

A seca nos verões de 2013/14 e 2014/15 na região Sudeste do Brasil: possíveis causas

Pedro Leite da Silva Dias ^{(1), (2)}

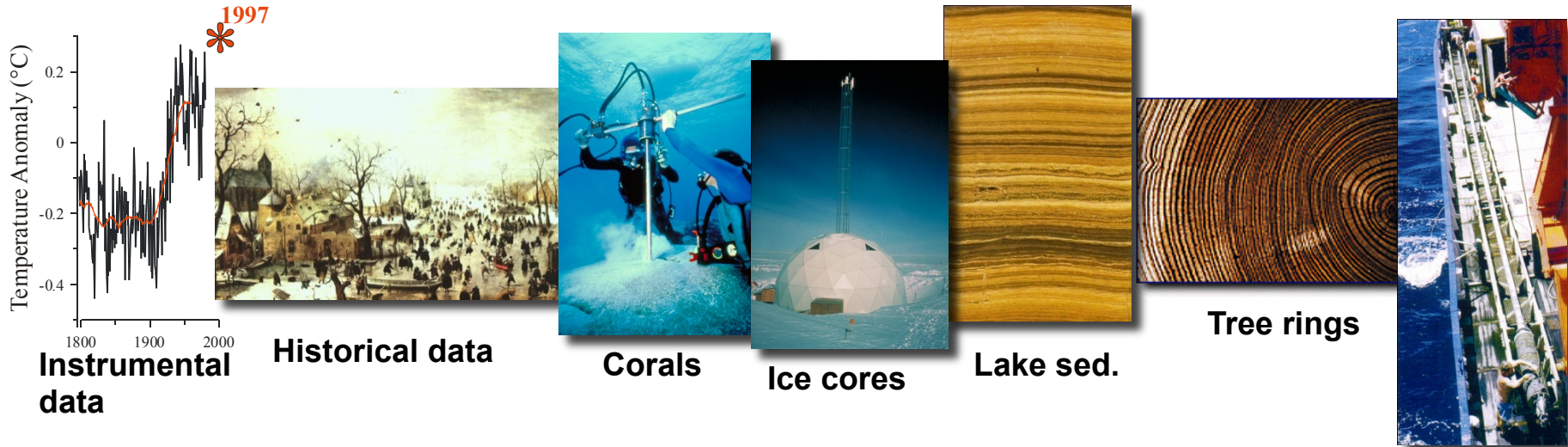
Maria Assunção Faus da Silva Dias ⁽²⁾

(1) Laboratório Nacional de Computação Científica/MCTI

(2) Instituto de Astronomia, Geofísica e Ciências Atmosféricas/USP

Universidade Federal de Santa Catarina, 24 de Abril de 2015

Paleoclimatic Reconstruction



“Instrumental records span only a tiny fraction of the Earth’s climatic history and so provides a totally inadequate perspective on climatic variation and the evolution of climate today”

“Only when the causes of past climatic fluctuations are understood it will be possible to fully anticipate or forecast climatic variations in the future”

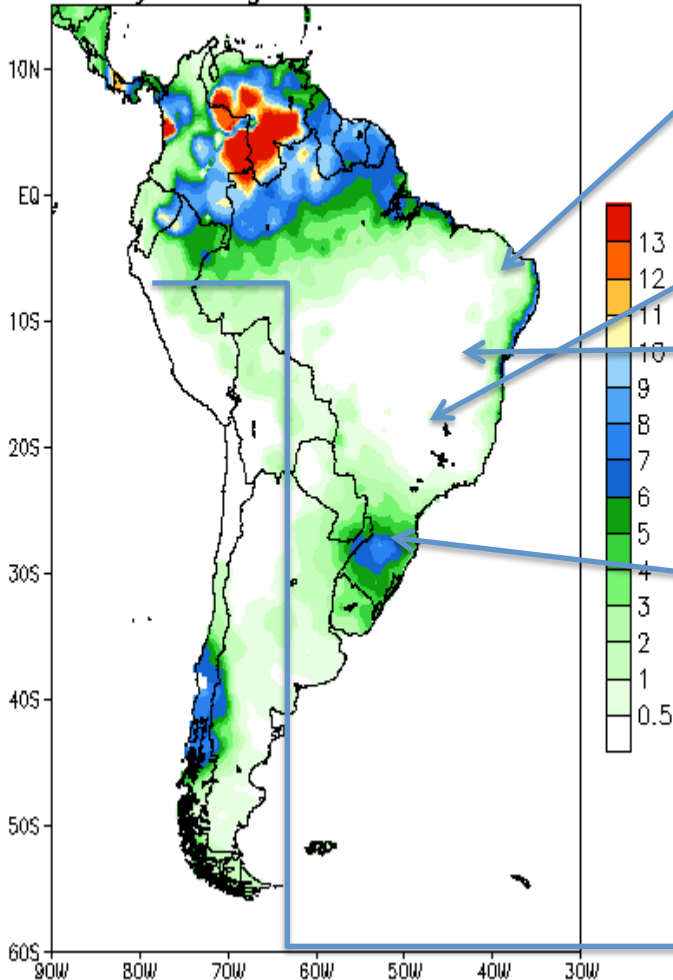
Raymond S. Bradley

Goals: Extend the instrumental records

Investigate what are the natural patterns of climate variability in South America? Teleconnection with global scale climate changes.

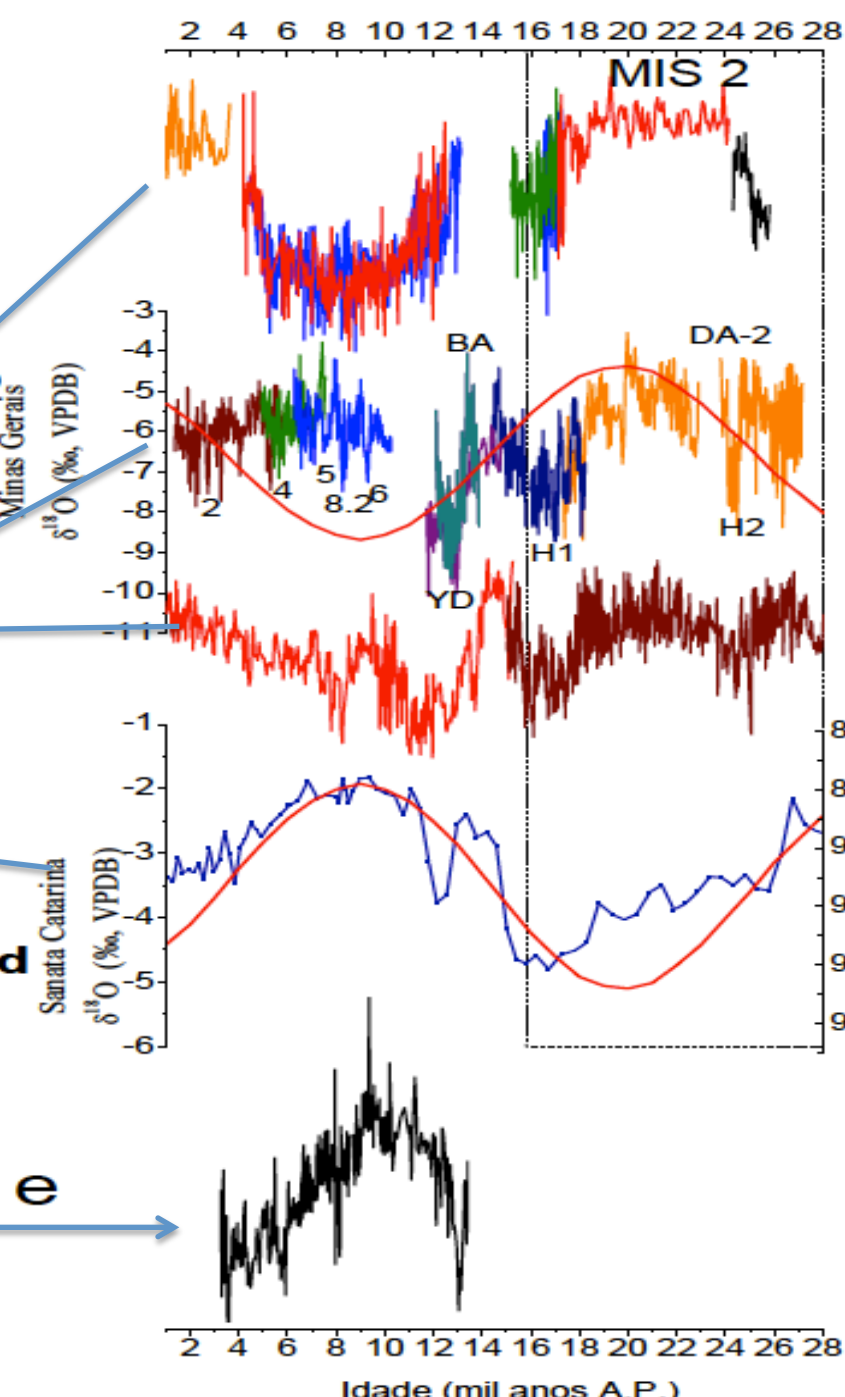
Speleothems

Precip. Climatology (mm/d) 1979–2006
5-day Average centered on 01JUL



b Minas Gerais
 $\delta^{18}O$ (‰, VPDB)

a Santa Catarina
 $\delta^{18}O$ (‰, VPDB)



a

seco
↓
úmido
↑

seco
↓
úmido
↑

c

seco
↓
úmido
↑

Insolação de Feb. 10°S (W/m²)

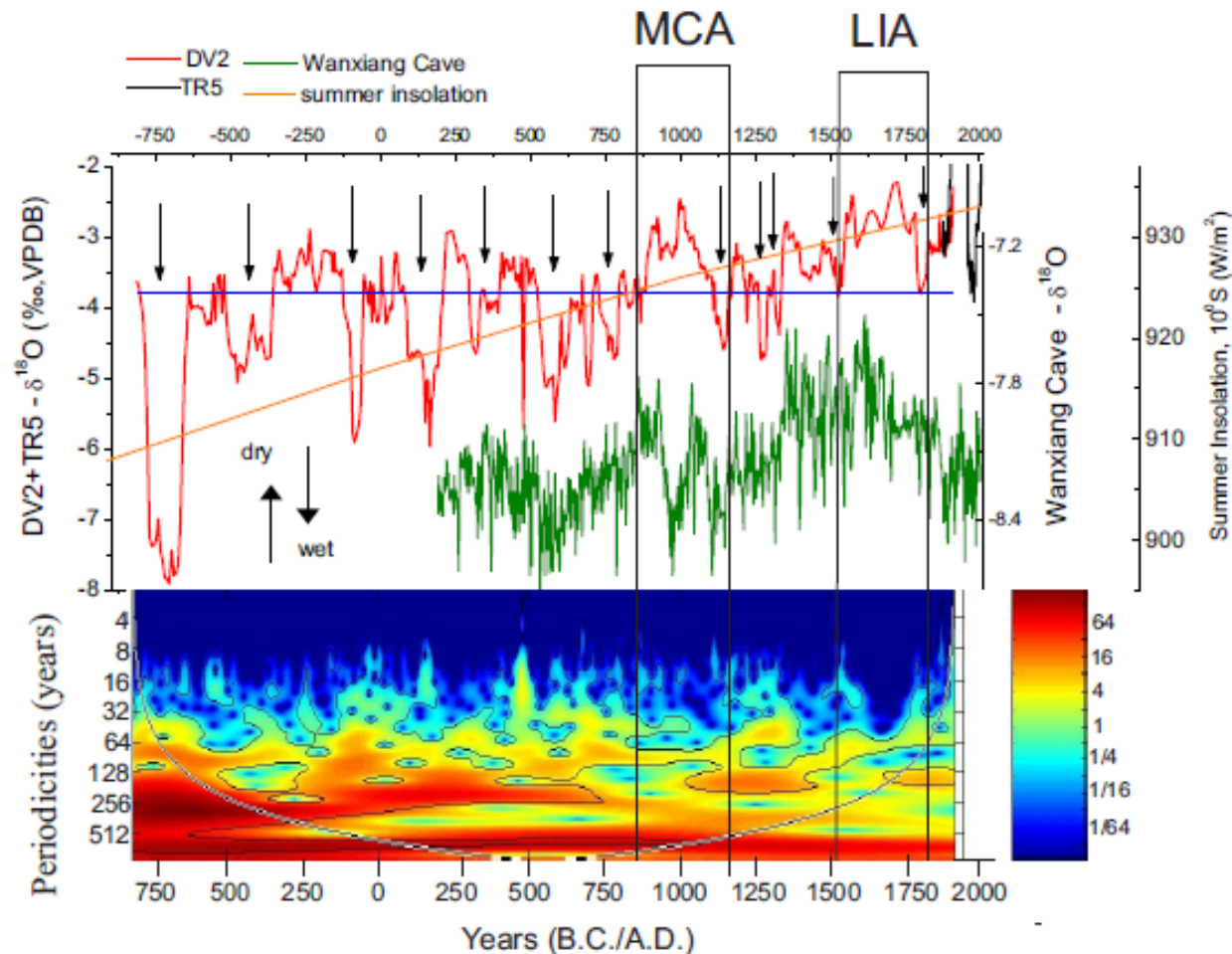
Andes Peruano
 $\delta^{18}O$ (‰, VPDB)

ed by NOAA/Climate Prediction Center 9 May 2008

Cruz et al. 2009

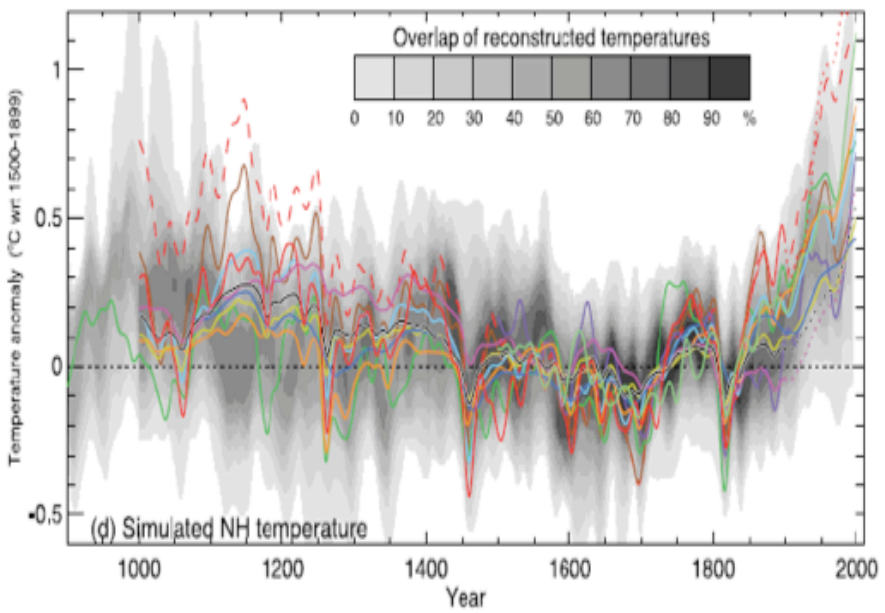
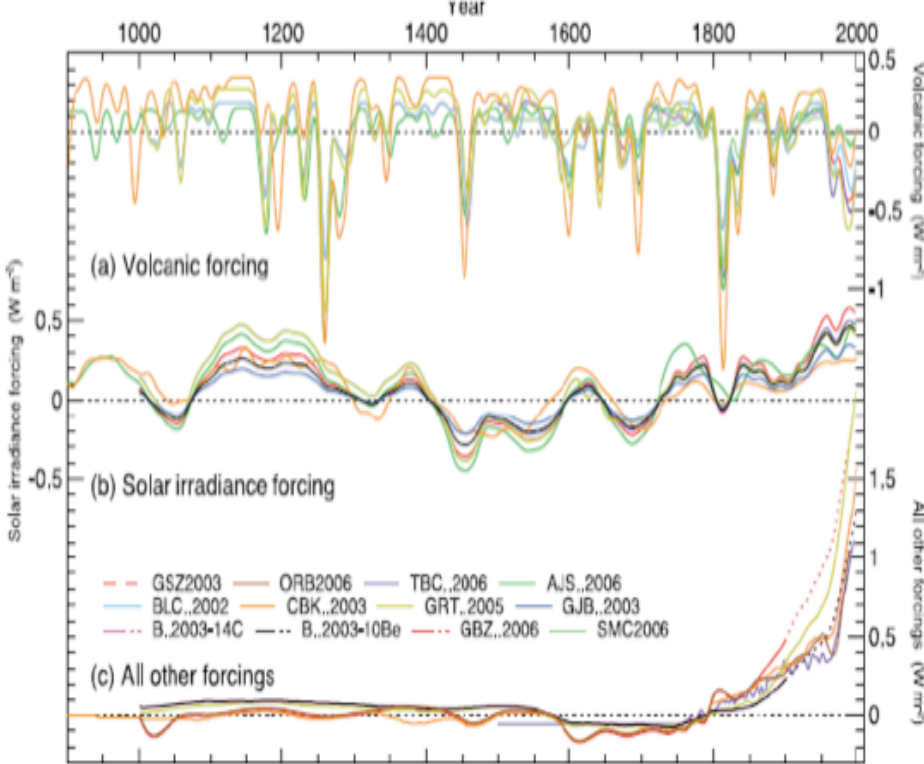
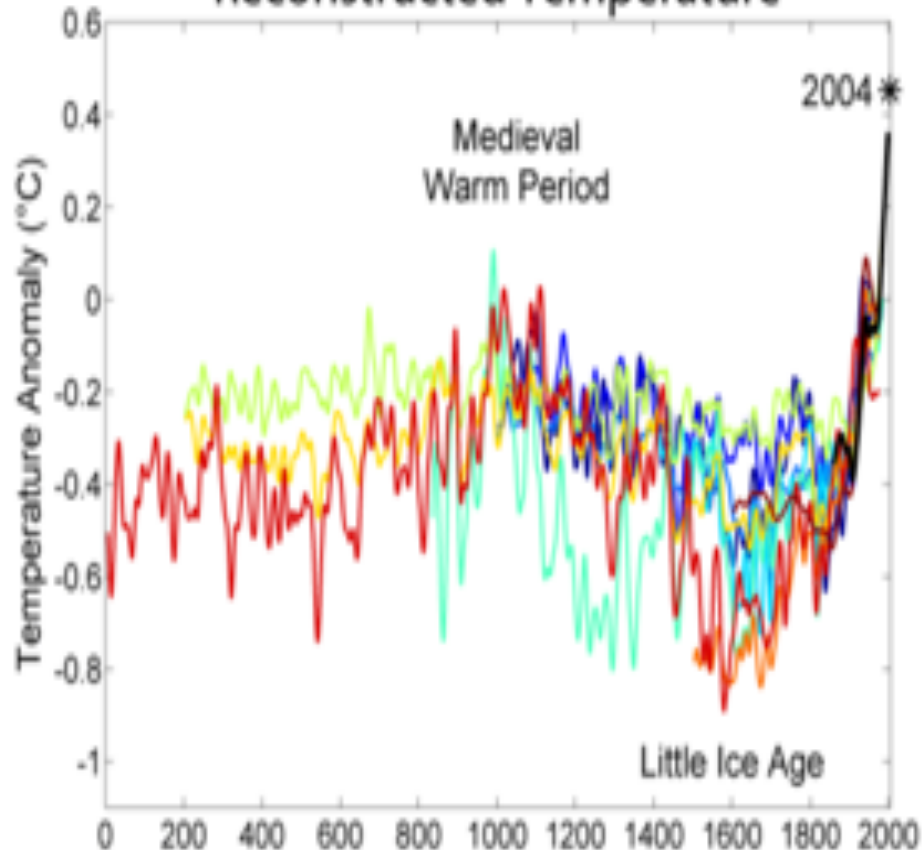
Multidecadal climate variability in Brazil Nordeste during the last 3000 years based on speleothem isotope records

Valdir Novello, Francisco Cruz et al. - [GRL](#)

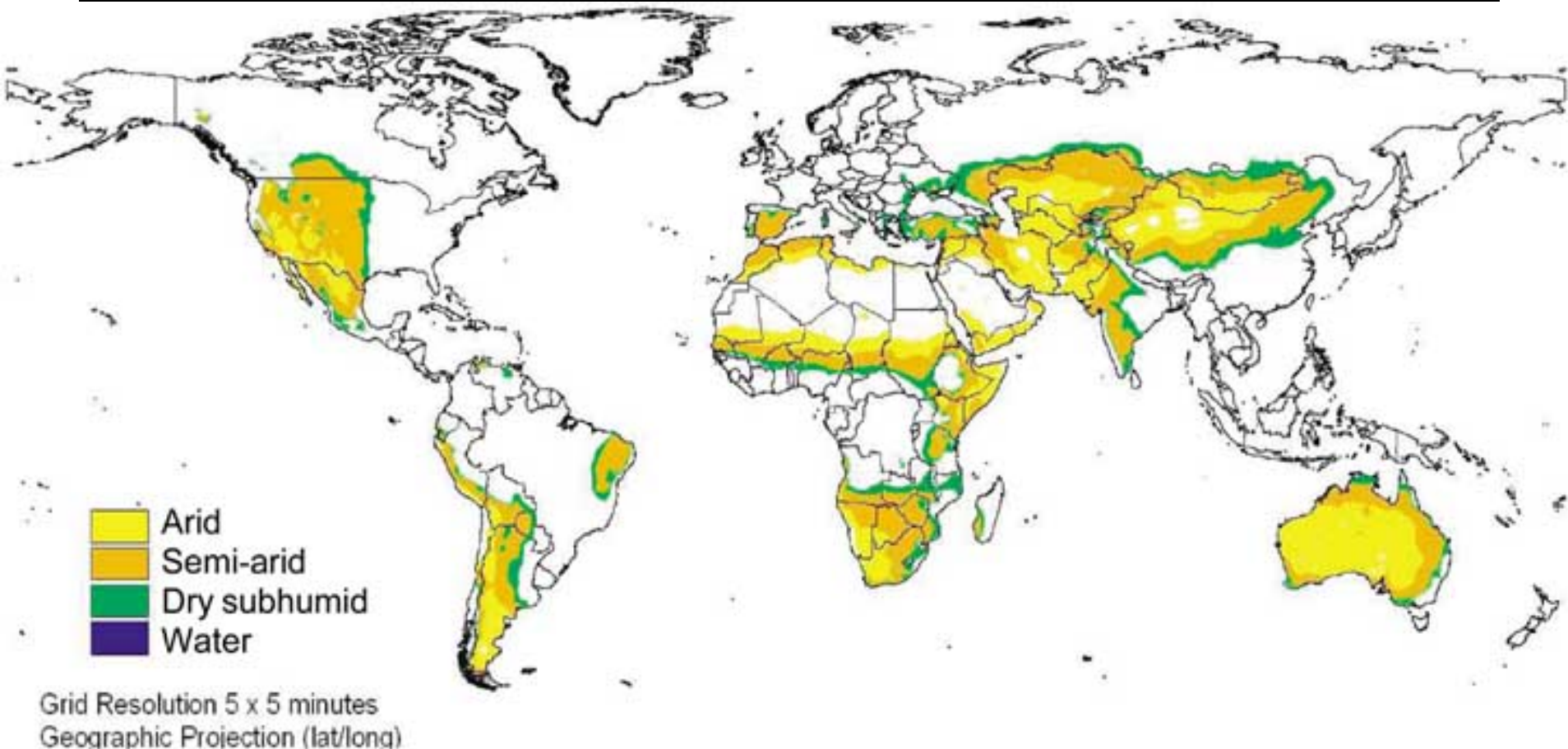


Last 1000 years:

Reconstructed Temperature



Áreas secas no mundo



Embora muitos associem a seca, principalmente, às terras secas do mundo, a **SECA** ocorre em praticamente **TODOS** os regimes climáticos.

A SECA DO SUDESTE É DEVIDA A MUDANÇAS CLIMÁTICAS?

- Compatível com cenários IPCC numa perspectiva mais longa. No momento, muito baixa probabilidade.

MUDANÇAS CLIMÁTICAS QUE JÁ ESTÃO OCORRENDO NO MUNDO

**IPCC 2013-2014
PAINEL
INTERGOVERNAMENTAL DE
MUDANÇA DO CLIMA**

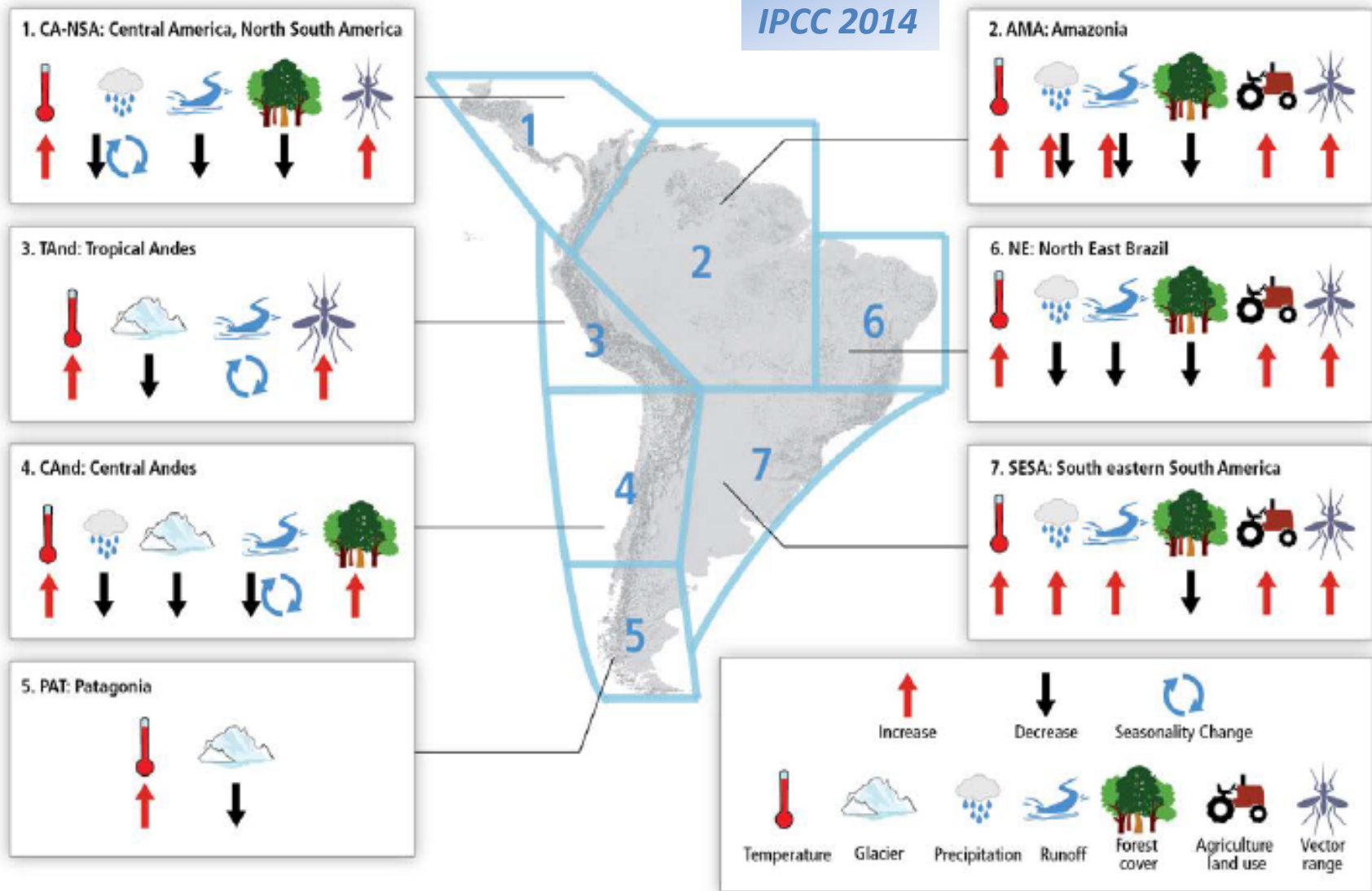


Figure 27-7: Summary of observed changes in climate and other environmental factors in representative regions of CA and SA. The boundaries of the regions in the map are conceptual (neither geographic nor political precision). Information and references to changes provided are presented in different sections of the chapter.

