Floresta Amazônica nas mudanças globais

Philip M. Fearnside

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http://philip.inpa.gov.br

XIII Congresso Florestal Estadual do Rio Grande do Sul; III Seminário Mercosul da Cadeia Madeira; 1º Congresso Florestal Júnior, Nova Prata - RS: 24 de setembro de 2018.

Instituto Nacional de Ciência e Tecnologia dos Serviços Ambientais da Amazônia – SERVAMB

http://inct-servamb.inpa.gov.br/

National Geographic Society

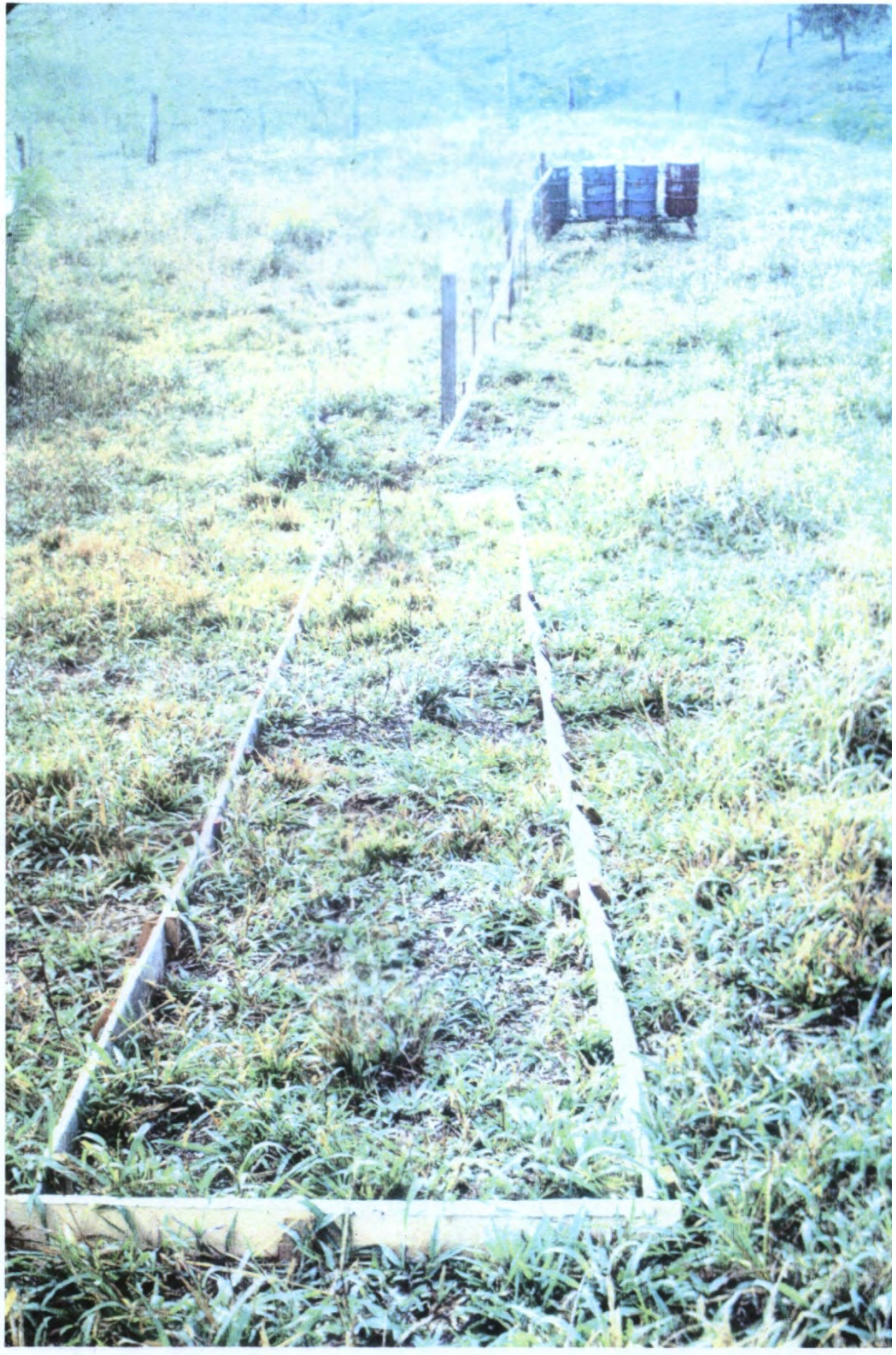


Foto: P.M. Fearnside

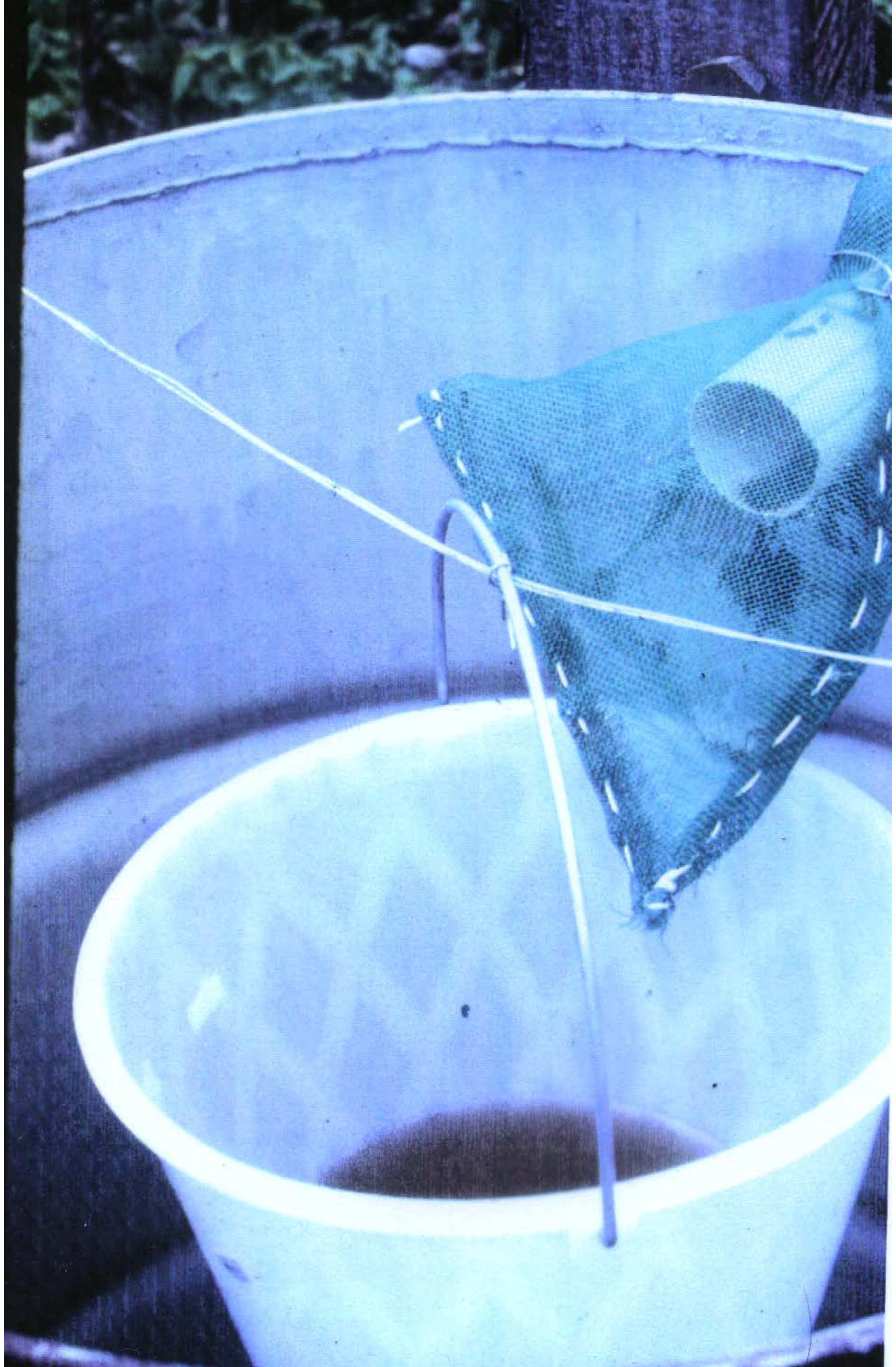


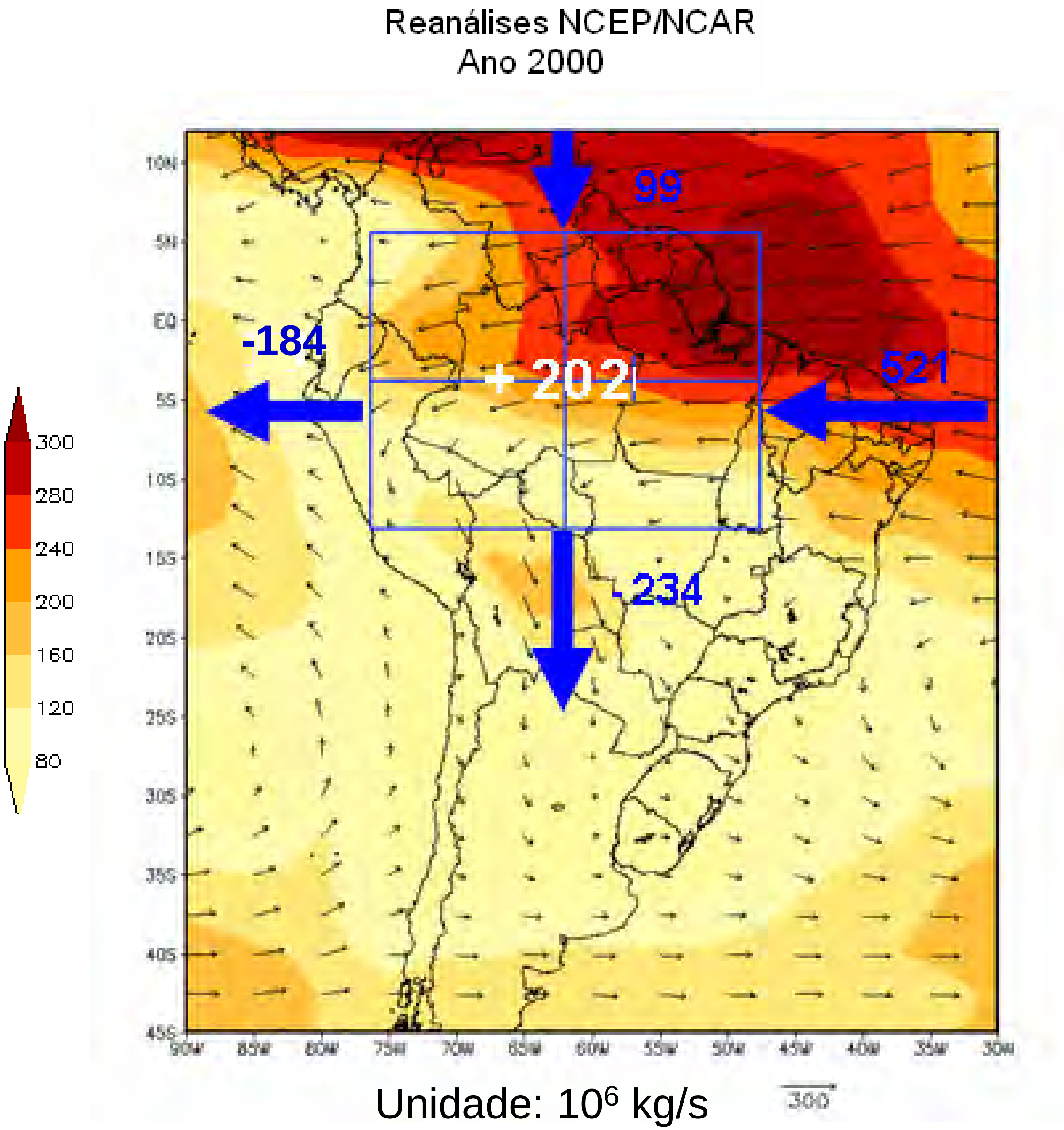
Foto: P.M. Fearnside

Foto: P.M. Fearnside

Fluxos de água na Amazônia

Descrição	*Volume de água (trilhões de m³/ano)*[a]	*Comparação com a vazão do rio Amazonas (%)*[b]
Transporte do Oceano Atlântico para dentro da região pelos ventos alísios	**10 ± 1**	**152%**
Vazão média do rio Amazonas na foz	**6,6**	**100%**
Precipitação na bacia hidrográfica do rio Amazonas	**15,05**	**228%**
Evapotranspiração	**8,43**	**128%**
Vapor d'água transportado por ventos para outras regiões	**3,4 ± 1**	**52%**

(a) Valores da revisão de Salati (2001), exceto o último item.
(b) Porcentagem em comparação com a vazão média na foz.

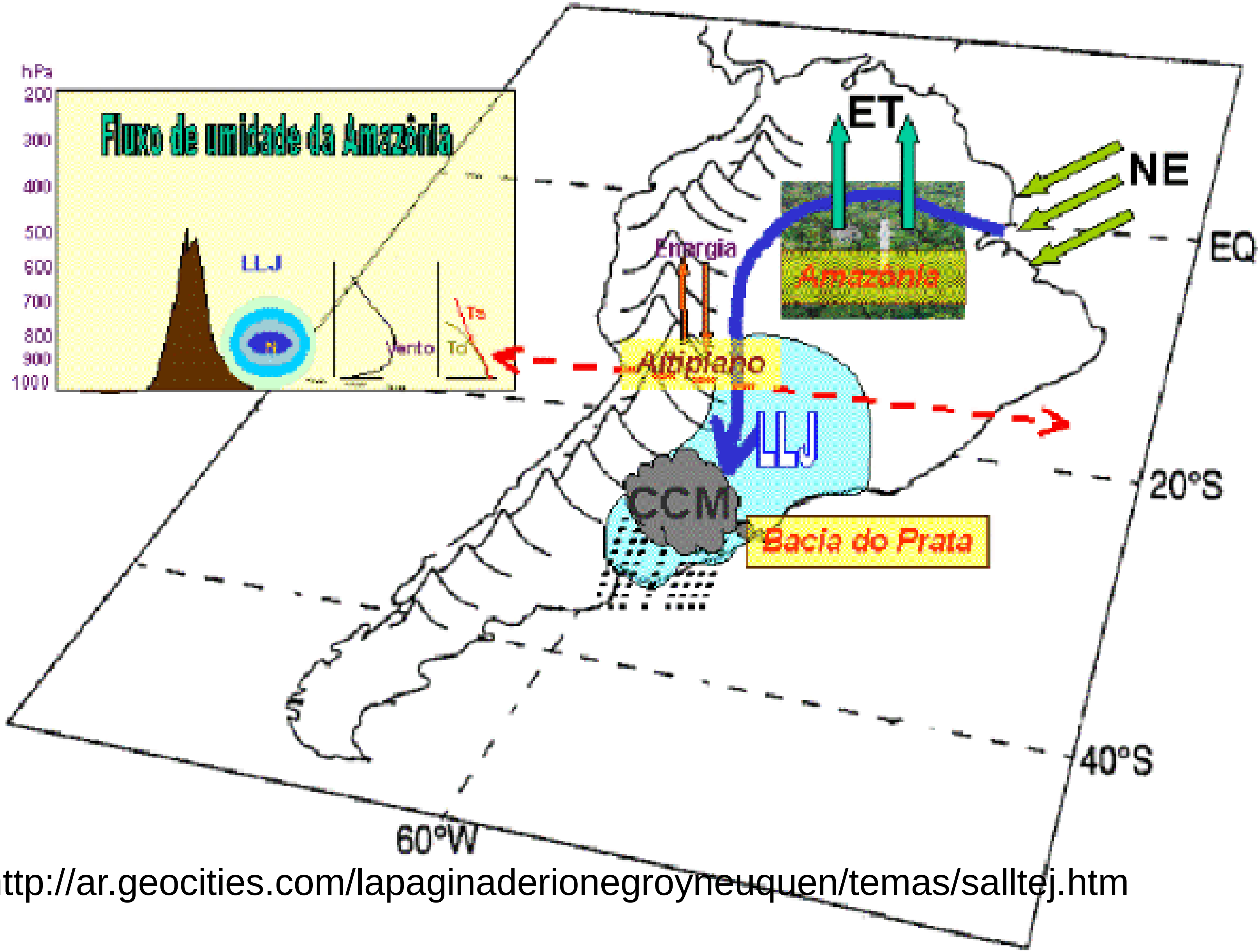


202 mil toneladas de vapor de água por segundo em uma área de aproximadamente 6 milhões de quilômetros quadrados

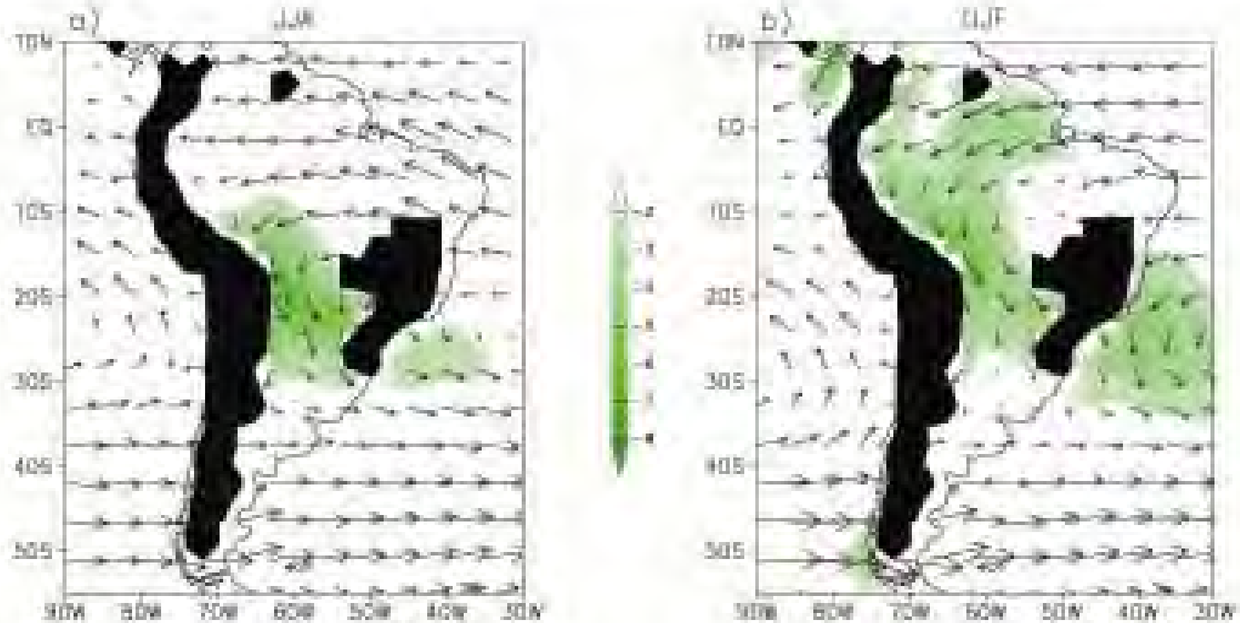
Equivalem a aproximadamente 1 metro de água líquida no ano

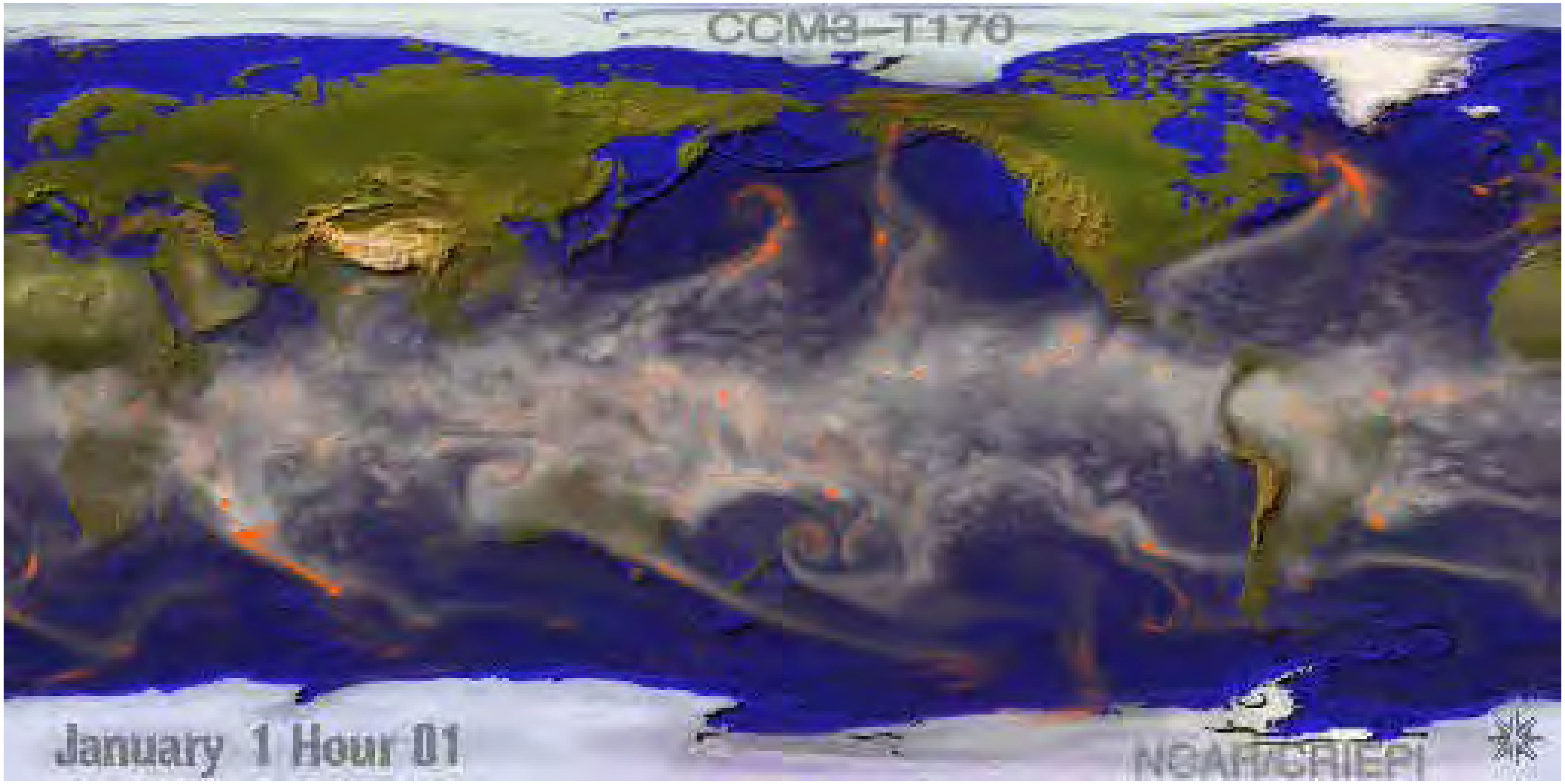
Correia, 2005

Domínio: (76,2W – 47,6W; 13,2S – 5,5N)



Fonte: http://ar.geocities.com/lapaginaderionegroyneuquen/temas/salltej.htm


a)
JJA
b)
DJF
10N
EQ
10S
20S
30S
40S
50S
90W
80W
70W
60W
50W
40W
30W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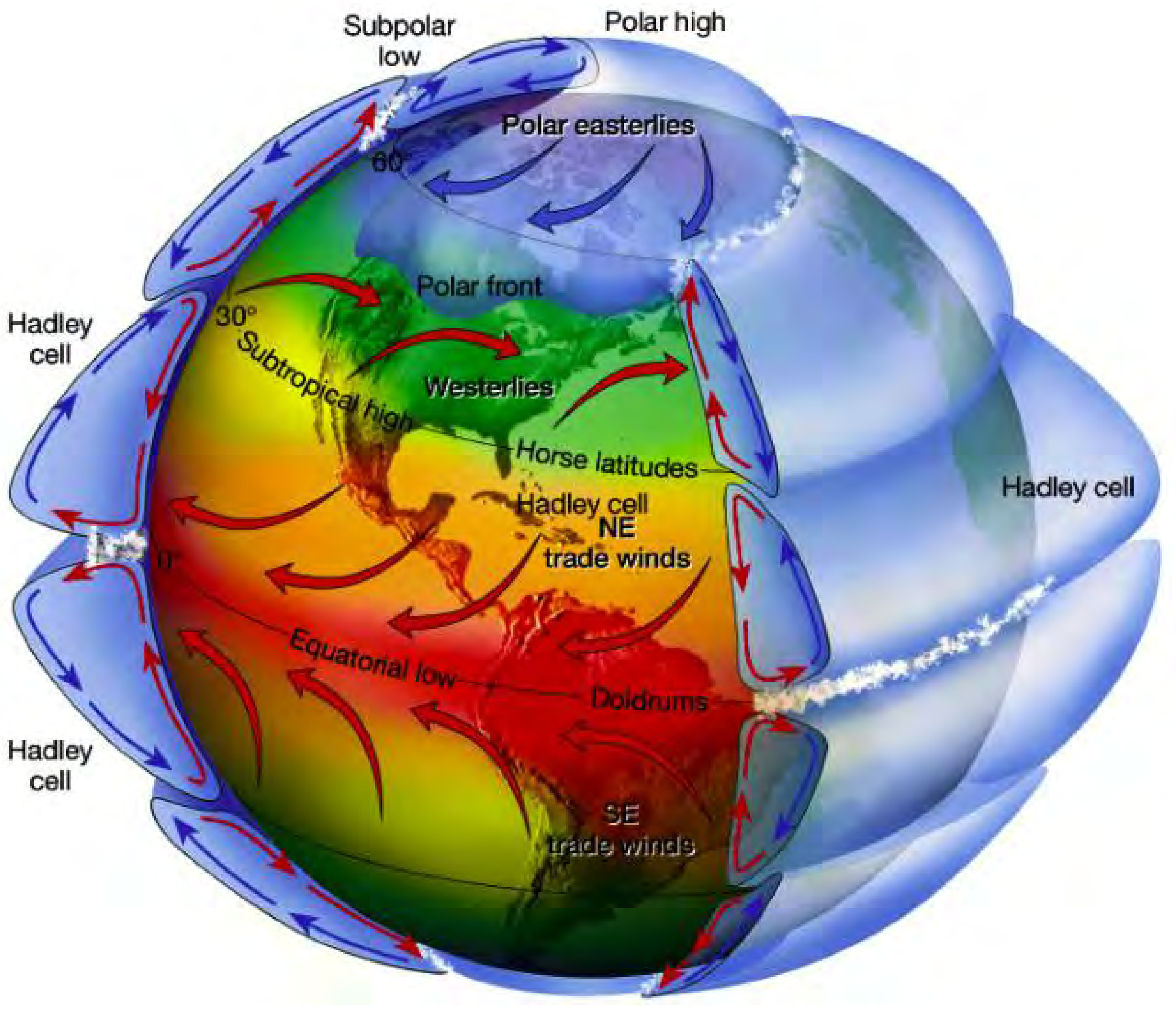
January 1 Hour 01
NCAR/CRIEPI

