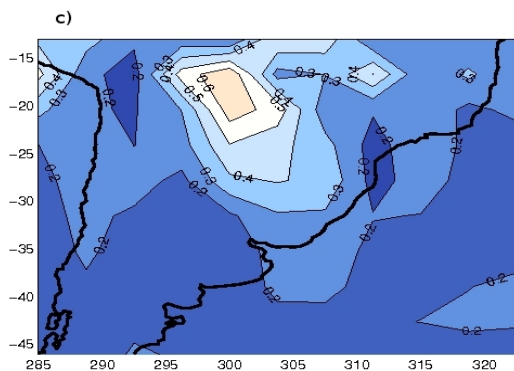
GOGA



GOGA-AL



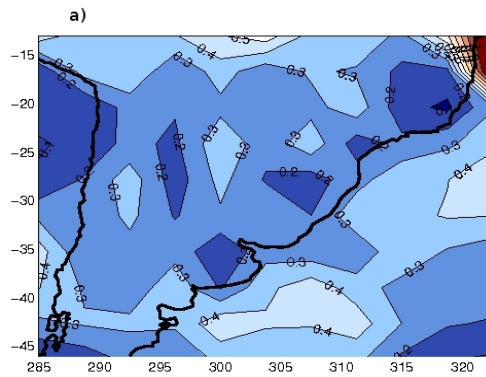
POGA-AL



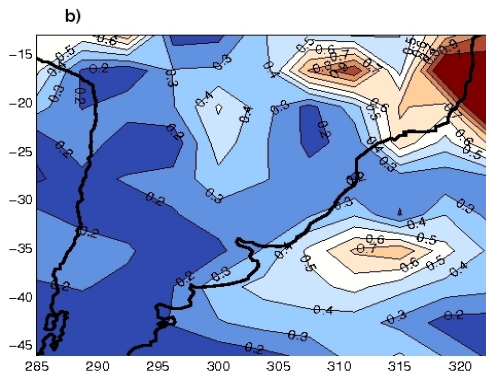
Land-atmosphere Interaction induces more consistent precipitation anomalies among ensemble members.

Signal/noise Variance of Ensemble Interdecadal

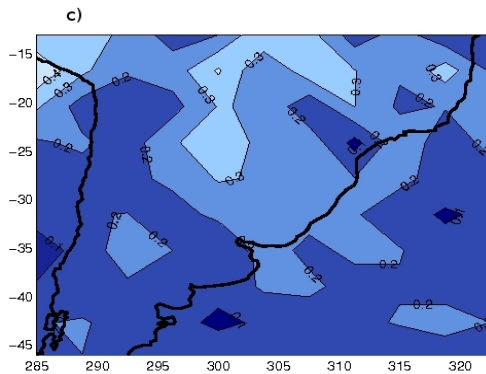
GOGA



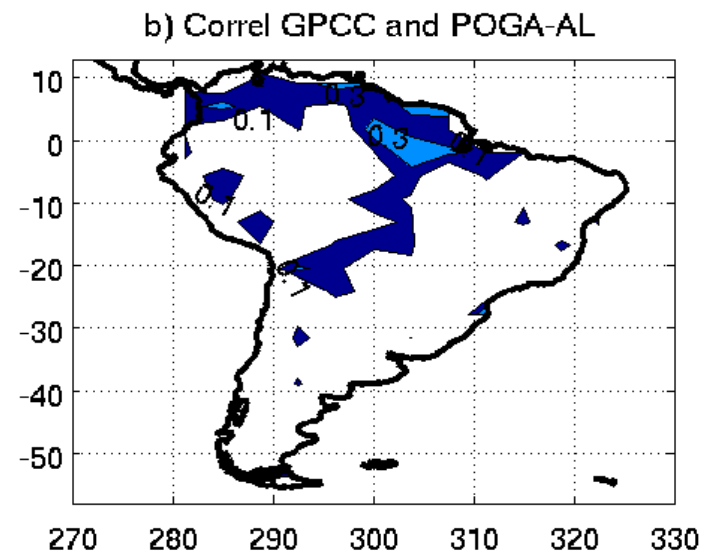
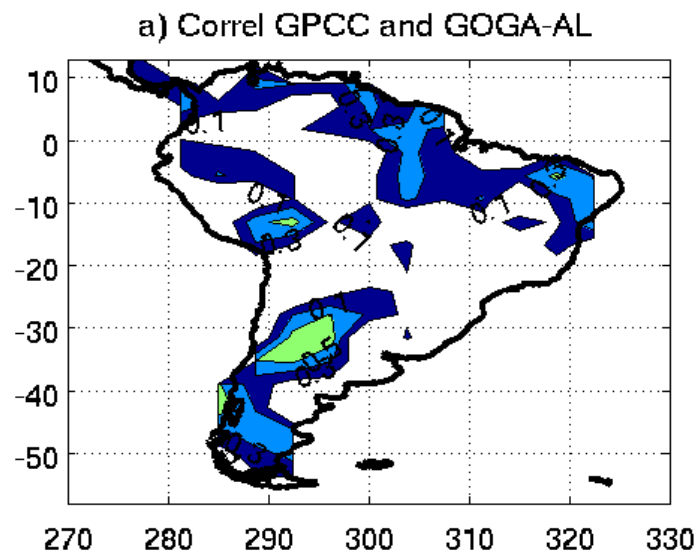
GOGA-AL