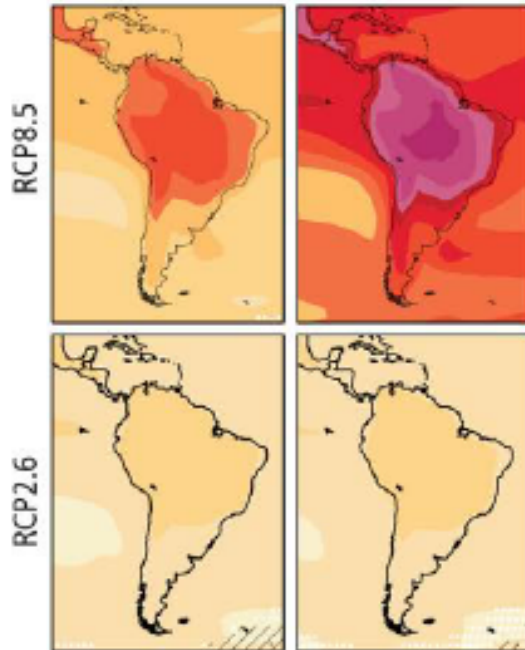
E O FUTURO? OS CENÁRIOS DO IPCC

Annual Temperature

Difference from 1986-2005 mean (°C)



mid-21st century late-21st century

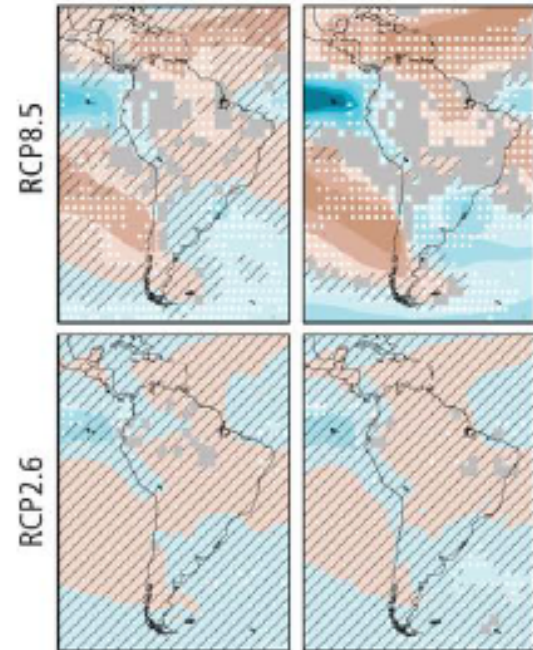


Annual Precipitation

Difference from 1986-2005 mean (%)



mid-21st century late-21st century



Solid Color

Very strong agreement

White Dots

Strong agreement

Gray

Divergent changes

Diagonal Lines

Little or no change

A SECA DO SUDESTE É DEVIDO AO DESMATAMENTO DA AMAZÔNIA?

- Evidencias científicas não são claras.

FORESTS news

A blog by the Center for International Forestry Research

[Climate Change](#)[Livelihoods](#)[Energy](#)[Gender](#)[Food security](#)

29

JAN
2015

The science is clear: Forest loss behind Brazil's drought

BY LOUIS VERCHOT

[f](#) 1.1K [t](#) 376 [g+](#) [p](#) [in](#) 124 [e](#) [m](#)



New research is showing the effects of forests on rainfall in the Amazon, and as deforestation in the region continues, rainfall in the southern part of Brazil will continue to be affected. [Flickr photo](#)

Is it “clear”?

Amazonian Deforestation and Regional Climate Change

CARLOS A. NOBRE,* PIERS J. SELLERS AND JAGADISH SHUKLA

Center for Ocean-Land-Atmosphere Interactions-COLA, University of Maryland, College Park, Maryland

(Manuscript received 7 December 1990, in final form 29 April 1991)

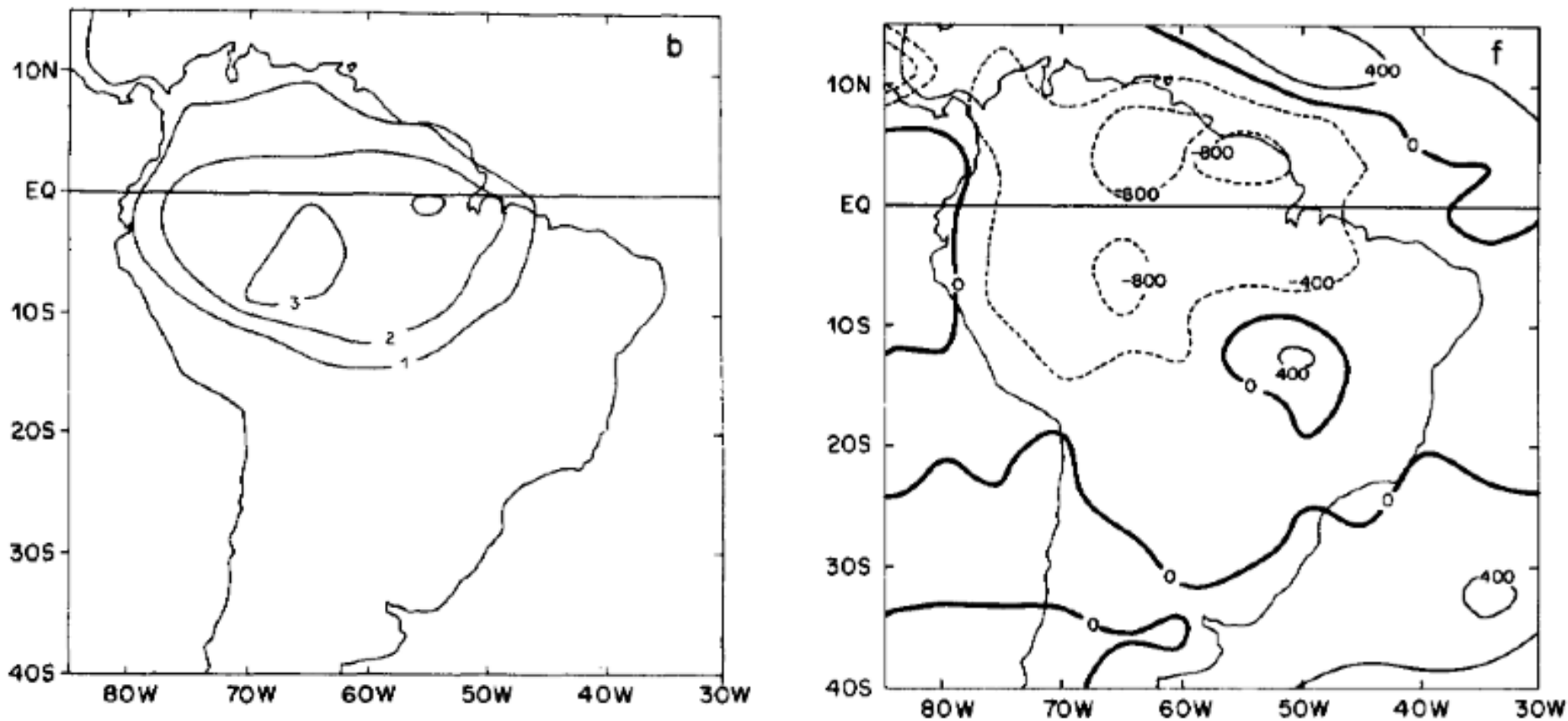
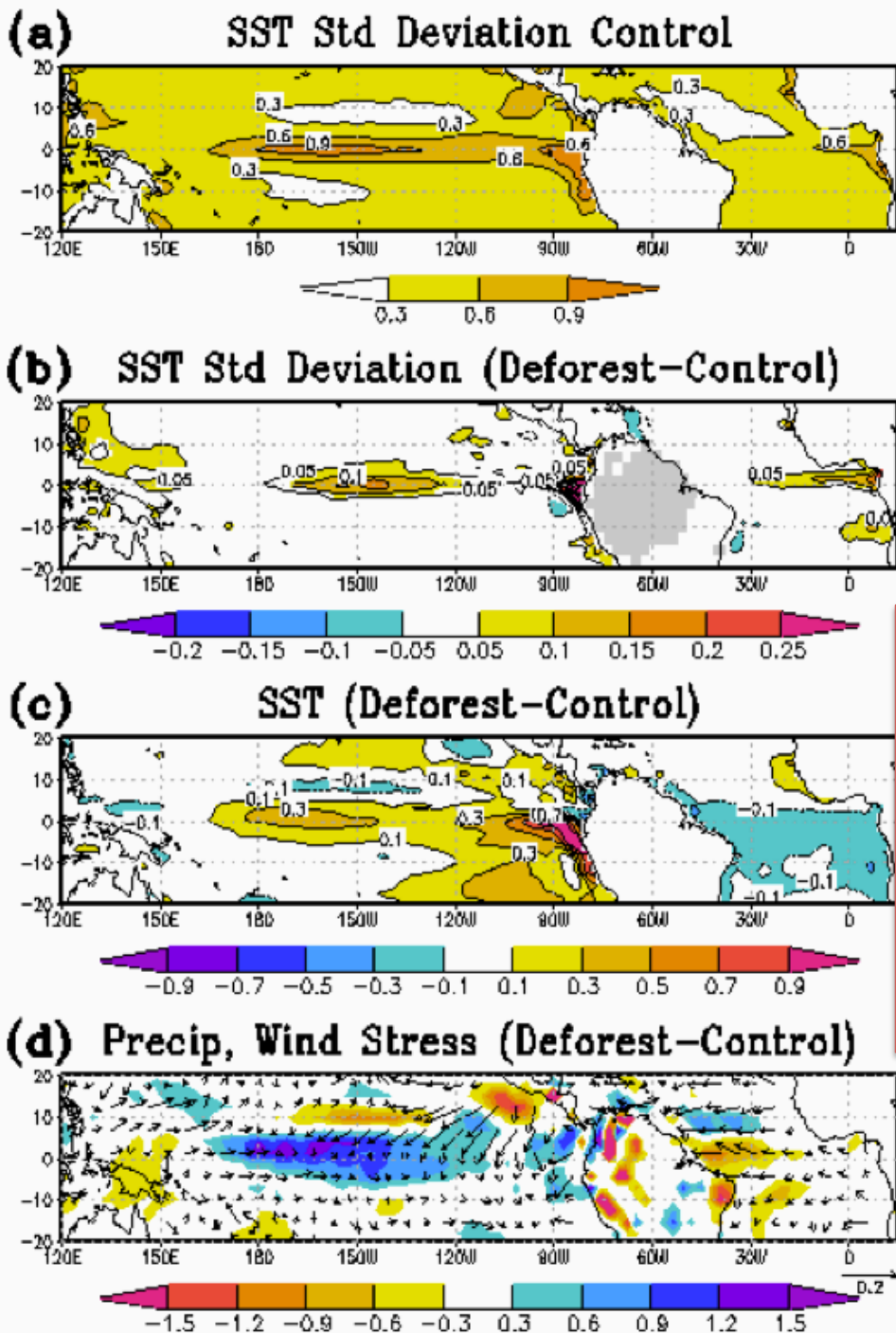


FIG. 10. Differences between 12-month means (January to December) of deforestation and control cases (deforested - control) for South America: (a) deep soil temperature ($^{\circ}\text{C}$), (b) surface temperature ($^{\circ}\text{C}$), (c) 850 hPa temperature ($^{\circ}\text{C}$), (d) 850 hPa specific humidity (g km^{-3}), (e) 850 hPa relative humidity (percent), (f) total precipitation (mm), and (g) sea level pressure (hPa).

Schneider et al. 2006....

Over ocean the Amazon deforestation leads to enhanced ENSO variability and annual mean warming in the eastern equatorial Pacific.

Figure 3. Effects of Amazon deforestation on the coupled climate from 100 years of simulation. (a) Standard deviation of CONTROL SST anomalies ($^{\circ}\text{C}$). (b) Difference of standard deviations of SST anomalies, DEFOREST minus CONTROL. Colored regions are significant at the 5% level. Deforested region is indicated in grey. (c) Annual mean SST difference ($^{\circ}\text{C}$), DEFOREST minus CONTROL. (d) Difference in annual mean precipitation (shaded, mm day^{-1}) and wind stress on the ocean (vectors, dynes cm^{-2}), DEFOREST minus CONTROL.



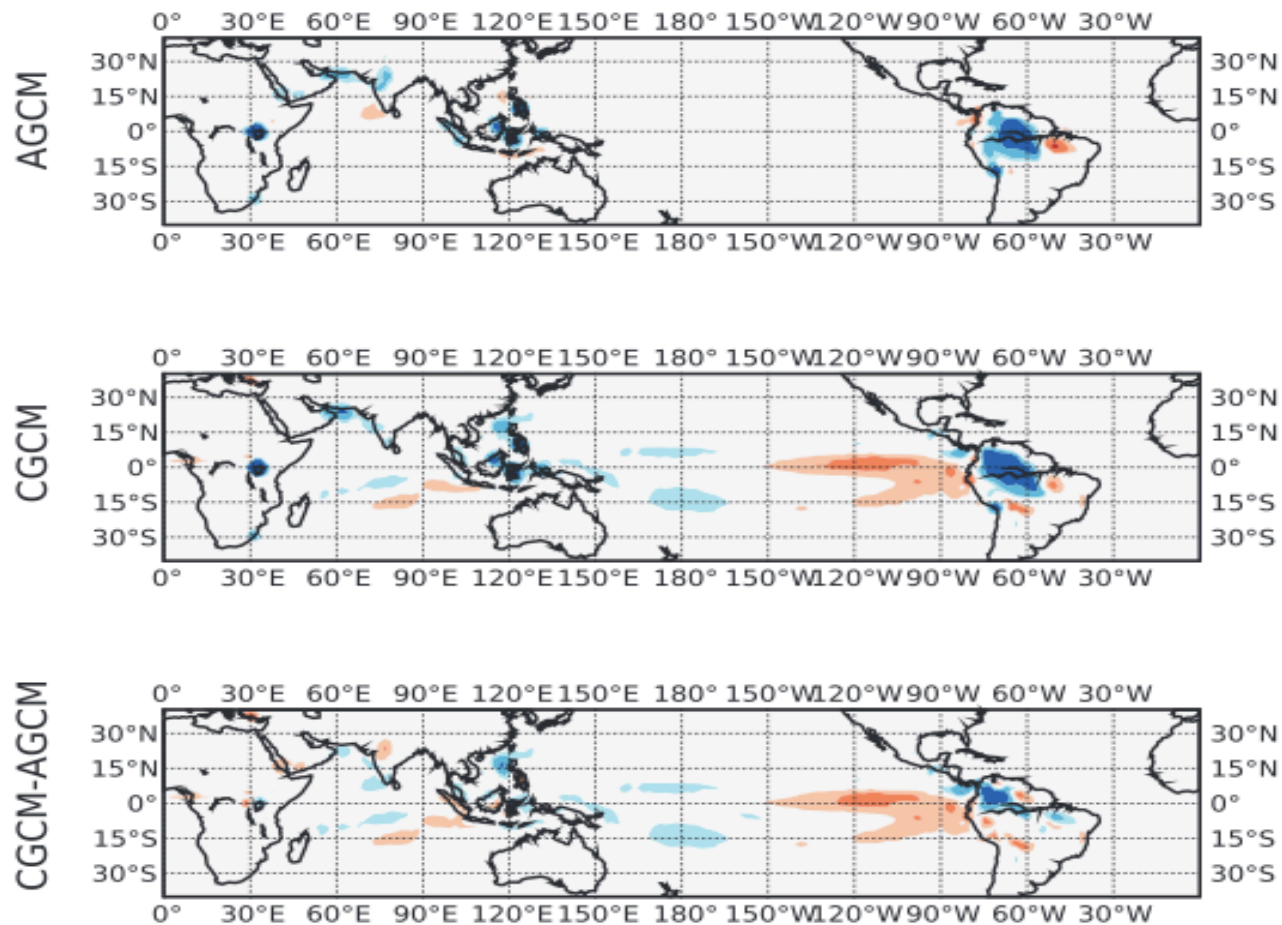
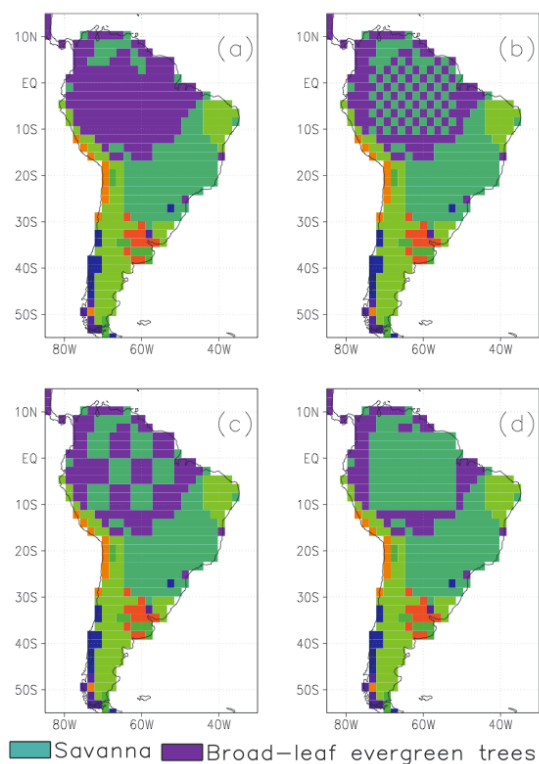
Amazon Deforestation and Climate Change in a Coupled Model Simulation

PAULO NOBRE, MARTA MALAGUTTI, DOMINGOS F. URBANO, ROBERTO A. F. DE ALMEIDA,
AND EMANUEL GIAROLLA

National Institute for Space Research (INPE), São José dos Campos, São Paulo, Brazil

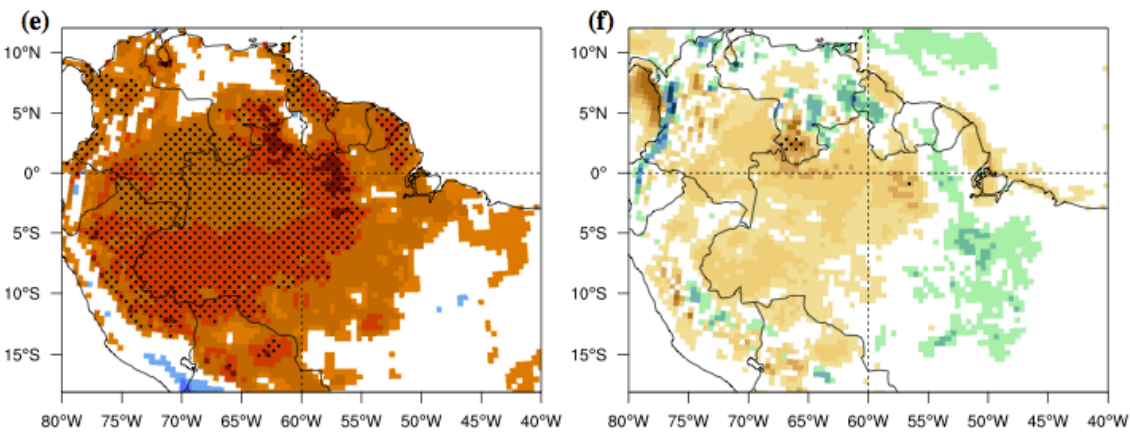
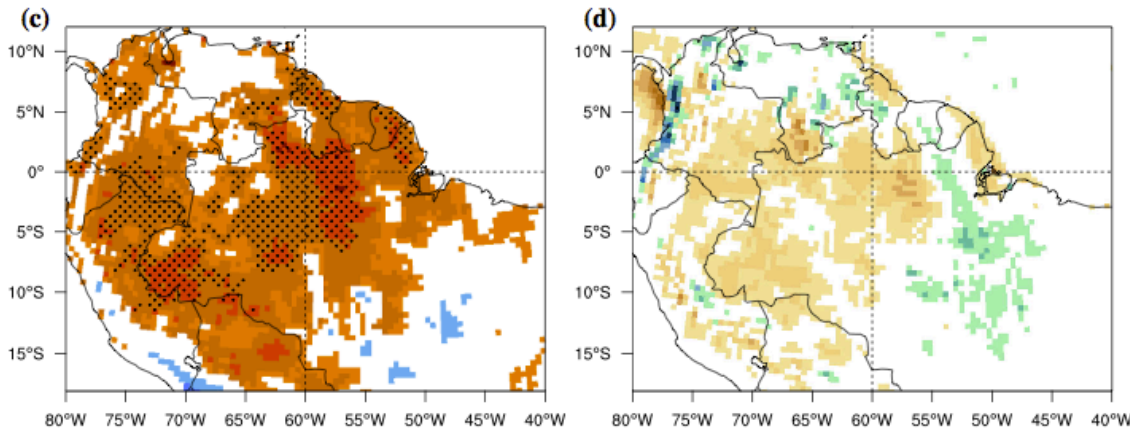
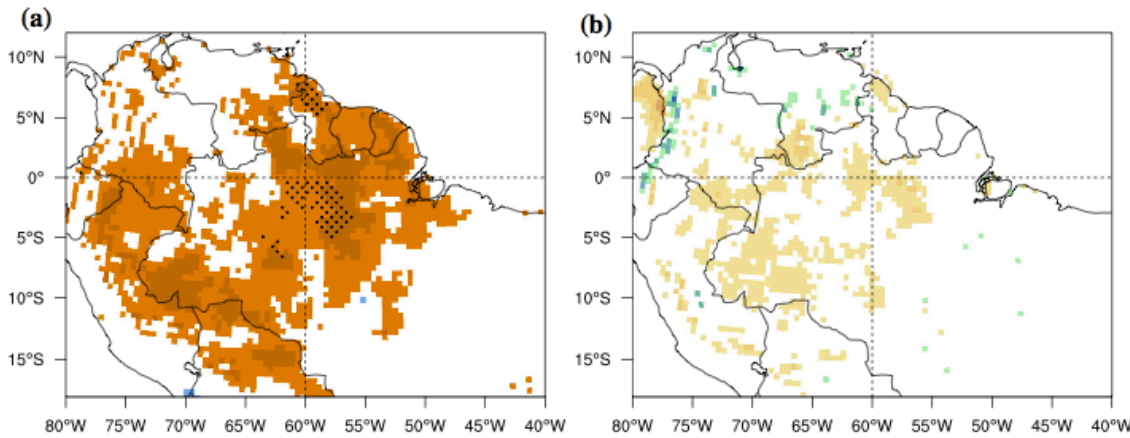
(Manuscript received 30 July 2008, in final form 4 May 2009)

Precipitation



Influence of Amazonian deforestation on the future evolution of regional surface fluxes, circulation, surface temperature and precipitation

Quentin Lejeune · Edouard L. Davin ·
Benoît P. Guillod · Sonia I. Seneviratne



Deforestation-induced annual mean anomalies in 2-m temperature (a, c, e, in °C) and precipitation (b, d, f, in mm/day) in the DEF_A2 (c, d) and DEF_TOT (e, f) simulations compared to CTL, for the period 1987–2010. Changes that are different from 0 at the 5% significance level after evaluation with a two-tailed *t* test are marked by stippling.

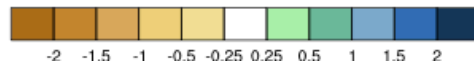


Table 3 Characteristics of the GCM studies used for the comparison in Fig. 7: reference for the studies, employed model and land surface scheme, resolution of the model, presence of a dipole pattern in the response of rainfall to deforestation (if we notice a dipole pattern, we firstly mention over which region of the Amazonian basin there is an increase in rainfall and then where the associated decrease is located), deforestation-induced mean change in surface temperature and precipitation over the Amazonian region, methodology for the SSTs (prescribed or computed by an ocean mixed layer model interacting with the atmospheric model), and category to which the studies pertain (“O” for “oldest” or “N” for “newest”)

Reference	Model/land surface scheme	Resolution	Dipole pattern	ΔT	ΔP	SSTs	Category
Dickinson and Henderson-Sellers (1988) ^a	CCM0B/BATS	4.5° × 7.5°	E/W	+3	0	Fixed	O
Lean and Warrilow (1989)	UKMO	2.5° × 3.75°	na	+2.4	-1.34	Fixed	O
Nobre et al. (1991)	NMC/SiB	1.8° × 2.8°	None	+2.5	-1.76	Fixed	O
Dickinson and Kennedy (1992)	CCM1/BATS1e	4.5° × 7.5°	na	+0.6	-1.4	Interactive	O
Henderson-Sellers et al. (1993)	CCM1/BATS1e	4.5° × 7.5°	None	+0.6	-1.61	Interactive	O
Manzi (1993) ^b	EMERAUDE/ISBA	2.8° × 2.8°	na	+1.3	-0.04	Fixed	O
Lean and Rowntree (1993)	UKMO	2.5° × 3.75°	None	+2.1	-0.81	Fixed	O
Dirmeyer and Shukla (1994)	NMC/SSiB	4.5° × 7.5°	NE/SW	+2	-0.28	Fixed	N
Polcher and Laval (1994a)	LMD3/SECHIBA	2.0° × 5.6°	SW/NE	+3.8	1.08	Fixed	O
Polcher and Laval (1994b)	LMD3/SECHIBA	2.0° × 5.6°	na	-0.11	-0.51	Fixed	N
Sud et al. (1996)	GLA/SSiB	4.0° × 5.0°	SE/NW	+2	-1.48	Fixed	N
Zhang et al. (1996)	CCM1/BATS1e	4.5° × 7.5°	None ^c	+0.3	-1.10	Interactive	O
Manzi and Planton (1996)	EMERAUDE/ISBA	2.8° × 2.8°	W/E	-0.5	-0.04	Fixed	O
Lean and Rowntree (1997)	UKMO	2.5° × 3.75°	None	+2.3	-0.27	Fixed	N
Hahmann and Dickinson (1997)	RCCM2/BATS1e	2.8° × 2.8°	E/W	+1	-0.99	Fixed	N
Costa and Foley (2000)	GENESIS/IBIS	4.5° × 7.5°	S/N	+1.4	-0.73	Interactive	N
Gedney and Valdes (2000)	ECMWF	3° × 3°	None	+1.3	-0.79	Fixed	N
Kleidon and Heimann (2000)	ECHAM	5.6° × 5.6°	E/W	+2.5	-0.38	Fixed	N
Voltaire and Royer (2004)	ARPEGE/ISBA ^d	2.8° × 2.8°	na	-0.1	-0.40	Fixed	O
Voltaire and Royer (2005) ^e	ARPEGE/ISBA ^d	2.8° × 2.8°	None	+0.6	-0.74	Interactive	N
Ramos da Silva et al. (2008)	GISS	4° X 5°	None	+0.8	-1.24	Fixed	N
Nobre et al. (2009) ^f	CPTEC/SSiB	1.85° X 1.85°	E/W	na	-3.3	Interactive	N
Medvigy et al. (2011)	OLAM	~ 25 km over South America, ~ 200 km otherwise	SE/NW	na	-0.17	Fixed	N

^a“na” means that no information was reported

^a Values were obtained from Henderson-Sellers et al. (1993)

^b Values are given as reported in Lean and Rowntree (1997)

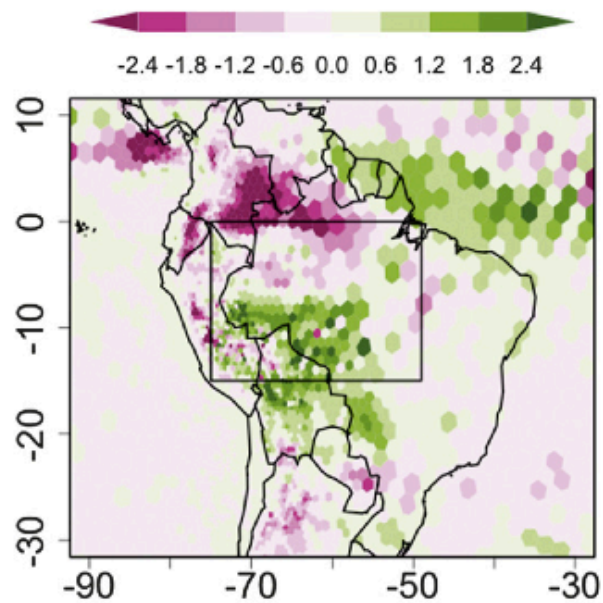
^c Based on the results of McGuffie et al. (1995)

^d ARPEGE is the improved version of the EMERAUDE model

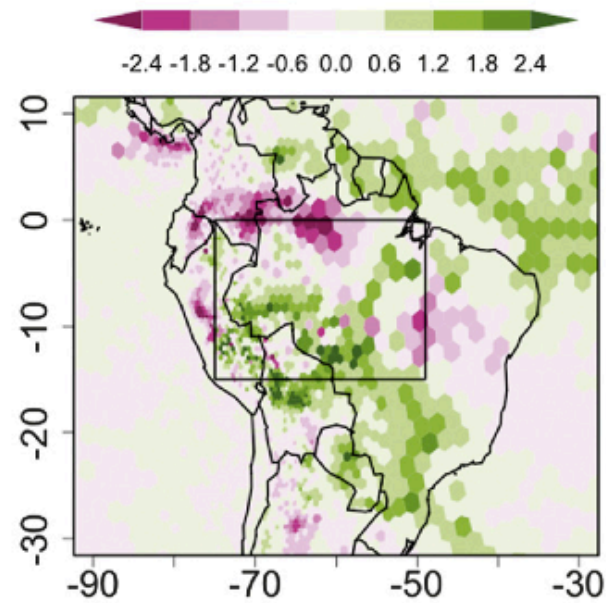
^e We consider the simulations run with the coupled ocean-atmosphere GCM using the corrected roughness length

^f We consider the simulations run with the coupled ocean-atmosphere GCM rather than the atmospheric GCM, because the current climate it represents is closer to observations

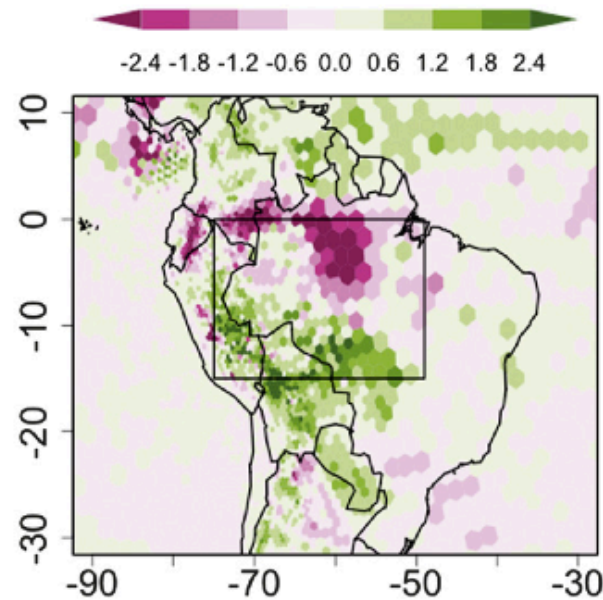
(a) FINE



(b) XFINE



(c) FINEV



(d) COARSE

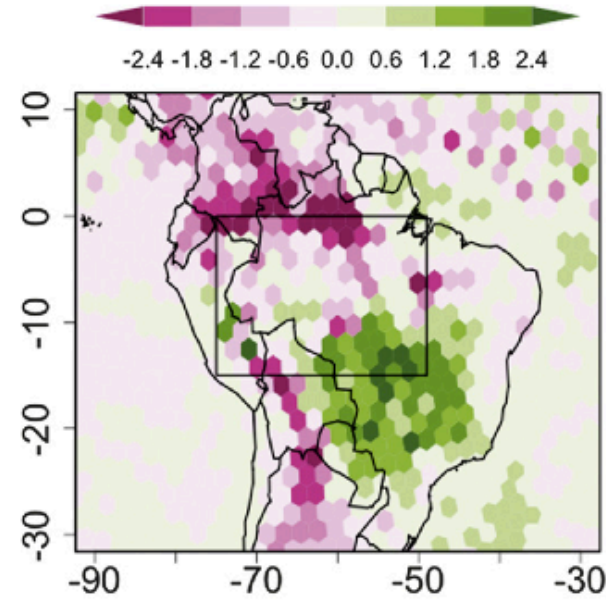


FIG. 10. Simulated changes in daily mean precipitation (DEF minus FOR; mm day^{-1}) from the (a) FINE, (b) XFINE, (c) FINEV, and (d) COARSE simulation pairs.