- **Circulação atmosférica**



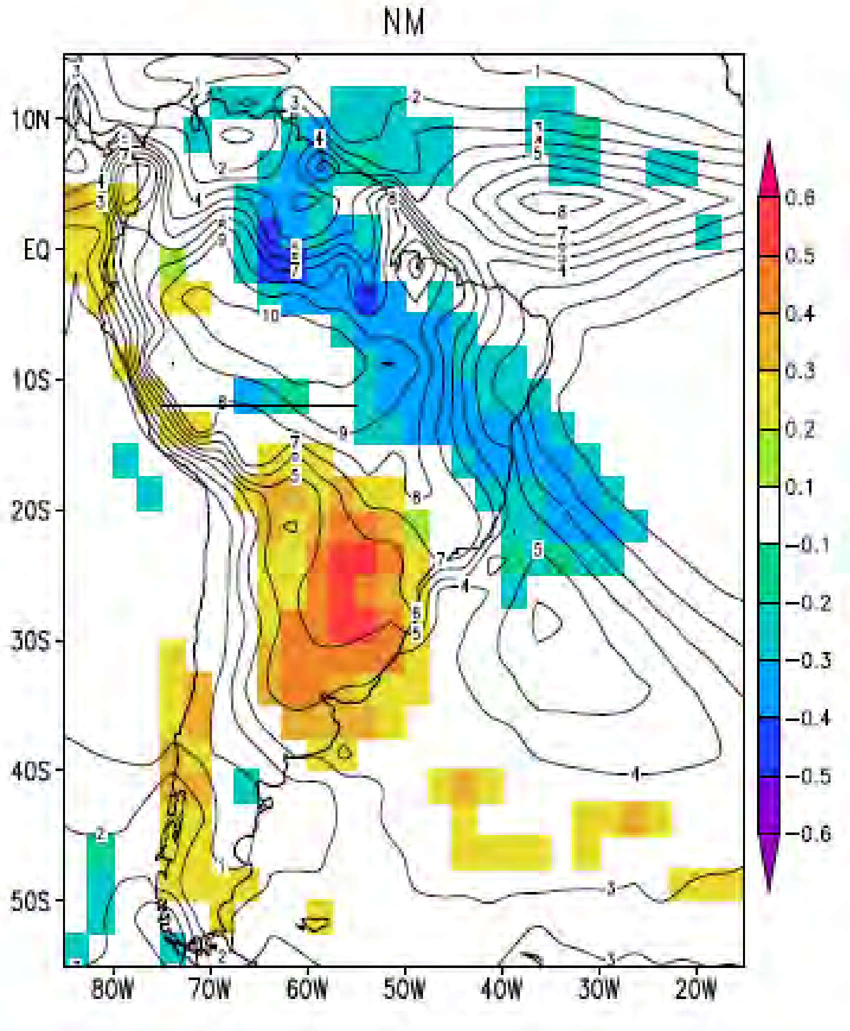


FIG. 8. The colors show correlations between the meridional moisture transport across 12S, from 75W to 55W (indicated by thick black line) and rainfall at each grid point. Values below the 95% significance level are masked out. Grey contours show the long term mean seasonal rainfall, for reference ($kg\, m^{-2}$).

Arraut et al., 2011. Journal of Climate

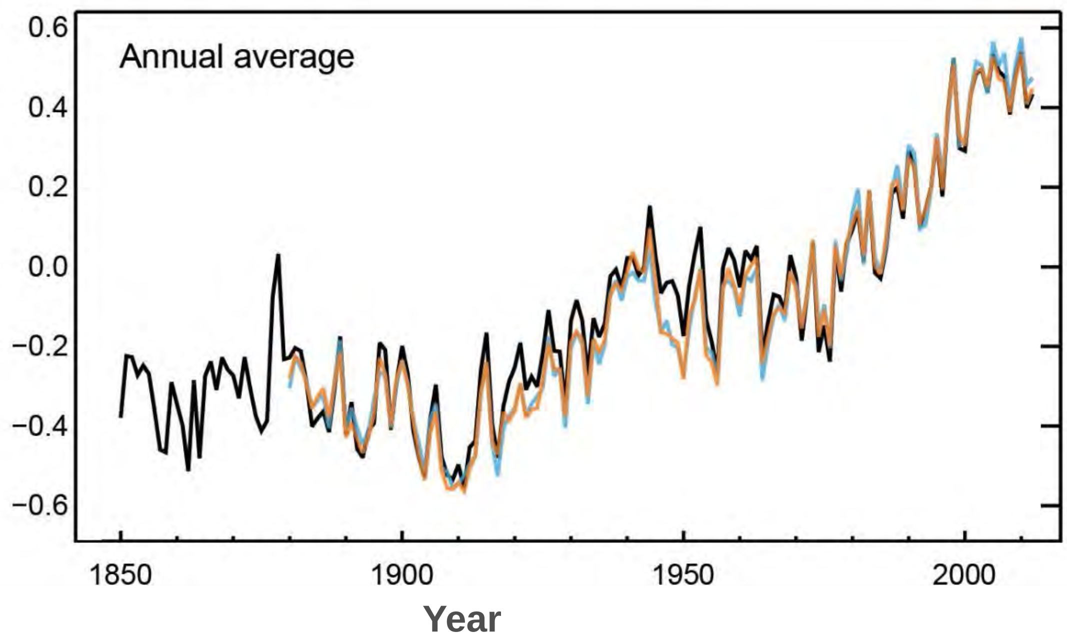
PHILIP FEARNSIDE

Rios voadores e a água de São Paulo 1: A questão levantada

Amazônia Real
09/02/2015
http://amazoniareal.com.br/tag/philip-m-fearnside/

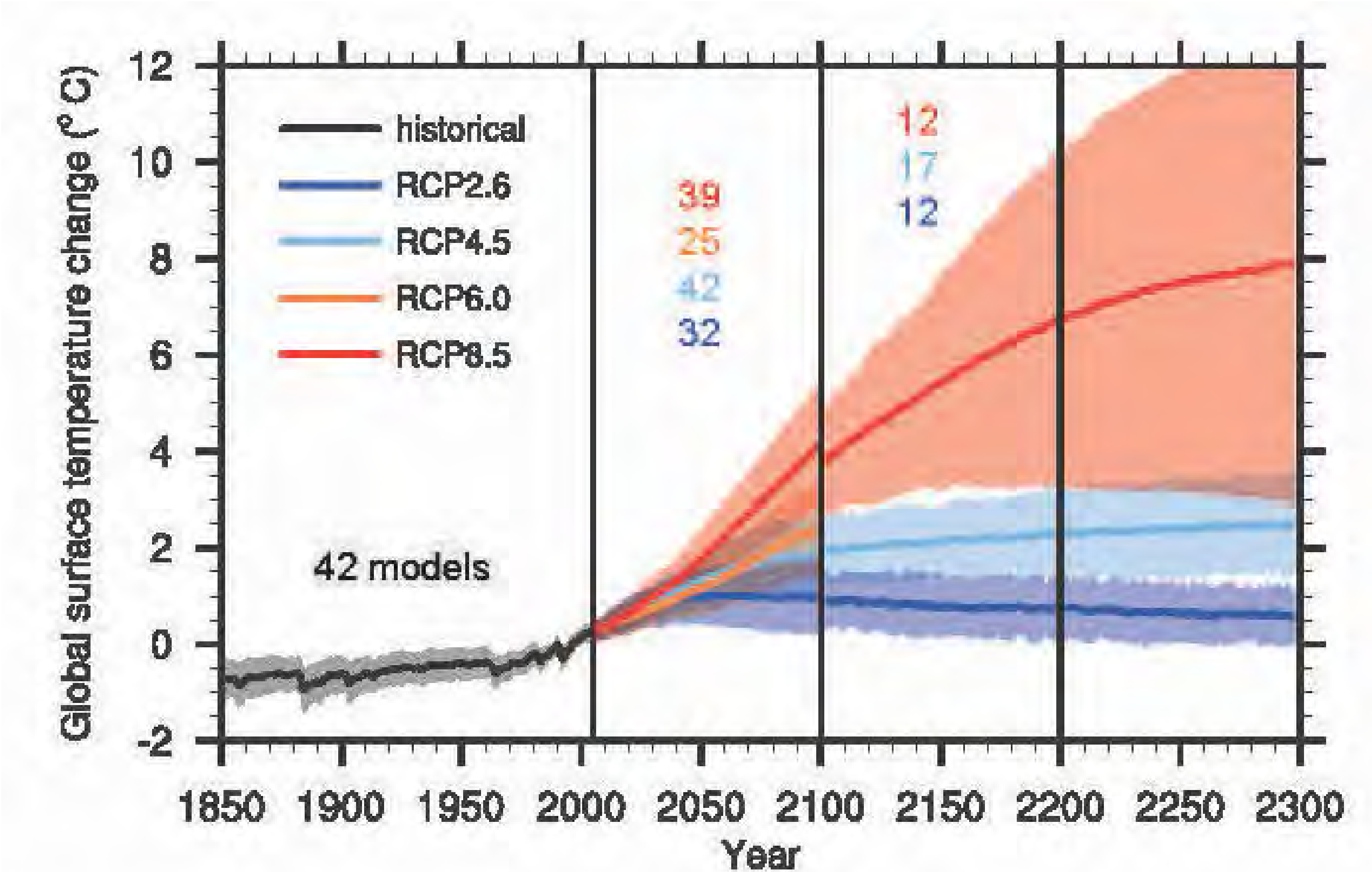
Humans are changing the climate

It is extremely likely that we are the dominant cause of warming since the mid-20th century



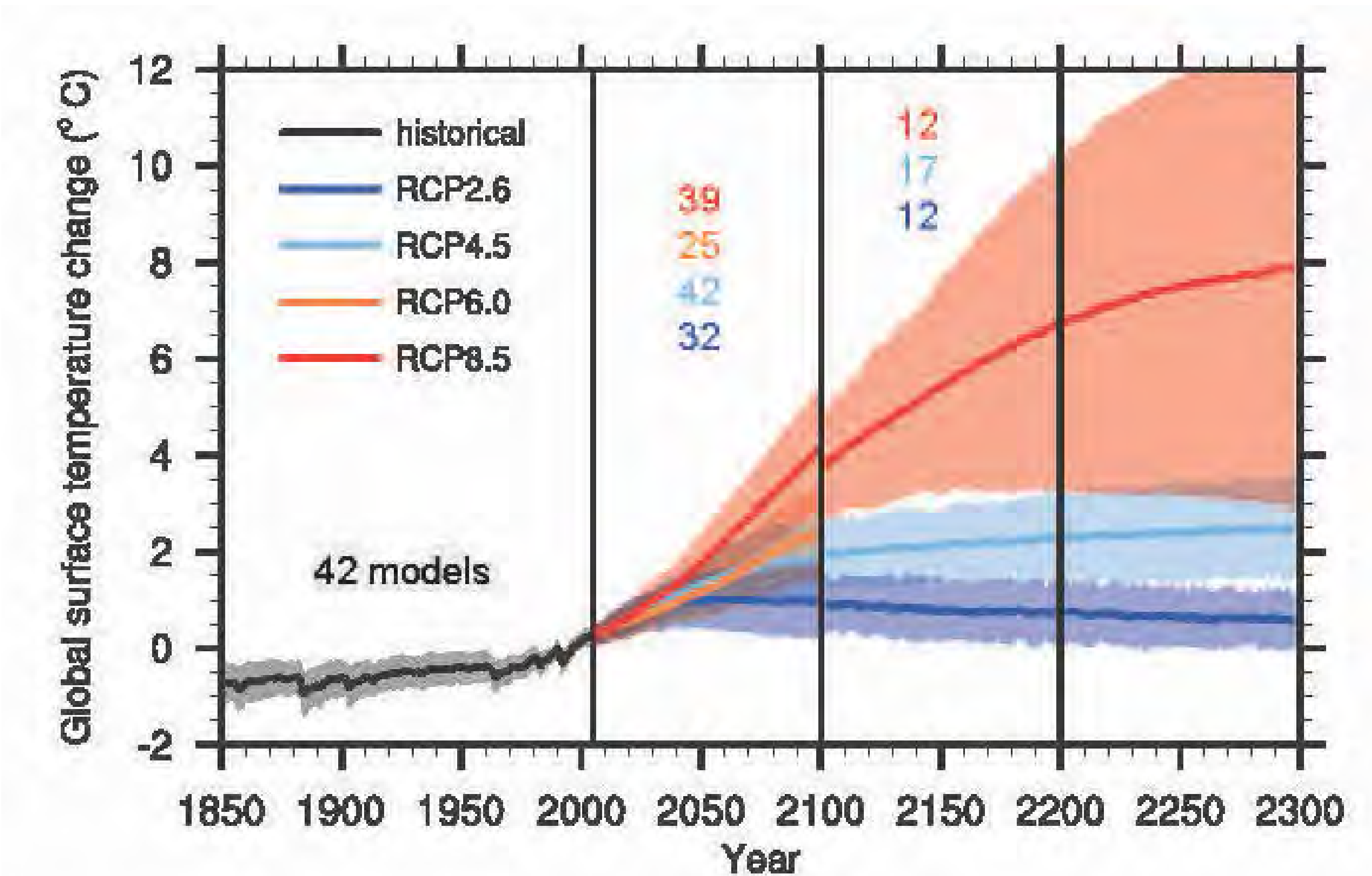
Globally averaged combined land and ocean surface temperatures

AR5 WGI SPM



Stocker, T.F. & 66 outros. 2013. Technical summary. p. 31-115 In: Stocker, T.F., Qin, D., Plattner, G.-K., Tignor, M., Allen, S.K., Boschung, J., Nauels, A., Yu Xia, Bex, V & Midgley, P.M. (Eds.). *Climate Change 2013: The Physical Science Basis. Working Group I Contribution to the IPCC Fifth Assessment Repor*t. Cambridge University Press, Cambridge, UK. http://www.ipcc.ch/report/ar5/wg1/

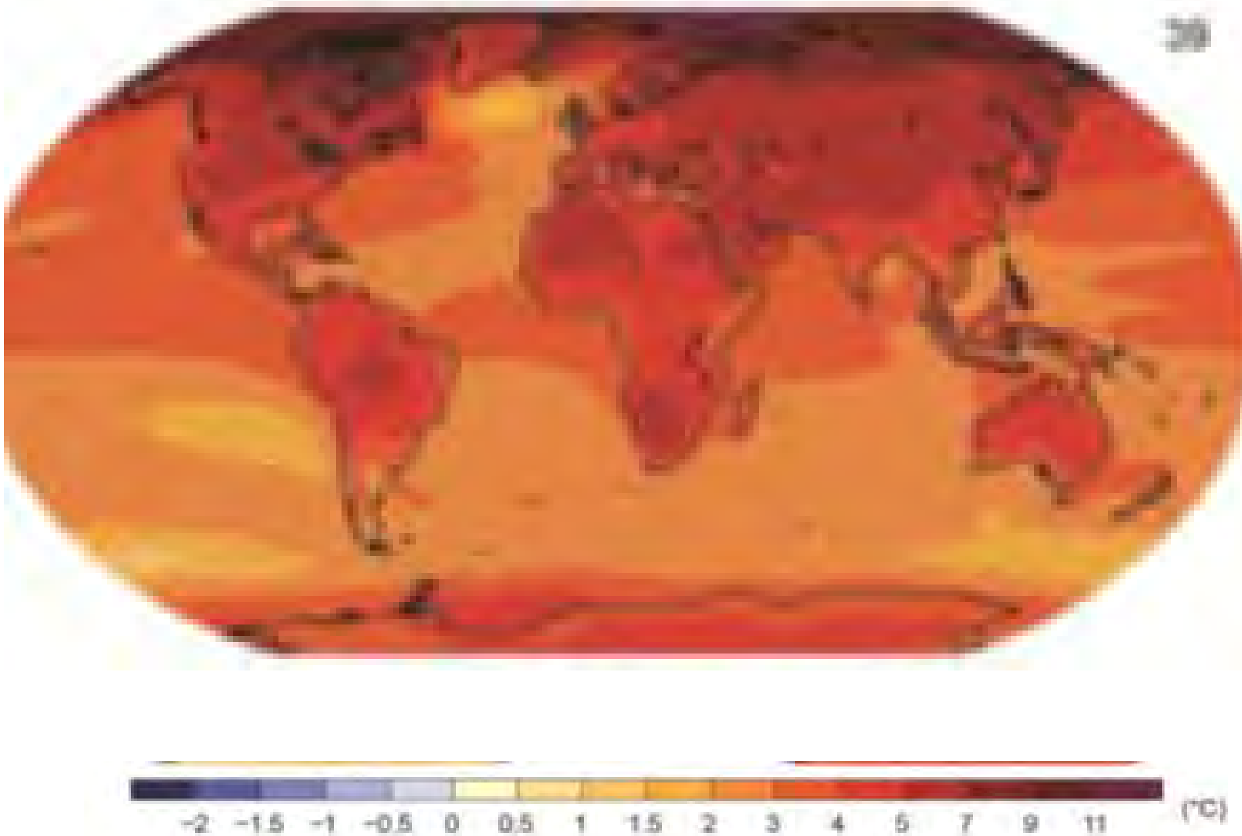
Goldilocks and the three bears



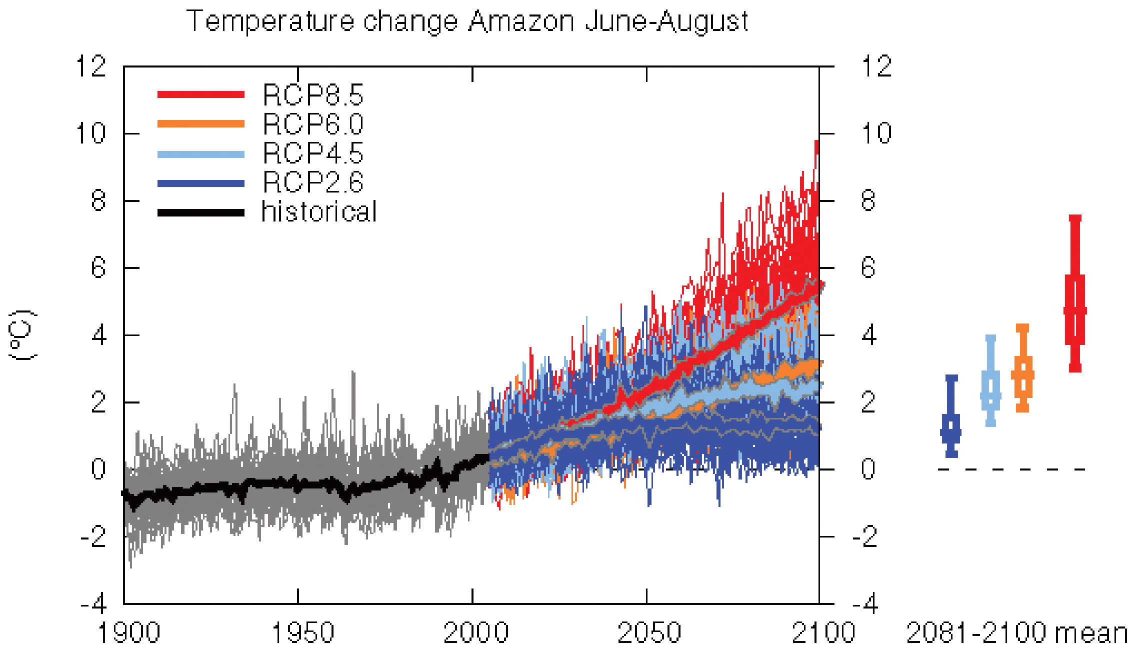
Stocker, T.F. & 66 outros. 2013. Technical summary. p. 31-115 In: Stocker, T.F., Qin, D., Plattner, G.-K., Tignor, M., Allen, S.K., Boschung, J., Nauels, A., Yu Xia, Bex, V & Midgley, P.M. (Eds.). *Climate Change 2013: The Physical Science Basis. Working Group I Contribution to the IPCC Fifth Assessment Repor*t. Cambridge University Press, Cambridge, UK. http://www.ipcc.ch/report/ar5/wg1/

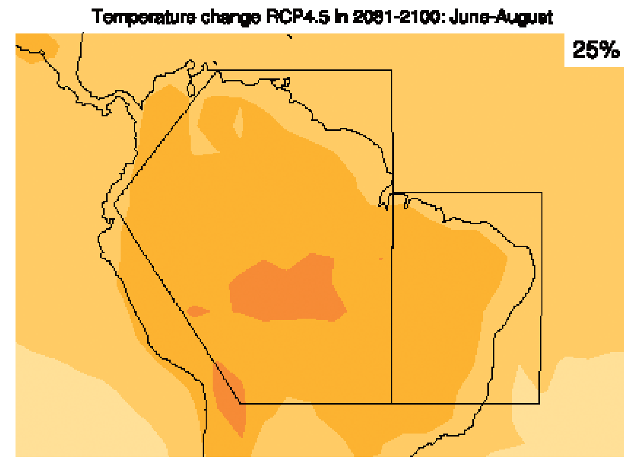
RCP 8.5

ture (1986−2005 to 2081−2100)



Atlas of Global and Regional Climate Projections





IPCC RCP8.5 Scenario: **2100 mean global temperature** is "likely" (66% probability) to increase by **4.8˚C over the 1996-2005 mean**.

In Amazonia, year 2100 temperatures in the **June-August** period would **be 6-8˚C over the 1996-2005 mean**.

(IPCC. 2013; AR-5, WG-I, p. 1343)

Trump says US will abandon global climate accord

“O efeito estufa é a maior falácia científica que existe na história”

[entrevista de 02/05/12 com Ricardo Augusto Felício].
http://globotv.globo.com/rede-globo/programa-do-jo/v/o-aquecimento-global-e-uma-mentira-e-o-que-afirma-o-climatologista-ricardo-augusto/1930554/

PHILIP FEARNSIDE

Os céticos de clima no Brasil 1: colaboração da mídia

Amazônia Real
16/03/2015 17:29
http://amazoniareal.com.br/tag/philip-m-fearnside/

FOLHA DE S.PAULO

DESDE 1921 ★★★ UM JORNAL A SERVIÇO DO BRASIL

OR DE REDAÇÃO: OTAVIO FRIAS FILHO TERÇA-FEIRA, 22 DE MAIO DE 2018 EDIÇÃO NACIONAL ★ CONCLUÍDA ÀS 21H09 ★ R$ 4,00

CRISE DO CLIMA

Mesmo com seca, ruralistas negam mudança climática

Bancado por grandes empresas, palestrante cético sobre mudanças climáticas faz sucesso entre ruralistas do Matopiba, fronteira agrícola que abrange quatro estados do Brasil. A área de cerrado, no entanto, já sofre com redução de chuvas. Ambiente B6

Presidência demite líderes de estudo sobre clima, a nove meses da COP de Paris

Demissões na Secretaria de Assuntos Estratégicos sinalizam diminuição da importância da questão climática dentro do órgão ligado à Presidência da República

13/03/2015

Claudio Angelo (OC)

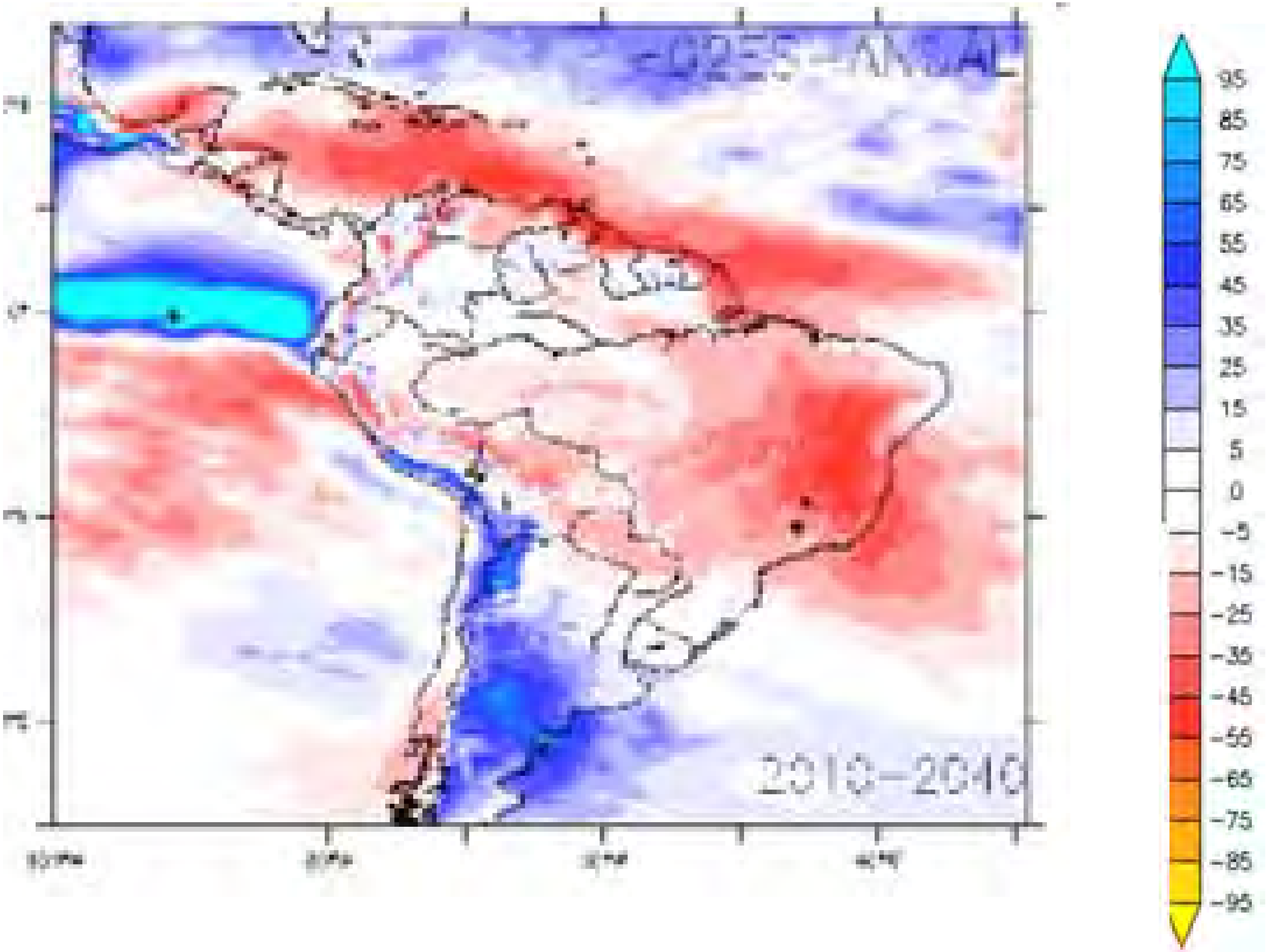
O ministro da Secretaria de Assuntos Estratégicos da Presidência da República, Mangabeira Unger, demitiu nesta semana os membros do quadro técnico da Secretaria de Desenvolvimento Sustentável da pasta. O secretário, Sérgio Margulis, de férias, deverá ser substituído nos próximos dias. A diretora de Programa Natalie Unterstell foi exonerada nesta sexta-feira.