POGA-AL



Same as on interannual time scales, but now SACZ has stronger signal (not necessarily right).

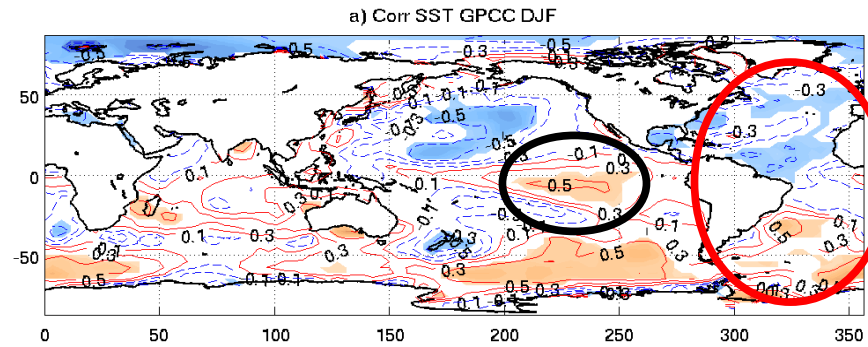
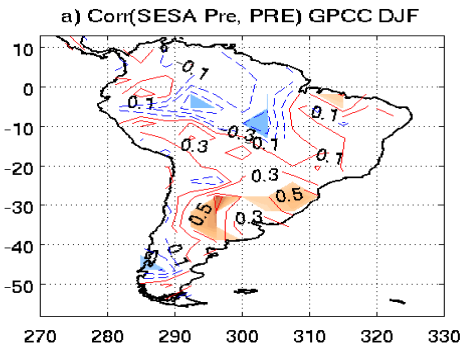


Point-to-point correlation between GPCCC and ensemble mean

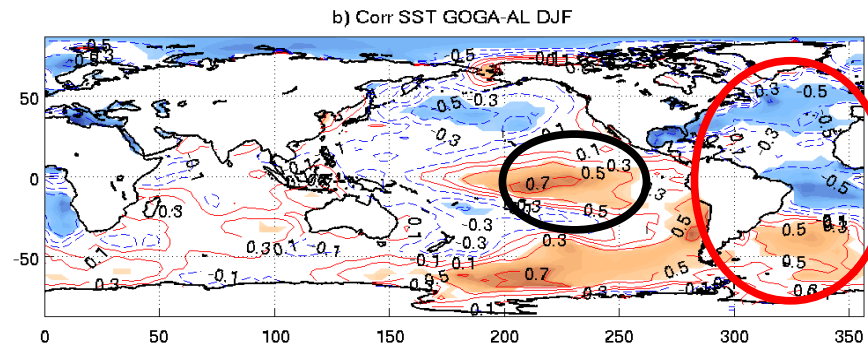
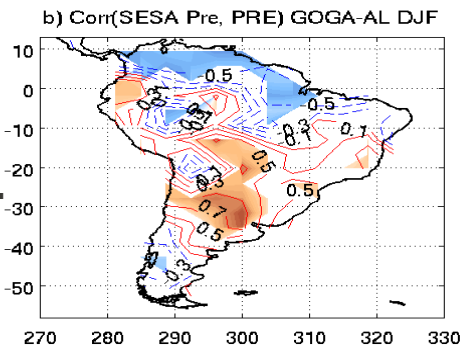
The westernmost part of SESA, the western Pampas, is the region where precipitation is well reproduced by the model when forced with global SST.