Simulated Changes in Northwest U.S. Climate in Response to Amazon Deforestation

DAVID MEDVIGY

Department of Geosciences and Program in Atmospheric and Oceanic Sciences, Princeton University, Princeton, New Jersey

ROBERT L. WALKO

Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida

MARTIN J. OTTE

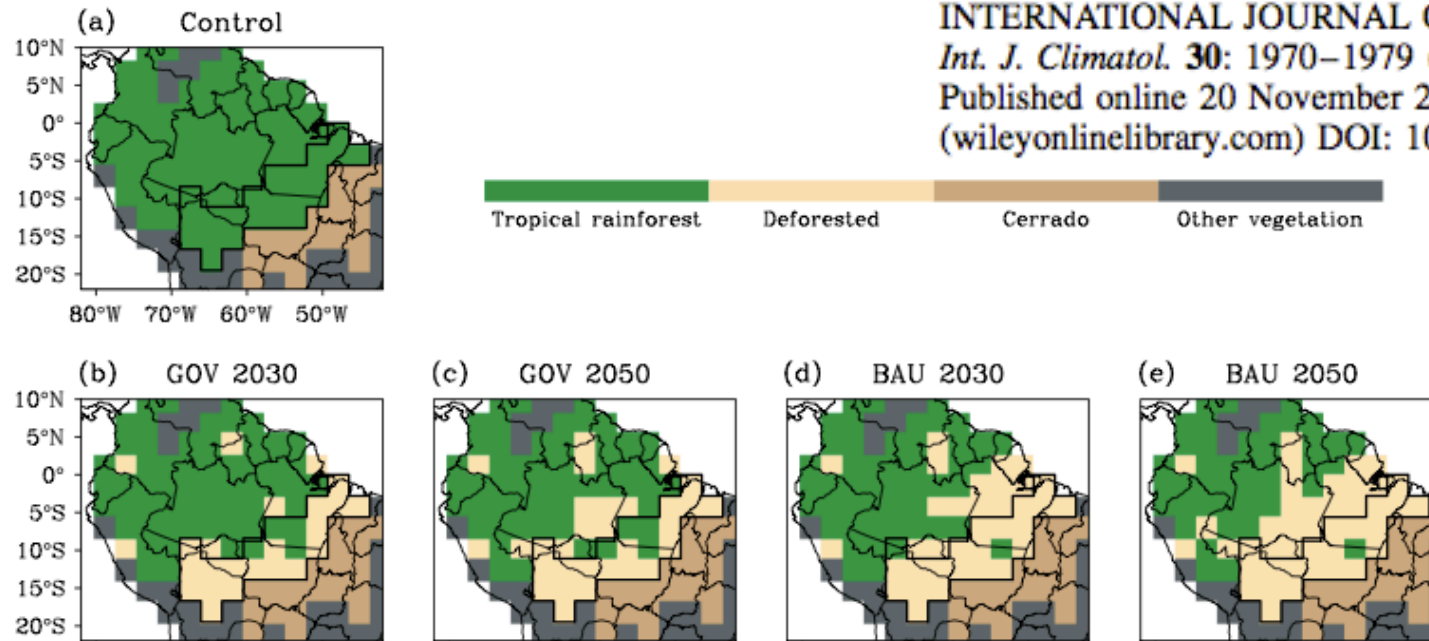
Atmospheric Modeling and Analysis Division, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina

RONI AVISSAR

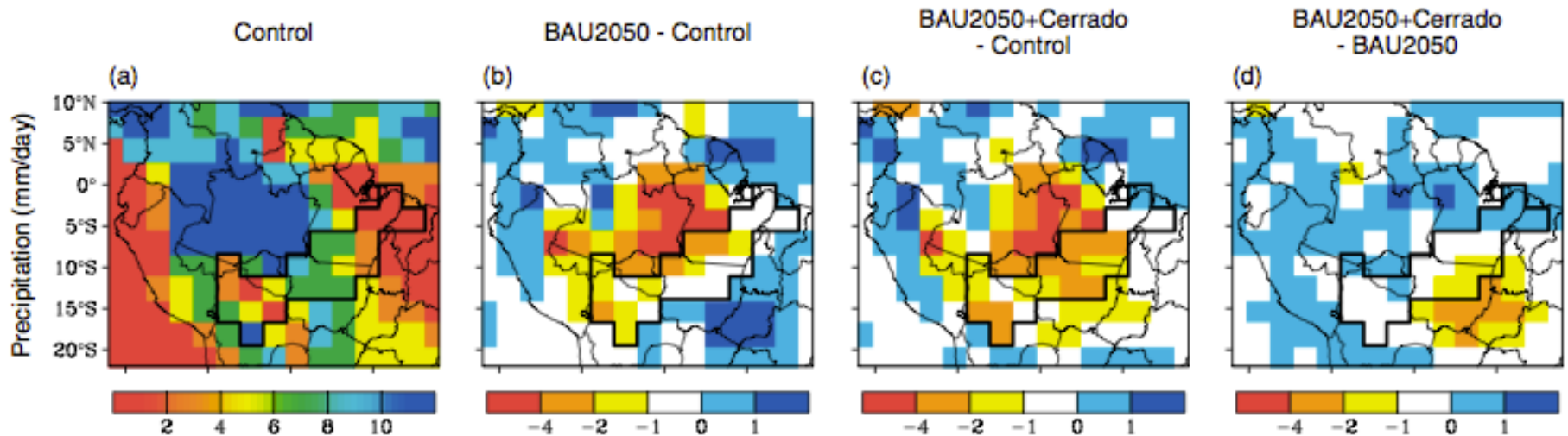
Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida

JOURNAL OF CLIMATE

INTERNATIONAL JOURNAL OF CLIMATOLOGY
Int. J. Climatol. **30**: 1970–1979 (2010)
 Published online 20 November 2009 in Wiley Online Library
 (wileyonlinelibrary.com) DOI: 10.1002/joc.2048



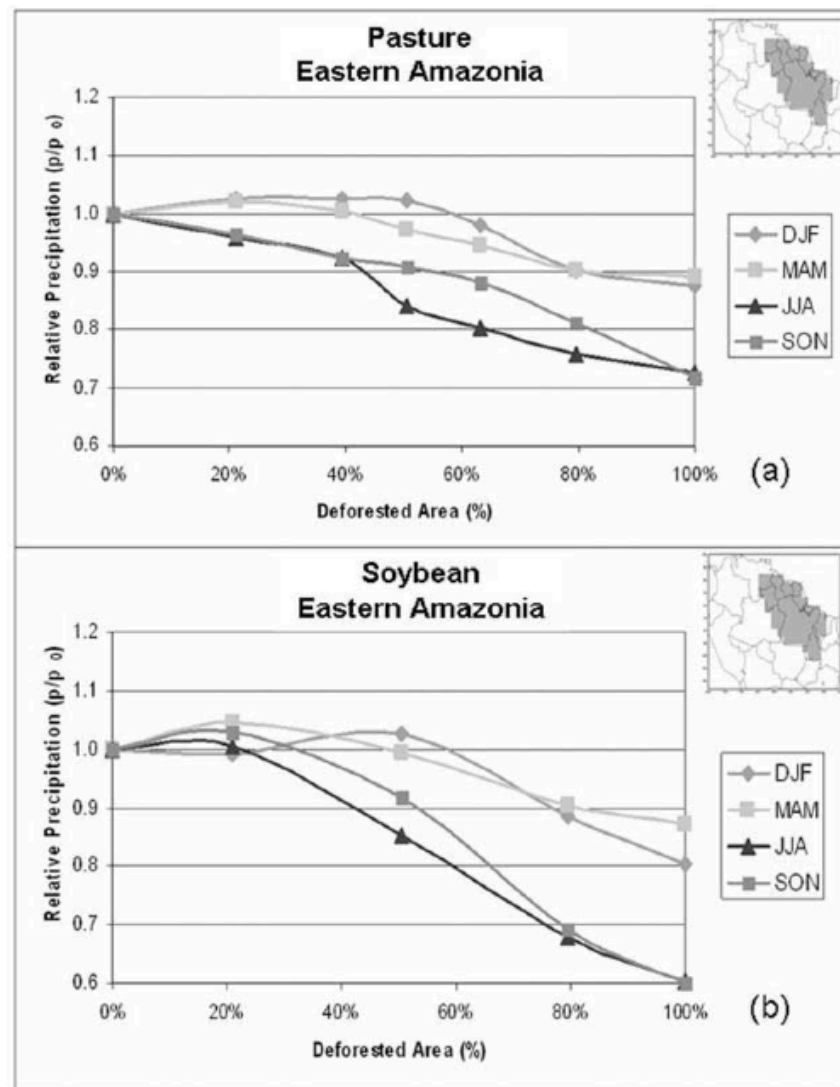
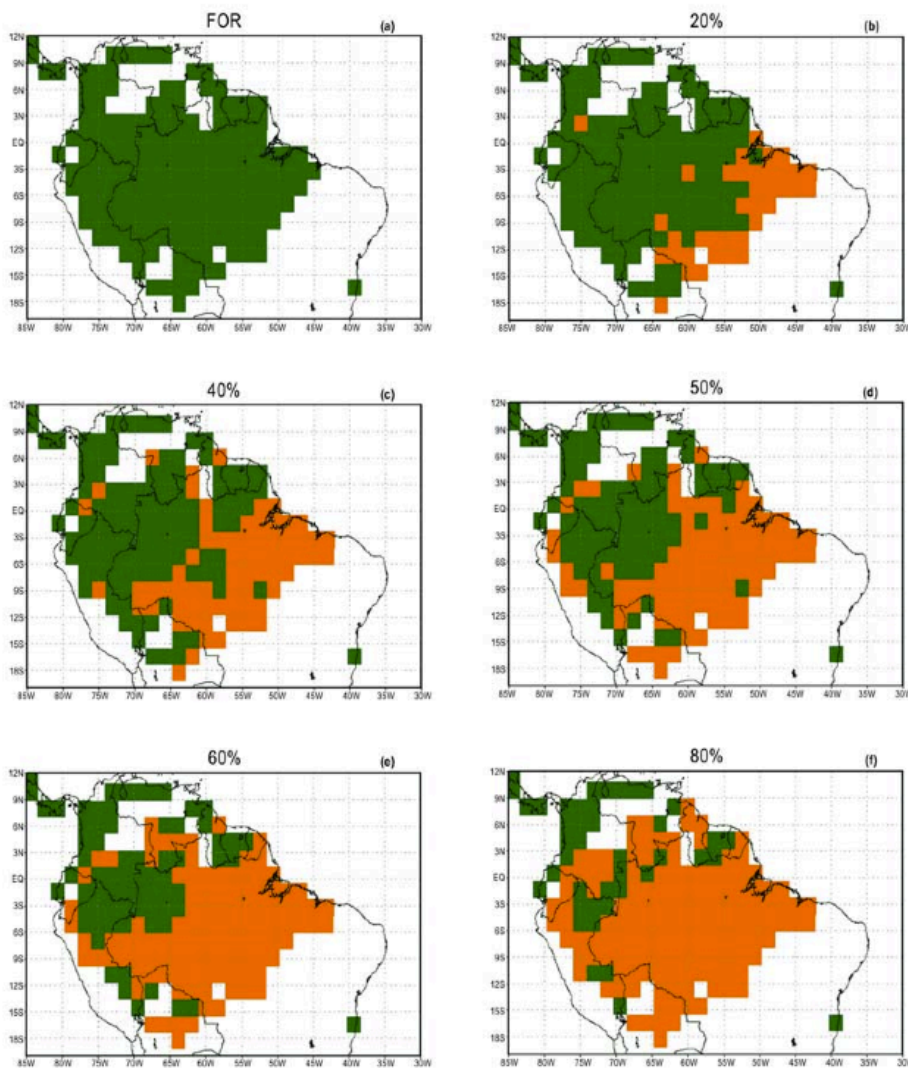
M.H. COSTA AND G.F. PIRES



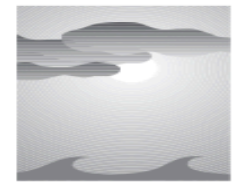
Regional climate change over eastern Amazonia caused by pasture and soybean cropland expansion

Gilvan Sampaio,¹ Carlos Nobre,¹ Marcos Heil Costa,² Prakki Satyamurty,¹ Britaldo Silveira Soares-Filho,³ and Manoel Cardoso¹

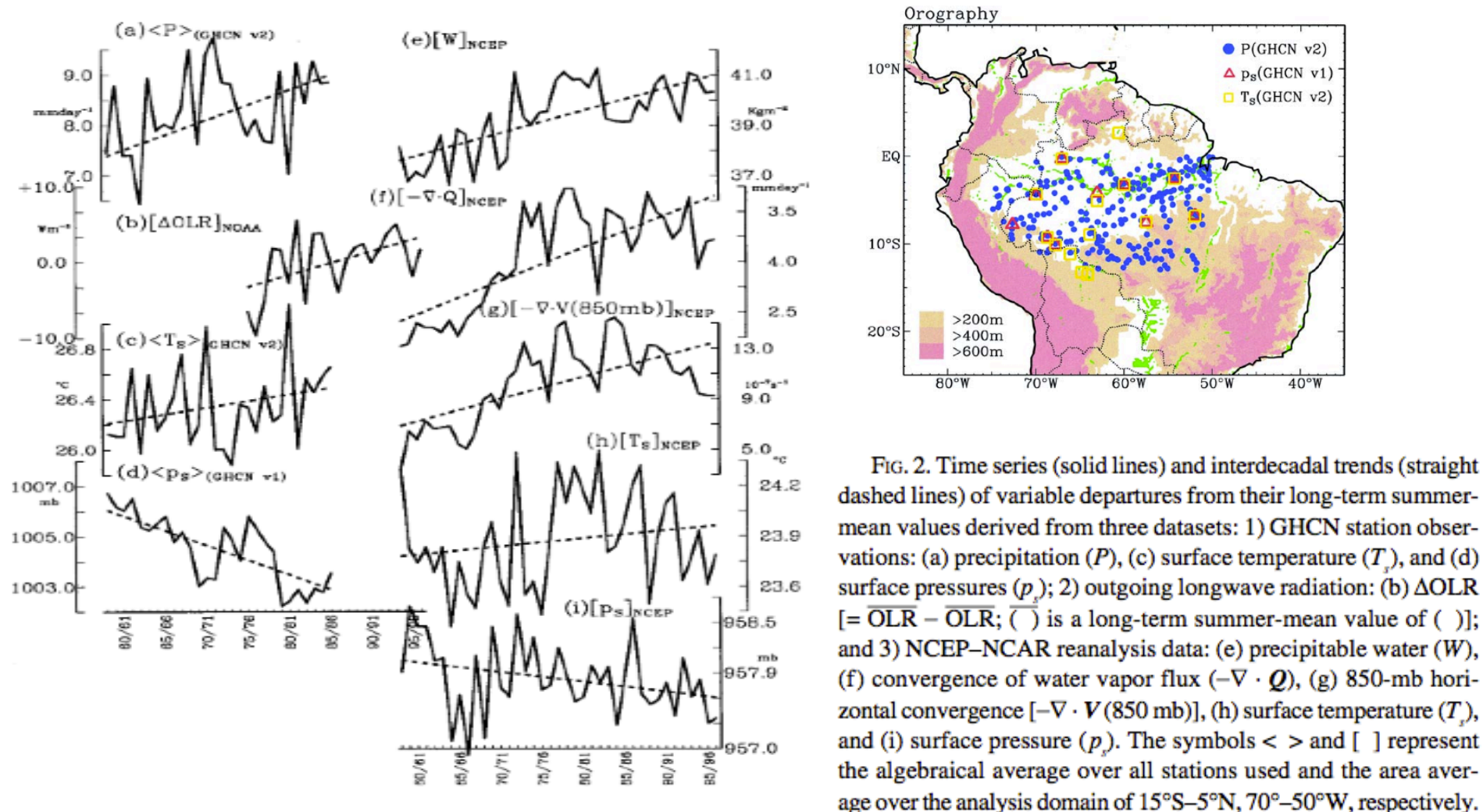
SAMPAIO ET AL.: REGIONAL CLIMATE CHANGE OVER EASTERN AMAZONIA



Suppressing Impacts of the Amazonian Deforestation by the Global Circulation Change



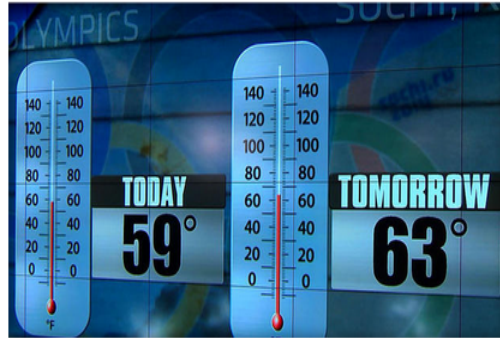
Tsing-Chang Chen, Jin-ho Yoon, Kathryn J. St. Croix, and Eugene S. Takle
 Atmospheric Science Program, Department of Geological and
 Atmospheric Sciences, Iowa State University, Ames, Iowa



AS CAUSAS DA SECA DE 2014 NO SUDESTE DO BRASIL

- Foi um fenômeno global!!!

Warm weather causing problems for outdoor sports at the Sochi Winter Olympics 2014



12 Comments / 603 Shares / Tweets / Stumble / Email

UK floods: The winners and losers

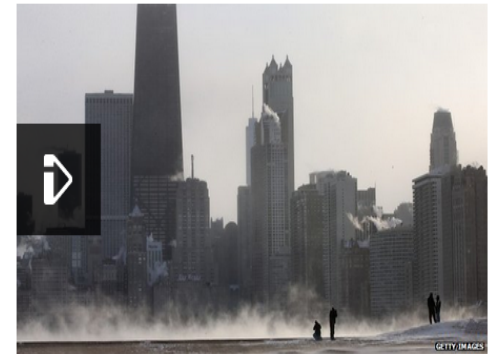
By Anthony Reuben
Head of statistics, BBC News



We have seen extraordinary amounts of rainfall in England and Wales in recent weeks, which has caused flooding in some areas.

8 January 2014 Last updated at 13:59 GMT

Big freeze shatters North America temperature records



BBC's Mark Mardell: "After a few minutes outside it's really painful to breathe"



THE STRAITS TIMES

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SINGAPO POLITICS asiareport COMMUNITIES READERS' POST STJOE

Viajes a Sapa Vietnam

sapavietnam.es
Viajes Sapa de 3dias 2noches 111Eur Viajes Sapa de 2dias 1noche 99 EuR

Home > SE Asia > Story >

PICTURES

Tourists flock to see rare snow in northern Vietnam

PUBLISHED ON DEC 17, 2013 5:18 PM

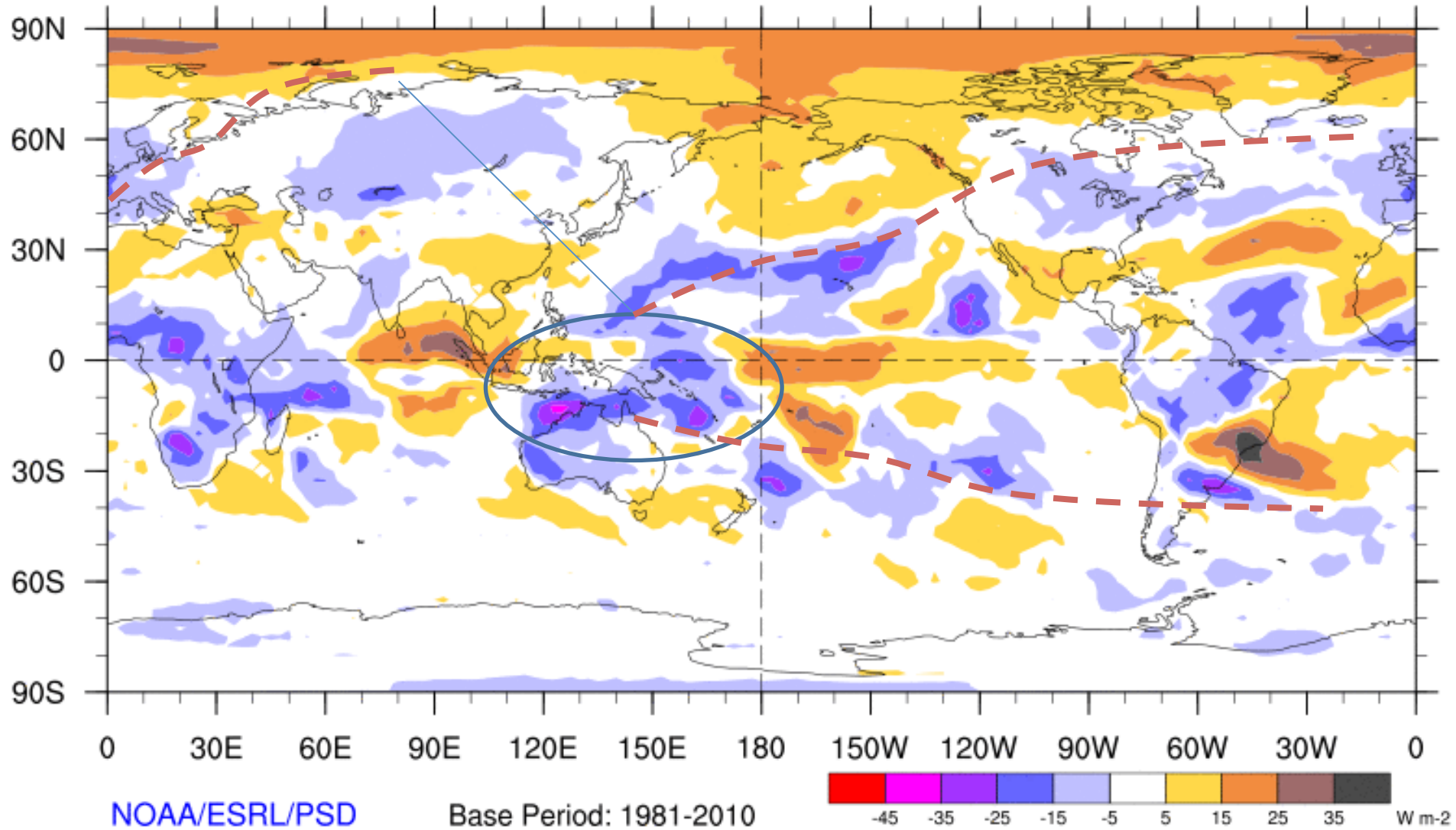
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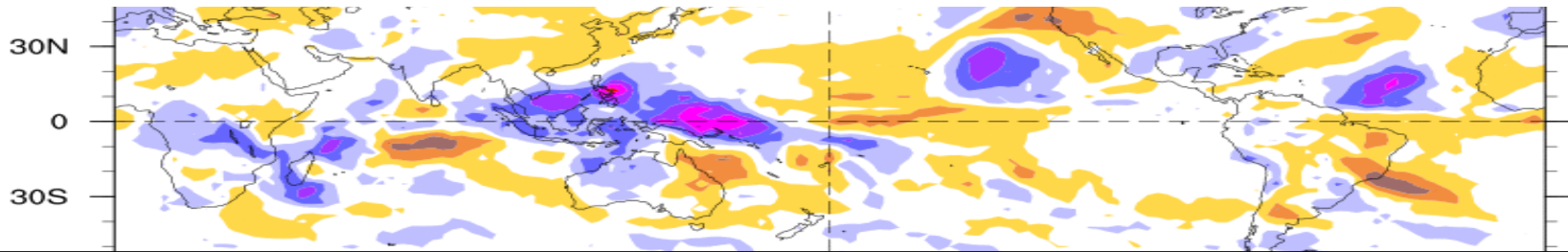
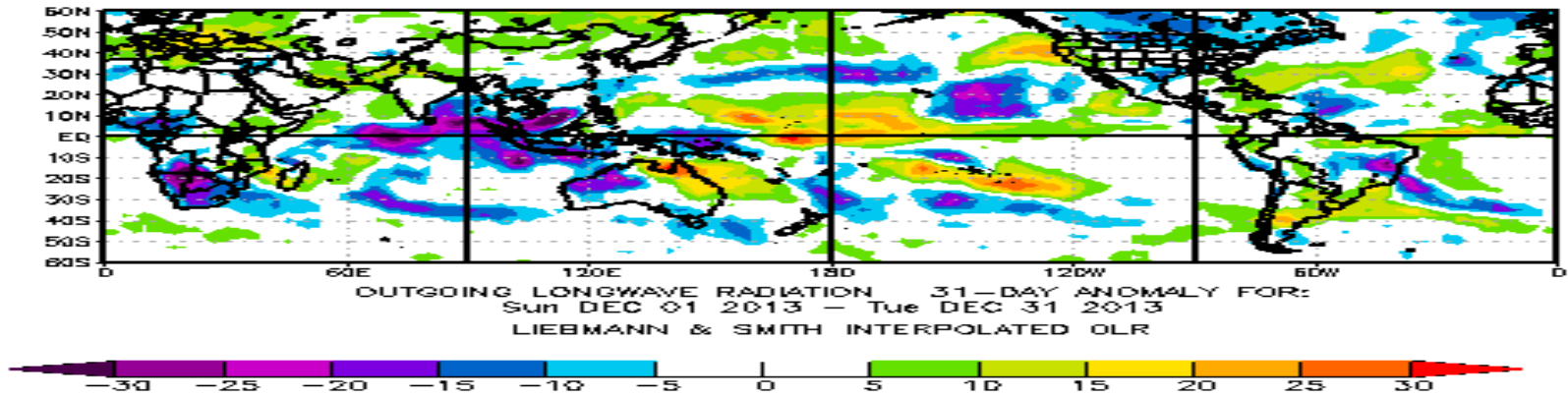
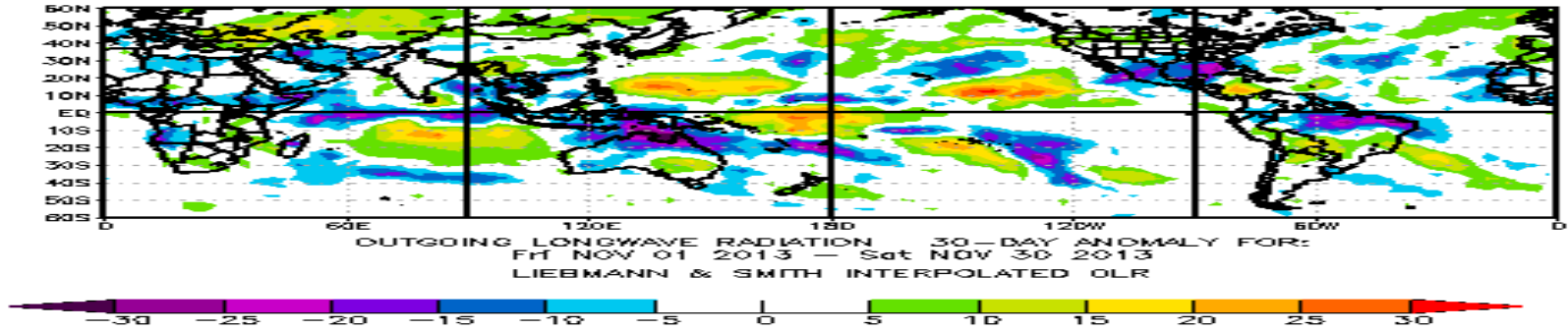
20 Janeiro a 18 de fevereiro de 2014

30-Day Average OLR Anomaly

2014/01/20 - 2014/02/18



OLR Anomalies – Nov, Dec (2013) and January 2014 (up to Jan 24)



OLR Anomaly Dec 25, 2013 to Jan 24, 2014

- Janeiros seco (15%) no Sul de MG (região do café fino):
 - 1984
 - 2001
- 2014 provavelmente um recorde...