Observatório do Clima, 13 *de março de* 2015.
http://observatoriodoclima.eco.br/presidencia-demite-lideres-de-estudo-sobre-clima-a-nove-meses-da-cop-de-paris#sthash.p16qIPBM.dpuf

servatorio do Clima

Sérgio Margulis e Natalie Unterstell, que trabalhavam na Secretaria de Assuntos Estratégicos da Presidência da República (Fotos: SAE/PR)

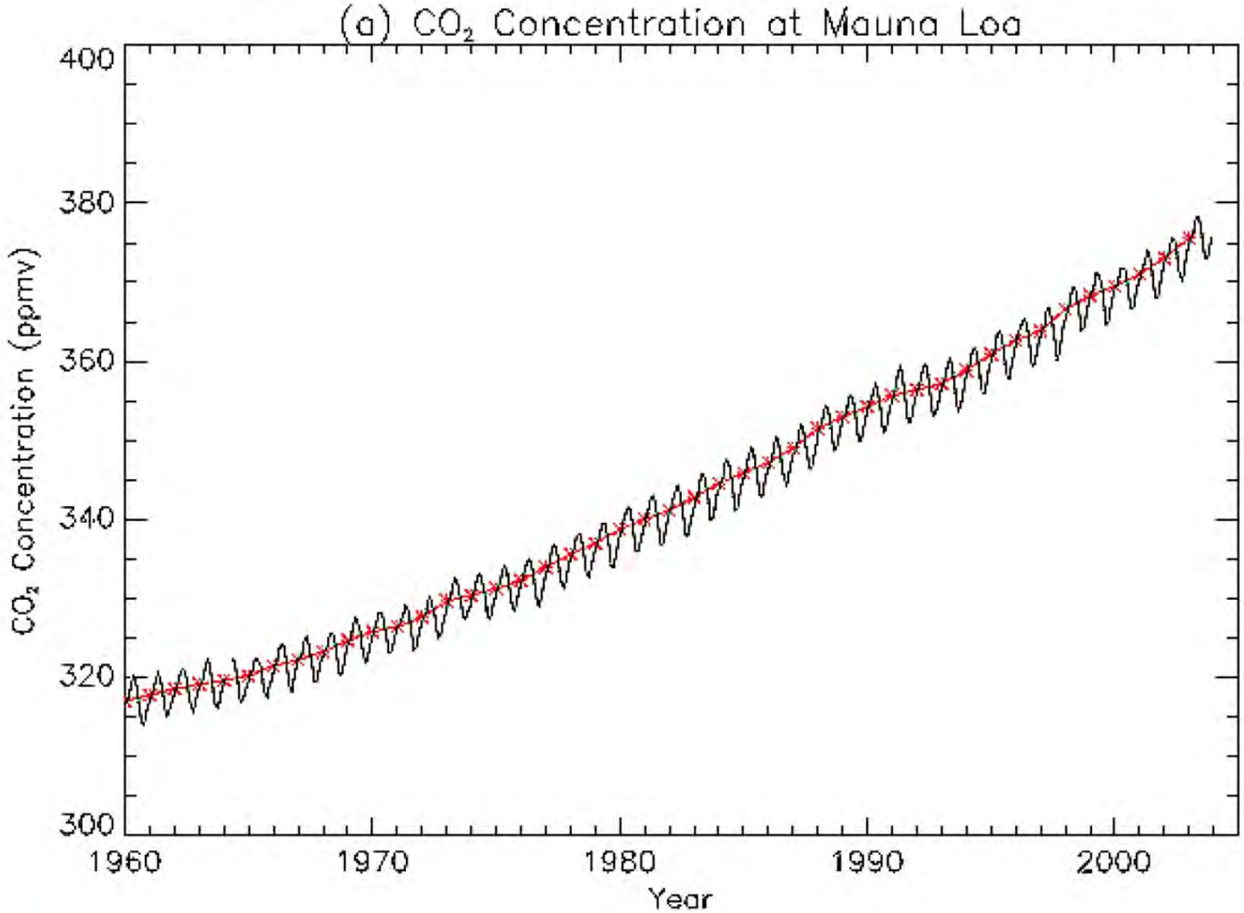
Margulis e Unterstell coordenavam o maior estudo já feito no país sobre adaptação às mudanças climáticas. Batizado “Brasil 2040”, o trabalho tem o objetivo de embasar políticas públicas de adaptação nos setores de energia, infraestrutura, agricultura e recursos hídricos. Quase uma dezena de grupos de pesquisa do país trabalha nele neste momento. A análise deveria ficar pronta em abril, e trazia más notícias sobre os impactos da mudança do clima na expansão do parque hidrelétrico brasileiro.



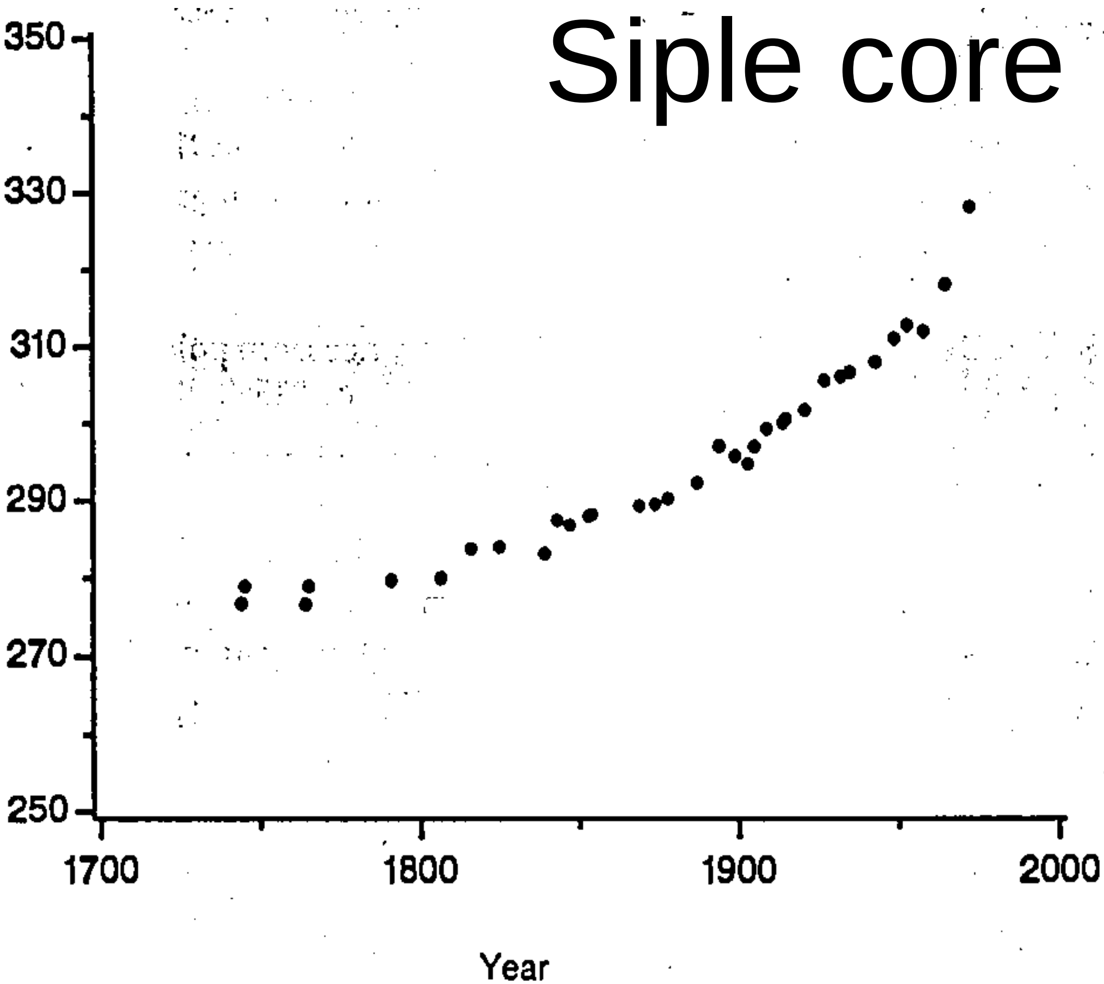
http://www.observatoriodoclima.eco.br/pais-podera-viver-drama-climatico-em-2040

Latif, M.; Semenov, V.A. & Park, W. 2015. **Super El Niños in response to global warming in a climate model.** *Climatic Change* 132(4): 489-500. doi :10.1007/s10584-015-1439-6

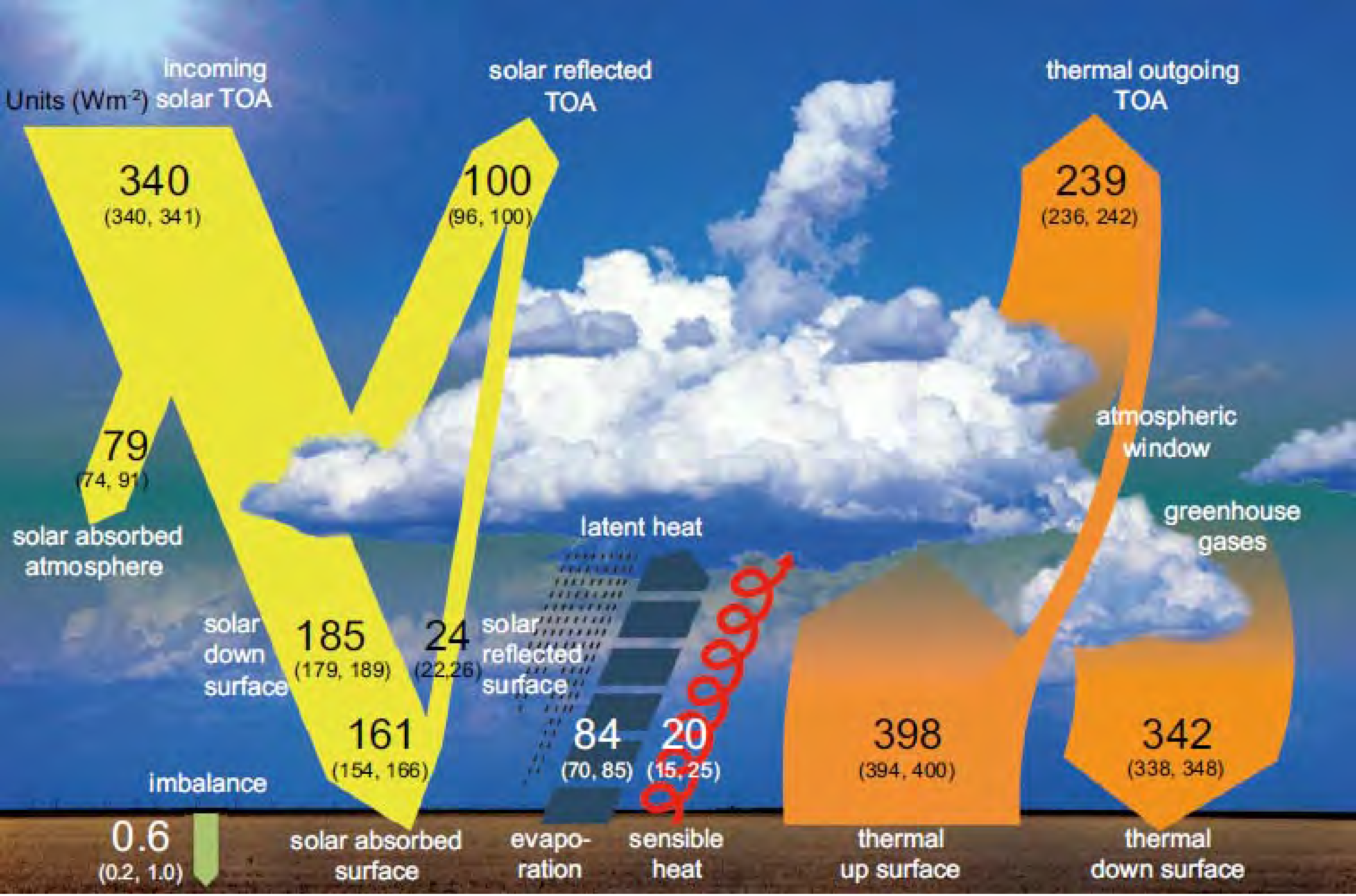
CO_2 Concentration (measured at Mauna Loa on Hawaii) increased from 318 ppmv in 1960 to 376 ppmv in 2003



Siple core

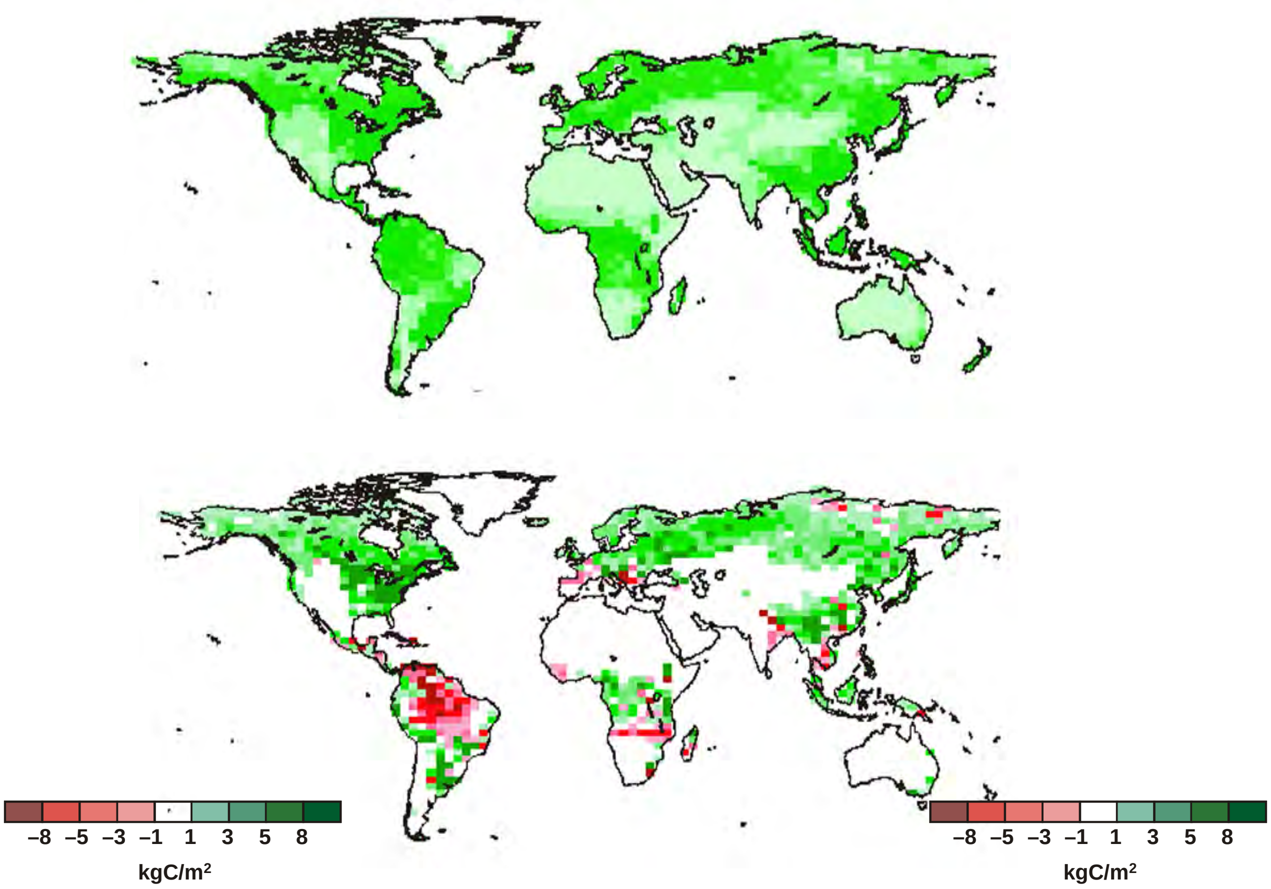


Atmospheric CO_2 derived from the Siple ice core.

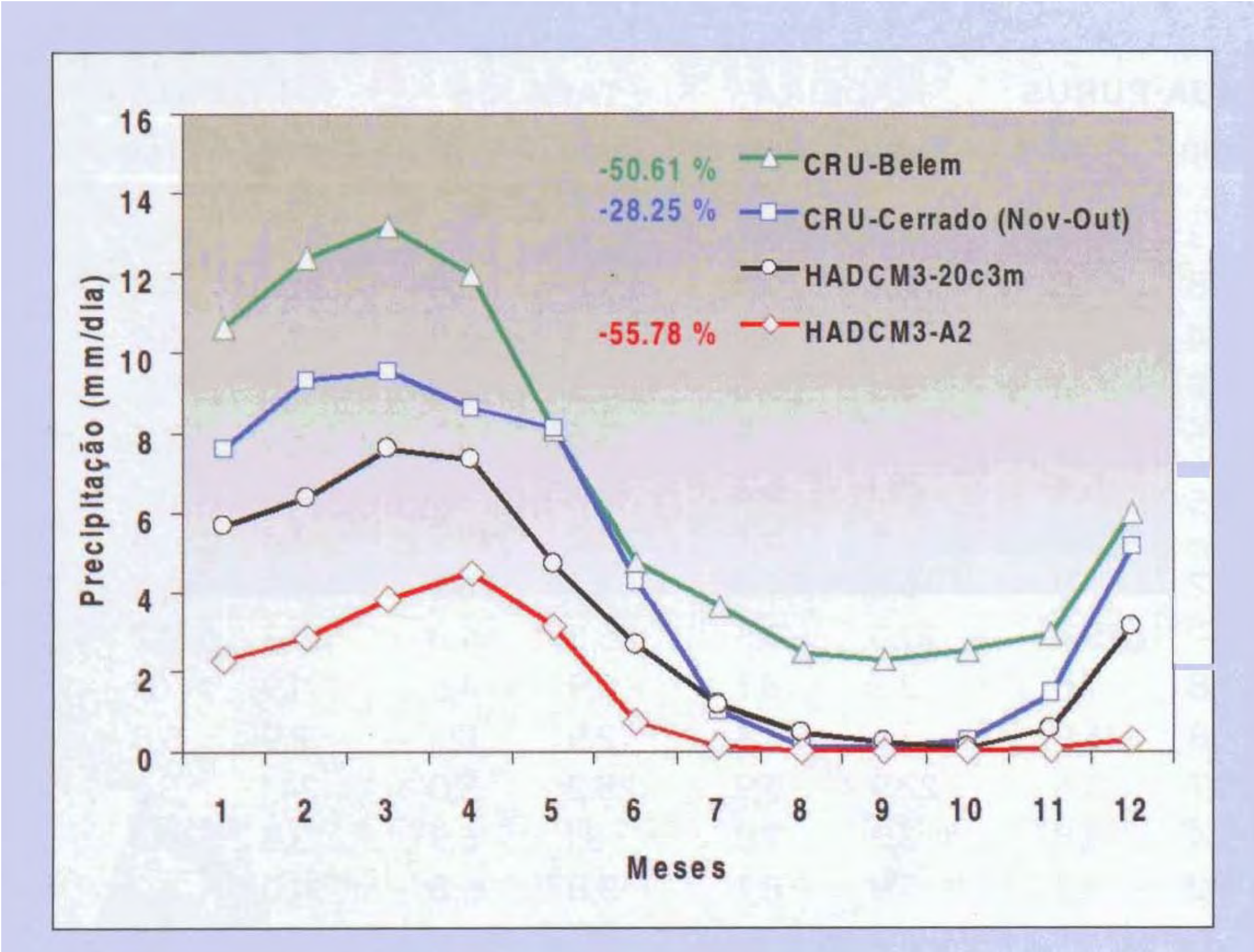


IPCC. 2013a. Summary for Policymakers. In: *Climate Change 2013: The Physical Science Basis*. pp. 3-29. https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_SPM_FINAL.pdf

Changes in vegetation biomass
between the present day and the 2080s



[Hadley Centre, 2000]



Cândido et al., 2007

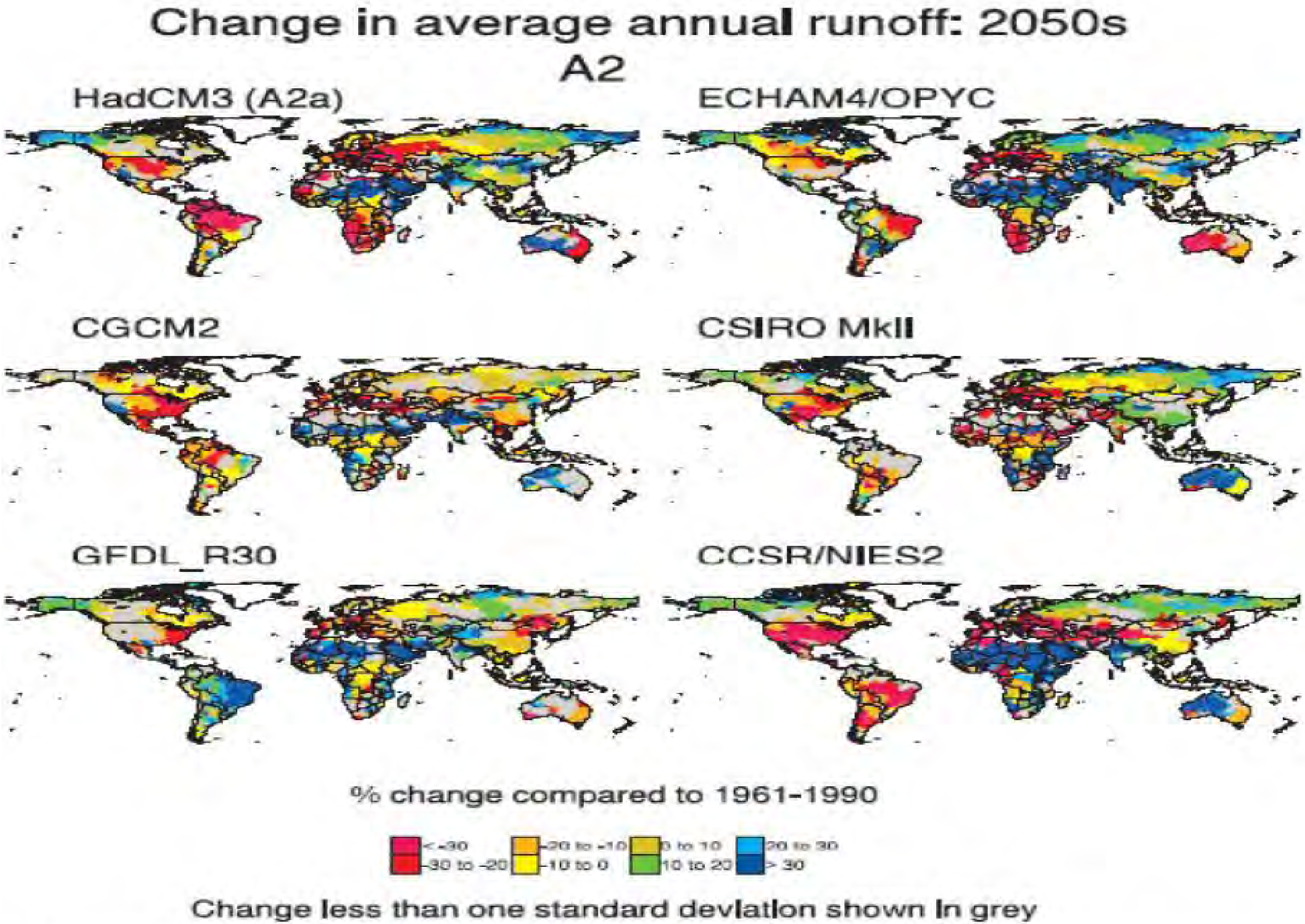


Figure 3.3: *Change in average annual runoff by the 2050s under the SRES A2 emissions scenario and different climate models (Arnell, 2003a).*