Correlation between SESA rainfall and South America rainfall and SST

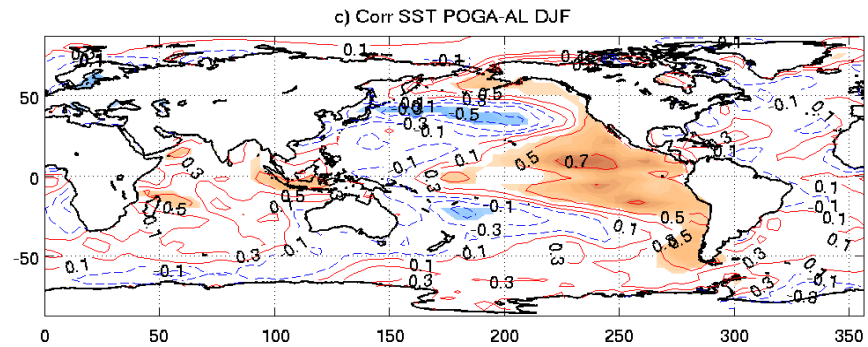
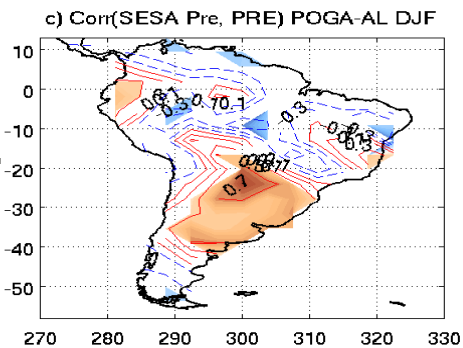
OBS



GOGA-AL



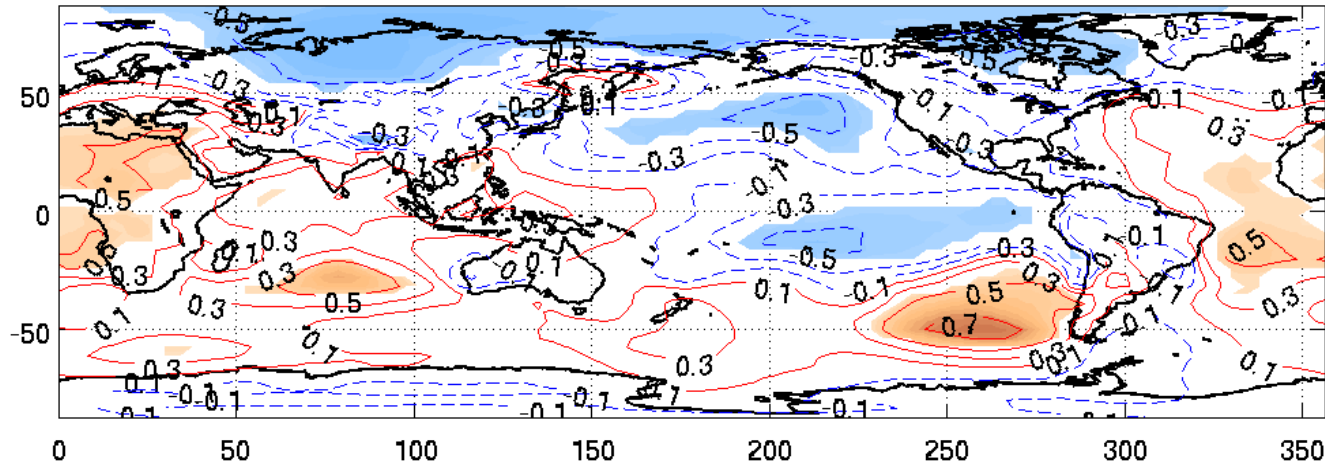
POGA-AL



GOGA-AL reproduces the right connections of the western Pampas to the global oceans