- O caso de Janeiro/2014 é excepcional?
- O que está acontecendo?
 - Influências remotas de fontes tropicais?
 - Papel das anomalias de TSM?
 - Papel da Oscilação Intrasazonal?

•Relacionamento entre circulações anômalas e fontes anômalas de calor?

•Quais circulações anômalas podem ser atribuídas a fontes tropicais de calor anômalas e quais não podem?

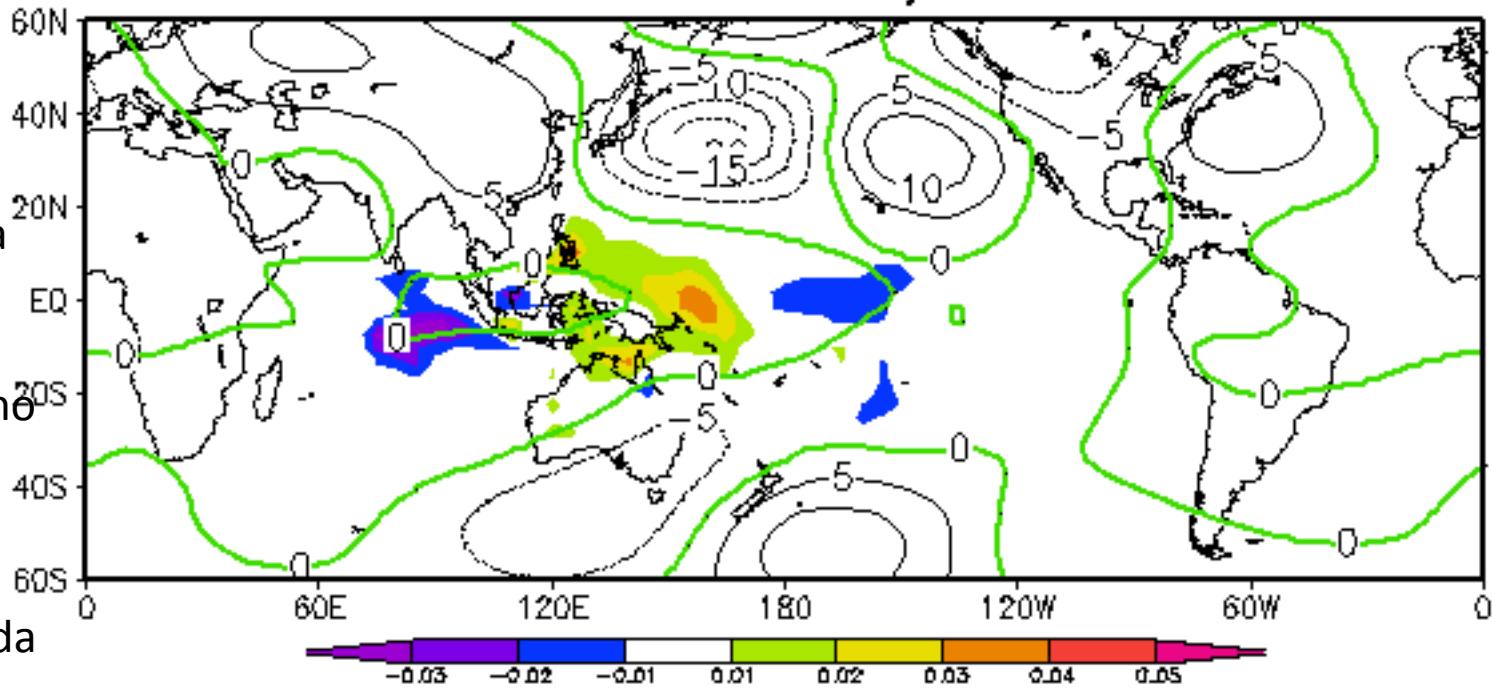
•Qual é a conexão entre as anomalias de circulação em diferentes regiões do planeta?

•Influence Functions (Grimm & Silva Dias 1995)

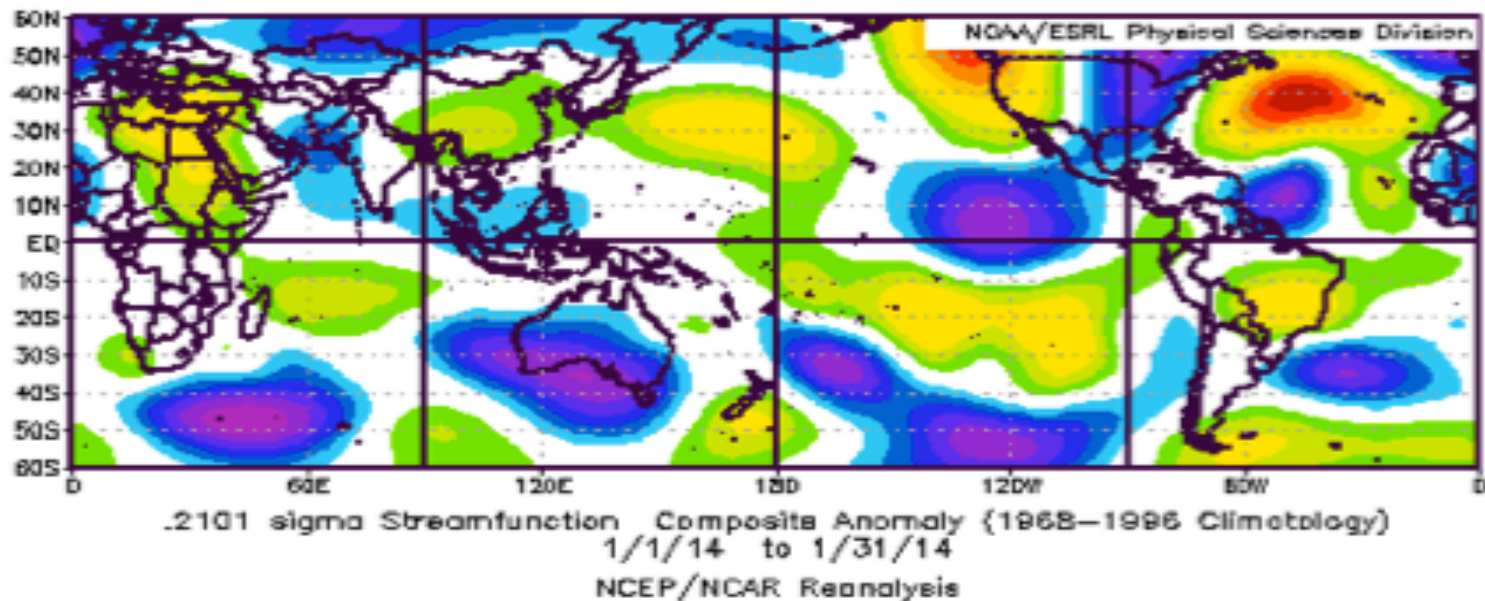
•Aravéquia (2003)

Geop. 200 hPa – Integral da F.I. de Jan Forçante ROLE de jan2014

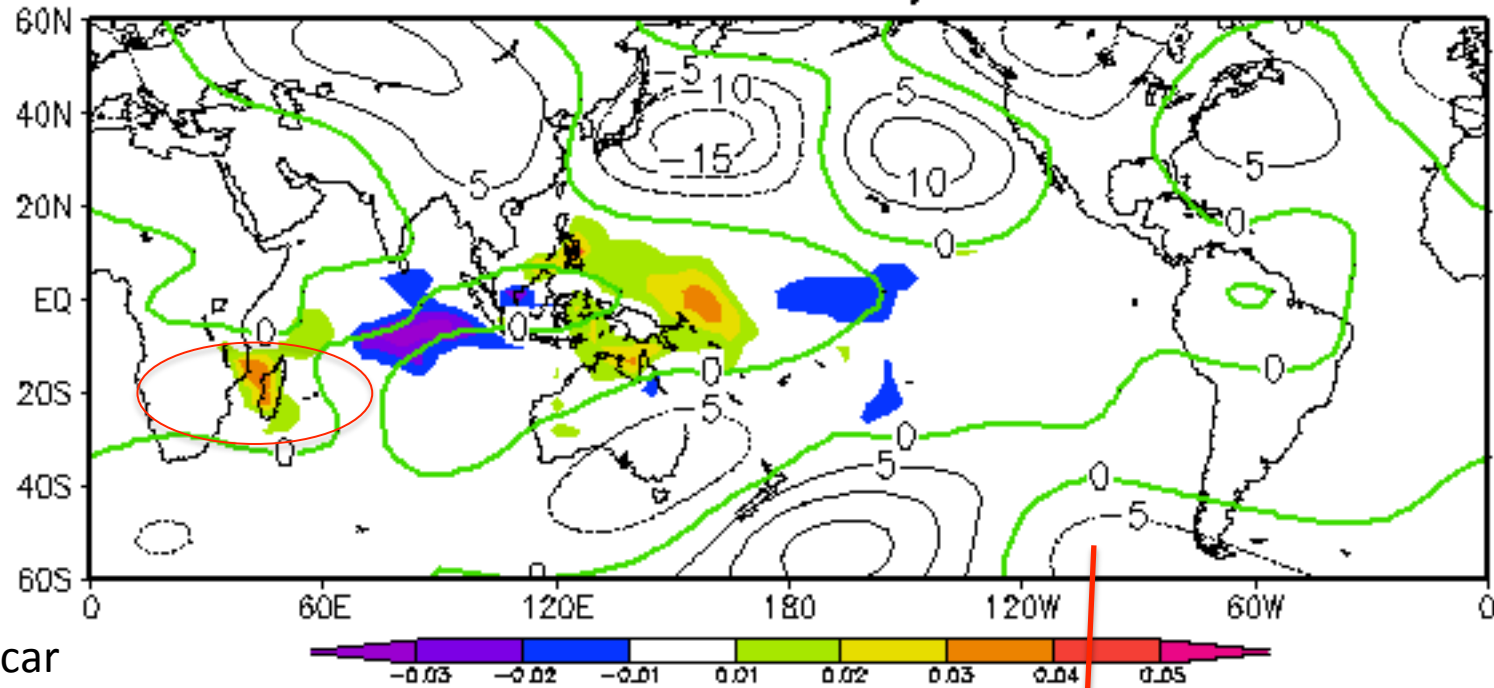
Anomalia negativa Indico, positiva no Pacifico Oeste e negativa na linha da data:



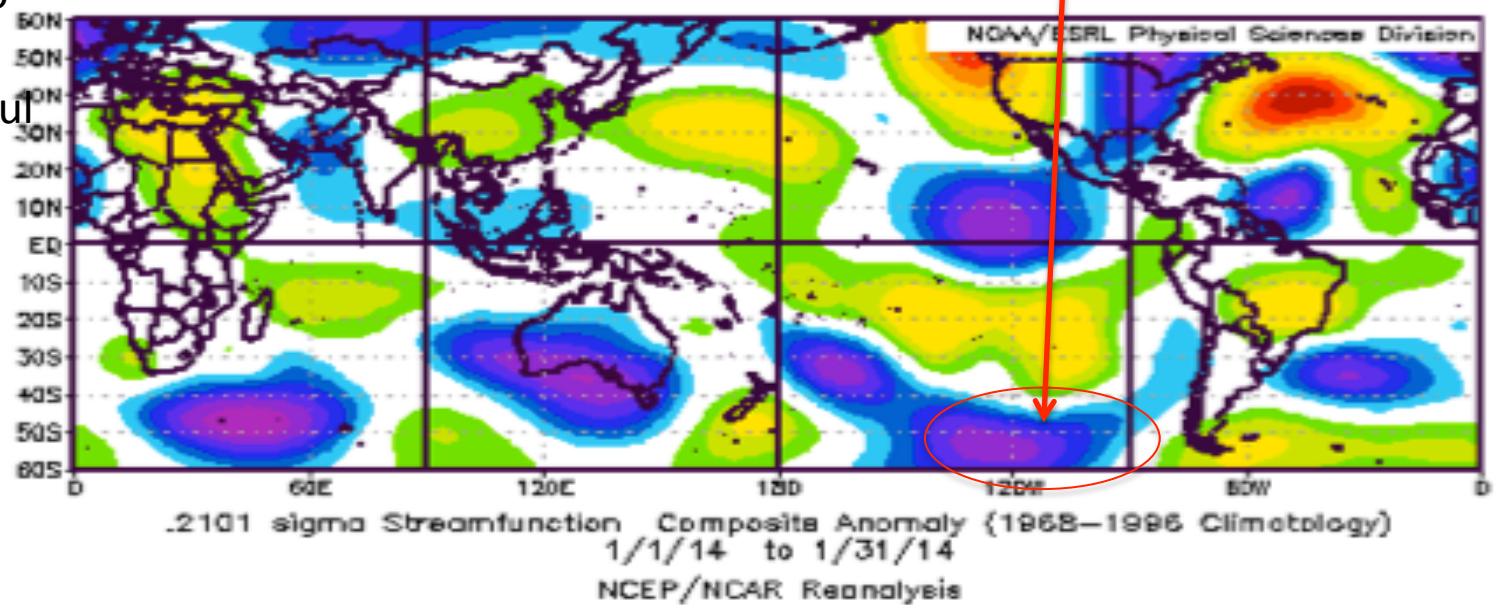
Padrão no Hem. Norte e trem de onda mais ao sul no Hem. Sul



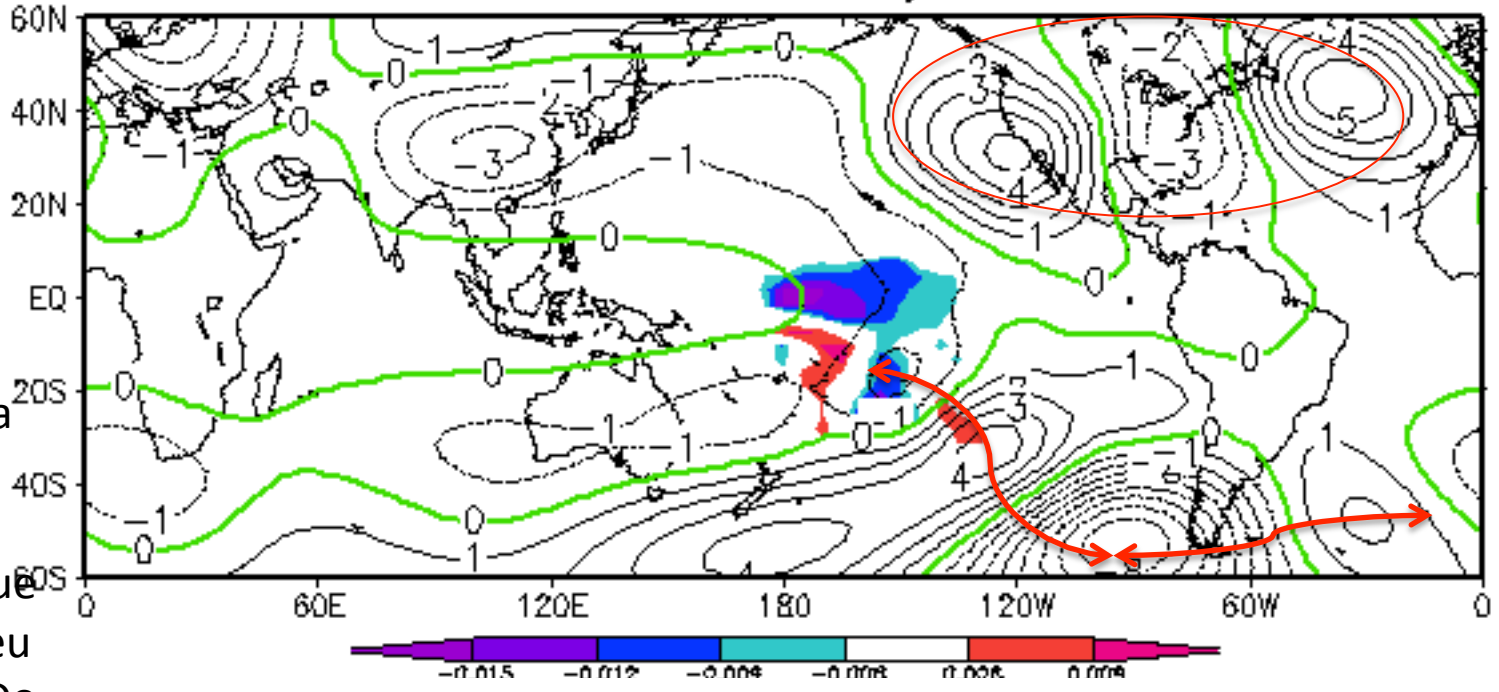
Geop. 200 hPa – Integral da F.I. de Jan Forçante ROLE de jan2014



Fonte
anômala
em
Madagascar
com efeito
relevante
no Hem. Sul

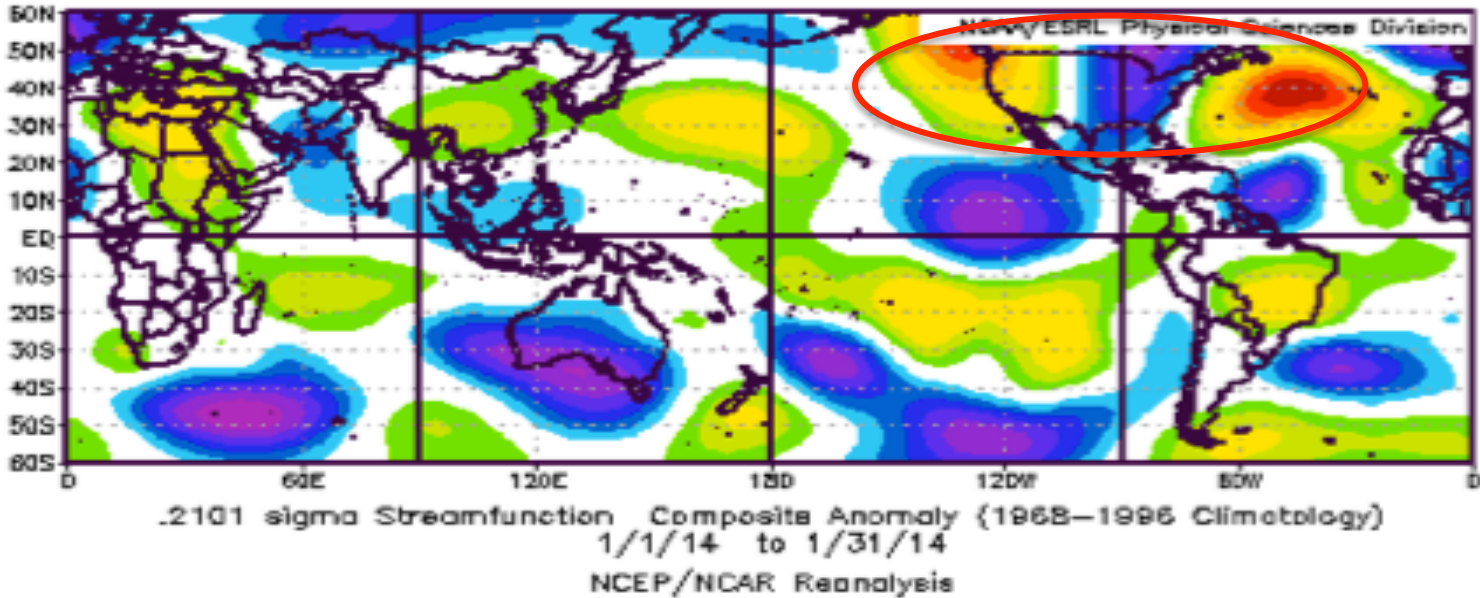


Geop. 200 hPa – Integral da F.I. de Jan Forçante ROLE de jan2014

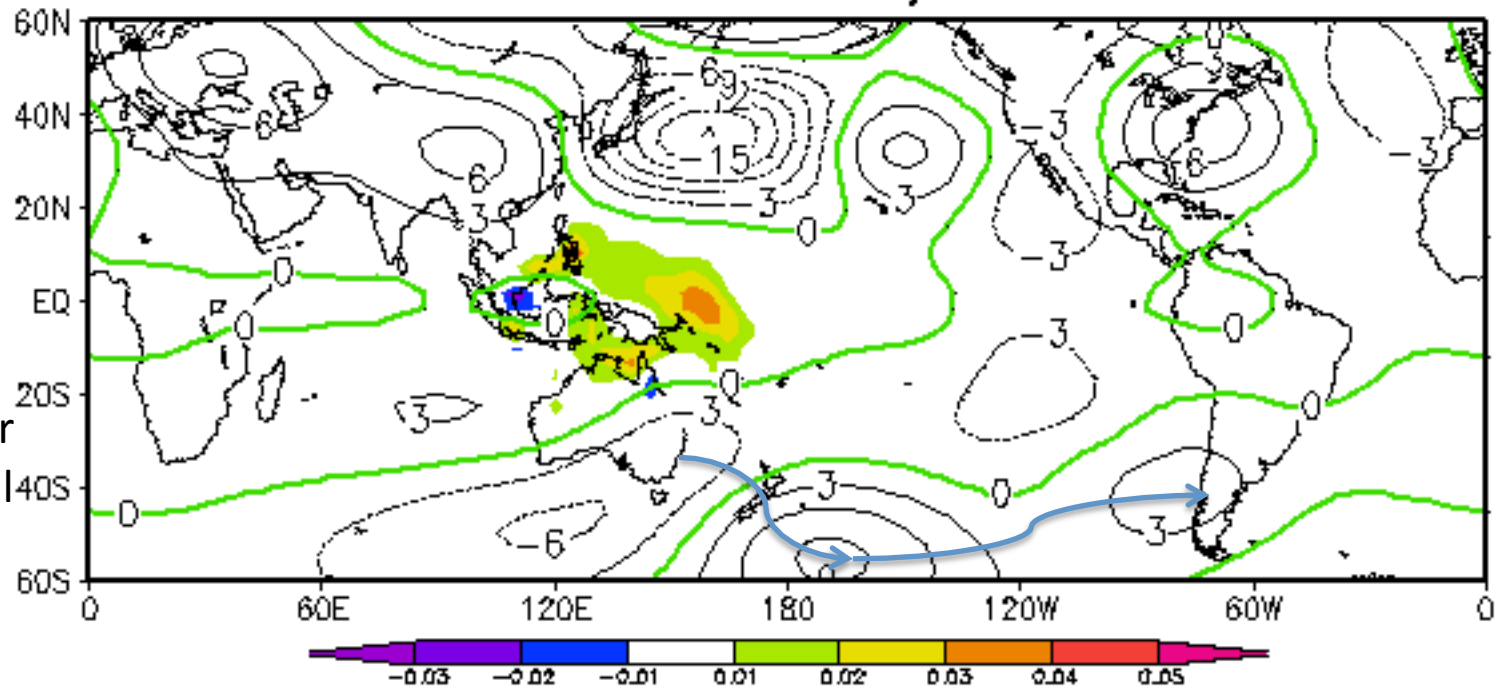


Anomalia negativa explica bem o que aconteceu Na Am. Do Norte.

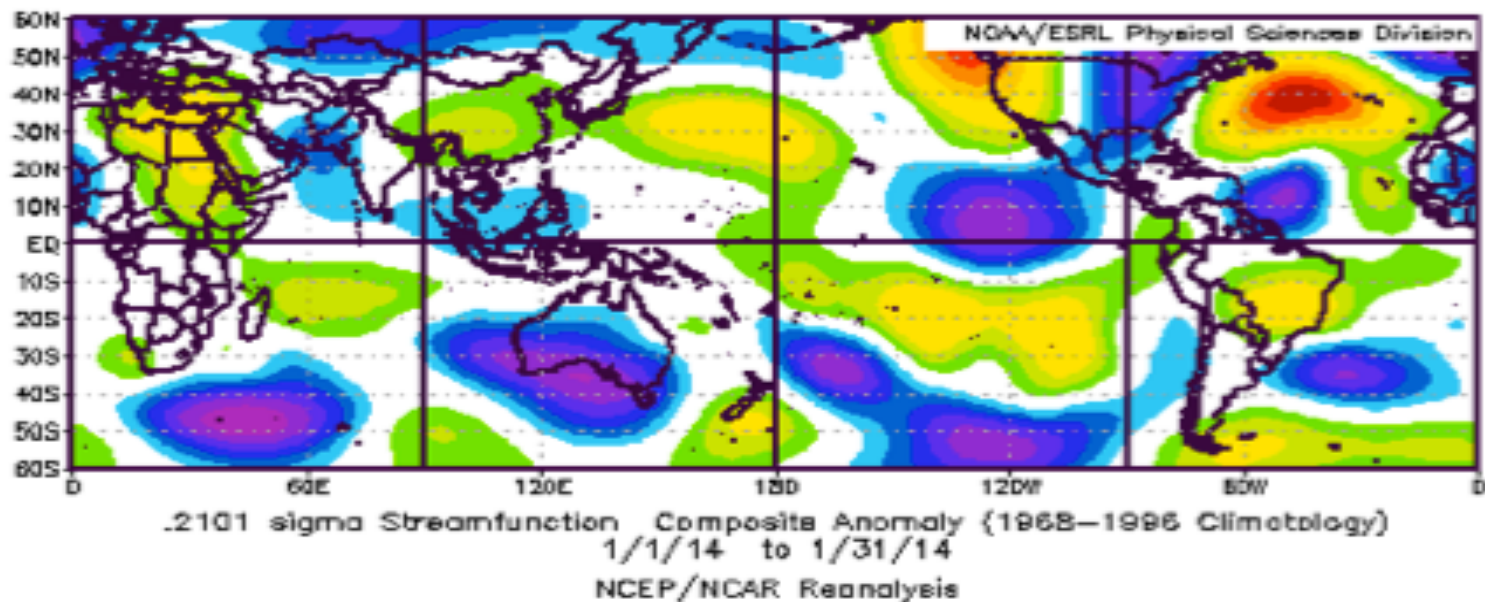
Alguma influência no Hem. Sul.