IPCC AR4 WG2 2007. Chapter 3

a

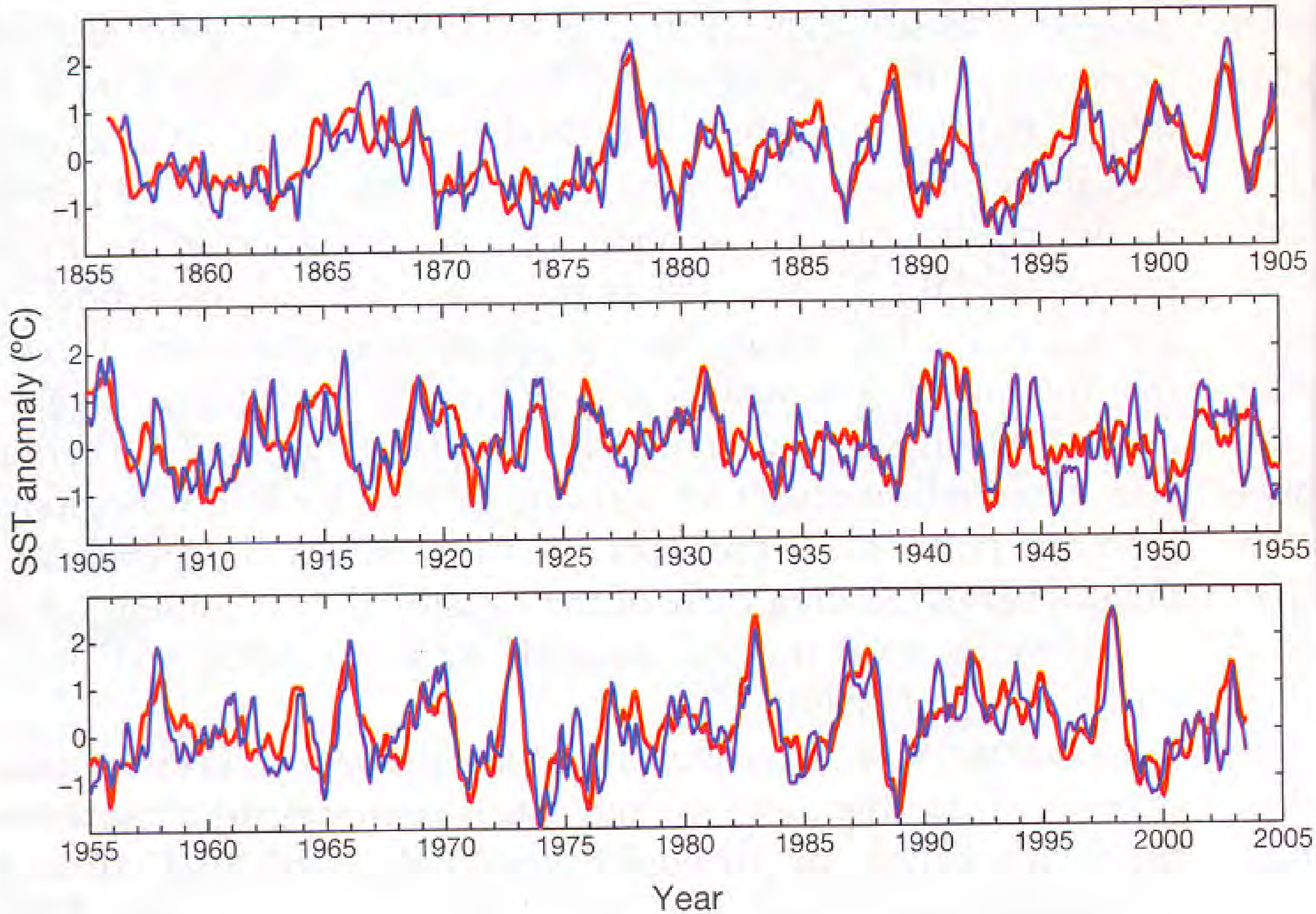
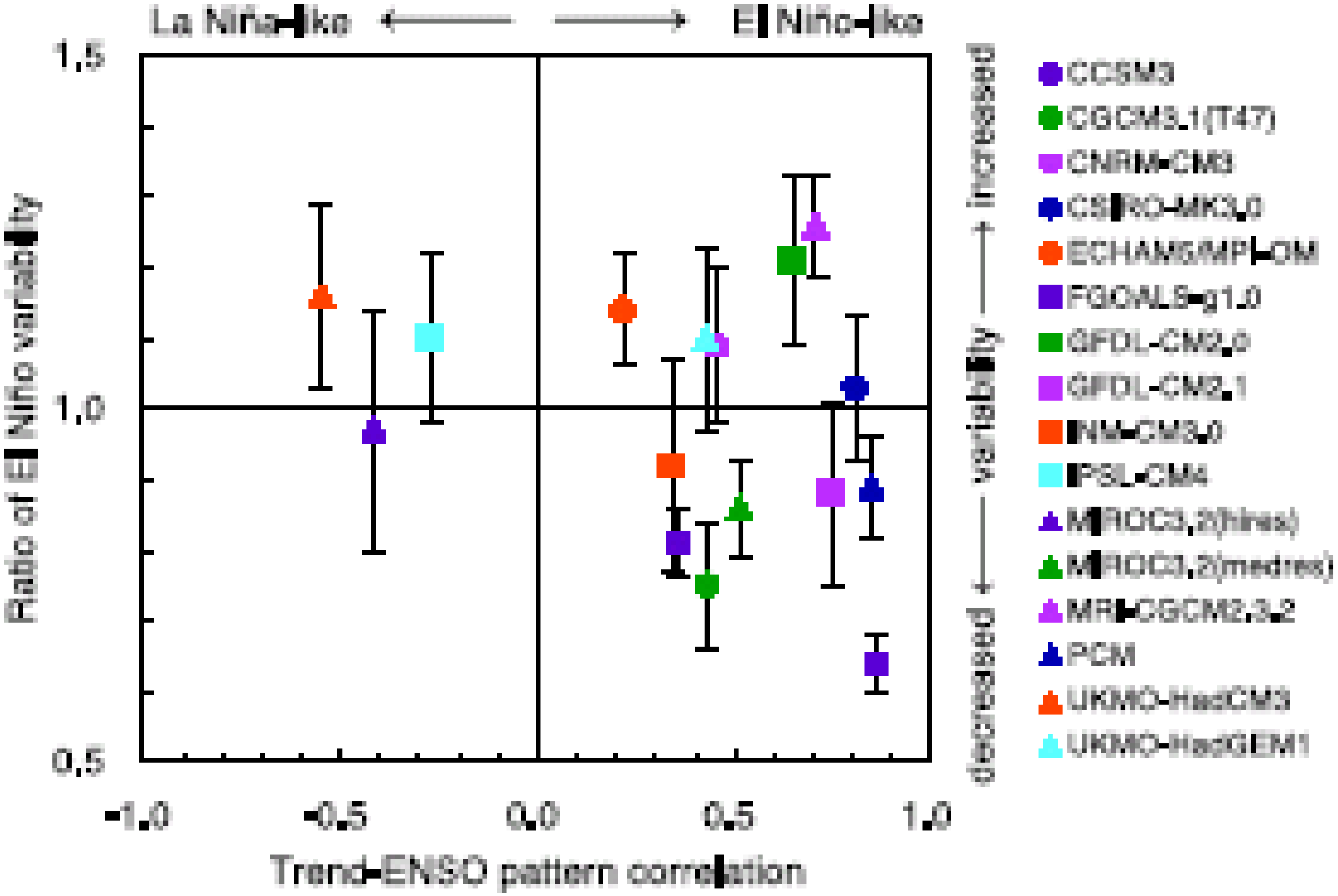
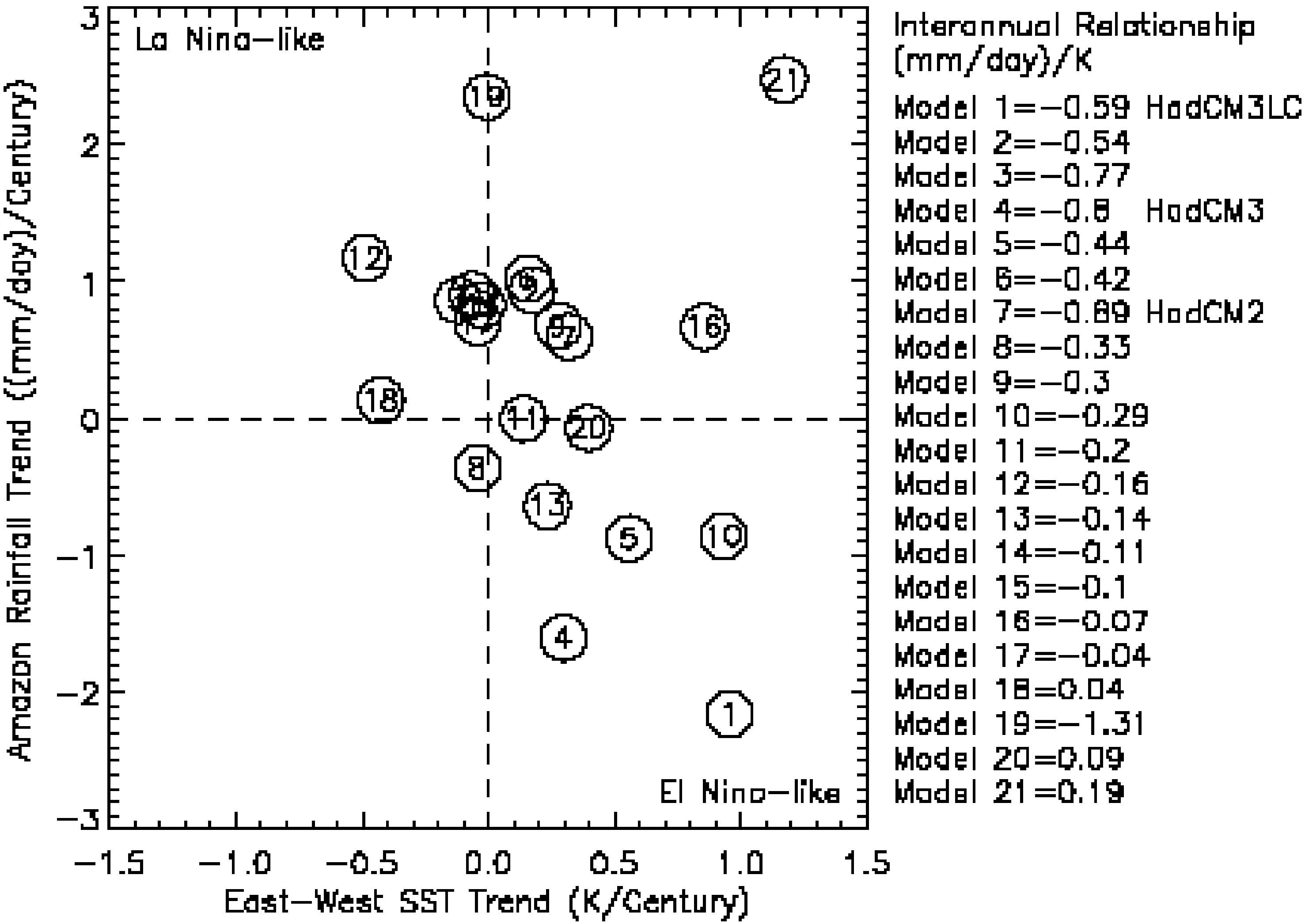


Figure 1 Retrospective predictions of El Niño and La Niña in the past 148 yr. **a,** Time series of SST anomalies averaged in the NINO3.4 region (5° S–5° N, 120–170° W). The red curve is monthly analysis of ref. 12 and the blue curve is the LDEO5 prediction at

6-mo
Top p
colour



IPCC 2007 AR-4, WG-I, p. 779



Cox et al. 2004

Anomalia de Temperatura da Superficie do Mar
Dezembro de 1997

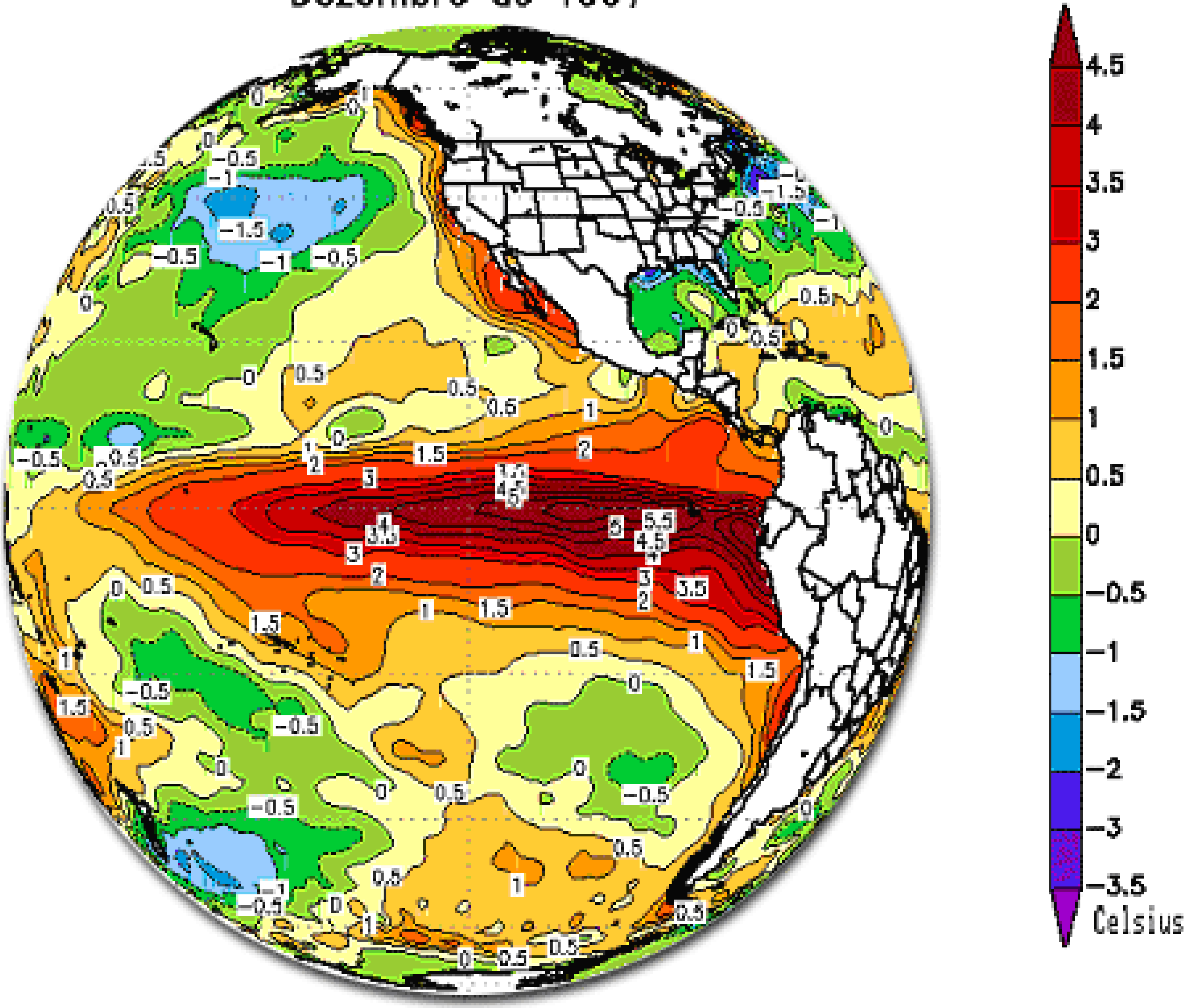
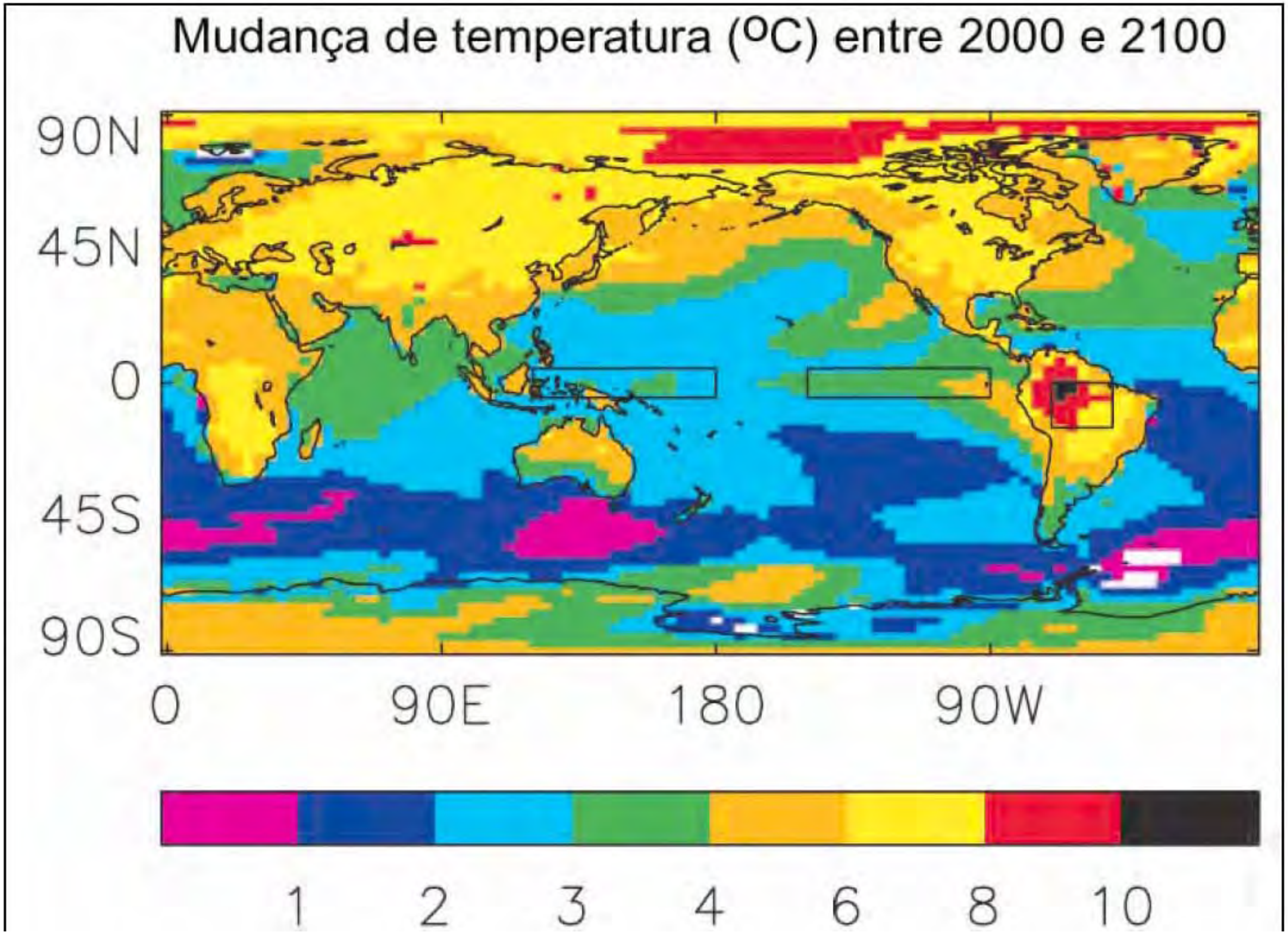


Photo by R.I. Barbosa



Cox et al. 2004

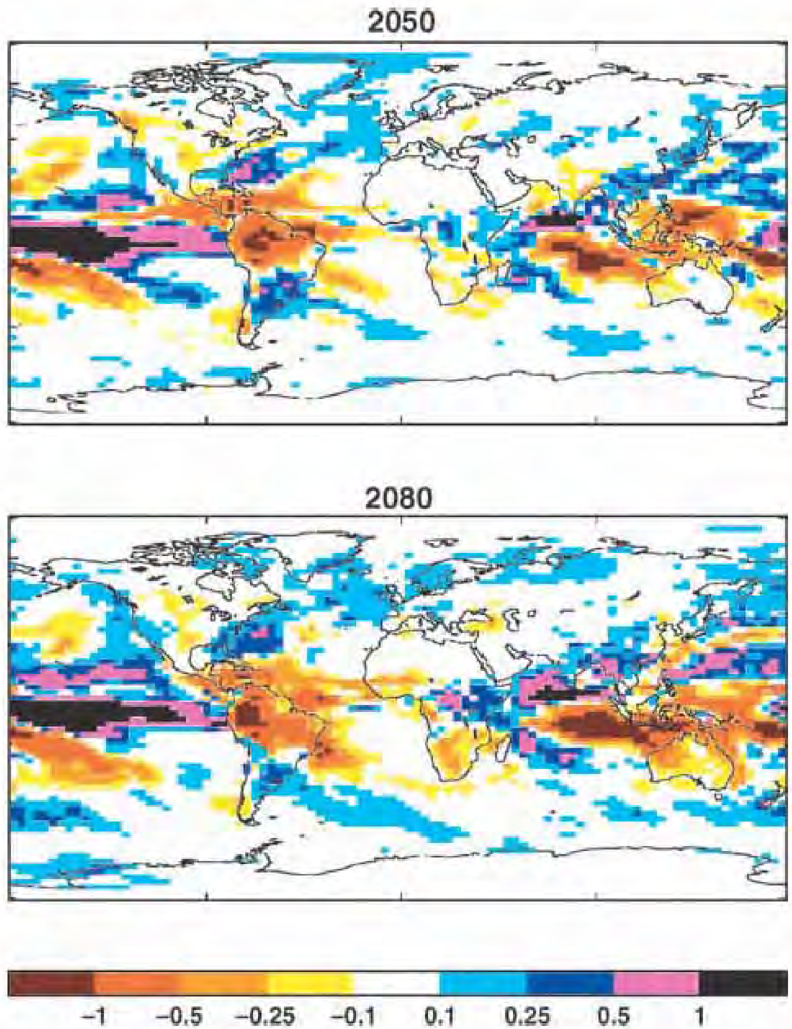
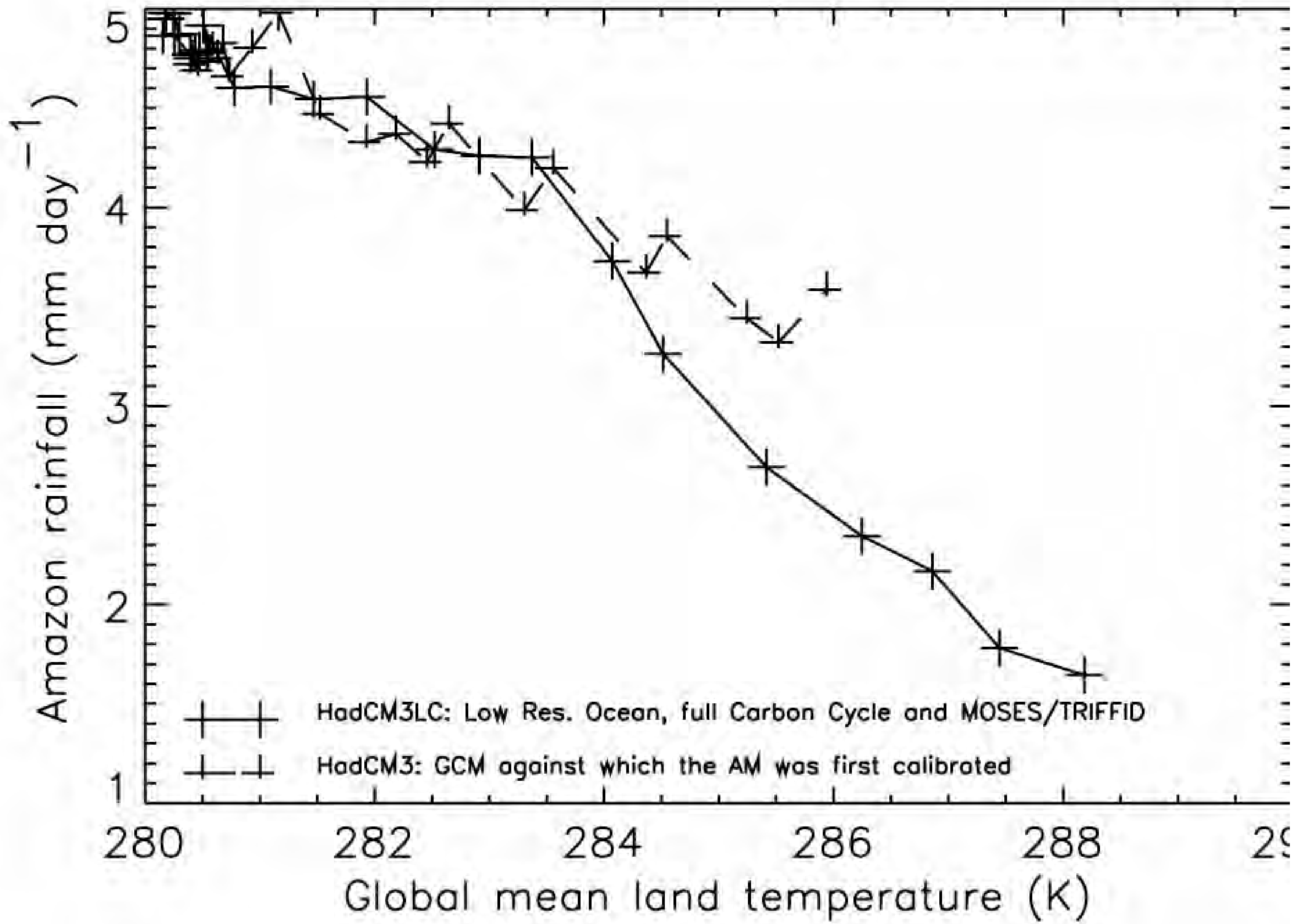