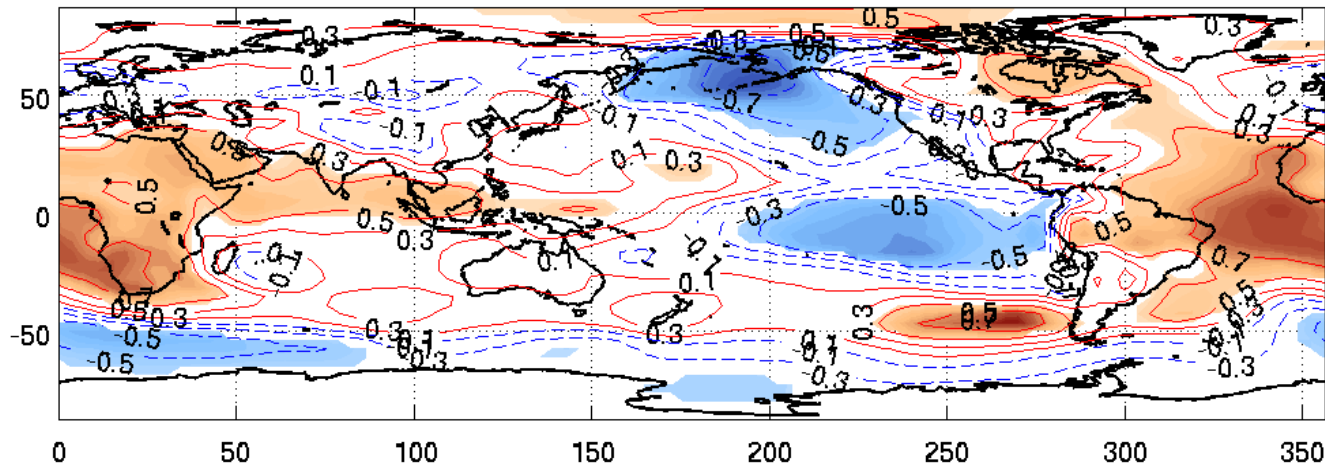
Correlation between SESA rainfall and SLP

a) Corr SLP OBS DJF



20th Century
Reanalysis

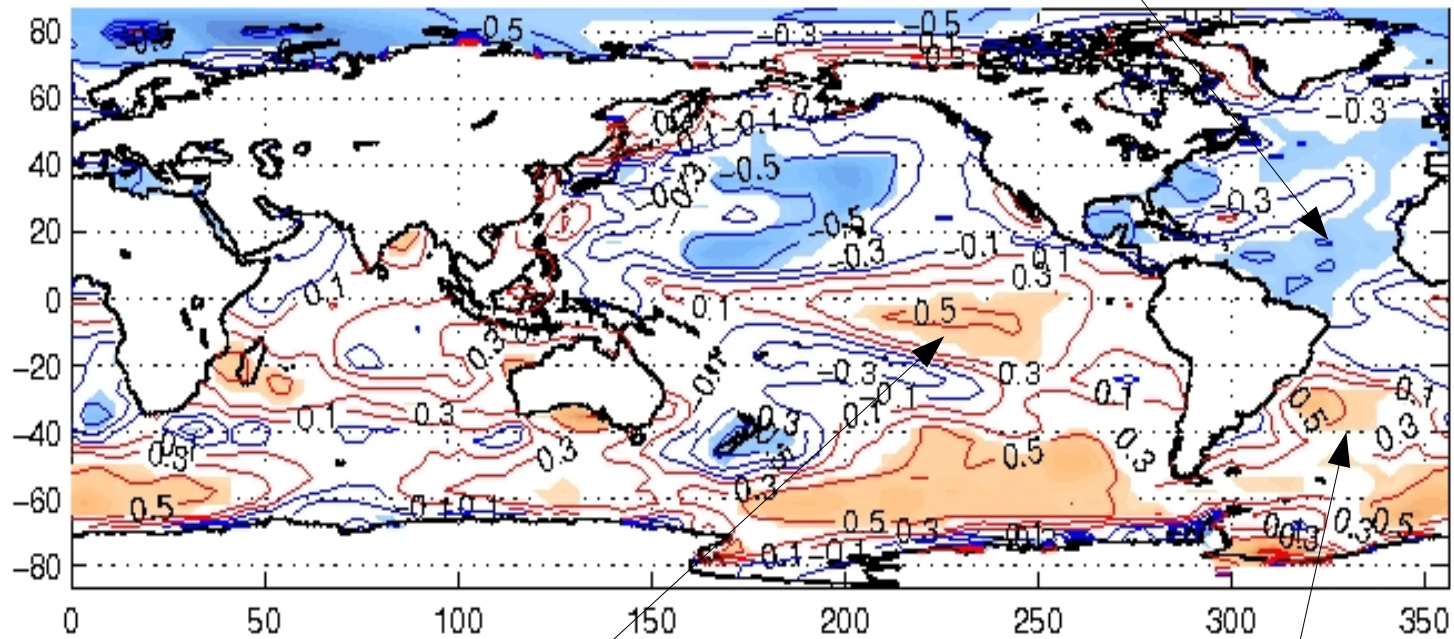
b) Corr SLP GOGA-IC2 DJF



GOGA-AL

GOGA-AL reproduces atmospheric circulation anomalies associated with rainfall in western Pampas

AMO? ($r=-0.46$)



PDO? ($r=0.09$)

Changes in Atlantic
Anticyclone / SACZ?