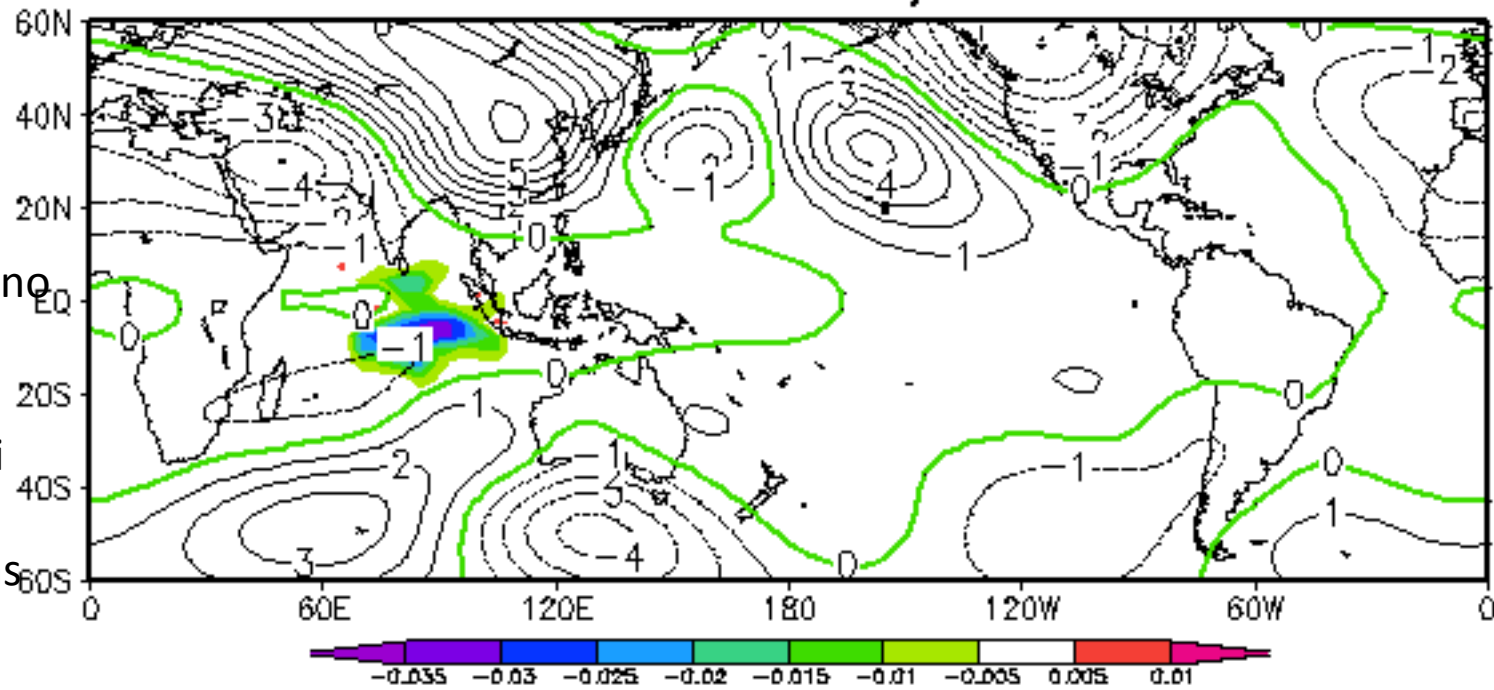
Geop. 200 hPa - Integral da F.I. de Jan Forçante ROLE de jan2014



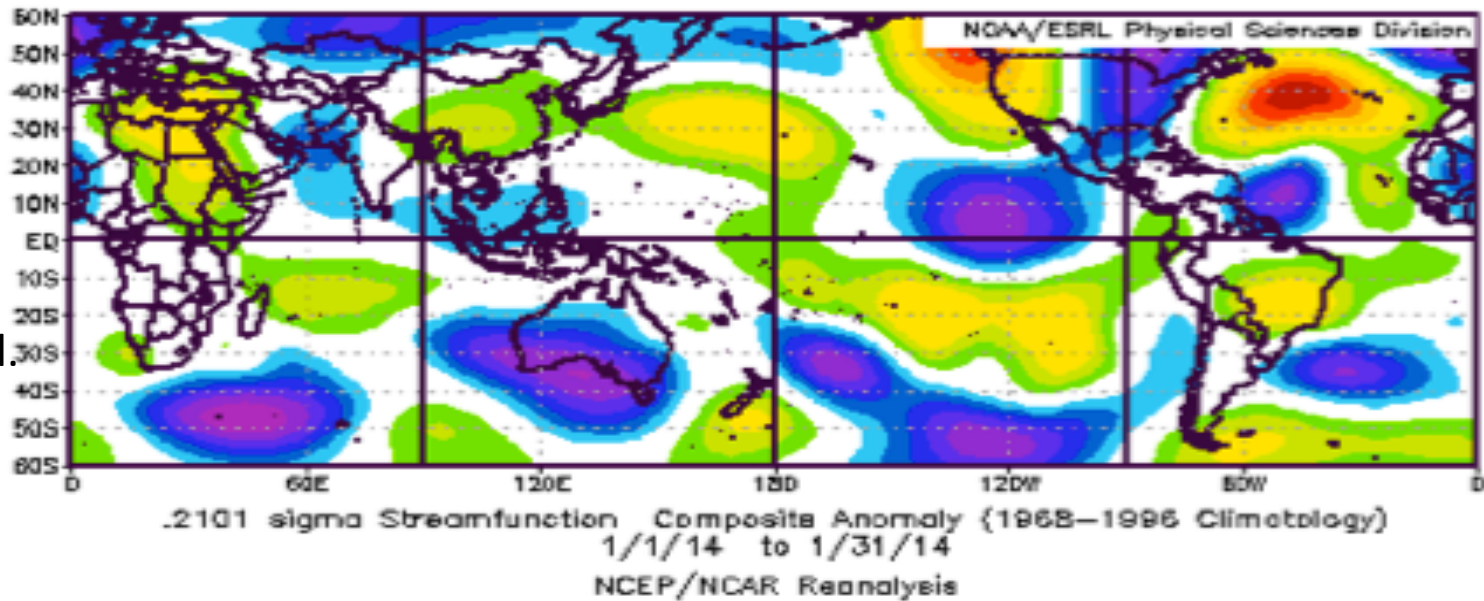
Não parece ser a principal fonte...



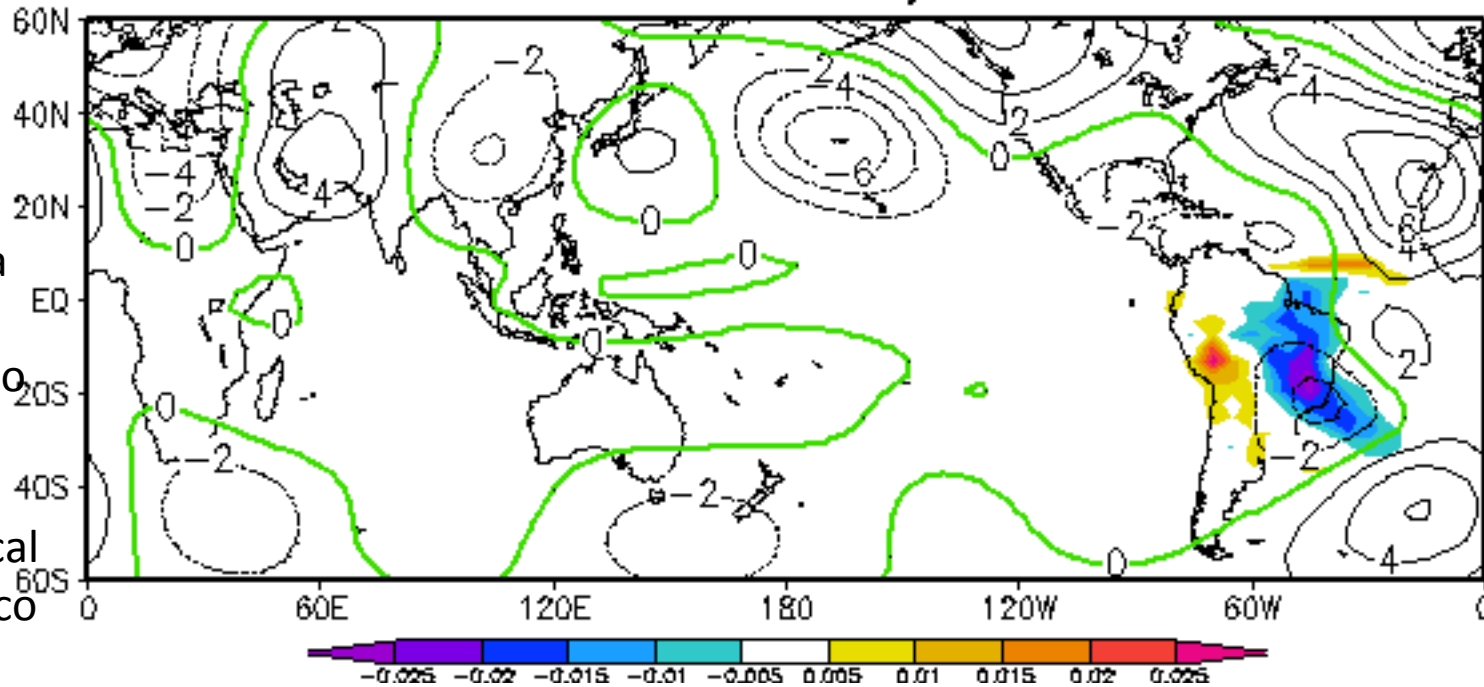
Geop. 200 hPa - Integral da F.I. de Jan Forçante ROLE de jan2014



Fonte negativa no Índico:
Contribui para anomalias na Ásia e ao sul da Austrália.
Também contribui para anomalias no sul da Am. Do Sul.



Geop. 200 hPa - Integral da F.I. de Jan Forçante ROLE de jan2014

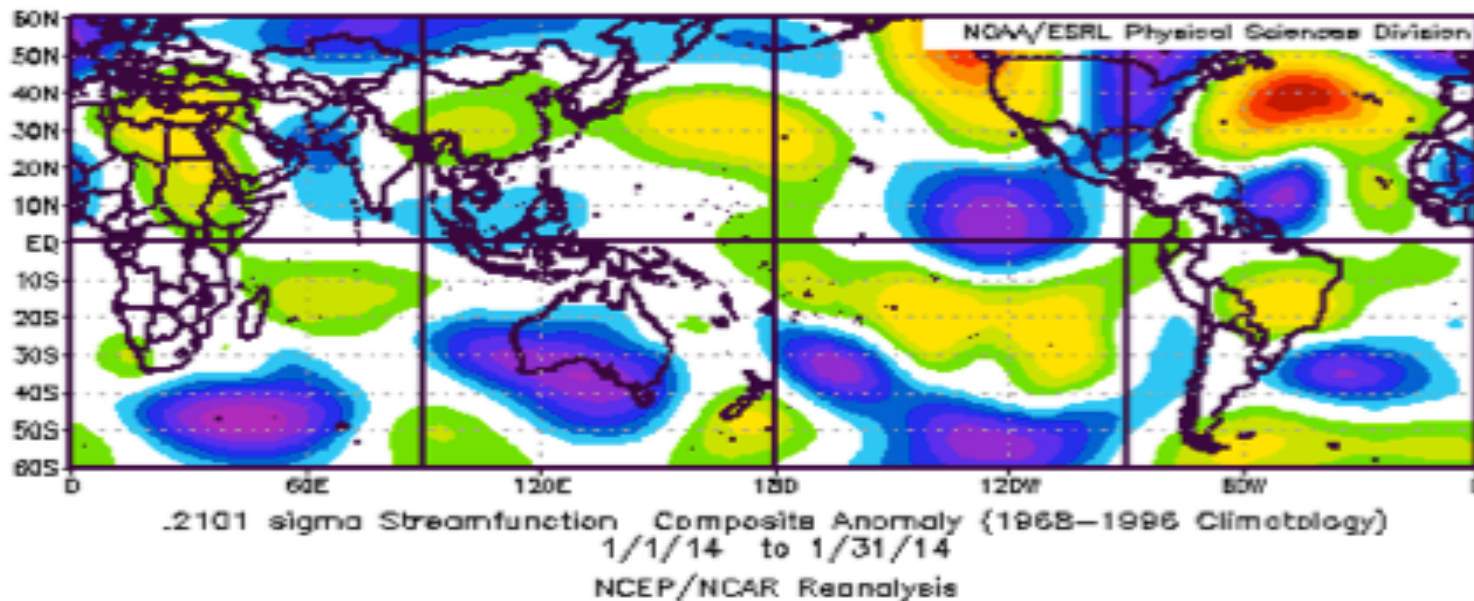


Anomalia da fonte da Am. Do Sul:

Efeito local baroclínico

->

Pressão alta na superfície no SE parece ser resposta local a fonte negativa.





A global perspective on the recent storms and floods in the UK

...“um padrão **persistente** de chuvas sobre a Indonésia e o Pacífico Tropical Oeste associado com altas temperaturas da água do mar nessa região”.

February 2014 - This winter the UK has been affected very severely by an exceptional run of winter storms, culminating in serious coastal damage and widespread, persistent flooding. This paper documents the record-breaking weather and flooding, considers the potential drivers and discusses whether climate change contributed to the severity of the weather and its impacts.



This series of winter storms has been exceptional in its duration, and has led to the wettest December to January period in the UK since records began. Heavy rains combined with strong winds and high waves led to widespread flooding and coastal damage, causing significant disruption to individuals, businesses and infrastructure.

The severe weather in the UK coincided with exceptionally cold weather in Canada and the USA. These extreme weather events on both sides of the Atlantic were linked to a persistent pattern of perturbations to the jet stream, over the Pacific Ocean and North America.

The major changes in the Pacific jet stream were driven by a persistent pattern of enhanced rainfall over Indonesia and the tropical West Pacific associated with higher than normal ocean temperatures in that region. The North Atlantic jet stream has also been unusually strong; this can be linked to exceptional wind patterns in the stratosphere with a very intense polar vortex.

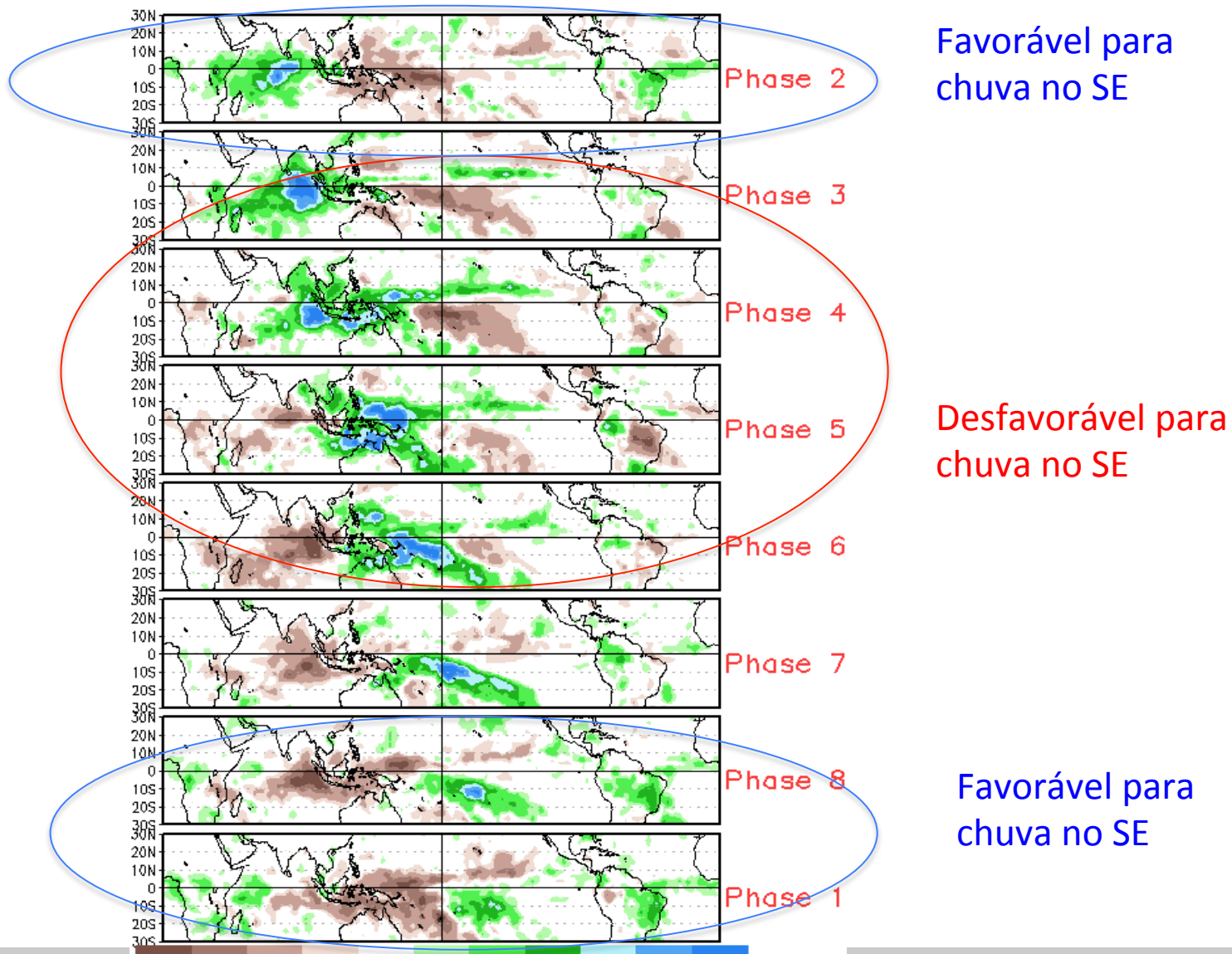
Outro efeito importante em Dez/2013 -> Janeiro de 2014

Intrasazonal – comportamento anômalo

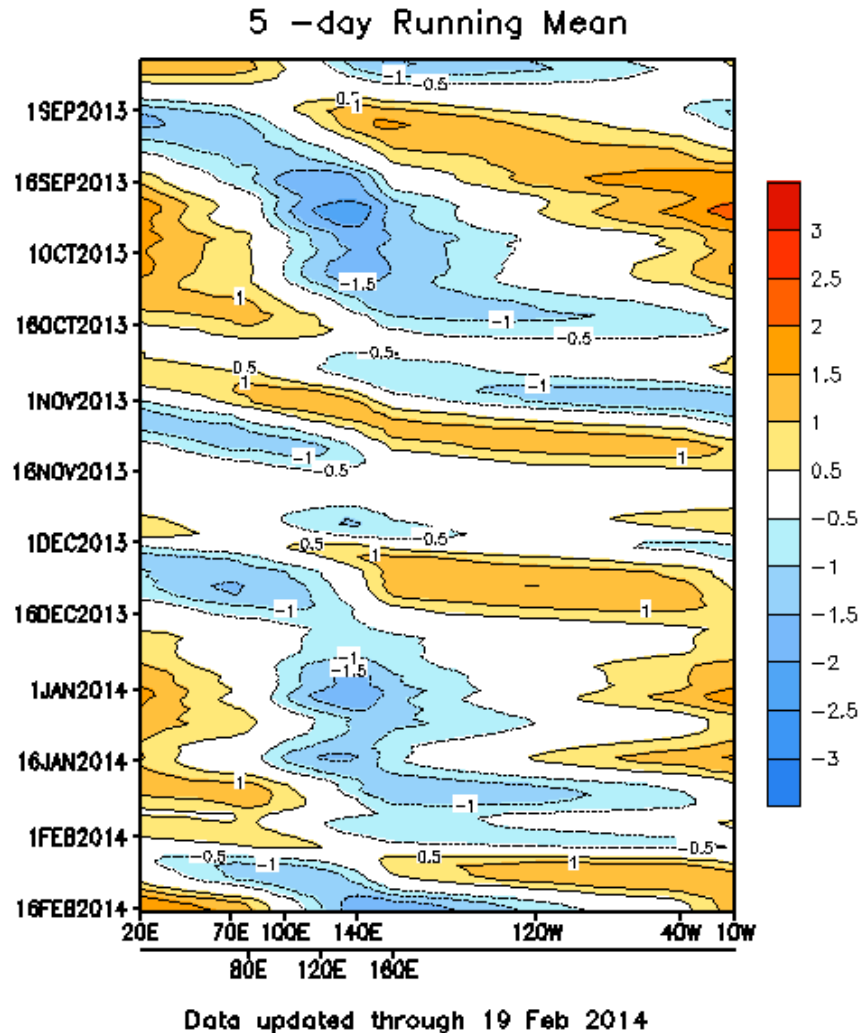
Estacionamento do ciclo no Pacífico Oeste
em Janeiro!!!!!!

MJO Composites – Global Tropics

Precipitation Anomalies (Nov-Mar)

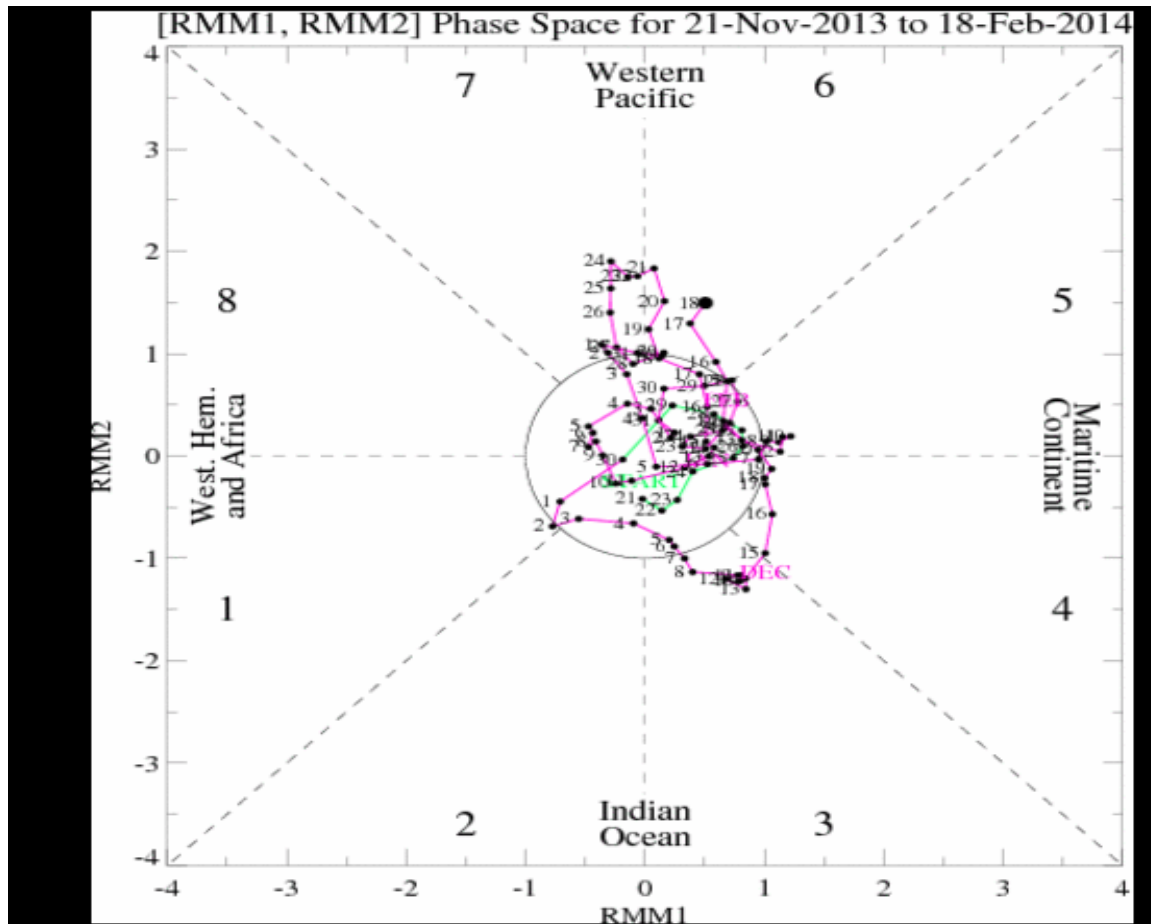


Oscilações intrasazonais ausentes no verão de 2013-2014



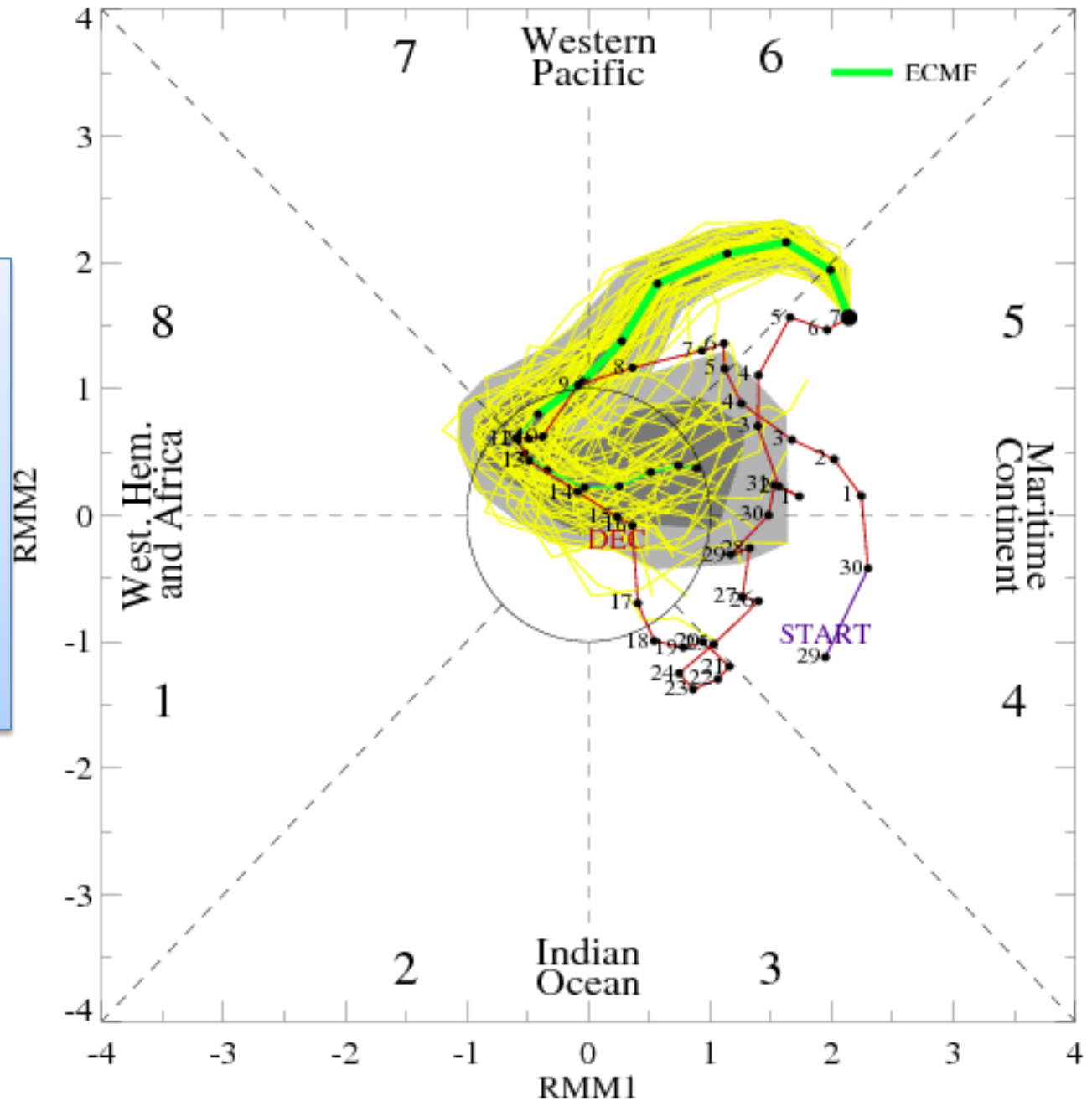
Intrasazonal em dezembro/2013 – fevereiro/2014