Fig. 8. Effect of including carbon cycle feedbacks on global precipitation patterns. Difference in precipitation (mm day^{-1}), CCYCLE – DYNVEG. 30-year mean centred around 2080

Betts et al. 2004 Theoretical and Applied Climatology



Huntingford et al. 2004 Theoretical and Applied Climatology

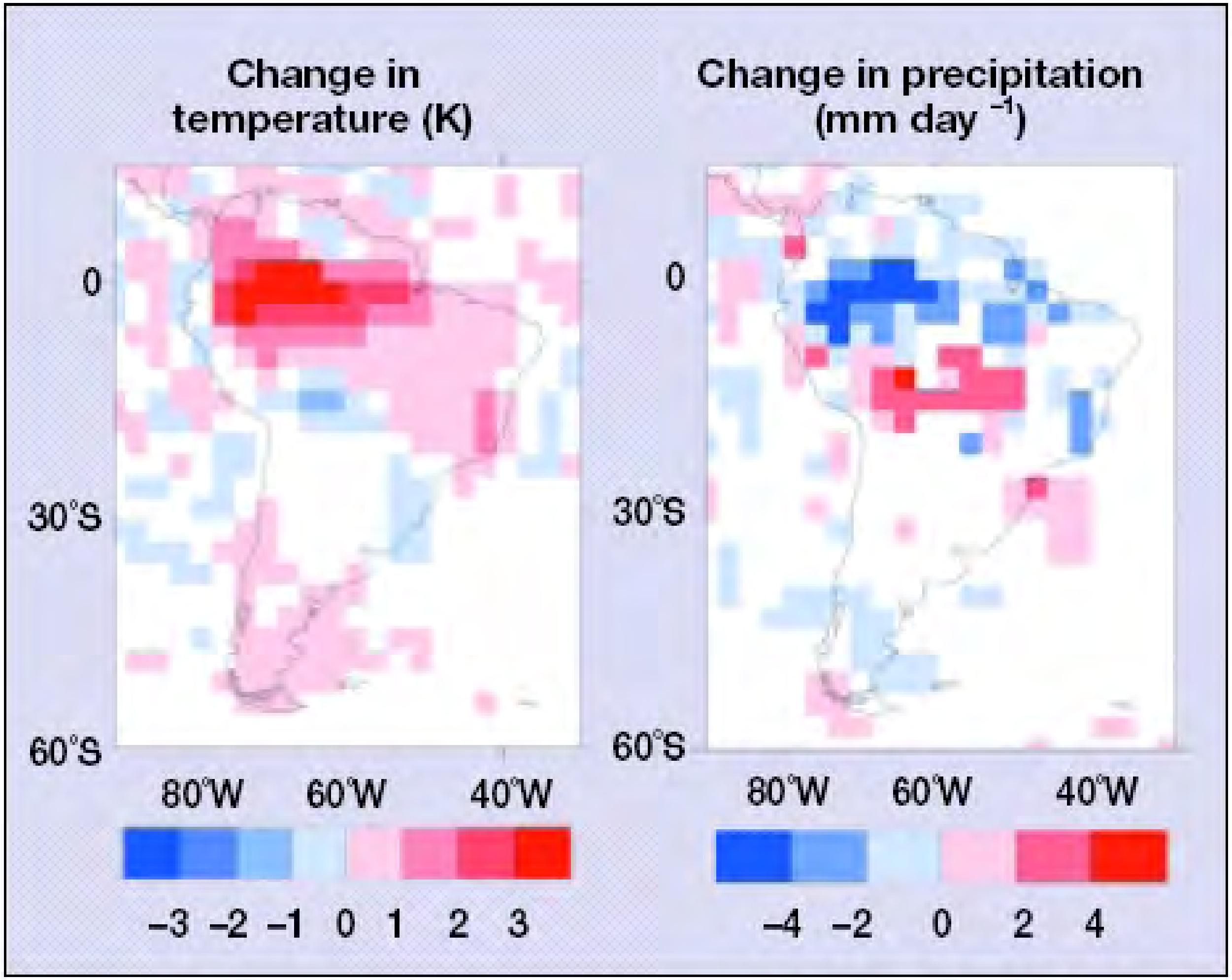


Figure 5. Changes in climate over Amazonia from complete deforestation. Snyder et al. *(unpublished) used the coupled CCM3-IBIS climate–biosphere model to determine the effects of large-scale deforestation on Amazonian climate. The results suggest that the Amazon climate may be highly sensitive to large-scale deforestation (adapted from Snyder* et al. *unpublished).*

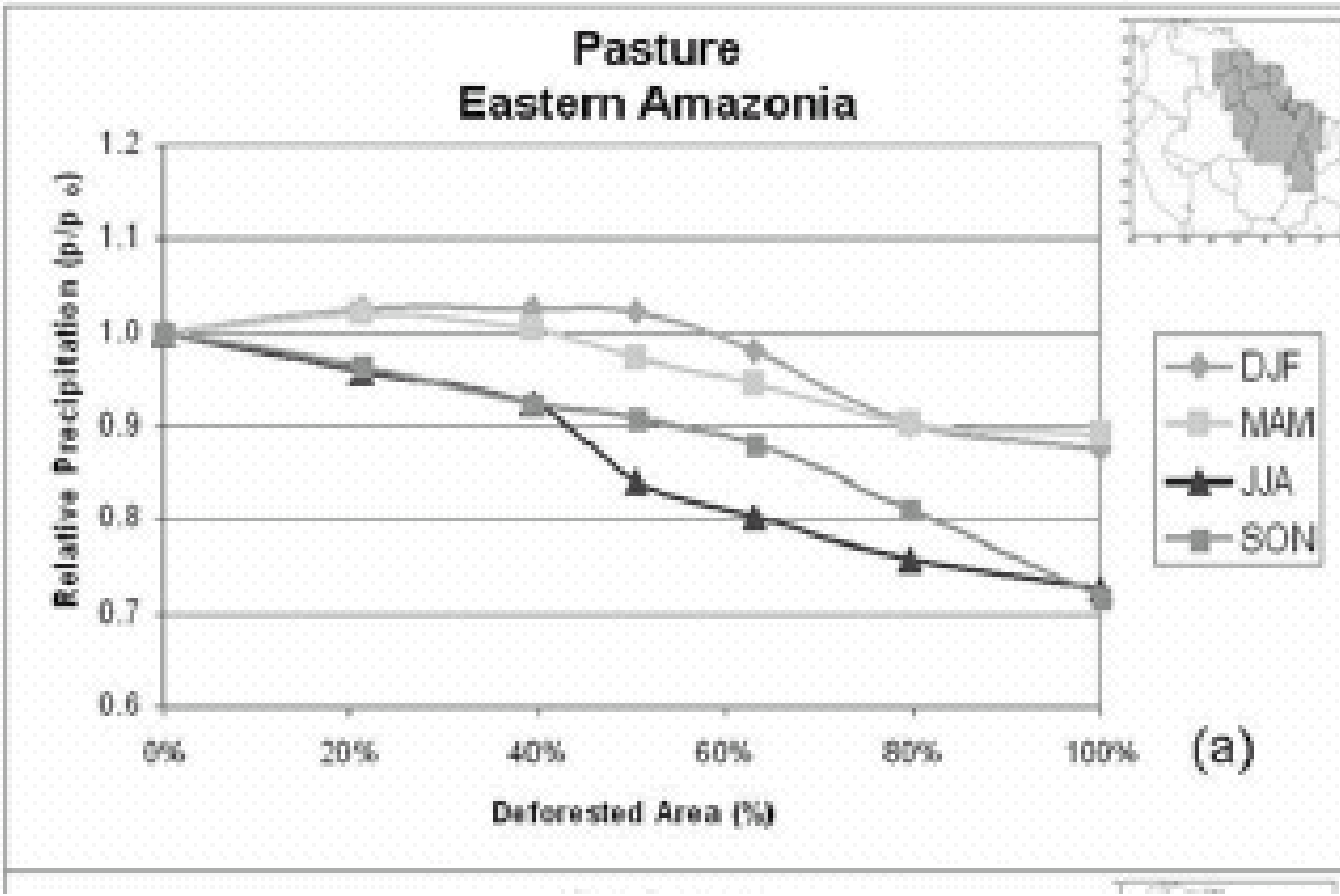
Foley et al. 2007 Frontiers in Ecology and the Environment

GEOPHYSICAL RESEARCH LETTERS, VOL. 34, L17709, doi:10.1029/2007GL030612, 2007

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 Cardoso[1]

Received 7 May 2007; revised 7 August 2007; accepted 9 August 2007; published 13 September 2007.



Pasture
Eastern Amazonia
Relative Precipitation (p/p o)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0%
20%
40%
60%
80%
100%
Deforested Area (%)
DJF
MAM
JJA
SON
(a)

Amazon Tipping Point

In the 1970s, Brazilian scientist Eneas Salati shattered the long held dogma that vegetation is simply the consequence of climate and has no influence on climate whatsoever (*1*). Using isotopic ratios of oxygen in rainwater samples collected from the Atlantic to the Peruvian border, he was able to demonstrate unequivocally that the Amazon generates approximately half of its own rainfall by recycling moisture 5 to 6 times as airmasses move from the Atlantic across the basin to the west.

From the start, the demonstration of the hydrological cycle of the Amazon raised the question of how much deforestation would be required to cause the cycle to degrade to the point of being unable to support rain forest ecosystems.

High levels of evaporation and transpiration that forests produce throughout the year contribute to a wetter atmospheric boundary layer than would be the case with non-forest.This surface-atmosphere coupling is more important where large-scale factors for rainfall formation are weaker, such as in central and eastern Amazonia. Near the Andes, the impact of at least modest deforestation is less dramatic because the general ascending motion of airmasses in this area induces high levels of rainfall in addition to that expected from local evaporation and transpiration.

Where might the tipping point be for deforestation-generated degradation of the hydrological cycle? The very first model to examine this question (*2*) showed that at about 40% deforestation, central, southern and eastern Amazonia would experience diminished rainfall and a lengthier dry season, predicting a shift to savanna vegetation to the east.

Moisture from the Amazon is important to rainfall and human wellbeing because it contributes to winter rainfall for parts of the La Plata basin, especially southern Paraguay, southern Brazil, Uruguay and central-eastern Argentina; in other regions, the moisture passes over the area, but does not precipitate out. Although the amount contributing to rainfall in southeastern Brazil is smaller than in other areas, even small amounts can be a welcome addition to urban reservoirs.

The importance of Amazon moisture for Brazilian agriculture south of the Amazon is complex but not trivial. Perhaps most important is the partial contribution of dry season Amazon evapotranspiration to rainfall in southeastern South America. Forests maintain an evapotranspiration rate year-round, whereas evapotranspiration in pastures is dramatically lower in the dry season. As a consequence, models suggest a longer dry season after deforestation.

In recent decades, new forcing factors have impinged on the hydrological cycle: climate change and widespread use of fire to eliminate felled trees and clear weedy vegetation. Many studies show that in the absence of other contributing factors, 4 degrees Celsius of global warming would be the tipping point to degraded savannas in most of the central, southern, and eastern Amazon. Widespread use of fire leads to drying of surrounding forest and greater vulnerability to fire in the subsequent year.

We believe that negative synergies between deforestation, climate change, and widespread use of fire indicate a tipping point for the Amazon system to flip to non-forest ecosystems in eastern, southern and central Amazonia at 20-25% deforestation.

The severity of the droughts of 2005, 2010 and 2015-16 could well represent the first flickers of this ecological tipping point. These events, together with the severe floods of 2009, 2012 (and 2014 over SW Amazonia), suggest that the whole system is oscillating. For the last two decades the dry season over the southern and eastern Amazon has been increasing. Large scale factors such as warmer sea surface temperatures over the tropical North Atlantic also seem to be associated with the changes on land.

We believe that the sensible course is not only to strictly curb further deforestation, but also to build back a margin of safety against the Amazon tipping point, by reducing the deforested area to less than 20%, for the commonsense reason that there is no point in discovering the precise tipping point by tipping it. At the 2015 Paris Conference of the Parties, Brazil committed to 12 million ha of reforestation by 2030. Much or most of this reforestation should be in southern and eastern Amazonia. The hydrological cycle of the Amazon is fundamental to human wellbeing in Brazil and adjacent South America.

–Thomas E. Lovejoy and Carlos Nobre

REFERENCES

1. E. Salati, A. Dall 'Ollio, E. Matsui, J. R. Gat, Recycling of Water in the Amazon, Brazil: an isotopic study. *Water Resour. Res.* **15**, 1250–1258 (1979).
2. G. Sampaio,C. A. Nobre, M. H. Costa, P. Satyamurty, B. S. Soares-Filho, M. Cardoso, Regional climate change over eastern Amazonia caused by pasture and soybean cropland expansion. *Geophys. Res. Lett.* **34**, L17709 (2007).

10.1126/sciadv.aat2340

Citation: T. E. Lovejoy, C. Nobre, Amazon Tipping Point. *Sci. Adv.* **4**, eaat2340 (2018).

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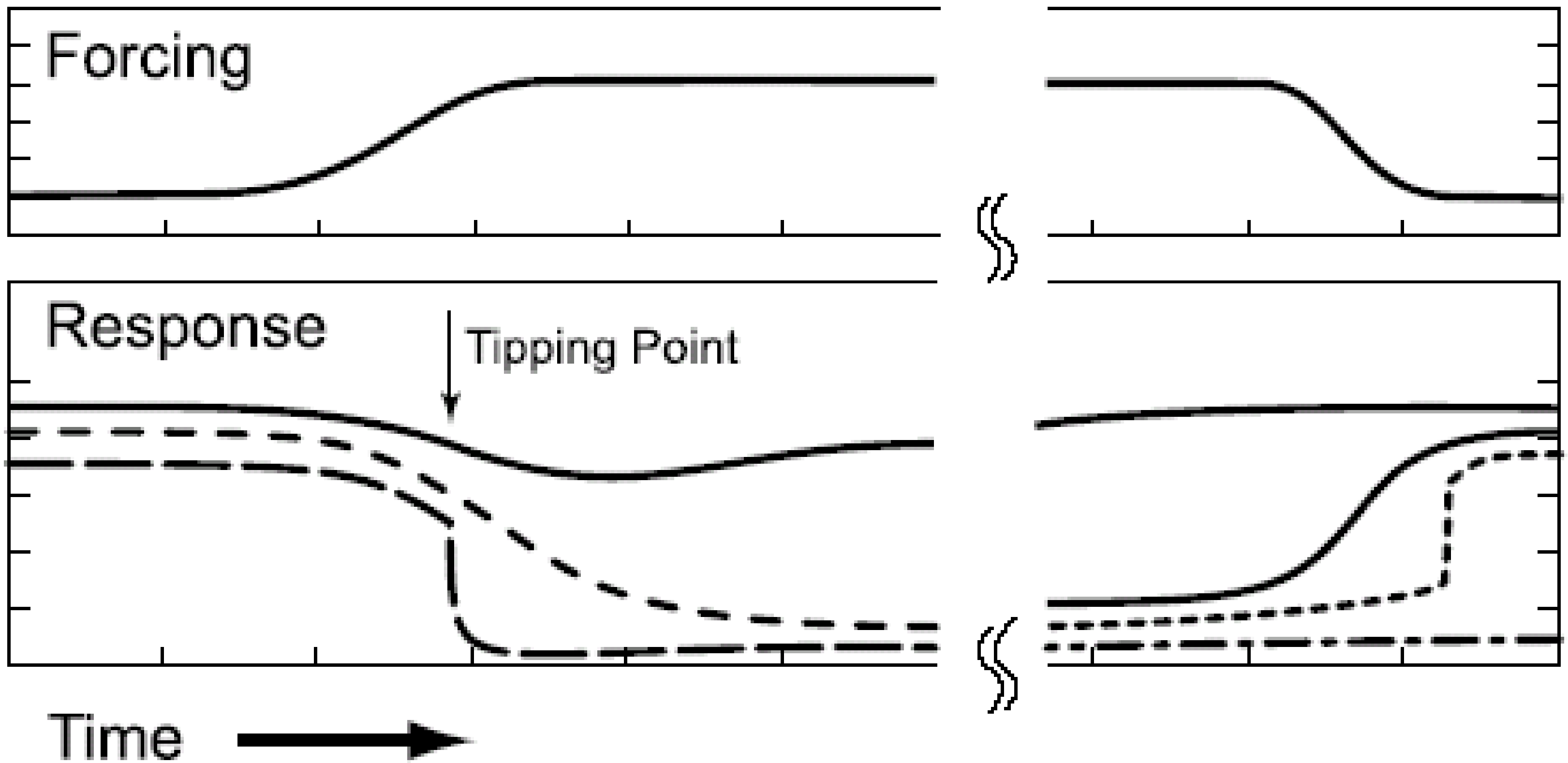
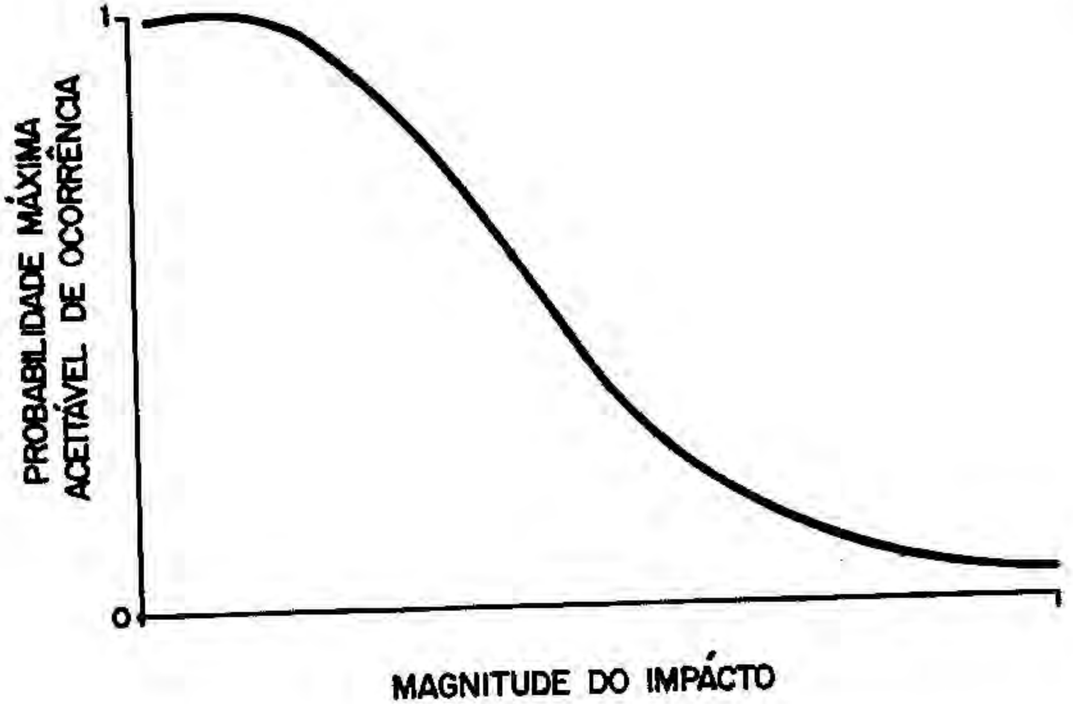
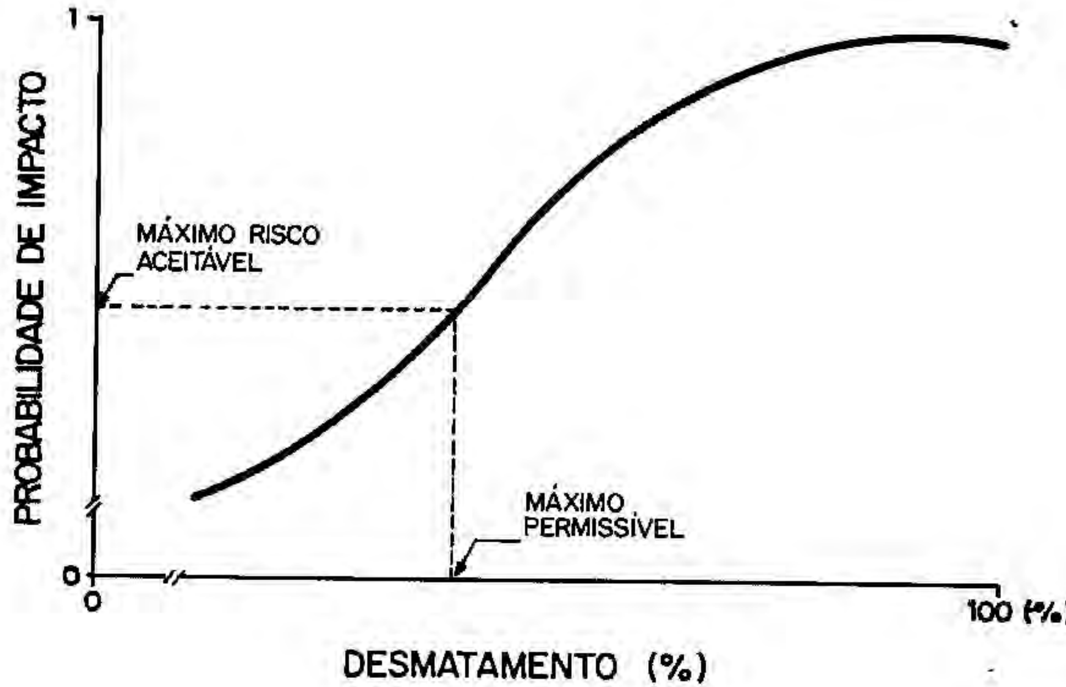
Carlos Nobre is a Member of the Brazilian Academy of Sciences and Senior Fellow of World Resources Institute Brazil.



IPCC, 2007 AR4 WG1 Ch. 10 p. 775



Fearnside, 1997 *Revista Brasileira de Biologia*



Fearnside, 1997 *Revista Brasileira de Biologia*

Fatores limitantes para o desenvolvimento da agropecuária na Amazônia brasileira.

Fearnside, P.M. 1997. Limiting factors for development of agriculture and ranching in Brazilian Amazonia. *Revista Brasileira de Biologia* 57(4): 531-549.