Mechanisms

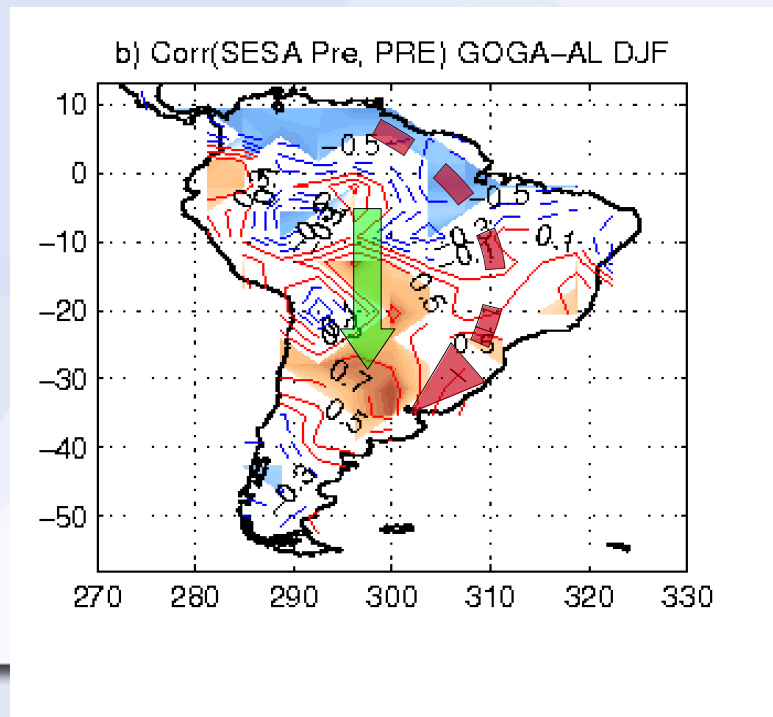
- Barreiro and Tippmann (2008)

Those El Niños that coincide with cold equatorial Atlantic induce stronger rainfall anomalies in DJF due to larger moisture supply from Amazon and convergence over SESA.

- Mo and Berbery (2011)

The combination warm Pacific-cold TNA induces persistent wet spells in subtropics due to

- Stronger southward flow from Amazon,
- Weakens regional Hadley cell and thus weakens subtropical subsidence.



Summary

- The western Pampas is the region with largest interdecadal/interannual variance ratio over SESA during DJF.
- The interannual variability and the linear trend are well captured by a model forced with Pacific-only SST (agrees w. Haylock et al 2006).
- The interdecadal variability over the western Pampas is the result of Pacific and Atlantic SST anomalies such that a positive C. Pacific-negative TNA see-saw induces increased rainfall.
- Origin of SSTa?

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"LINC"
Learning about Interacting Networks in Climate

The LINC Project

Improving our understanding of the Earth's complex climate phenomena, such as El Niño-Southern Oscillation (ENSO), has a huge economic and social impact for present and future generations, and can underpin advances in areas as diverse as energy, environment, agricultural and marine sciences. Given the complexity of the inter-relations between the subsystems that constitute our climate, it is important to approach the problem from an interdisciplinary perspective. However, there is a great shortage of qualified workforce to perform this task and a major challenge is the education and training of young qualified researchers that can approach climate phenomena from a complex systems point of view.

This requires knowledge from several fields such as physics, dynamical systems theory and computer science, and also requires a detailed understanding of Earth sciences such as meteorology and oceanography. There is also a clear need for improving the coordination and cooperation of the research teams working on these issues.

Marie-Curie Initial Training Network (ITN)

NEWS

20.02.2012 13:18
Kick-Off Meeting finished
The Kick-Off Meeting was held on 15. and 16. 2. in Barcelona.
Cat: newsforall

22.12.2011 15:27
LINC website launched!
On December 22nd 2011 the first version of the LINC website launched.
Cat: newsforall
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Improve the present understanding of atmospheric teleconnection processes by employing as a framework complex network theory and analysis