MJO estacionada principalmente nas fases 3,4, 5,6, exceto no final de fevereiro quando entrou na 7 que é um pouco mais favorável para chuvas no SE



MJO Index Forecast for 08Jan2015-22Jan2015

Diagnostico e
previsão da
atividade da
intrasazonal no
início de janeiro
de 2015



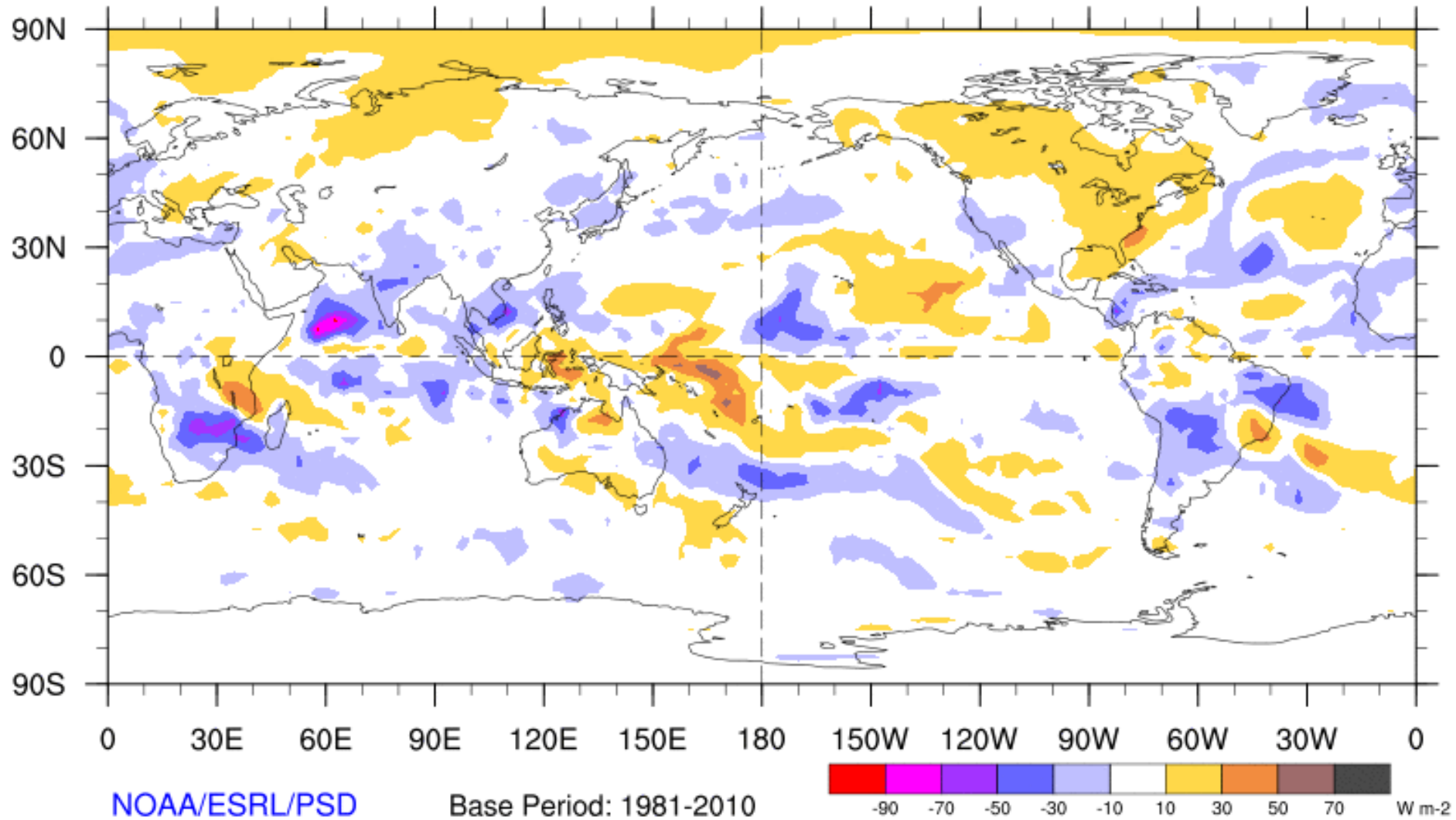
E em 2014/15?

O que vem acontecendo com a
intrasazonal?