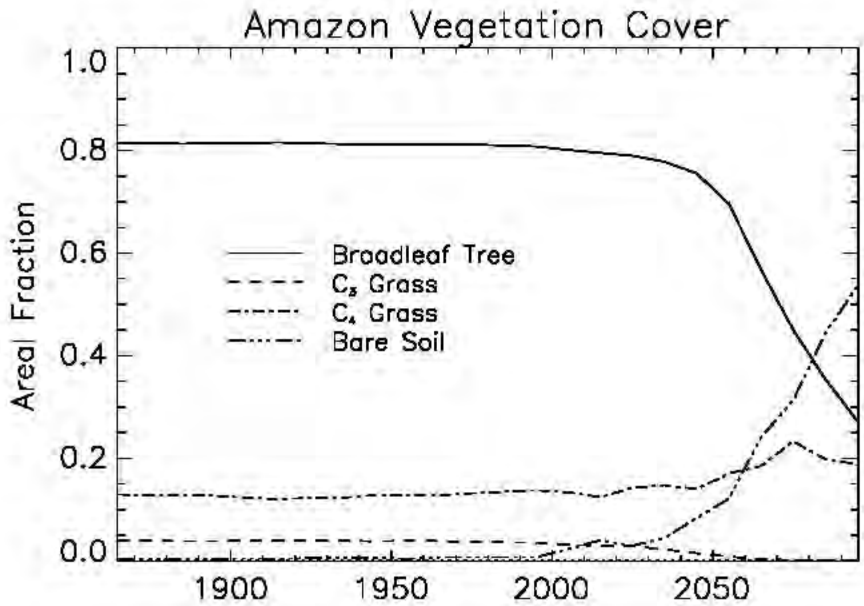


Figure 6: Evolution of the vegetation cover in the Amazon box from the coupled climate-carbon cycle simulation

Cox et al. 2004 Theoretical and Applied Climatology

Ecological Complexity 22 (2015) 65–75

Contents lists available at ScienceDirect

Ecological Complexity

journal homepage: www.elsevier.com/locate/ecocom

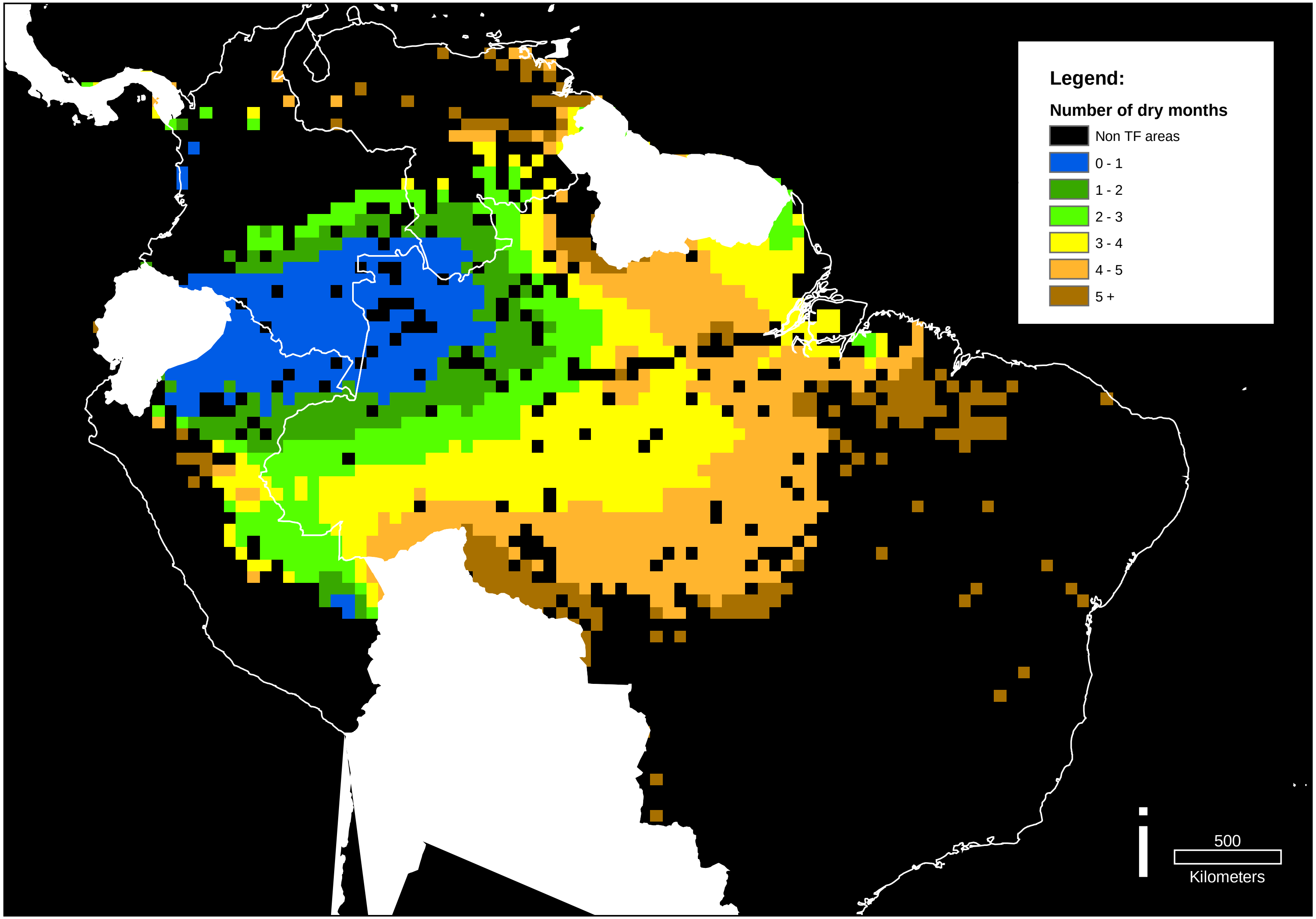
Original Research Article

Synergistic effects of drought and deforestation on the resilience of the south-eastern Amazon rainforest

Arie Staal[a,b,*], Stefan C. Dekker[b], Marina Hirota[c], Egbert H. van Nes[a]

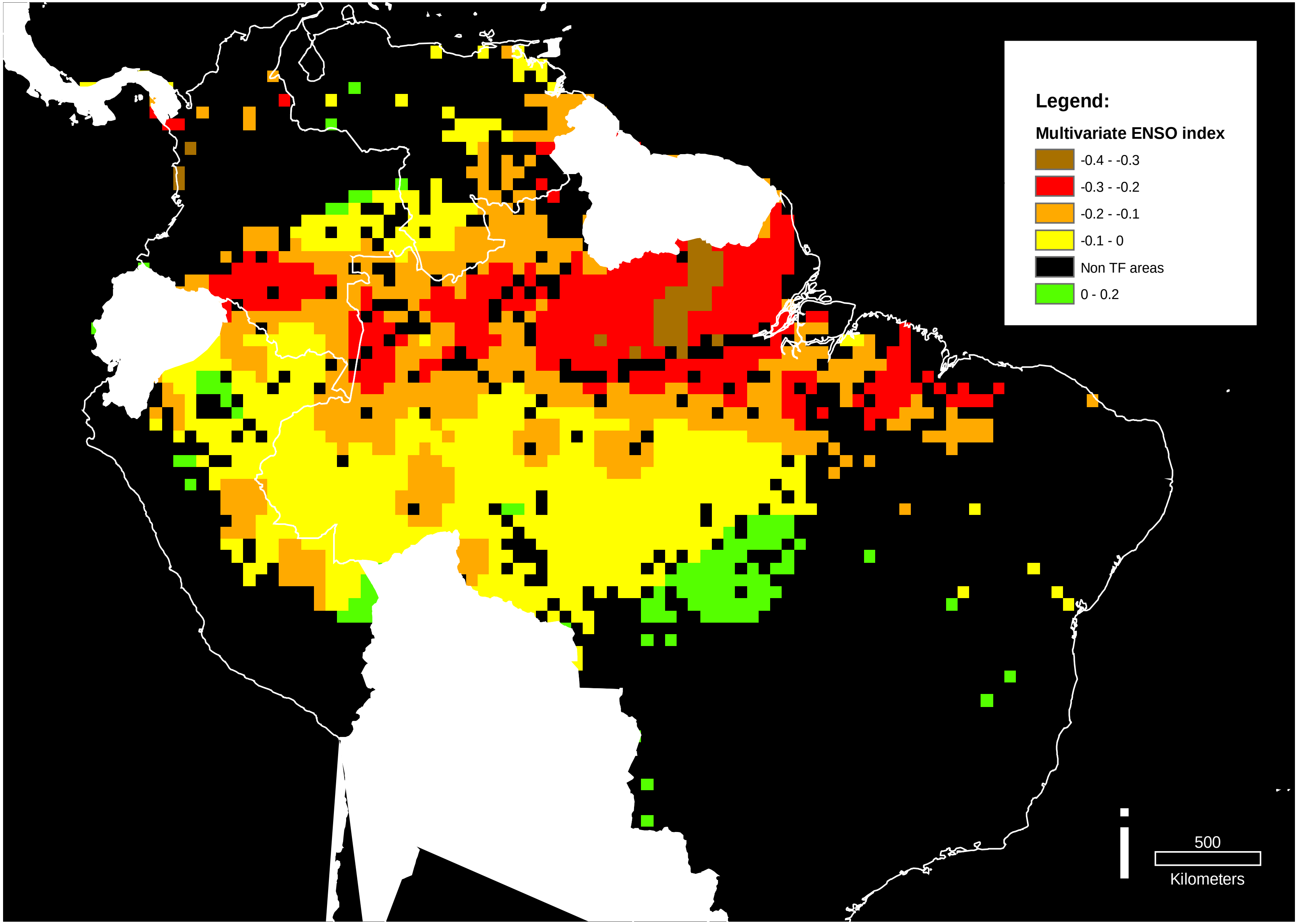
[a] Aquatic Ecology and Water Quality Management Group, Wageningen University, P.O. Box 47, 6700 AA, Wageningen, The Netherlands
[b] Department of Environmental Sciences, Copernicus Institute for Sustainable Development, Utrecht University, P.O. Box 80115, 3508 TC Utrecht, The Netherlands
[c] Department of Physics, Federal University of Santa Catarina, P.O. Box 476, 88040-970, Florianópolis, Brazil

Length of dry season

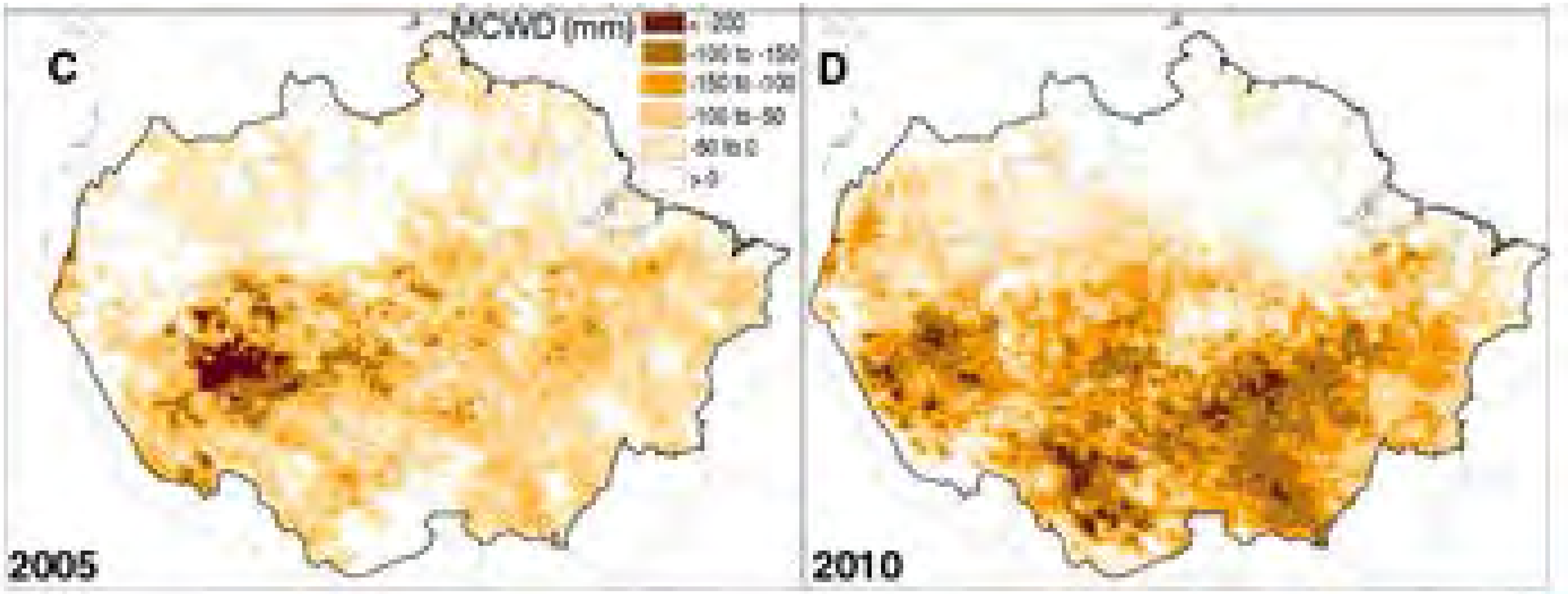


Derived from the New et al 2001 dataset

Impact of El Nino



Malhi and Wright 2004 *Spatial patterns and recent trends in the climate of tropical forest regions.* Philosophical Transactions of the Royal Society

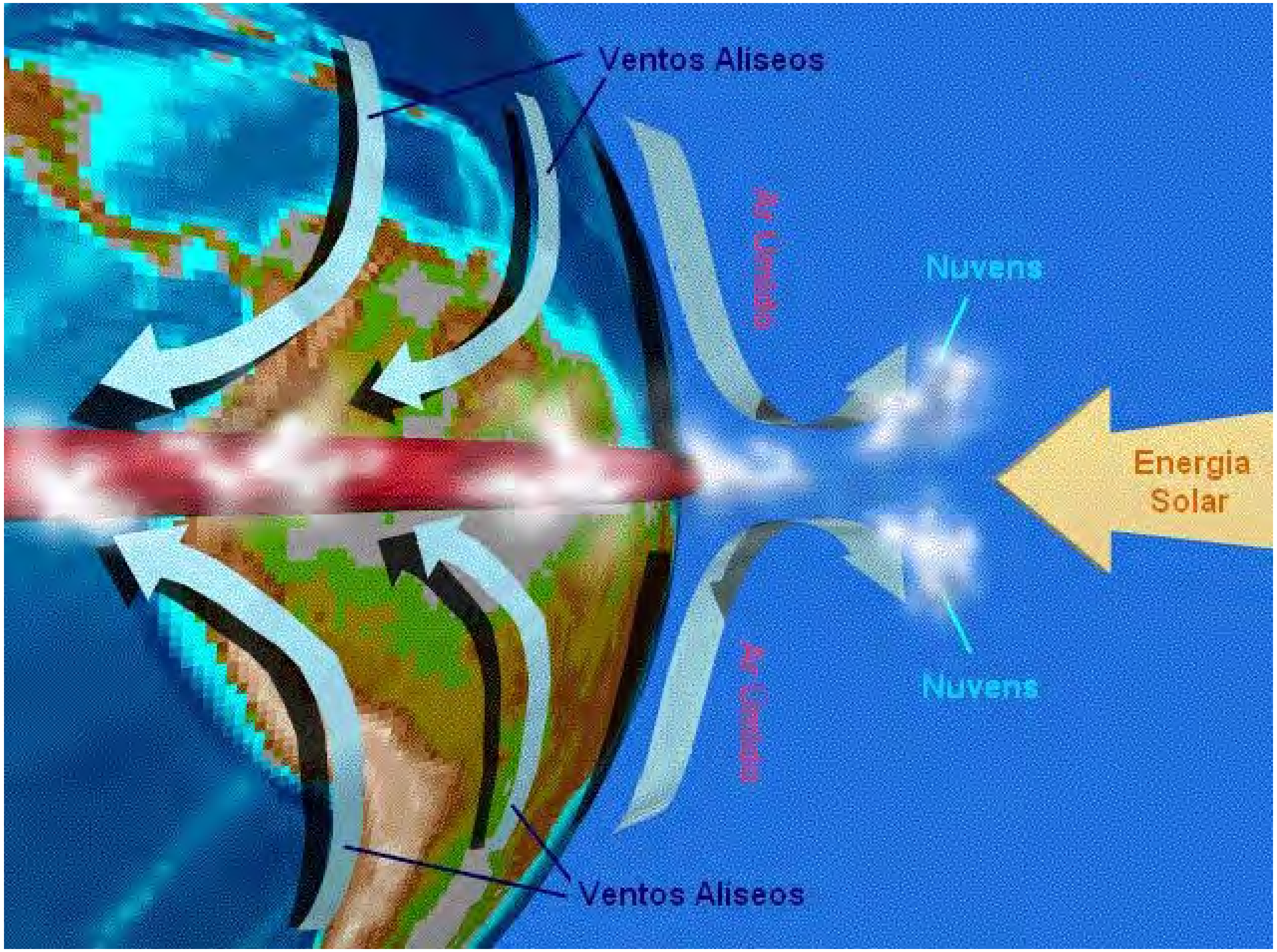


Lewis, S. L., Brando, P. M., Phillips, O. L., Van Der Heijden, G. M. F., & Nepstad, D. 2011. The 2010 Amazon drought. *Science*, 331: 554. http://doi.org/10.1126/science.1200807

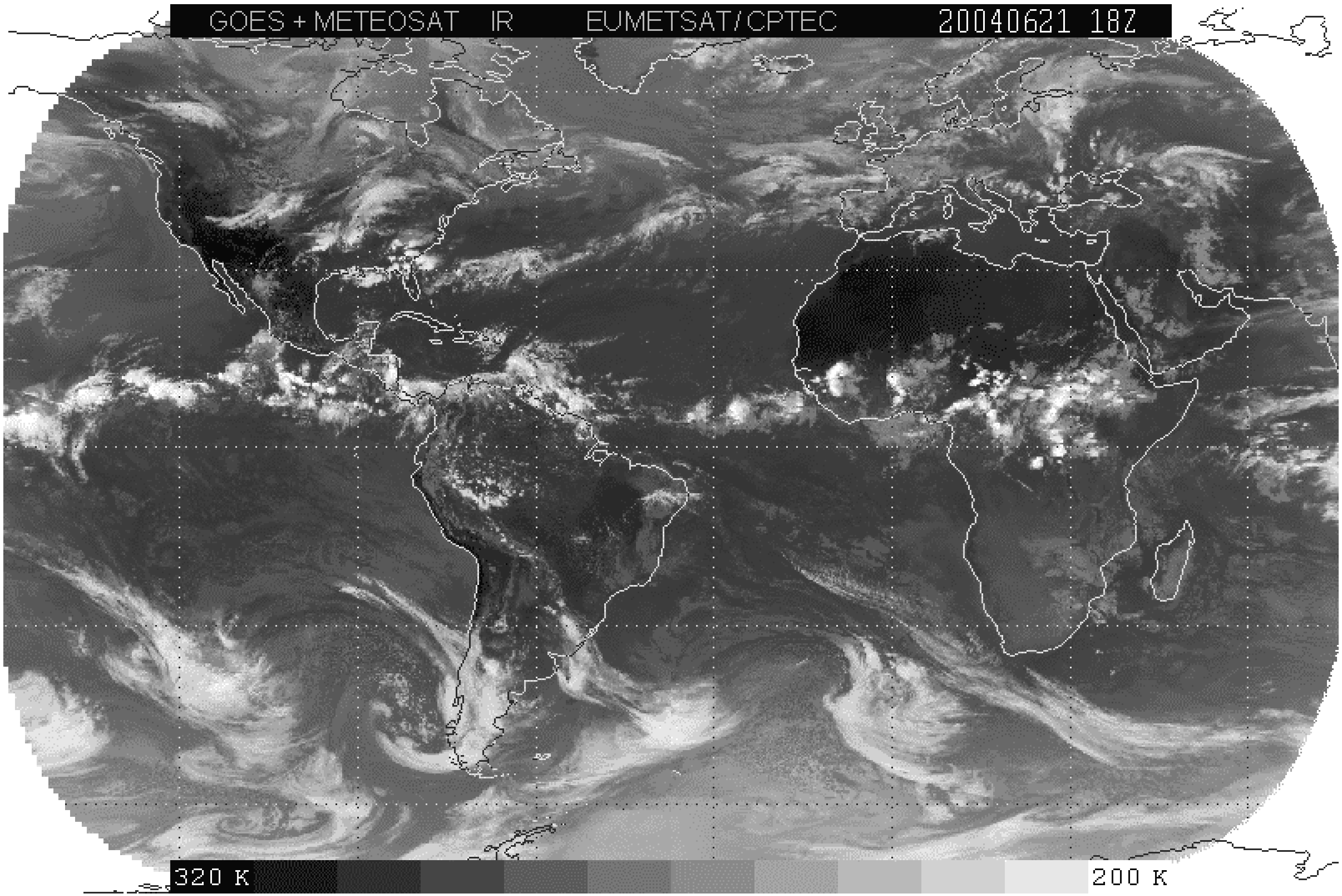
Seca de 2005

Fotos Greenpeace


Fotos Greenpeace


Ventos Alíseos
Ar Umido
Nuvens
Energia
Solar
Nuvens
Ar Umido
Ventos Alíseos

Zona intertropical de convergência

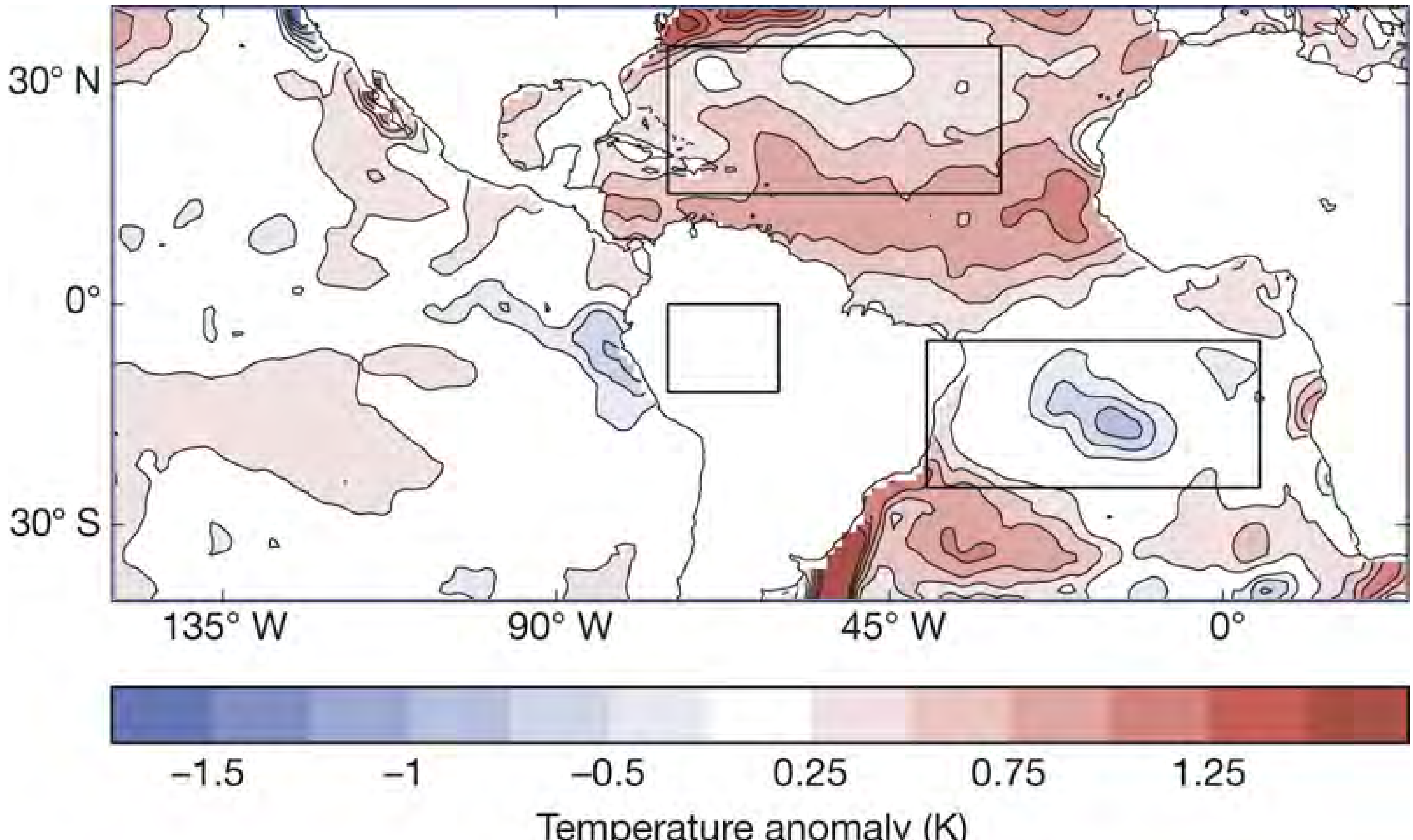


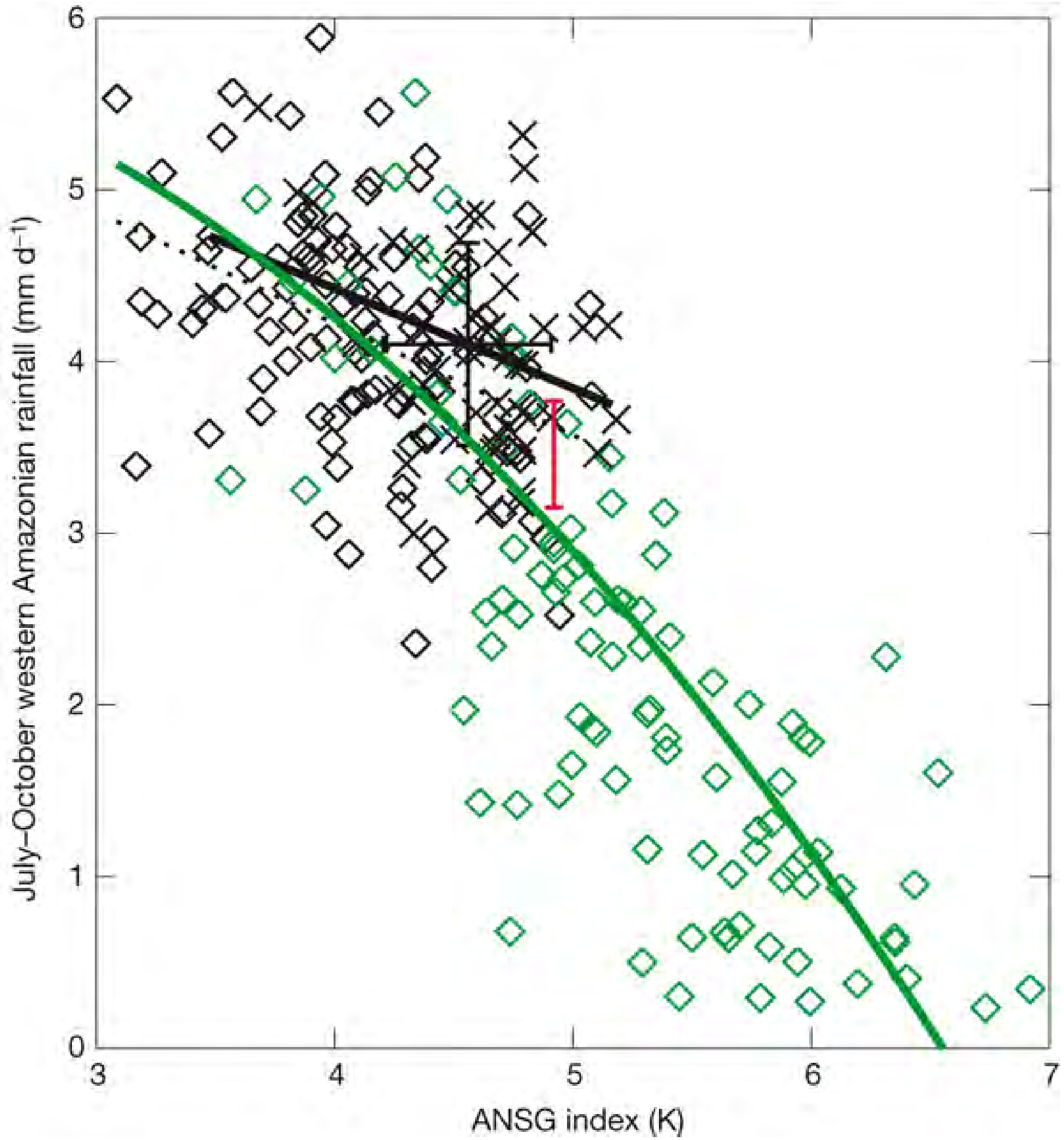
nature Vol 453|8 May 2008|doi:10.1038/nature06960

LETTERS

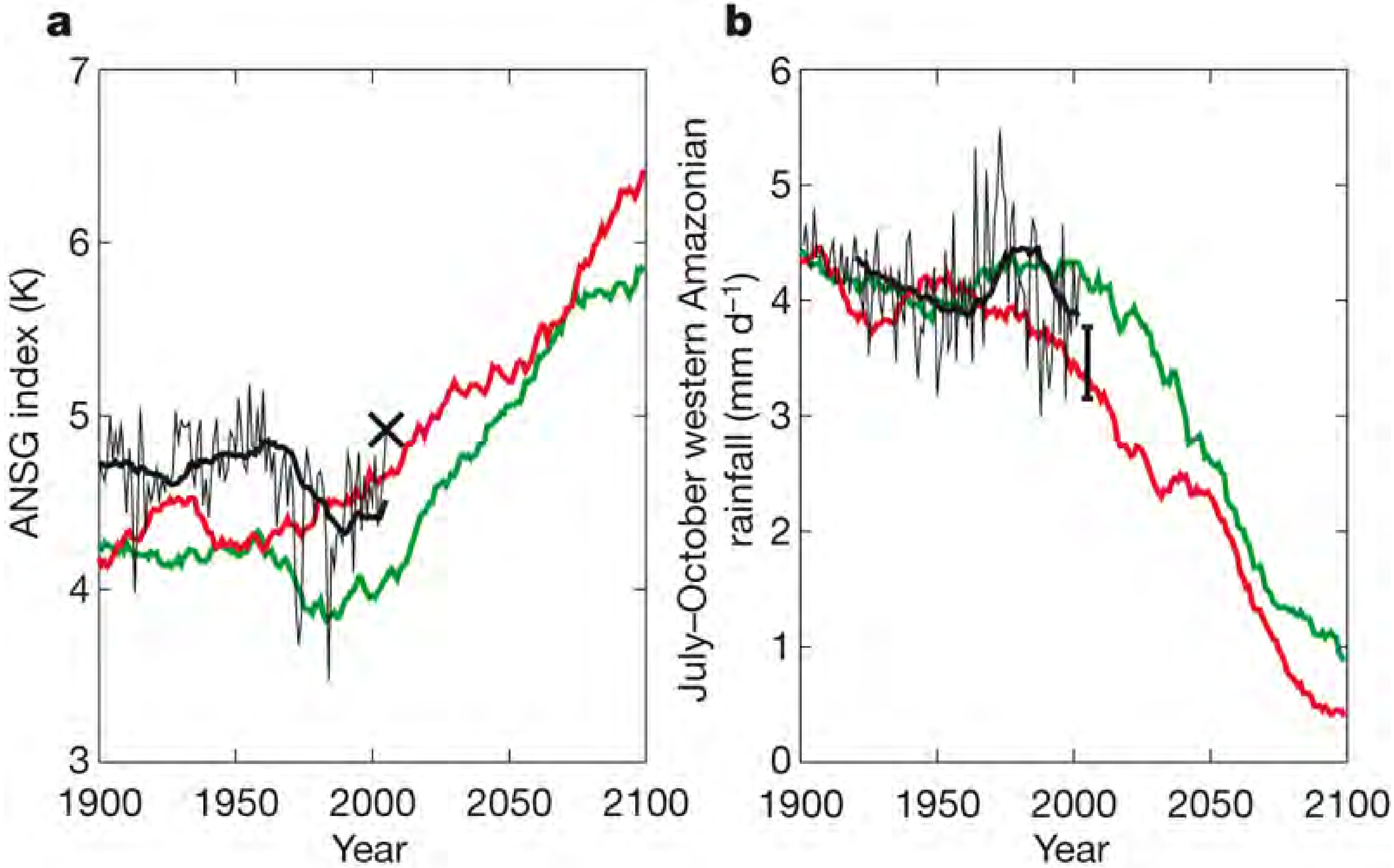
Increasing risk of Amazonian drought due to decreasing aerosol pollution

Peter M. Cox[1,2], Phil P. Harris[3], Chris Huntingford[3], Richard A. Betts[2], Matthew Collins[2], Chris D. Jones[2], Tim E. Jupp[1], José A. Marengo[4] & Carlos A. Nobre[4]

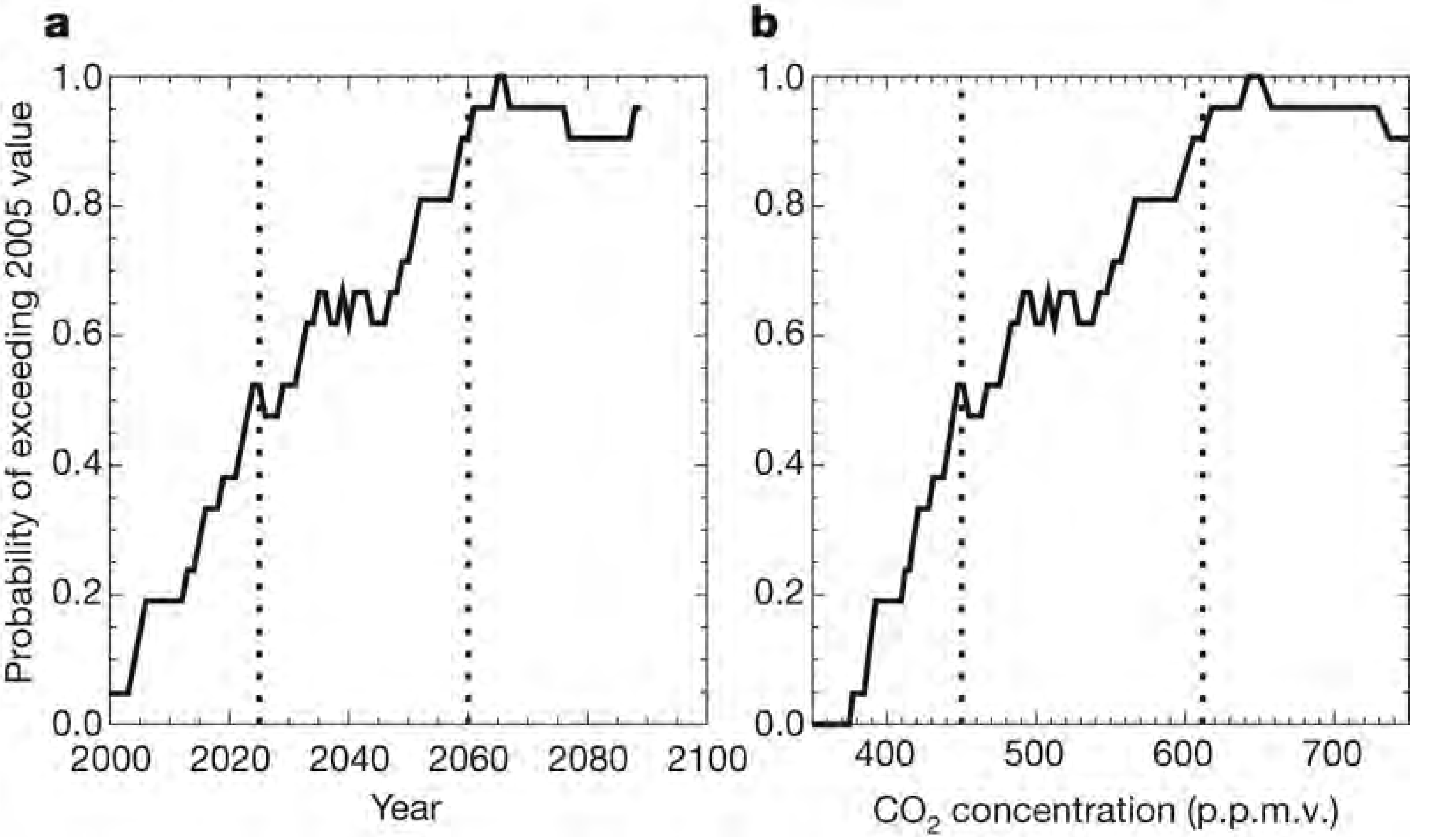

30° N
0°
30° S
135° W
90° W
45° W
0°
−1.5
−1
−0.5
0.25
0.75
1.25
Temperature anomaly (K)



July–October western Amazonian rainfall (mm d⁻¹)
ANSG index (K)
0
1
2
3
4
5
6
3
4
5
6
7



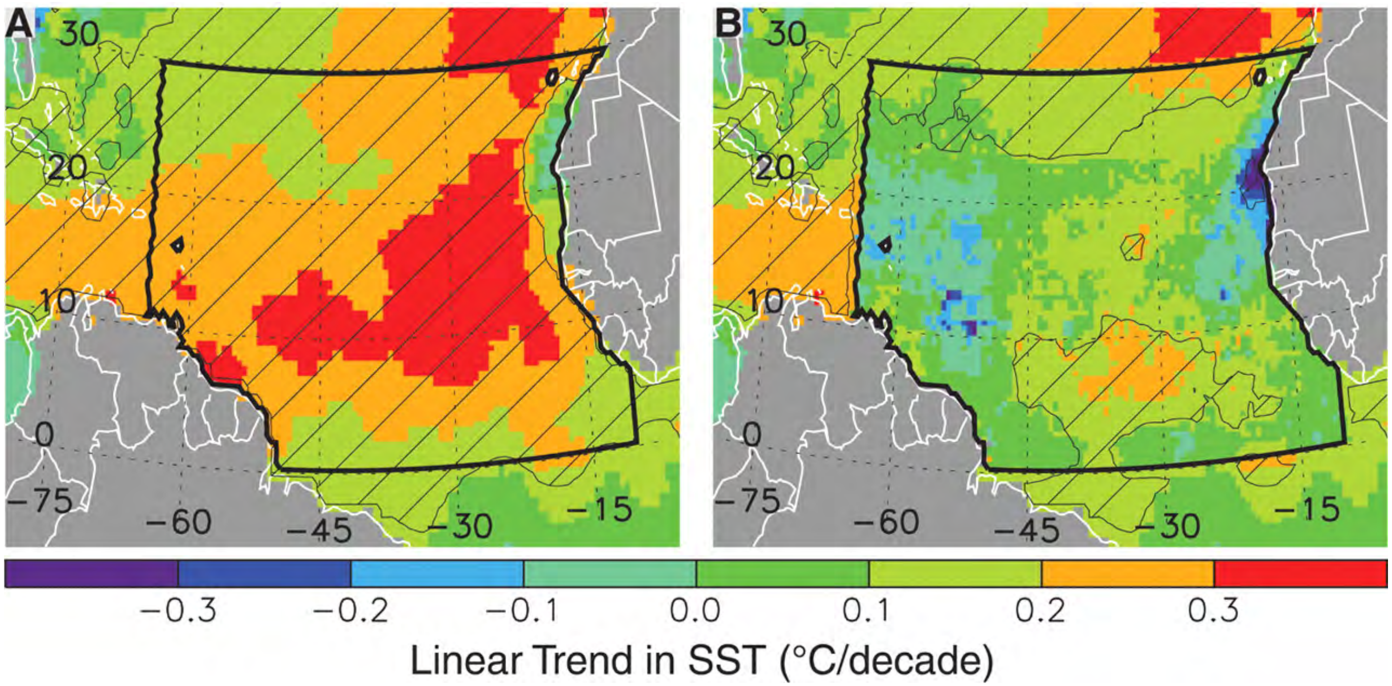
a
ANSG index (K)
7
6
5
4
3
1900
1950
2000
2050
2100
Year
b
July–October western Amazonian rainfall (mm d⁻¹)
6
5
4
3
2
1
0
1900
1950
2000
2050
2100
Year


a
b
Probability of exceeding 2005 value
1.0
0.8
0.6
0.4
0.2
0.0
2000
2020
2040
2060
2080
2100
Year
400
500
600
700
CO2 concentration (p.p.m.v.)

The Role of Aerosols in the Evolution of Tropical North Atlantic Ocean Temperature Anomalies

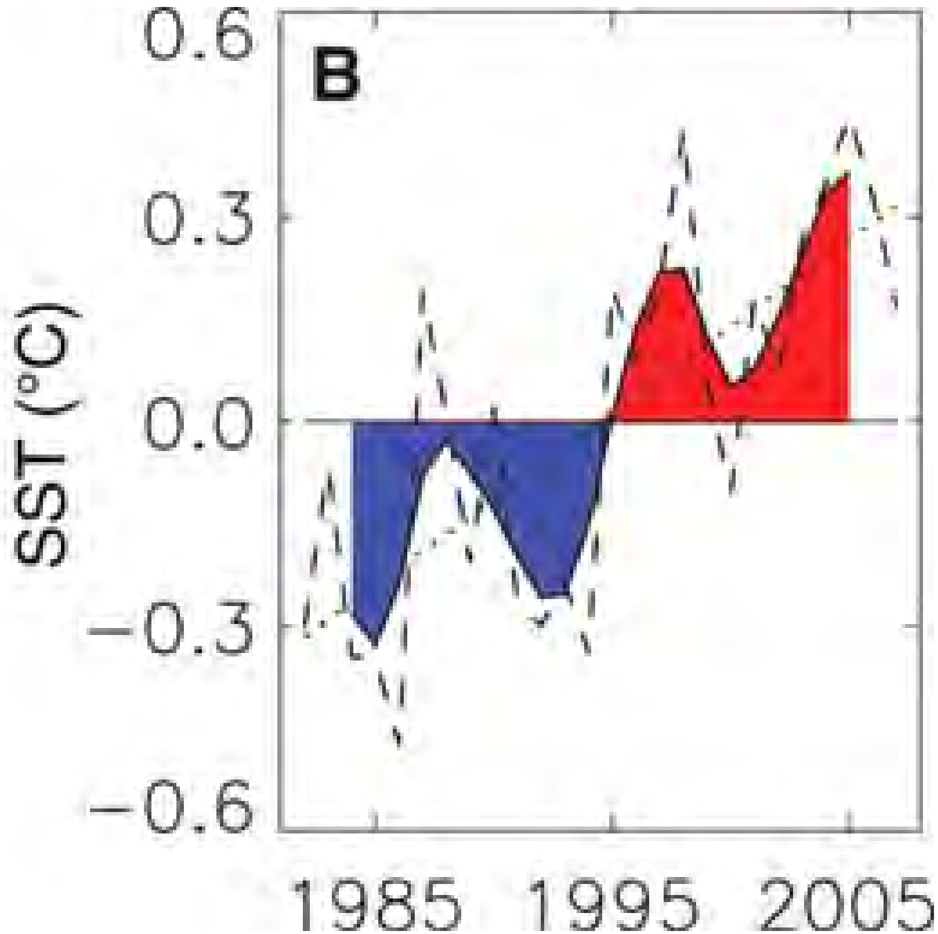
Amato T. Evan,[1,2]* Daniel J. Vimont,[2] Andrew K. Heidinger,[3] James P. Kossin,[4] Ralf Bennartz[2]

Fig. 4 Map of linear trends in observed SST (A) and the residual SST (B)



A. T. Evan et al., Science 324, 778 -781 (2009)

Published by AAAS



A. T. Evan et al., Science 324, 778 -781 (2009)

JOURNAL OF CLIMATE 15 JANUARY 2013 DOI: 10.1175/JCLI-D-11-00366.1

Comparing Tropical Forest Projections from Two Generations of Hadley Centre Earth System Models, HadGEM2-ES and HadCM3LC

PETER GOOD, CHRIS JONES, JASON LOWE, RICHARD BETTS, AND NICOLA GEDNEY

Met Office Hadley Centre, Exeter, United Kingdom

LETTER

doi:10.1038/nature11882

Sensitivity of tropical carbon to climate change constrained by carbon dioxide variability

Peter M. Cox[1], David Pearson[2], Ben B. Booth[2], Pierre Friedlingstein[1], Chris Huntingford[3], Chris D. Jones[2] & Catherine M. Luke[1]

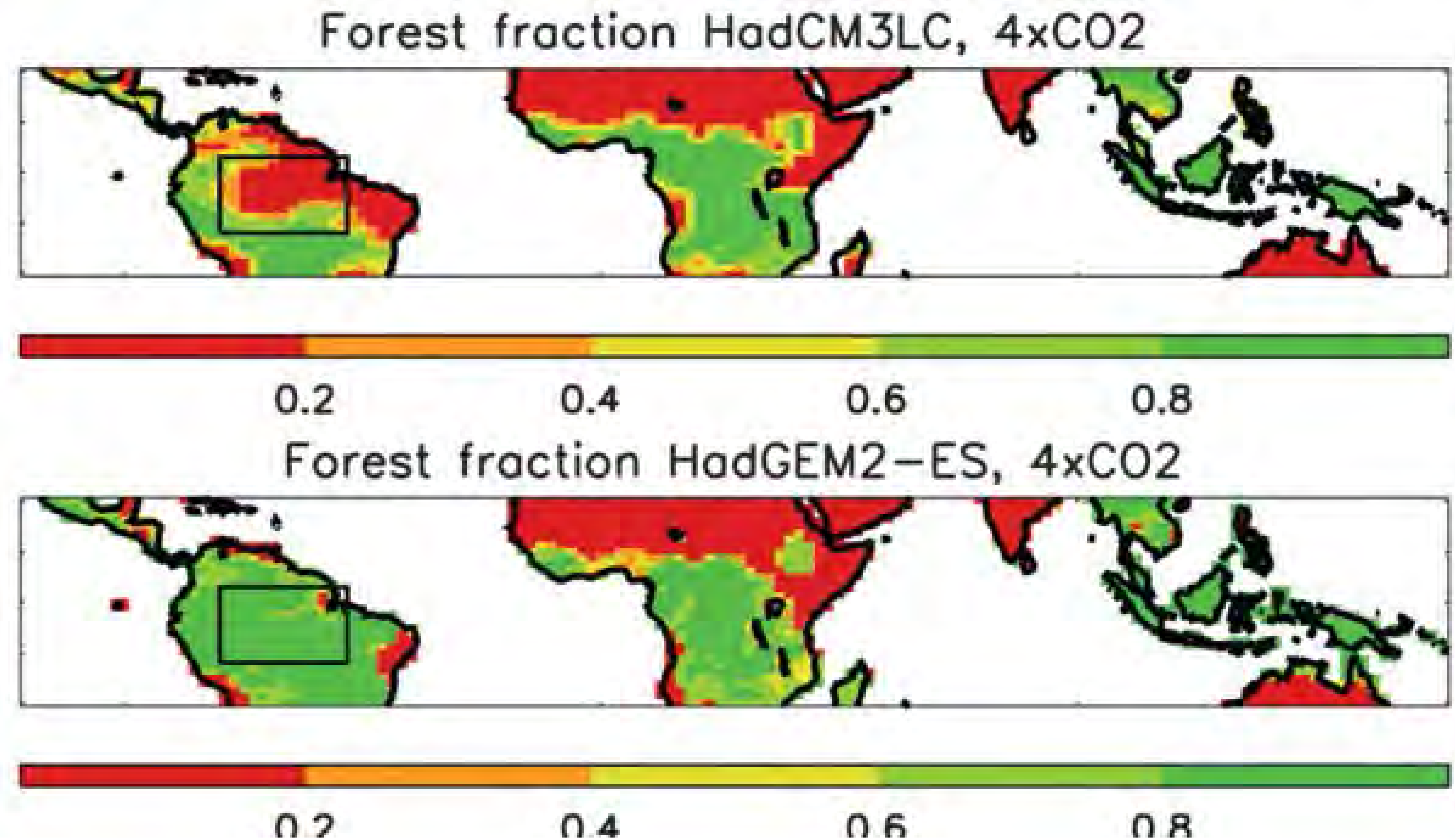
nature geoscience

LETTERS

PUBLISHED ONLINE: 10 MARCH 2013 | DOI: 10.1038/NGEO1741

Simulated resilience of tropical rainforests to CO_2-induced climate change

Chris Huntingford[1]*, Przemyslaw Zelazowski[2], David Galbraith[2,3], Lina M. Mercado[1,4], Stephen Sitch[3,4], Rosie Fisher[5], Mark Lomas[6], Anthony P. Walker[6], Chris D. Jones[7], Ben B. B. Booth[7], Yadvinder Malhi[2], Debbie Hemming[7], Gillian Kay[7], Peter Good[7], Simon L. Lewis[3,8], Oliver L. Phillips[3], Owen K. Atkin[9], Jon Lloyd[3,10], Emanuel Gloor[3], Joana Zaragoza-Castells[11], Patrick Meir[9,11], Richard Betts[7], Phil P. Harris[1], Carlos Nobre[12], Jose Marengo[12] and Peter M. Cox[13]



Good *et al*., 2013, p. 496.

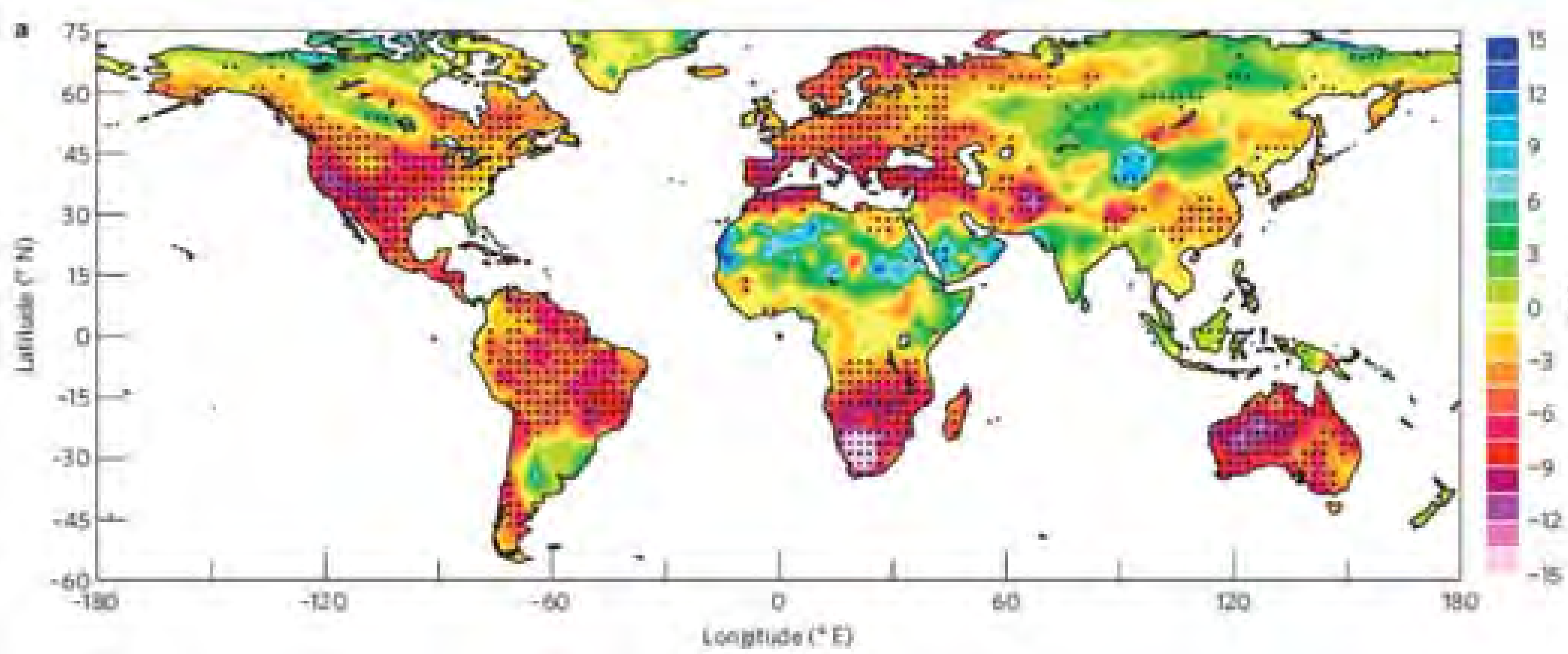
LETTERS
PUBLISHED ONLINE: 5 AUGUST 2012 | DOI: 10.1038/NCLIMATE1633

nature climate change

Increasing drought under global warming in observations and models

Aiguo Dai

DOI: 10.1038/NCLIMATE1633



Soil moisture

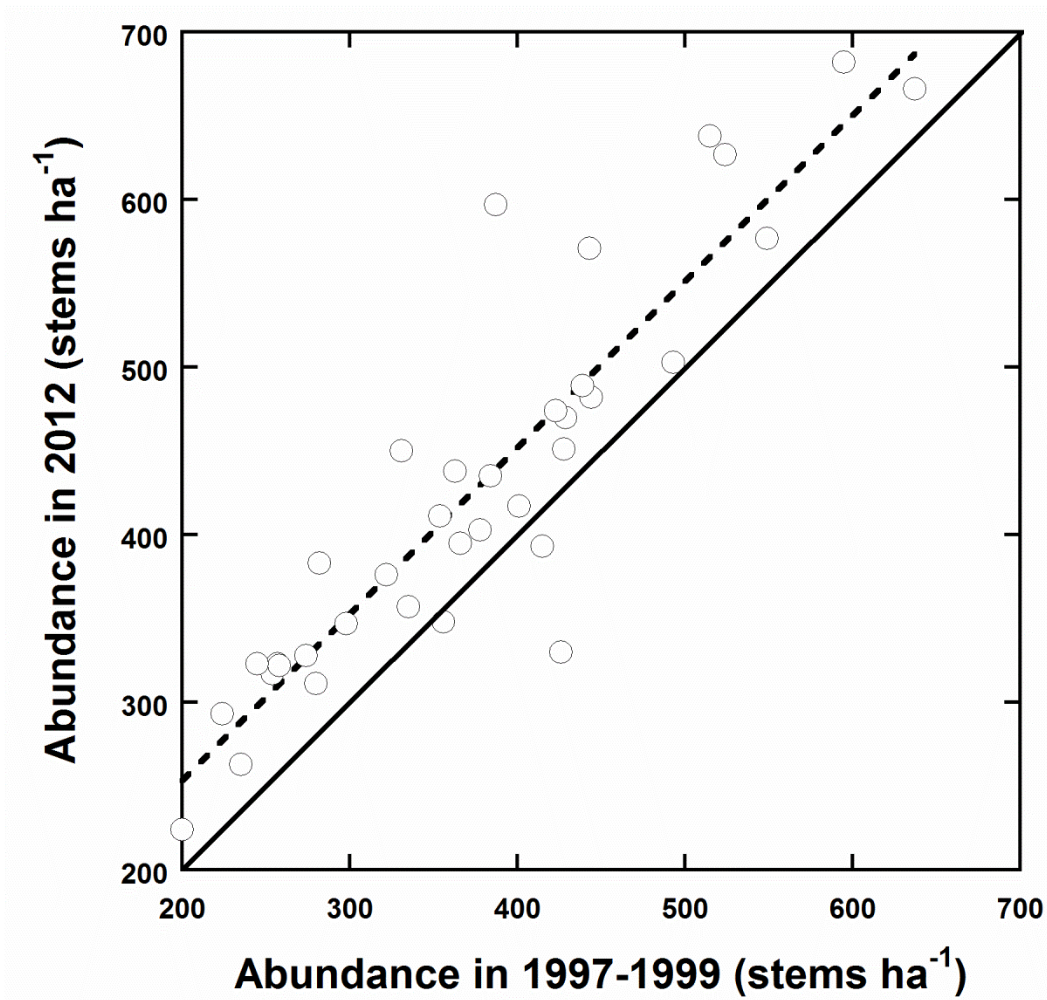
Changes by 2099: Means of 14 models in CIMP5 ensemble