Estimador de precipitação por satélite – positivo chuva abaixo do normal

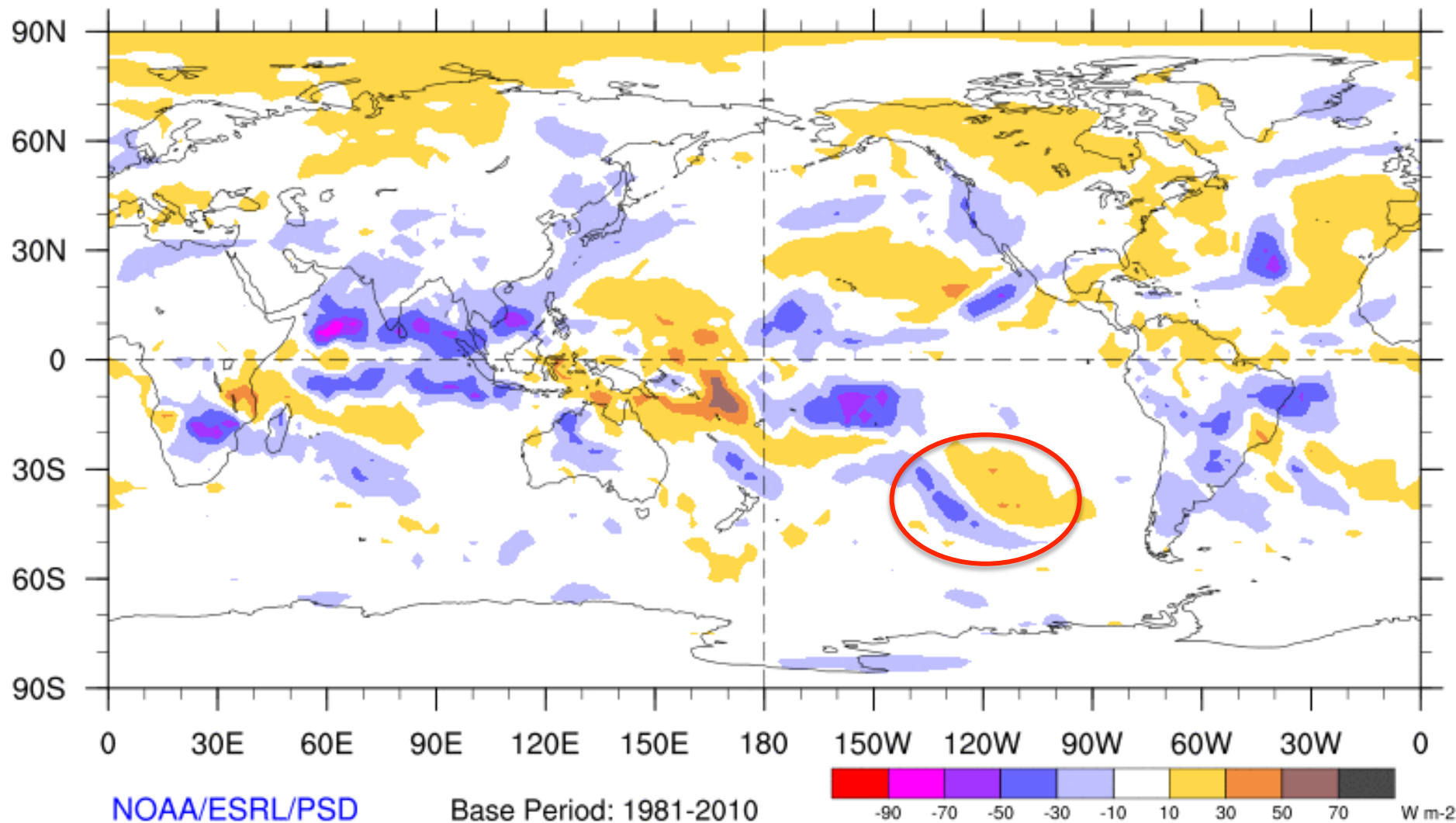
7-Day Average OLR Anomaly

2014/12/12 - 2014/12/18



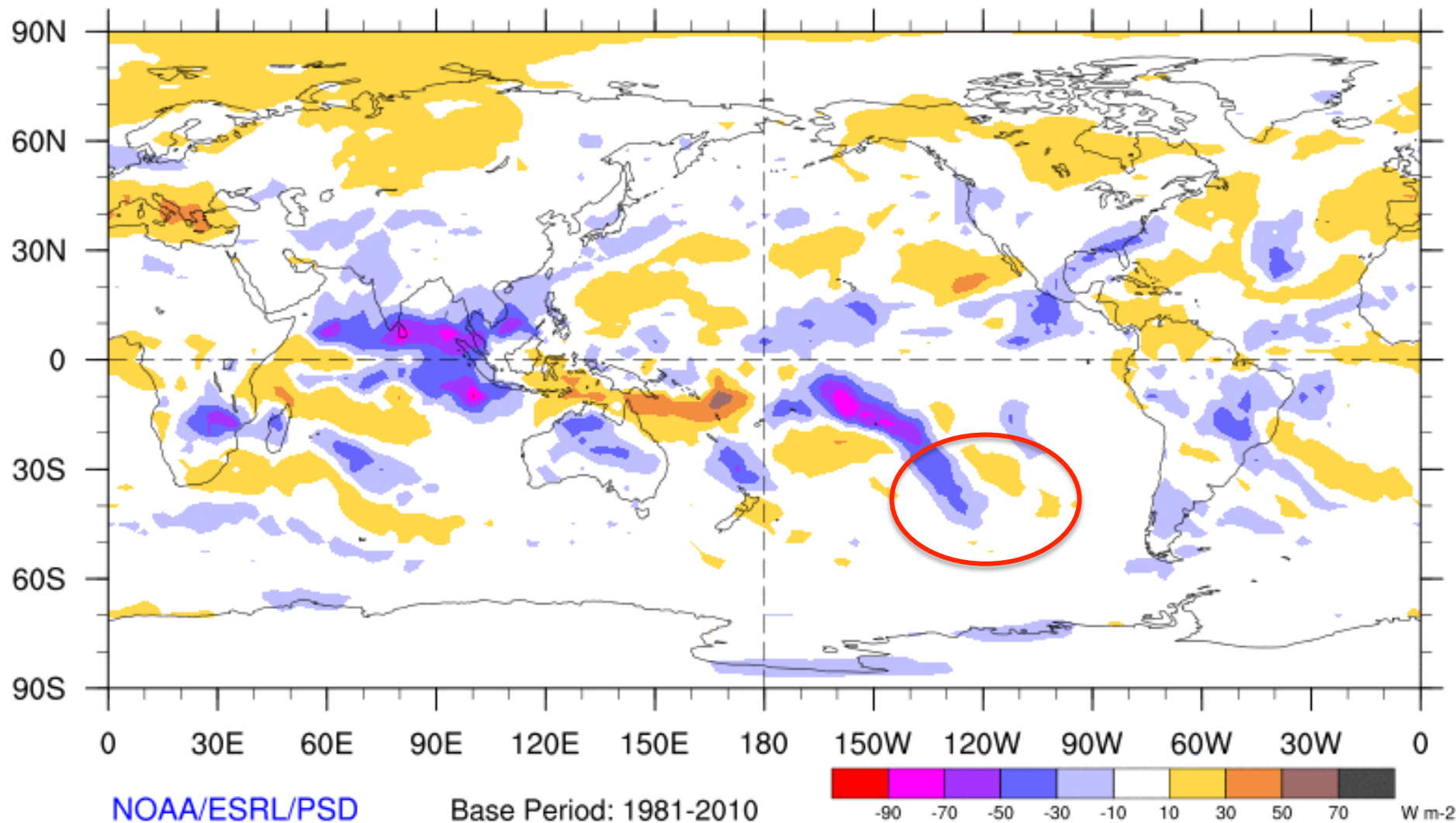
7-Day Average OLR Anomaly

2014/12/15 - 2014/12/21



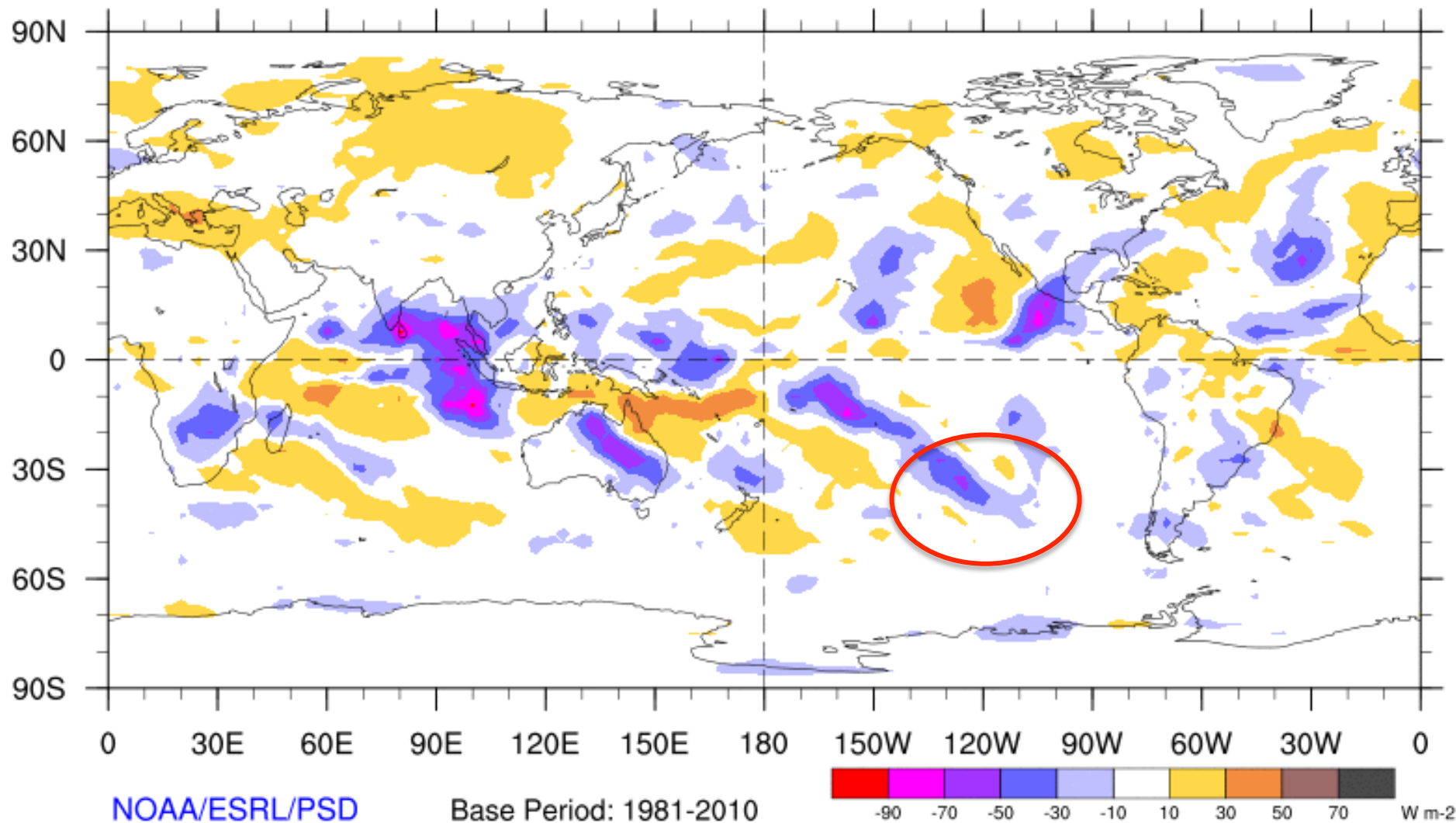
7-Day Average OLR Anomaly

2014/12/18 - 2014/12/24



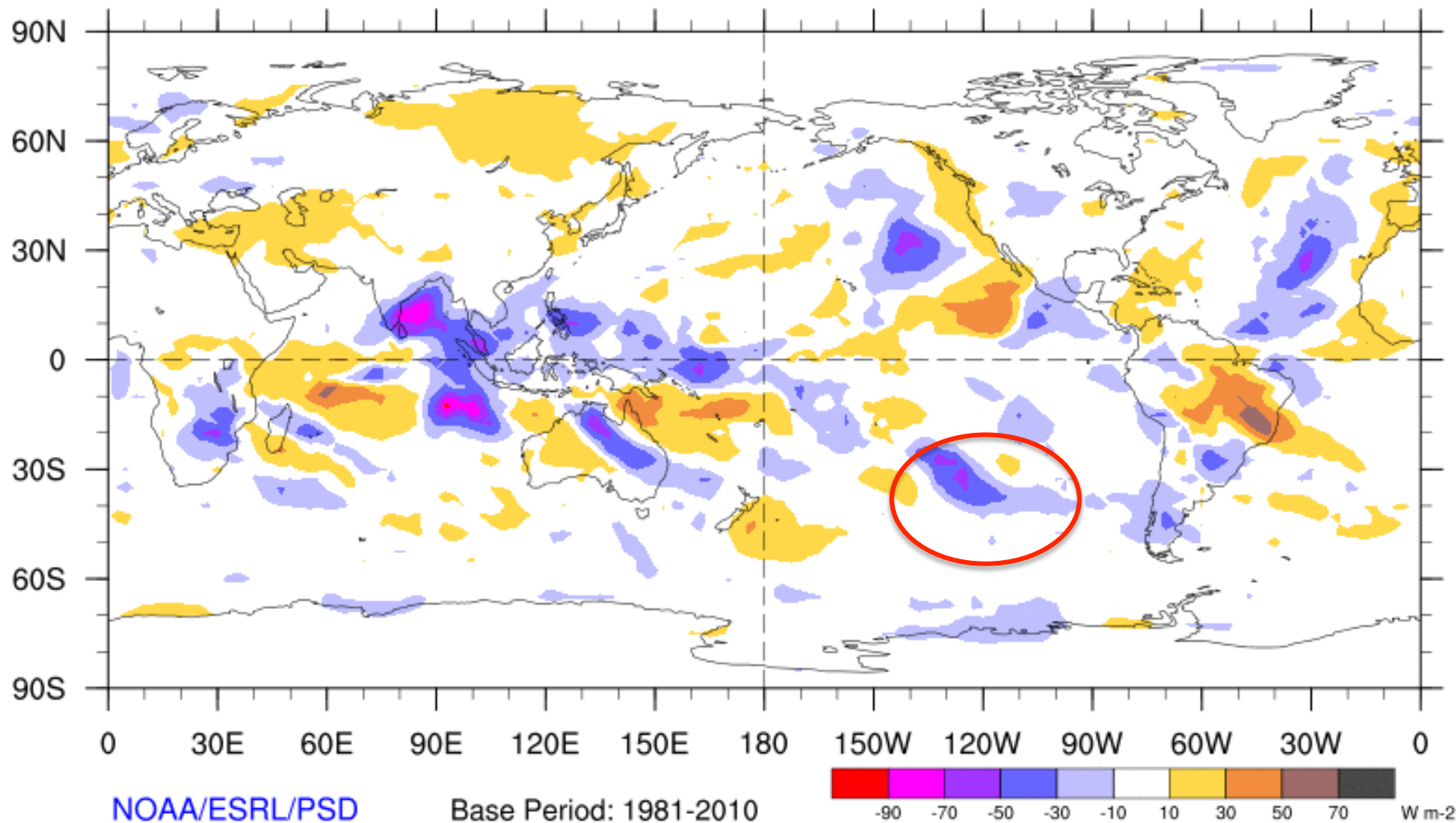
7-Day Average OLR Anomaly

2014/12/21 - 2014/12/27



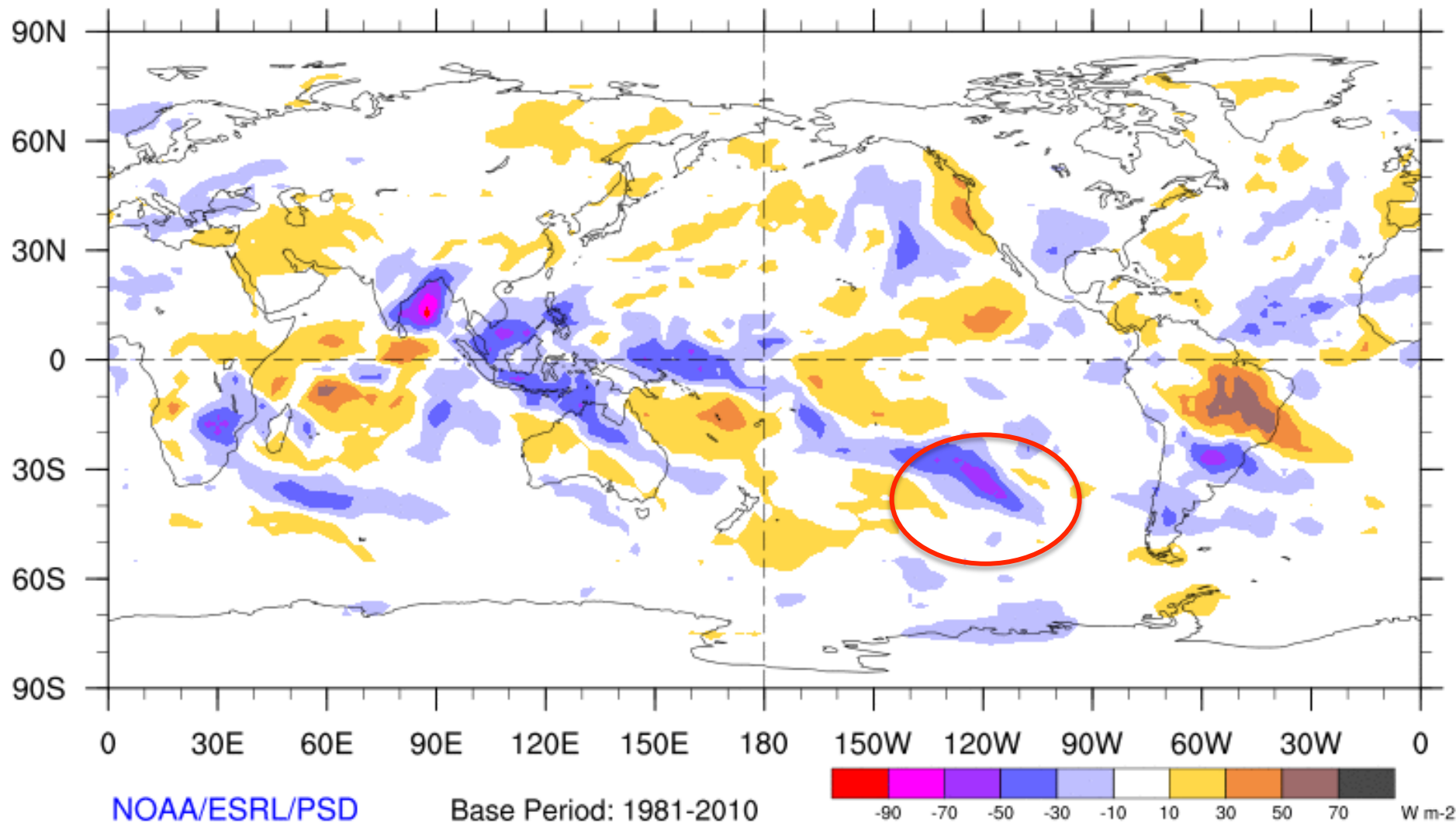
7-Day Average OLR Anomaly

2014/12/24 - 2014/12/30



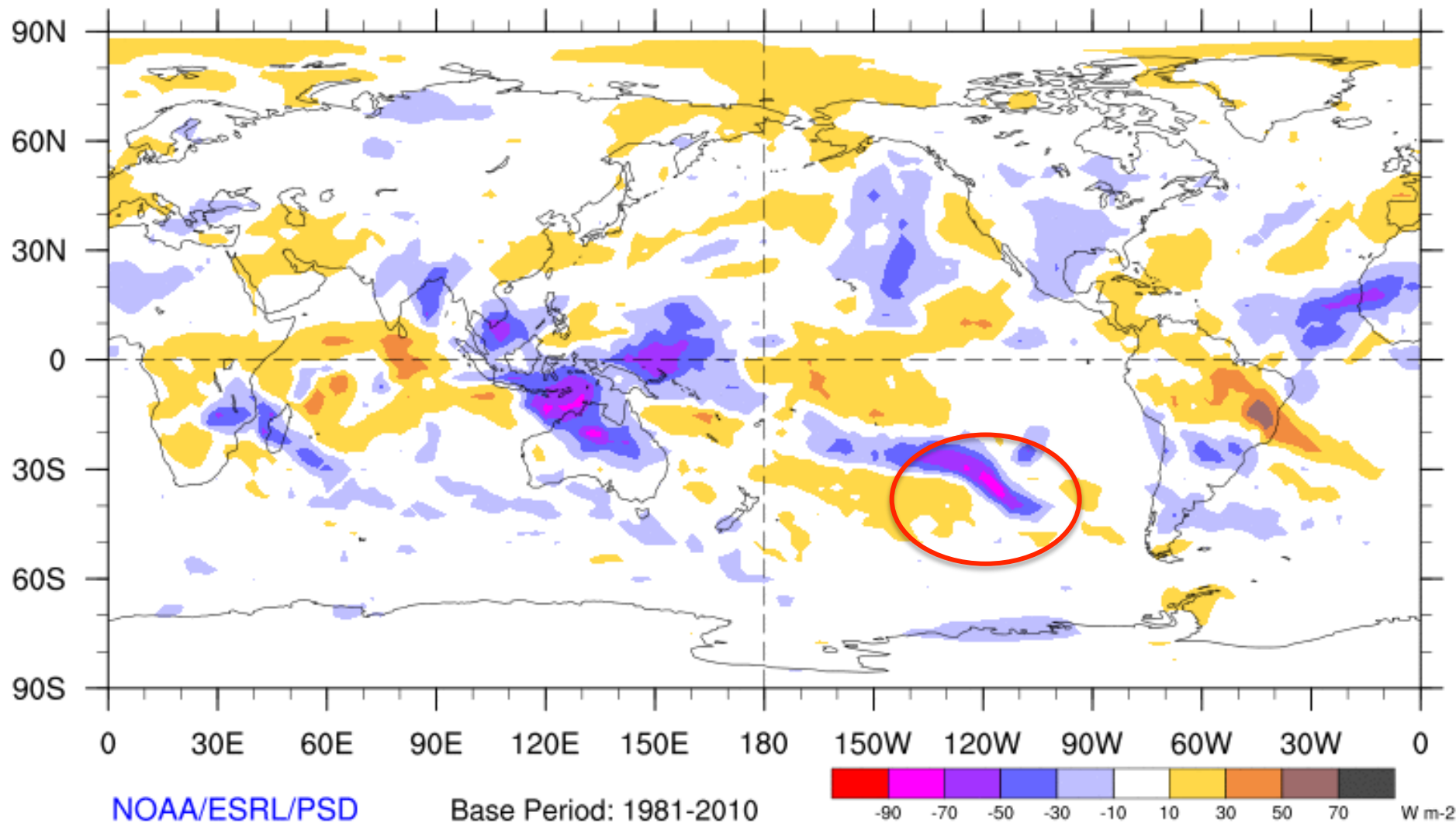
7-Day Average OLR Anomaly

2014/12/27 - 2015/01/02



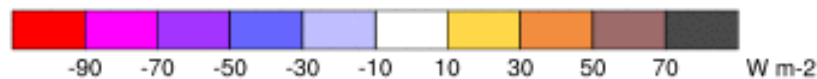
7-Day Average OLR Anomaly

2014/12/30 - 2015/01/05



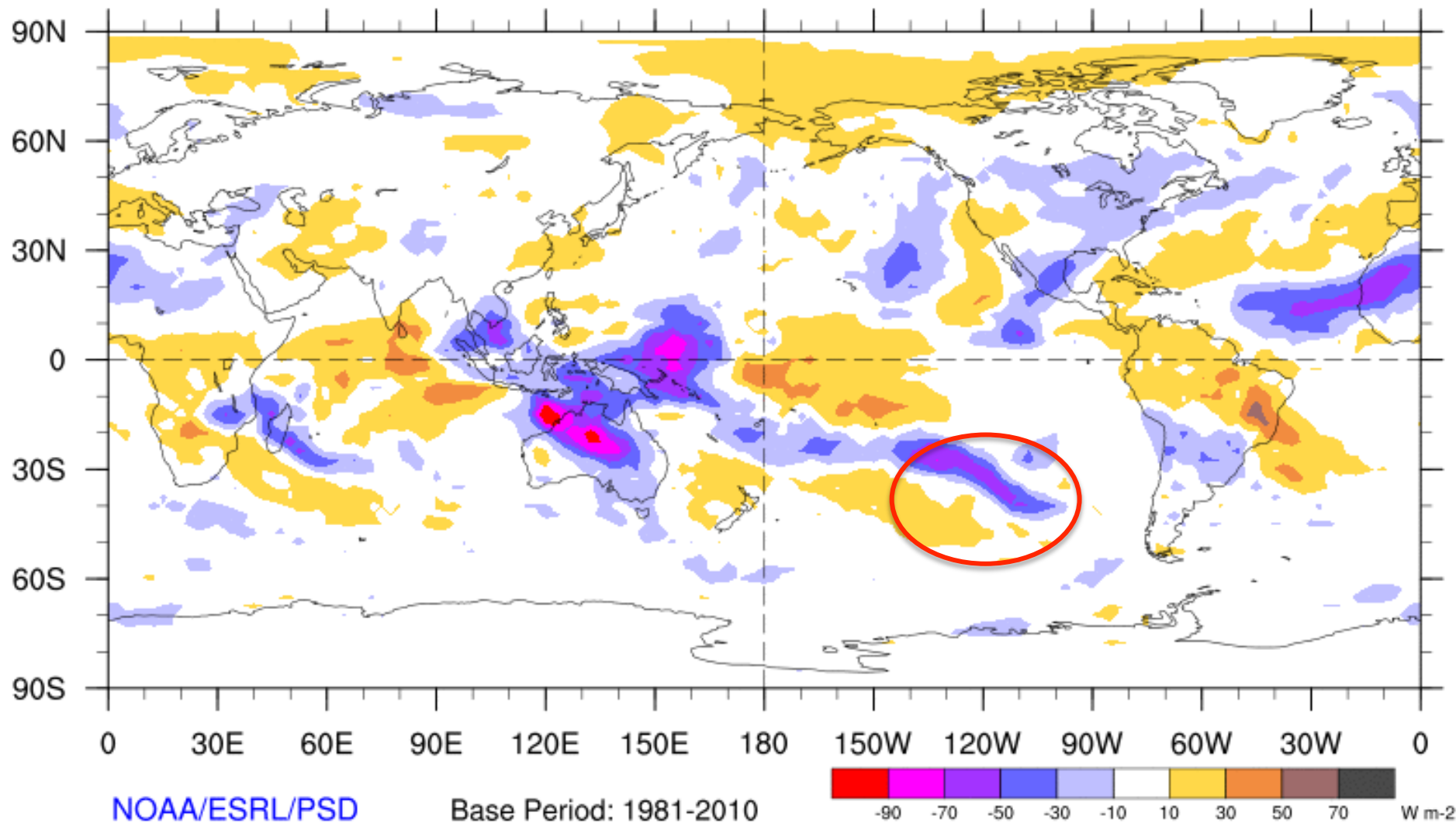
NOAA/ESRL/PSD

Base Period: 1981-2010



7-Day Average OLR Anomaly

2015/01/02 - 2015/01/08



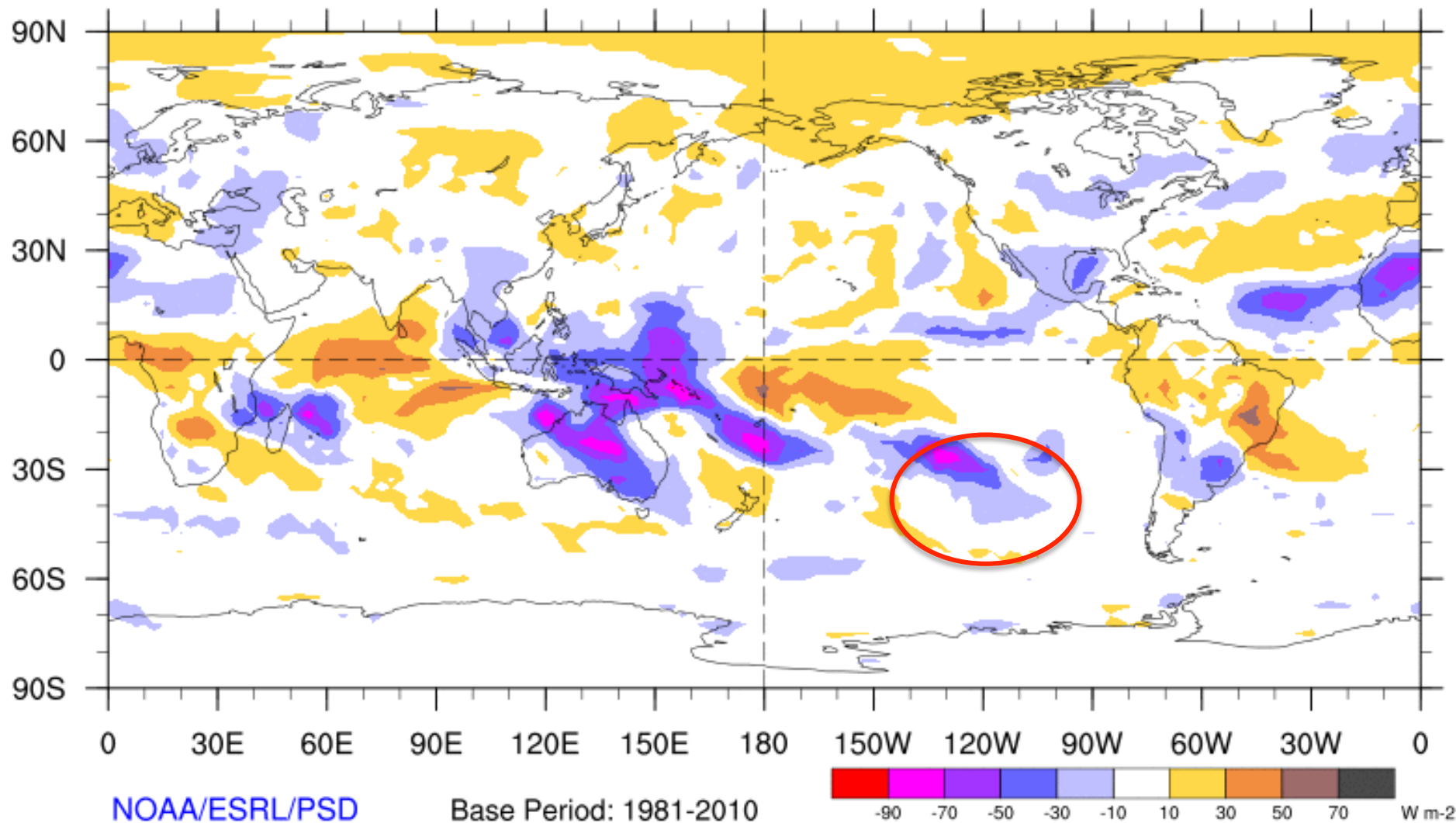
NOAA/ESRL/PSD

Base Period: 1981-2010



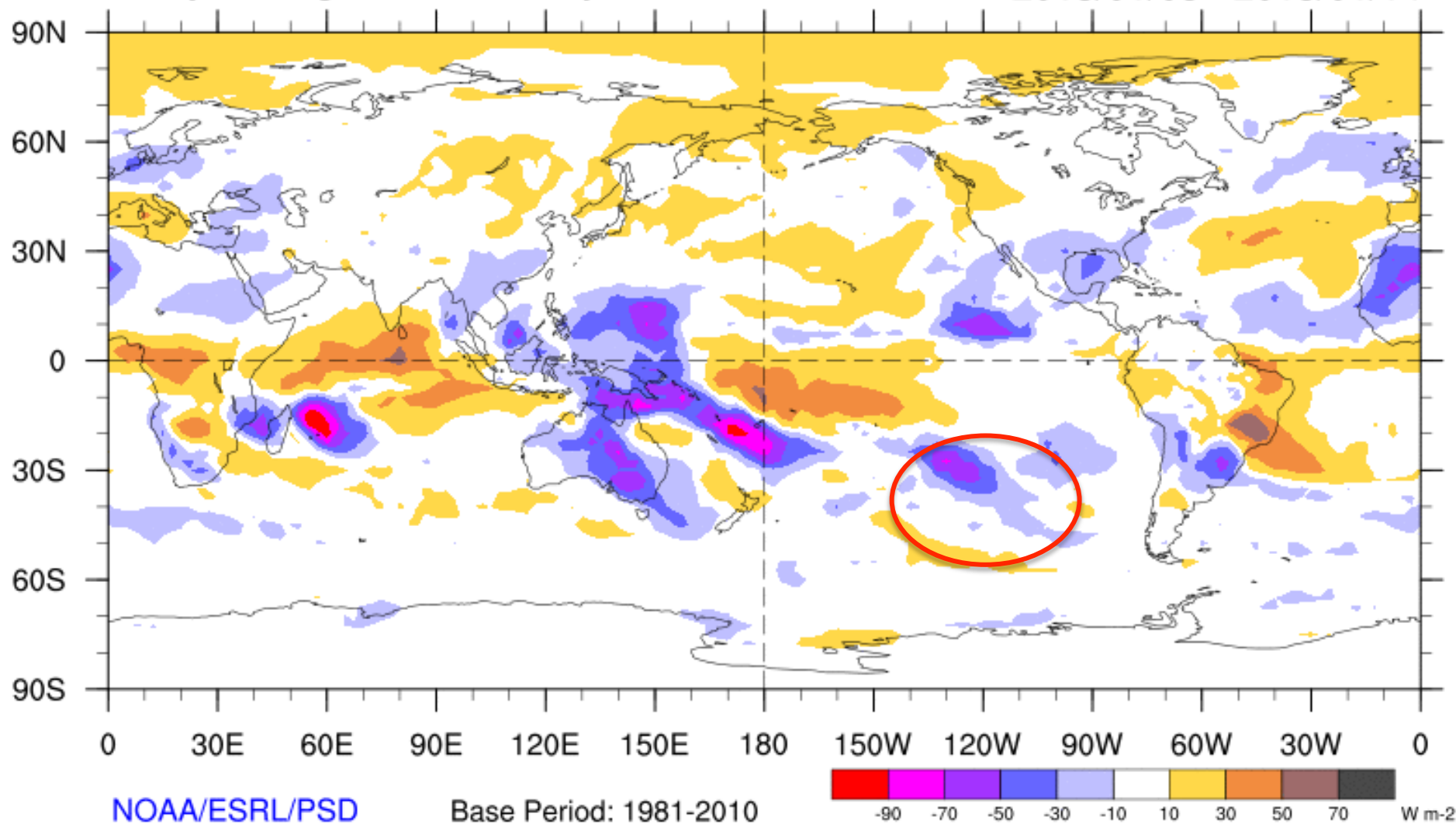
7-Day Average OLR Anomaly

2015/01/05 - 2015/01/11



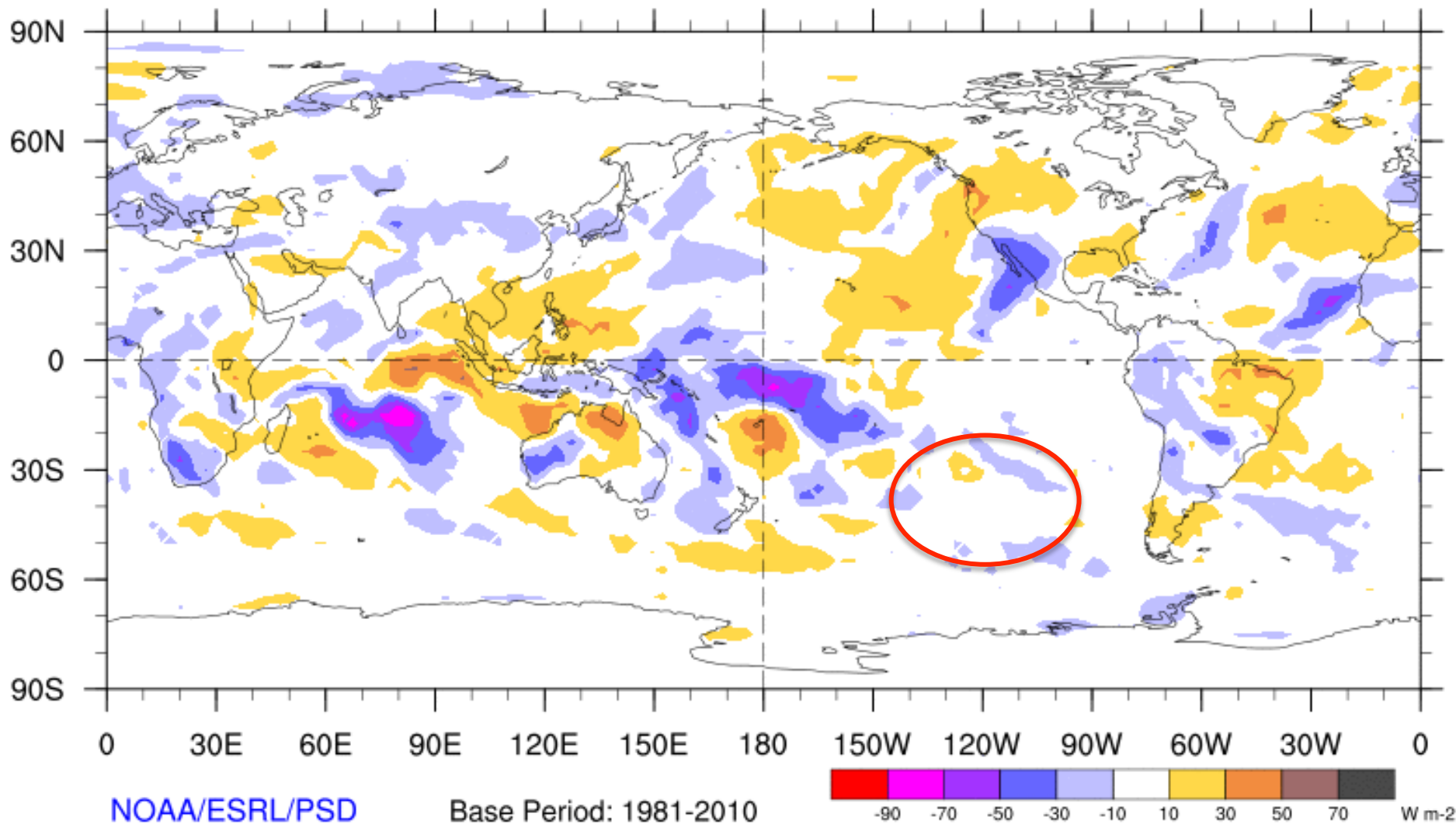
7-Day Average OLR Anomaly

2015/01/08 - 2015/01/14



7-Day Average OLR Anomaly

2015/01/25 - 2015/01/31



NOAA/ESRL/PSD

Base Period: 1981-2010



Comentário em 09/01/2015

- MJO quase neutra até 17 de dezembro;
- Entrou da fase 3 logo depois – ou seja, situação de escala planetária inicia a fase desfavorável para chuvas no SE;
- Atinge fase mais desfavorável a partir do Natal;
- Fase predominantemente desfavorável (5) no início de janeiro.

- Prognósticos para os próximos 15 dias:
 - Maior parte dos modelos indica continuidade da fase desfavorável 6 até dia 13-15 de janeiro;
 - Depois entra na fase 7 que é um pouco mais favorável para organização da precipitação no SE;
 - Mas no horizonte até o dia 24 a amplitude na fase 7,8 permanece pequena, exceto na previsão da UKMET e JMA.
 - Ou seja, sem o indício claro de um período com ZCAS bem estruturada;
 - Ou seja, muito semelhante a Janeiro de 2014 ... mas um pouco mais favorável para episódios de precipitação isolados.

Algumas especulações:

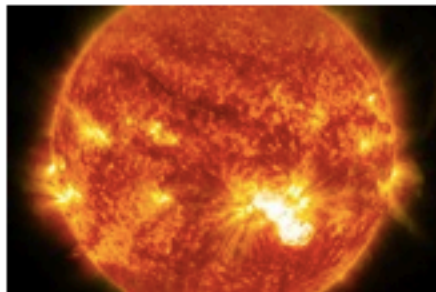
- Por que a intrasazonal “parou” no Pacífico Oeste e a ZCAS não se formou durante o verão?
 - Pouco provável que o efeito da mudança climática tenha papel fundamental... Assim como desmatamento na Amazonia
 - Interação com ciclos de mais longo período – ENSO : mecanismo explorado pelo Enver Ramirez em sua tese.
 - Pacífico Oeste apresenta algumas peculiaridades: entre elas, condições de propagação vertical de energia -> pode explicar o estacionamento. (precisa ser mais explorado...)
 - Em 2013 e 2014 ocorreram explosões solares de grande porte => impacto no ozônio => propagação vertical de energia . Evidências recentes de conexão entre O3 na estratosfera e a propagação da Intrasazonal!!! (plausível mas requer mais estudos).

Huge Solar Flare Erupts from Biggest Sunspot in 24 Years (Photos)

by [Tariq Malik](#), SPACE.com Managing Editor | October 25, 2014 06:37am ET

More ▾

The biggest sunspot on the face of the sun in more than two decades unleashed a major flare on Friday (Oct. 24), the fourth intense solar storm from the active star in less than a week.



The solar flare occurred Friday afternoon, reaching its peak at 5:41 p.m. EDT (2141 GMT), and triggered a strong radio blackout at the time, according to the U.S. Space Weather Prediction Center. NASA's sun-watching Solar Dynamics Observatory captured [stunning video of the huge solar flare](#).

Desafios e Oportunidades (1)

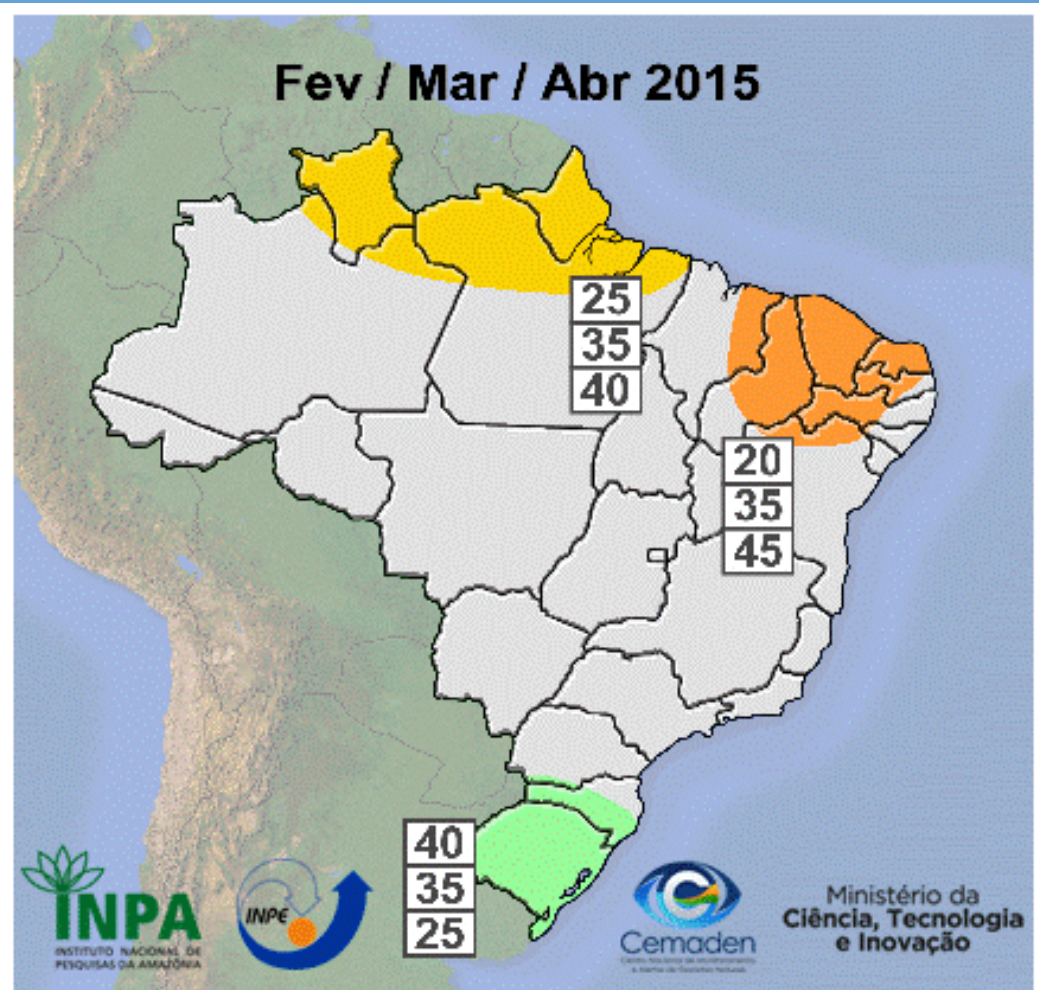
- Previsão estendida de clima
- Monitoramento
 - Um Monitor de Secas para o Brasil
- Educação e Treinamento em um mundo em mudança
 - Flexibilização de currículos e atribuições
 - o profissional da Meteorologia que fala sobre riscos e vulnerabilidades

Desafios e Oportunidades (2)

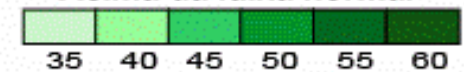
- Previsão climática:
 - Tendência no momento é usar super-conjuntos de modelos (estimar incerteza devido a condição inicial e da formulação de processo físicos) – uso de técnicas bayesianas, inteligência artificial (- mais recente – “deep thinking)”
 - No Brasil, por portaria, definiu-se em 2013 que a previsão tem que ser “por consenso” ... um retrocesso enorme.
 - Temos que modernizar a forma de atacar problemas complexos como a previsão climática.

Previsões para o trimestre FMA 2015

Previsão de “consenso”



Previsão de probabilidade (%) de chuva em três categorias
Abaixo da faixa normal Acima da faixa normal

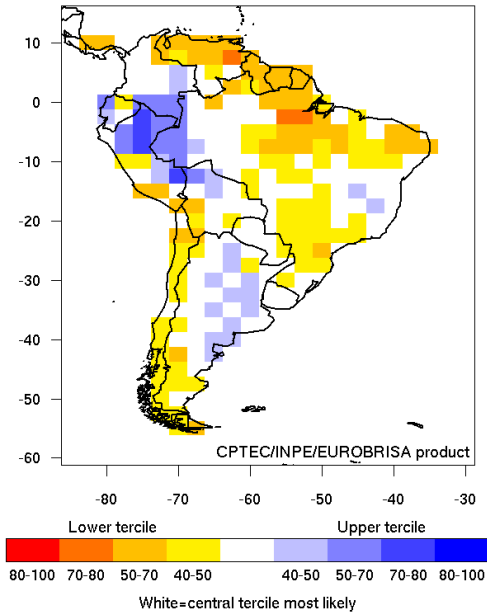


Nota: As cores no mapa ilustram a maior probabilidade prevista nas categorias acima ou abaixo da normal climatológica

- Acima da normal
- Dentro da normal
- Abaixo da normal

ÁREA CINZA: O prognóstico por consenso indica igual probabilidade para as três categorias

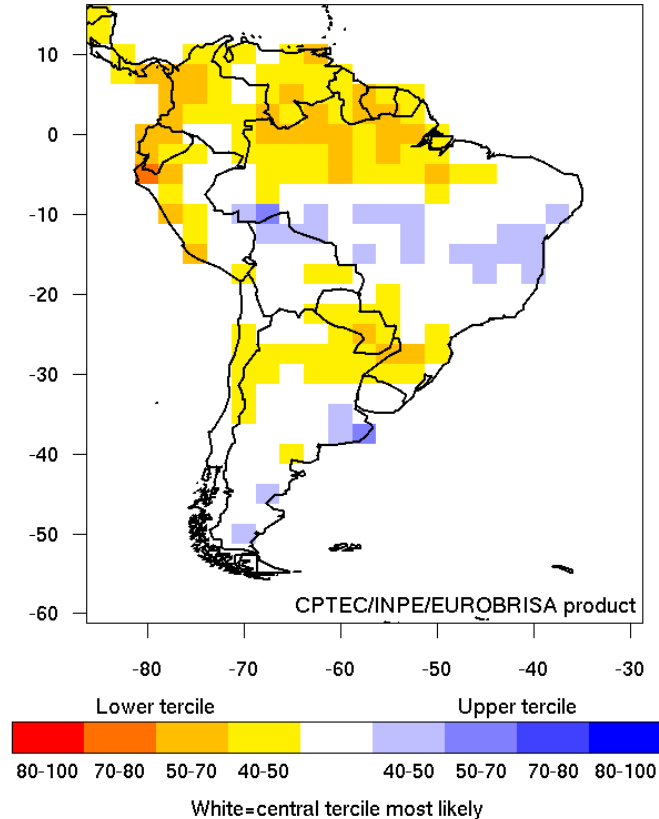
ECMWF: Prob. most likely precip. tercile (%)
 Issued: Dec 2014 Valid for JFM 2015



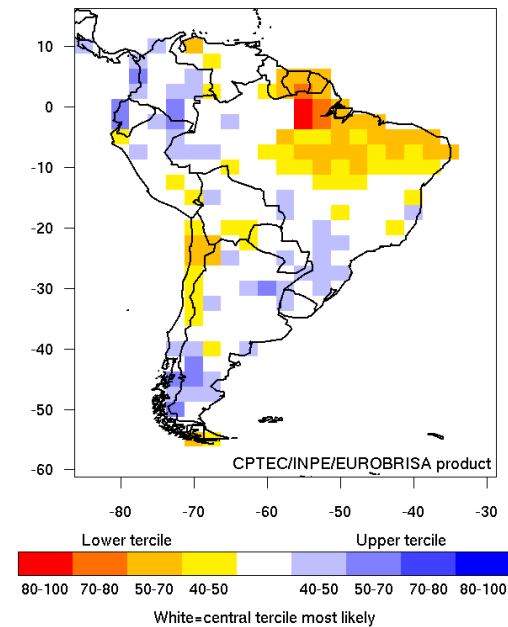
Programa EUROBRISA:

Combinação bayesiana de vários modelos

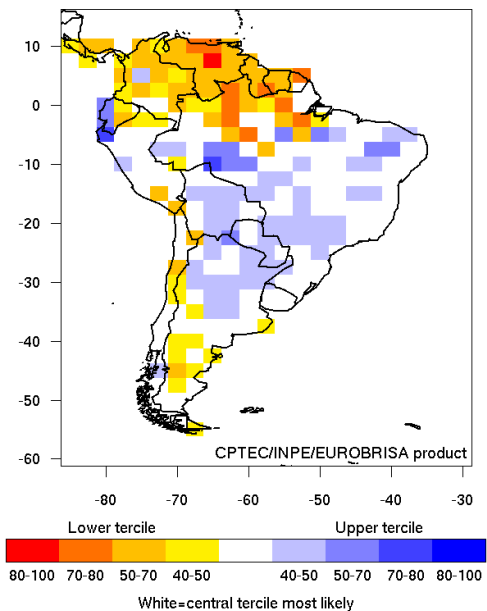
Integrated: Prob. of most likely precip. tercile (%)
 Issued: Dec 2014 Valid for JFM 2015



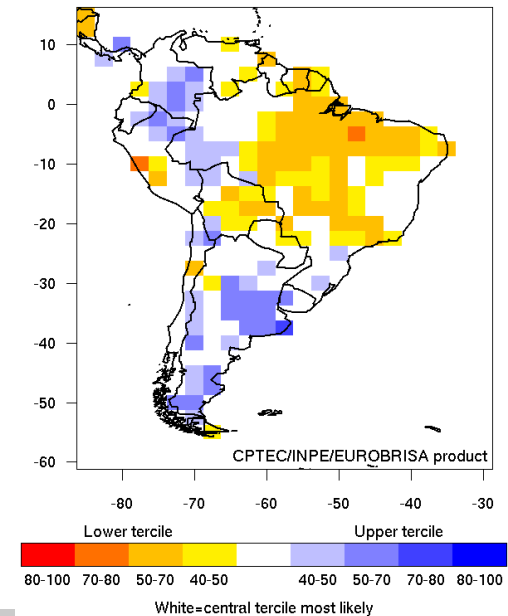
Meteo-France: Prob. most likely precip. tercile (%)
 Issued: Dec 2014 Valid for JFM 2015



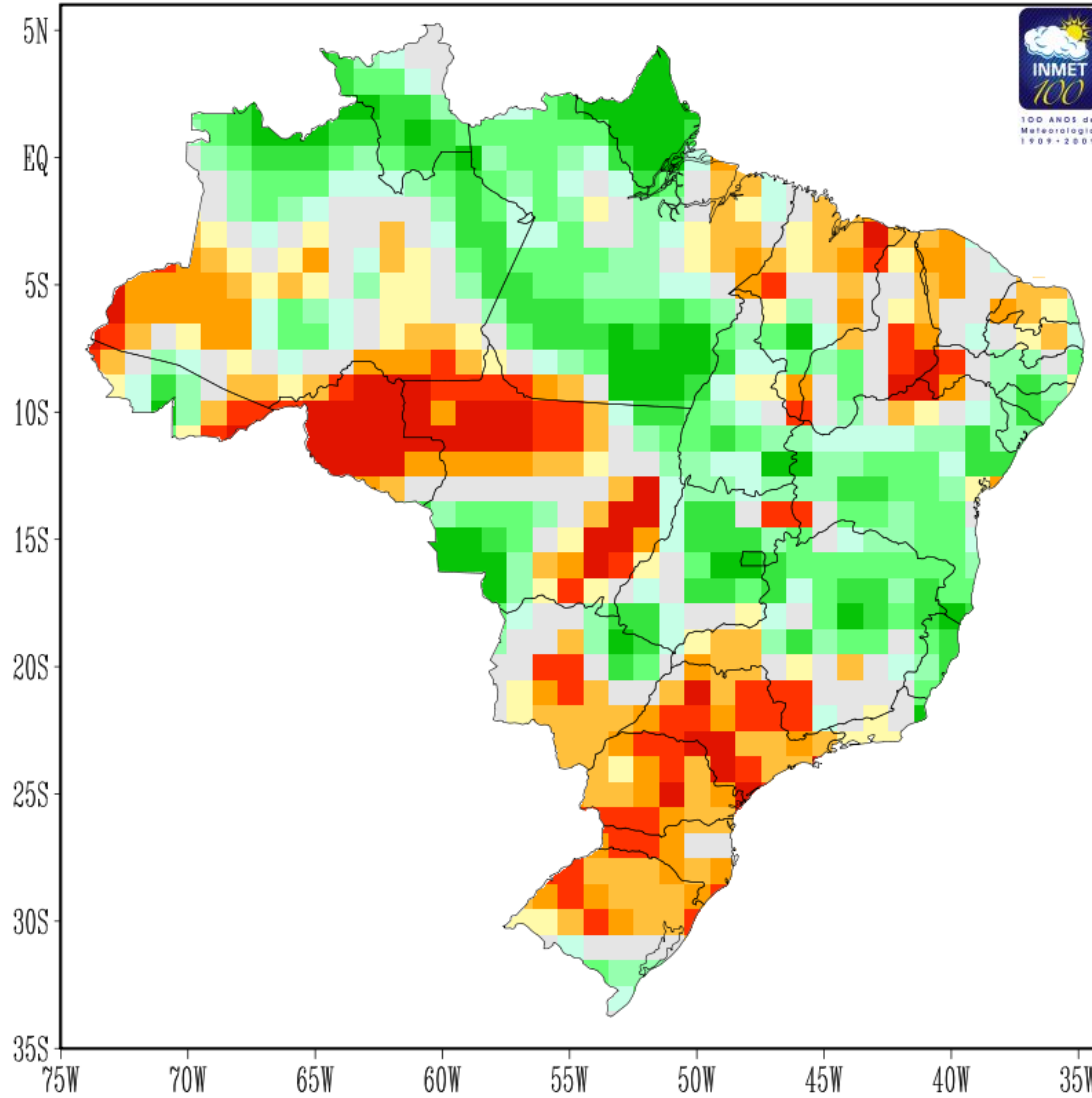
UKMO: Prob. most likely precip. tercile (%)
 Issued: Dec 2014 Valid for JFM 2015



Empirical: Prob. most likely precip. tercile (%)
 Issued: Dec 2014 Valid for JFM 2015



PREVISÃO PROBABILÍSTICA DE PRECIPITACAO
ATUALIZACAO - JANEIRO/2015
VALIDO PARA FEVEREIRO-MARCO-ABRIL/2015



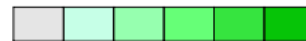
Probabilidade (%) do Tercil mais Provavel

Abaixo da Normal



60 50 45 40 35

Acima da Normal



35 40 45 50 60

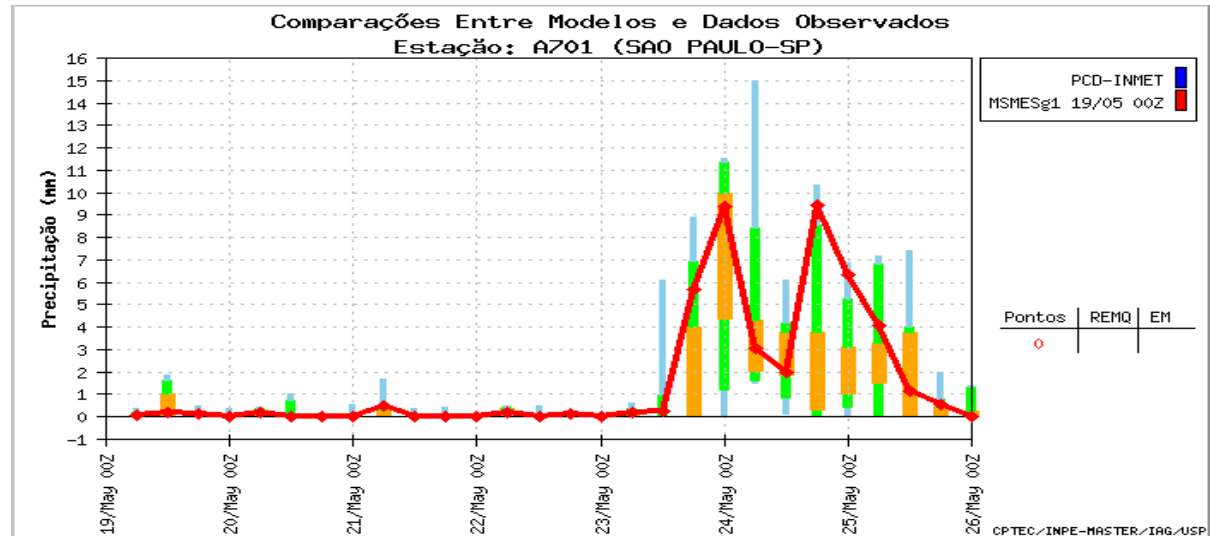
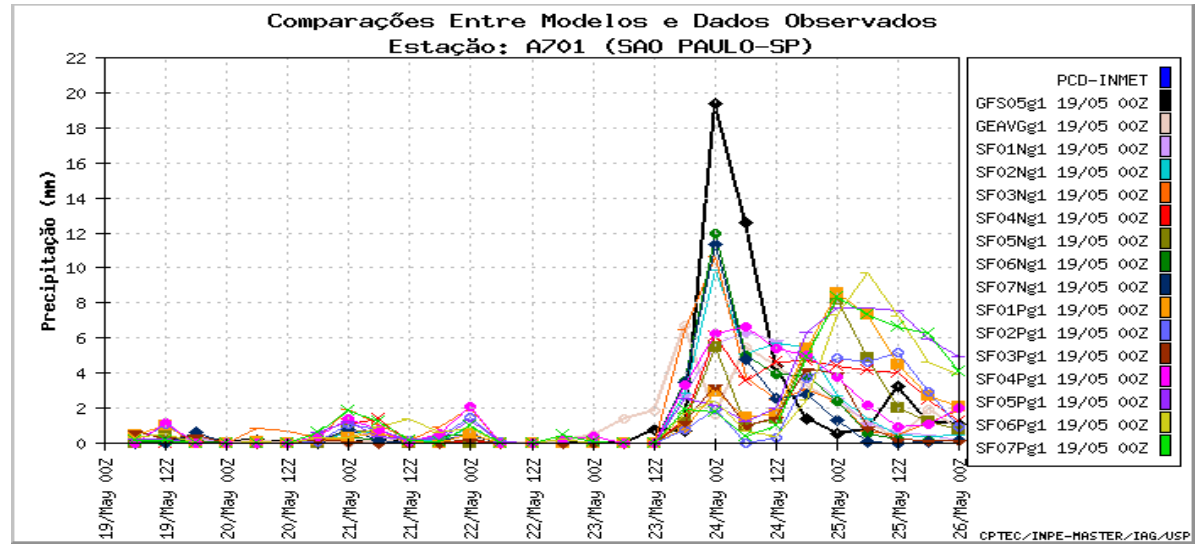
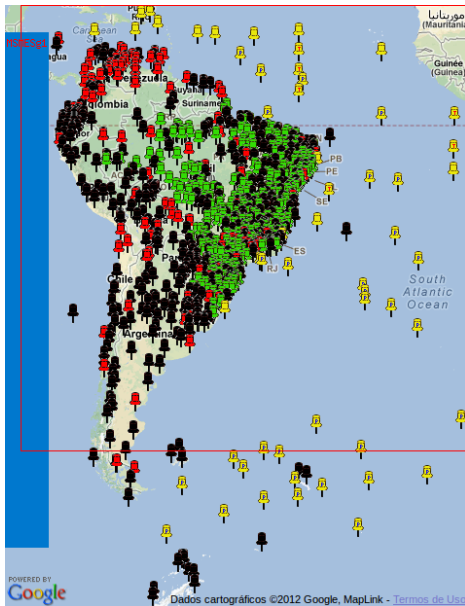
Precisamos urgentemente atualizar a forma de fazer previsões climáticas

- Evitar o uso da previsão de consenso – justificável no passado;
- Lidar com a incerteza;
- Usar formas objetivas de atribuir probabilidades.
- Usar novas ferramentas: p. ex. – oscilação intrasazonal

Exemplo para a previsão de 15 dias...

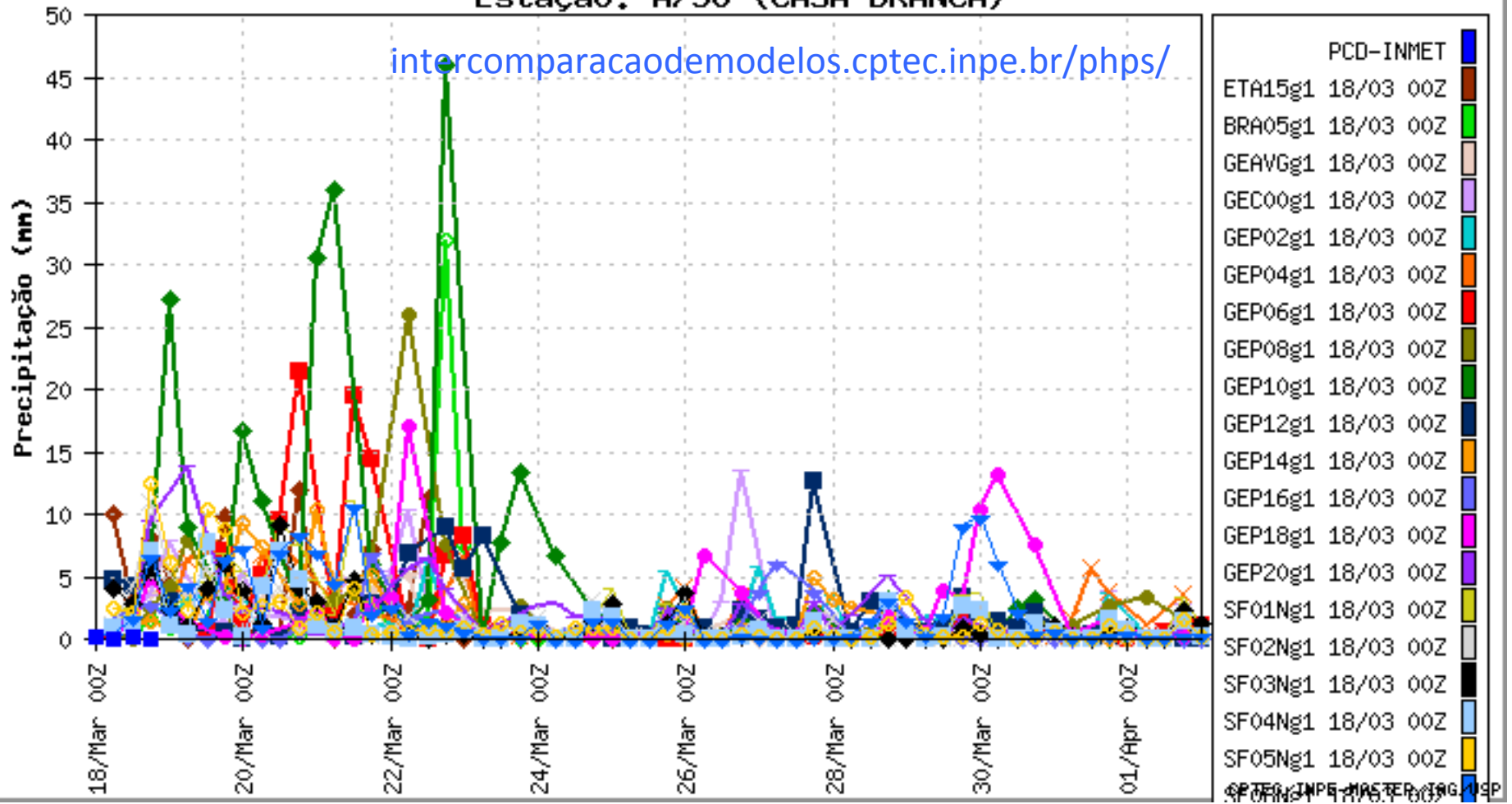
- Previsão probabilística – baseada em superconjunto de modelos (estimulado pelo programa TIGGE/THORPEX- WMO)
- Controle exercido pela variabilidade intrasazonal...

Um outro exemplo com correção bayesiana – Página de intercomparação de modelos do MASTER: www.master.iag.usp.br/intercomp



É fundamental ter bons dados pluviométricos para determinar a correção do viés e os pesos bayesianos atribuídos a cada previsão

Comparações Entre Modelos e Dados Observados Estação: A738 (CASA BRANCA)

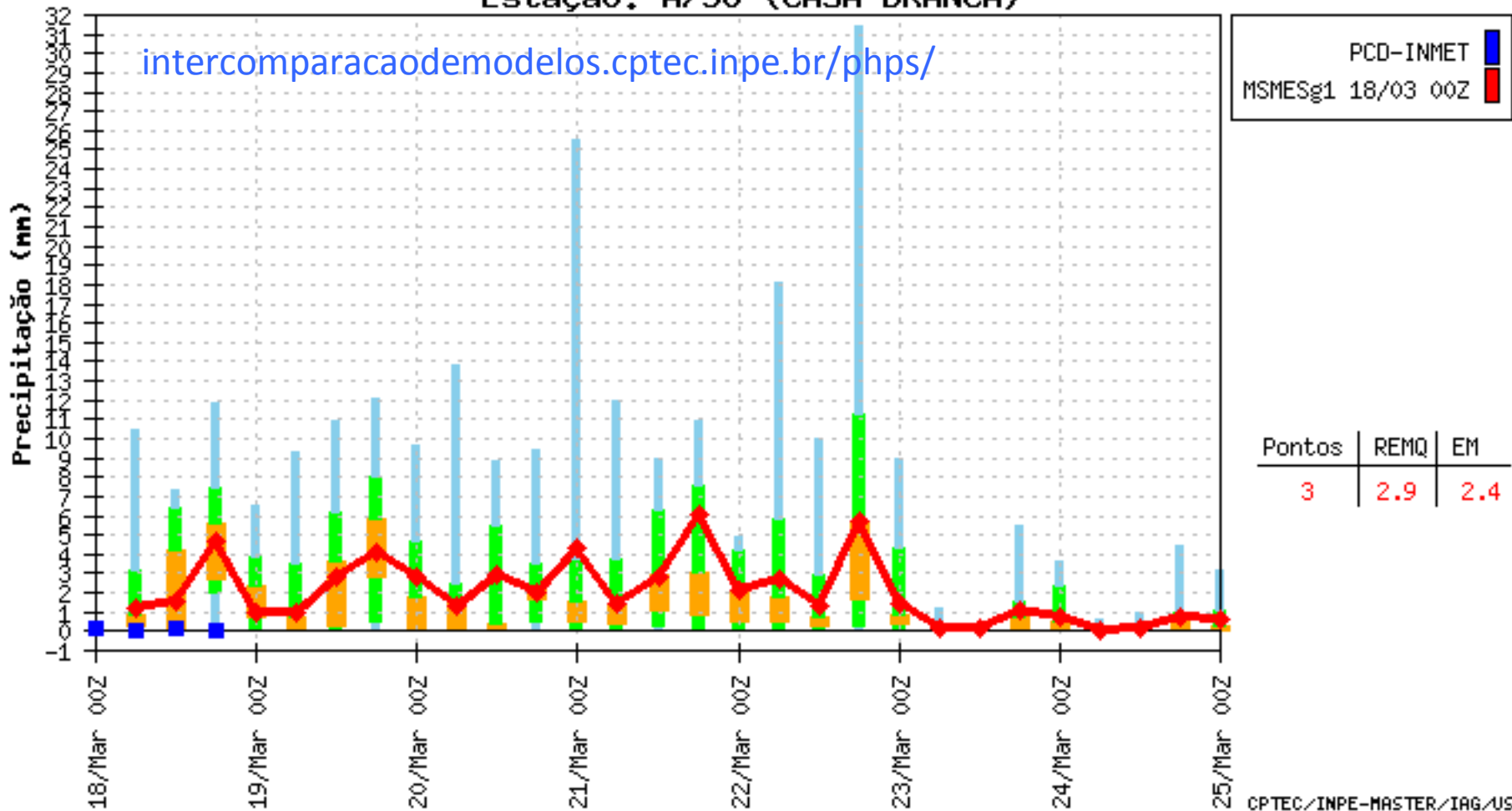


Ex.: previsão para o NE do Estado
de SP para os próximos 15 dias...

Comparações Entre Modelos e Dados Observados

Estação: A738 (CASA BRANCA)

intercomparacaodemodelos.cptec.inpe.br/phps/

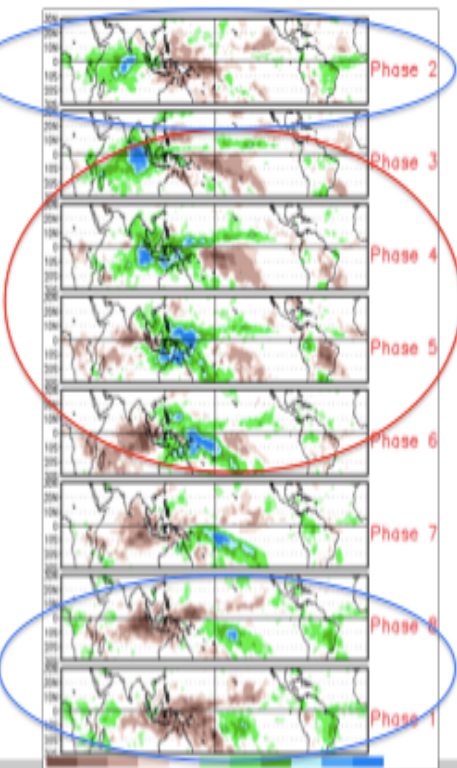


CPTEC/INPE-MASTER/IAG/USP

Previsão probabilística de precipitação – quintis

<-15% - 15->35% - 35 a 65% - 65 a 85% - 85%->

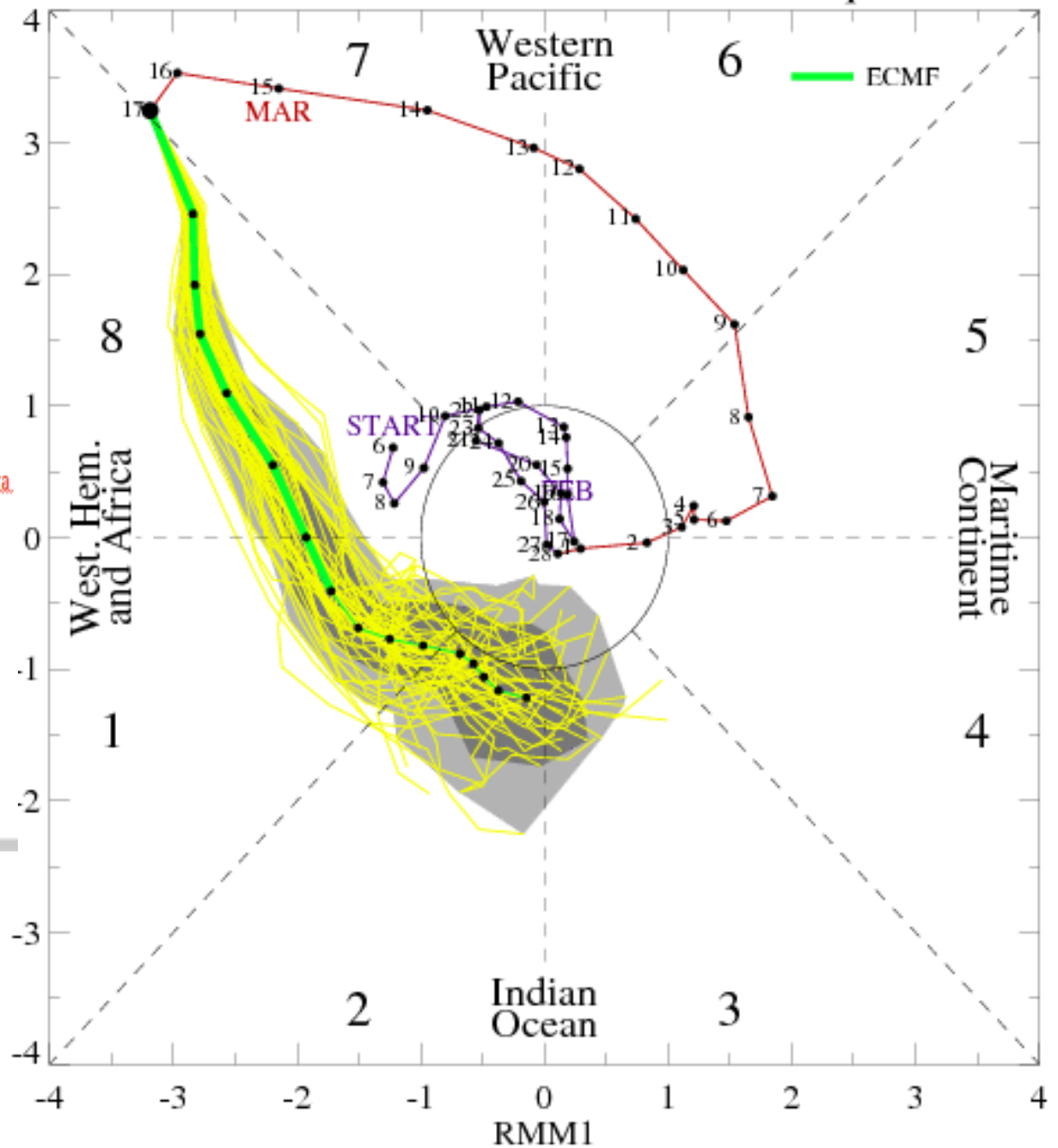
MJO Index Forecast for 18Mar2015-01Apr2015



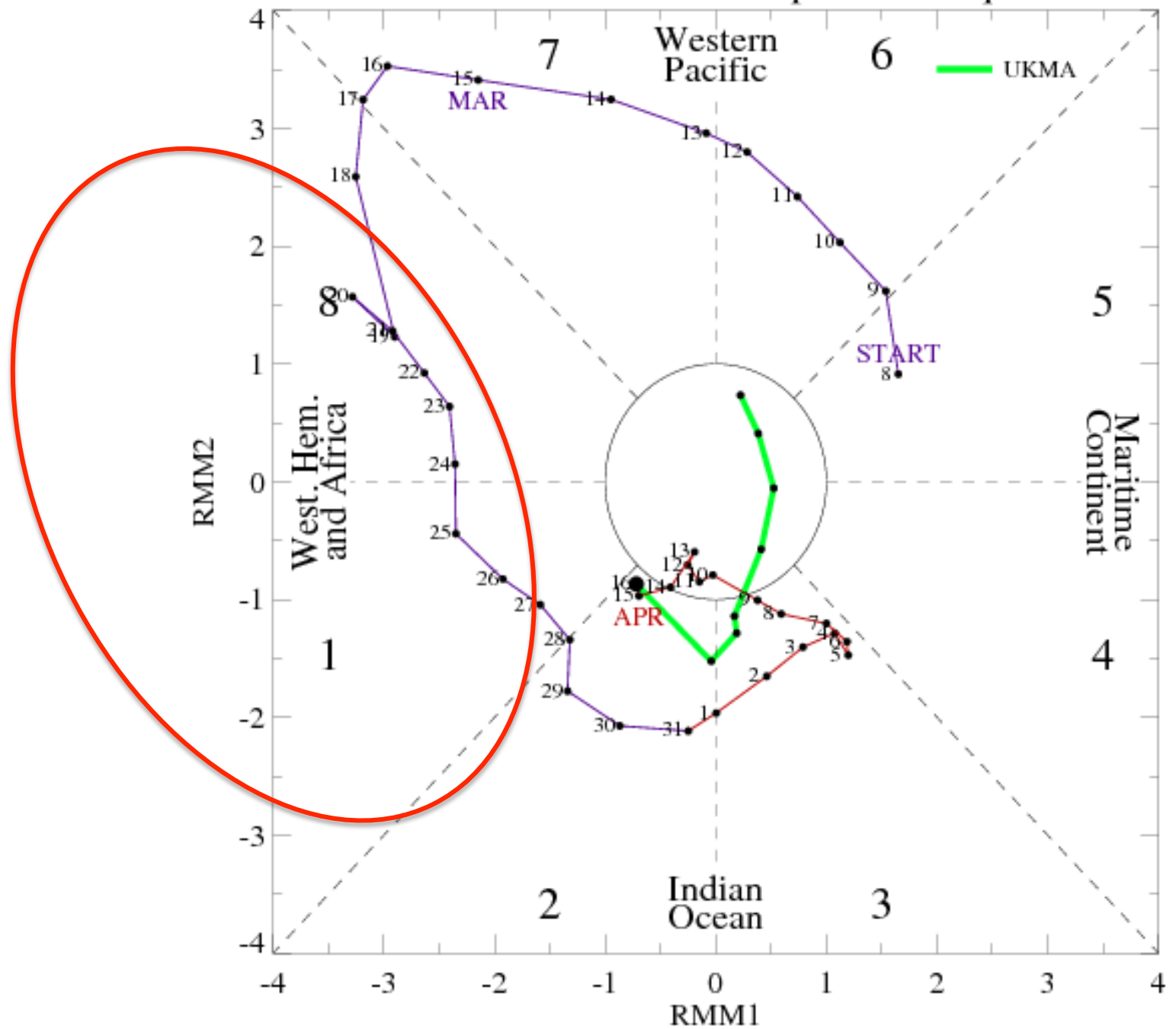
Favorável para
chuva no SE

Desfavorável para
chuva no SE

Favorável para
chuva no SE



MJO Index Forecast for 17Apr2015-23Apr2015



Ou seja....

- Seca de 2013/14 e 14/15 faz parte de uma anomalia global, com raiz no Pacífico Oeste
 - Fortemente associada à anomalia da variabilidade intrasazonal. Causas: especulações mas ainda incerto.
- Precisamos enfrentar as incertezas nas previsões
 - Uso de superconjuntos de modelos dinâmicos;
 - Amostrar a incerteza e transformar em previsão probabilística:
 - Métodos bayesianos, redes neurais, algoritmos genéticos

Obrigado

- pldsdias@Incc.br