Dai, 2012

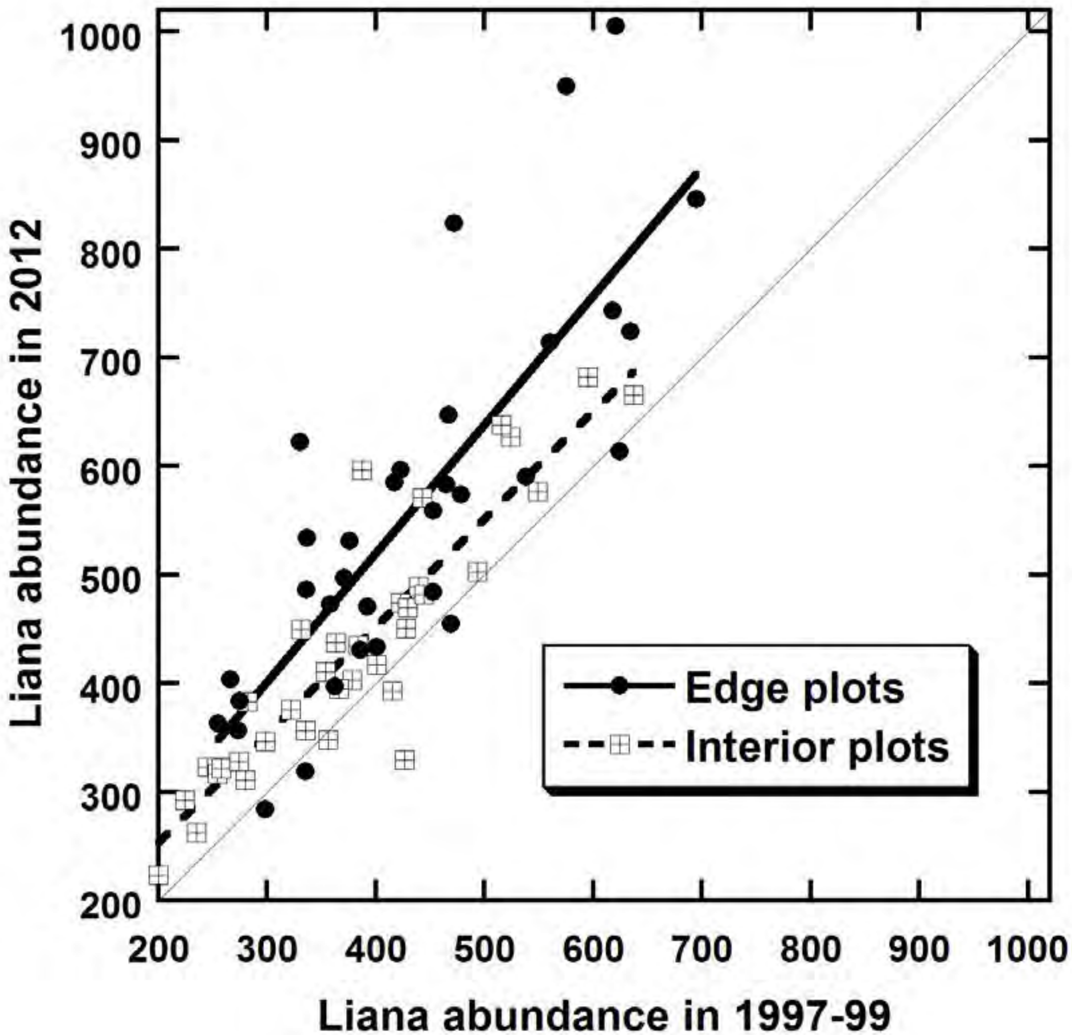
Lianas, CO_2 e a mortalidade da floresta amazônica

Fearnside, P.M. 2013. Vines, CO_2 and Amazon forest dieback. *Nature* [online comment]
http://www.nature.com/nature/journal/vaop/ncurrent/full/nature11882.html

Foto: P.M. Fearnside. Buriticupu, Maranhão



Laurance, W.F., A.S. Andrade, A. Magrach, J.L.C. Camargo, J.J. Valsko, M. Campbell, P.M. Fearnside, W. Edwards, T.E. Lovejoy & S.G. Laurance. 2014. Long-term changes in liana abundance and forest dynamics in undisturbed Amazonian forests. *Ecology* 95(6): 1604-1611. doi: 10.1890/13-1571.1



Laurance, W.F.; A.S. Andrade, A. Magrach, J.L.C. Camargo, M. Campbell, P.M. Fearnside, W. Edwards, J.J. Valsko, T.E. Lovejoy & S.G. Laurance. 2014. Apparent environmental synergism drives the dynamics of Amazonian forest fragments. *Ecology* 95(11): 3018-3026. doi: 10.1890/14-0330.1

FIGURA 24.4 Um experimento ECAL Os círculos visíveis na foto aérea são anéis de tratamento de enriquecimento de CO_2 ao ar livre (ECAL) em uma floresta de pinus jovens (*Pinus taeda*) na Floresta Experimental de Duke. O CO_2 liberado de tubos plásticos circunda as parcelas do tratamento a taxas calculadas para aumentar a concentração de CO_2 200 ppm acima das concentrações naturais de CO_2 no ambiente.

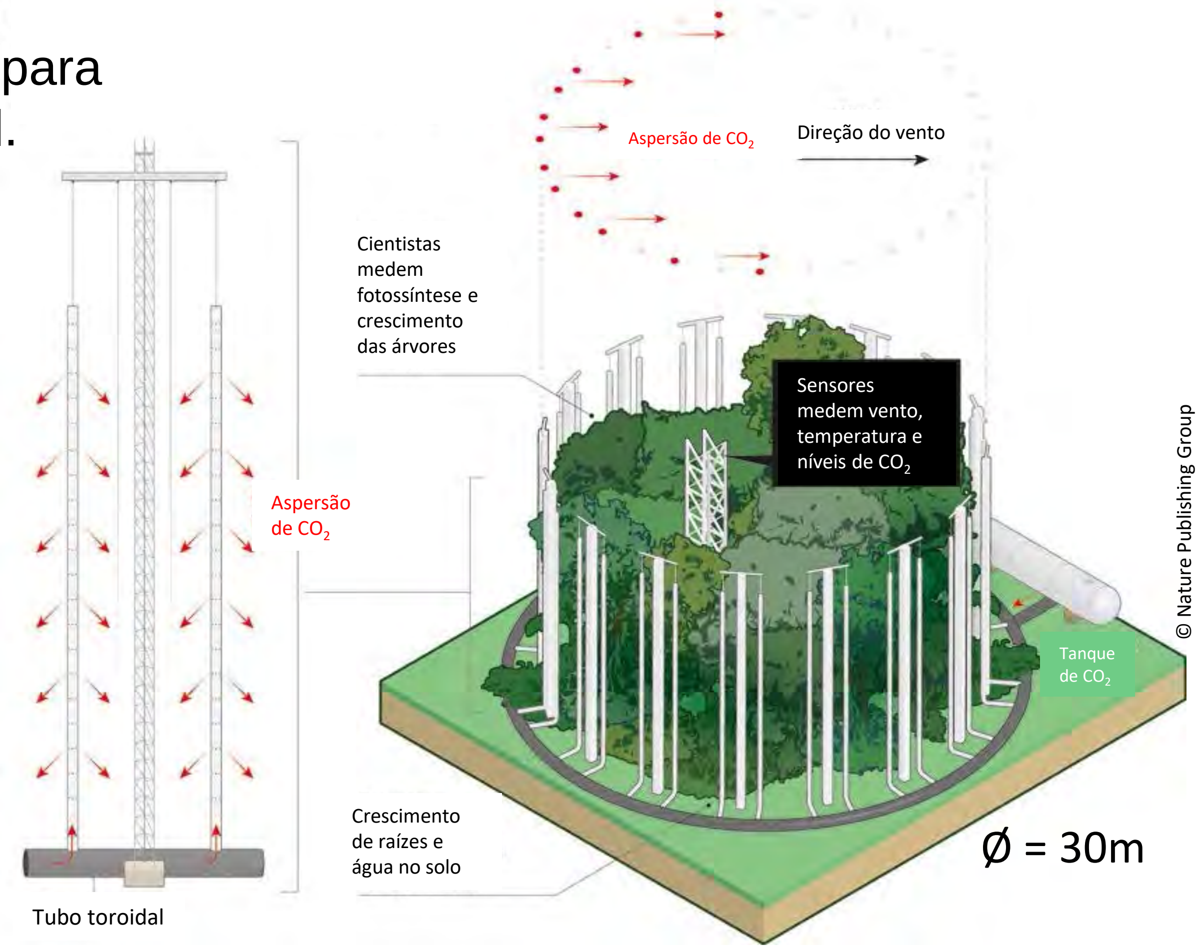
Para testar isso… Tecnologia FACE (Free-Air CO_2 Enrichment)

CO_2 é lançado no ar de uma pequena porção da floresta em uma concentração 50% acima da atual encontrada na atmosfera.

O sistema de torres é aberto para não alterar o microclima local.

Portanto a quantidade de CO_2 utilizada é suscetível ao vento.

Concentração-alvo: +200 ppmv



Esse tipo de experimento nunca foi feito antes em uma floresta tropical!

AMAZONFACE

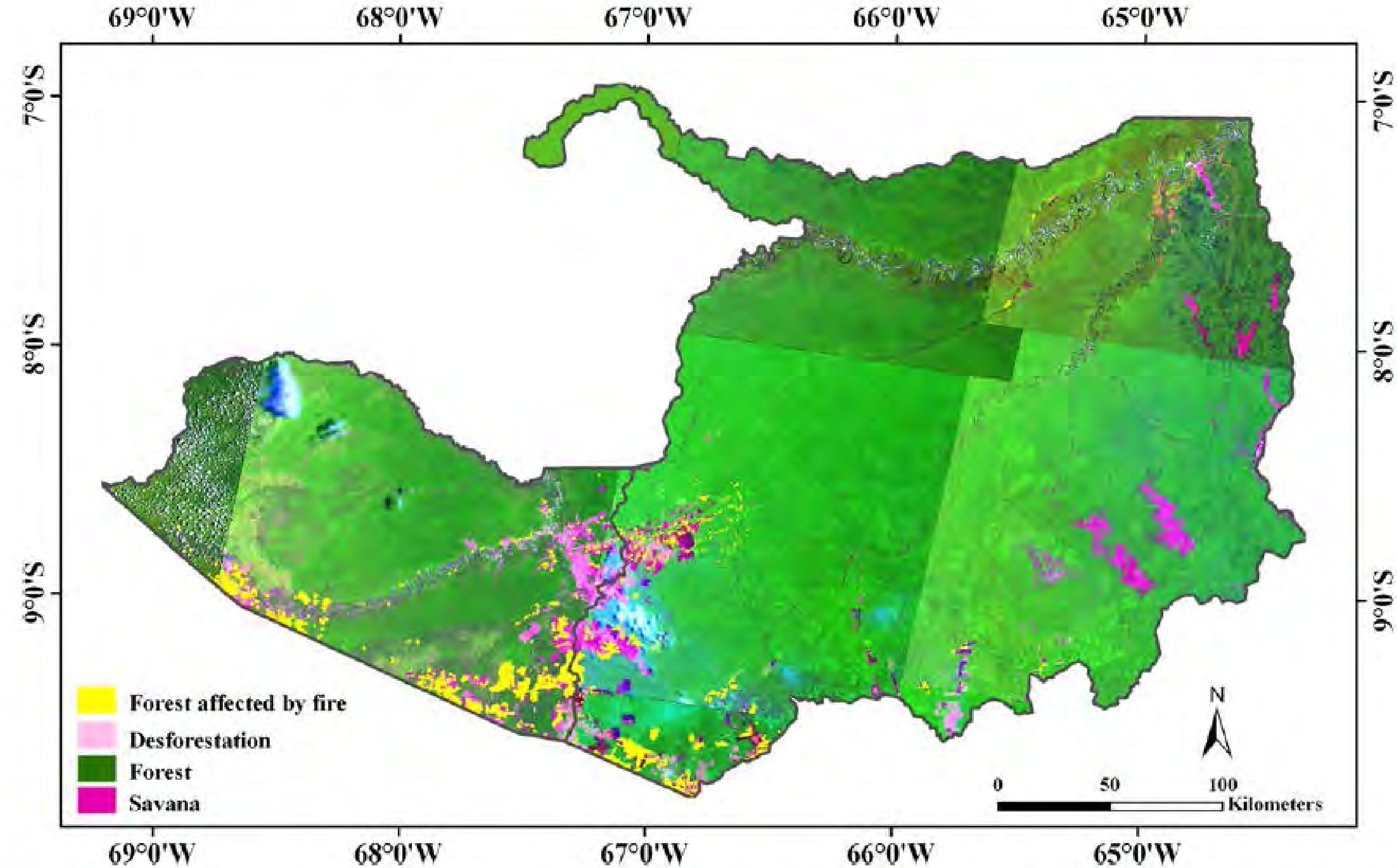
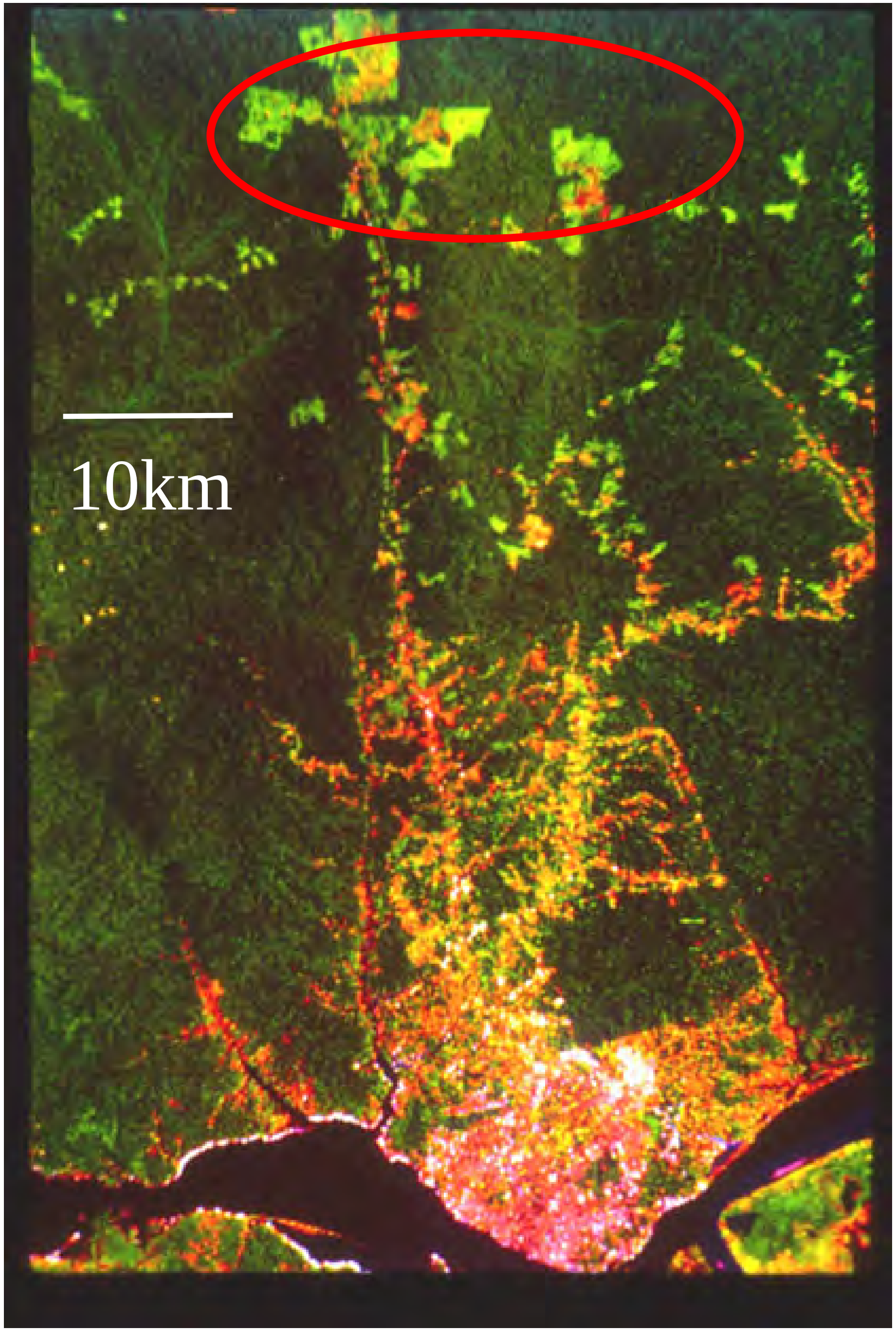


Fig. 3. Areas of forests affected by fires (polygons in yellow) in 2005 in Boca do Acre and Lábrea, Amazonas, Brazil. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Árvore morta e invasão de bambus como resultado dos incêndios no Acre durante a seca de 2005, fenômeno climático cujo aumento acentuado da frequência é previsto para as próximas décadas devido ao aquecimento global, caso as emissões continuem sem limitações.

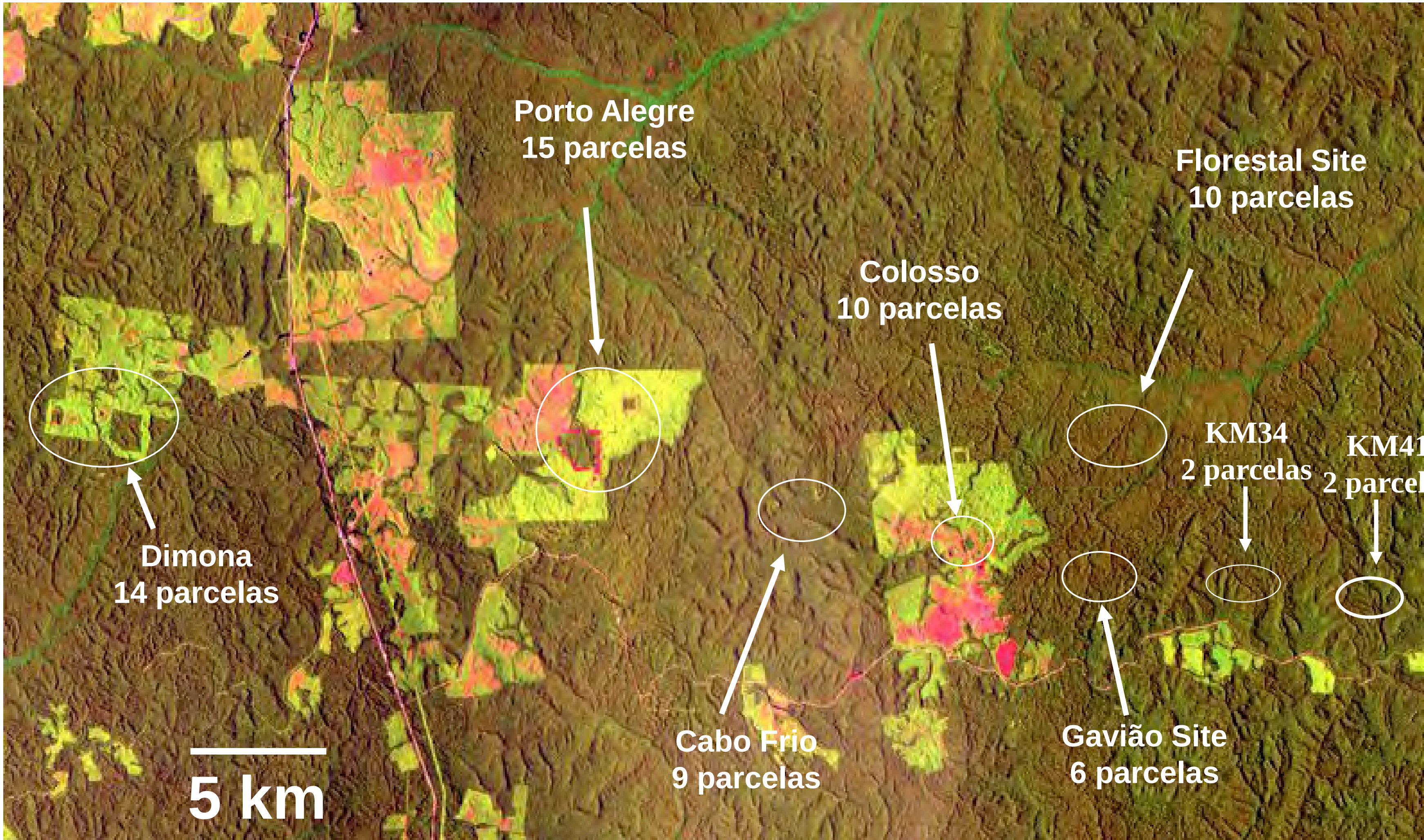
Incêndios florestais no sudoeste da Amazônia brasileira: estimativas de área e potenciais emissões de carbono.

Vasconcelos, S.S., P.M. Fearnside, P.M.L.A. Graça, E.M. Nogueira, L.C. de Oliveira & E.O. Figueiredo. 2013. **Forest fires in southwestern Brazilian Amazonia: Estimates of area and potential carbon emissions.** *Forest Ecology and Management* 291: 199-208.
https://doi.org/10.1016/j.foreco.2012.11.044

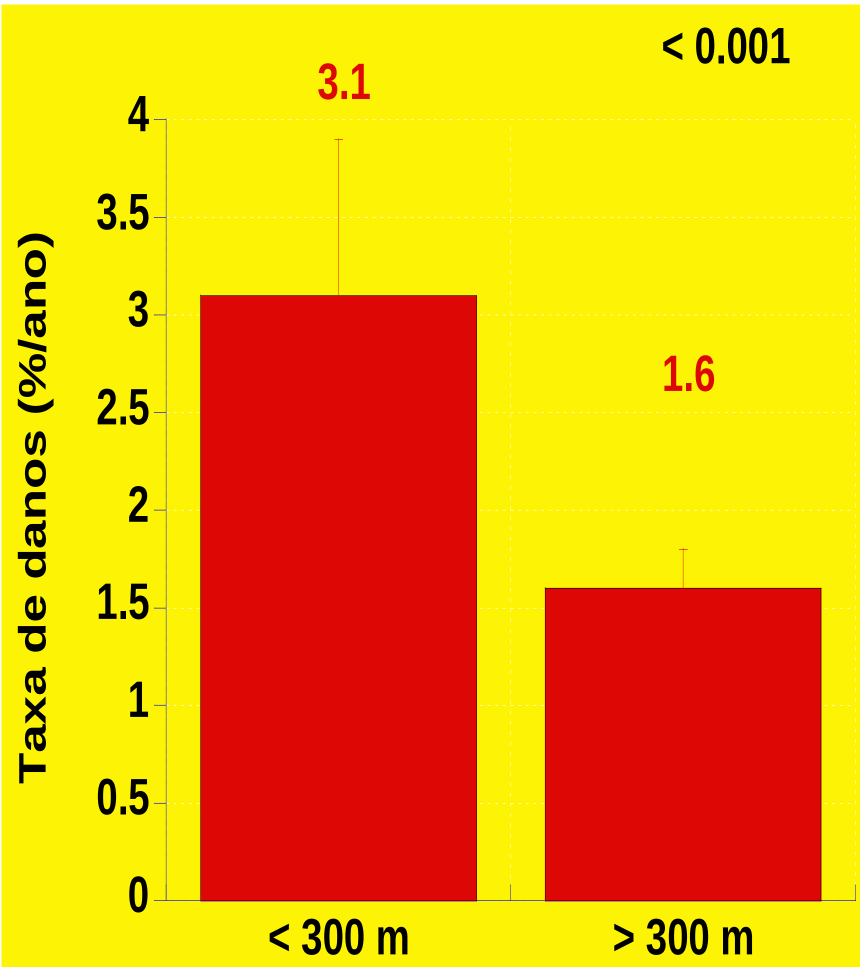


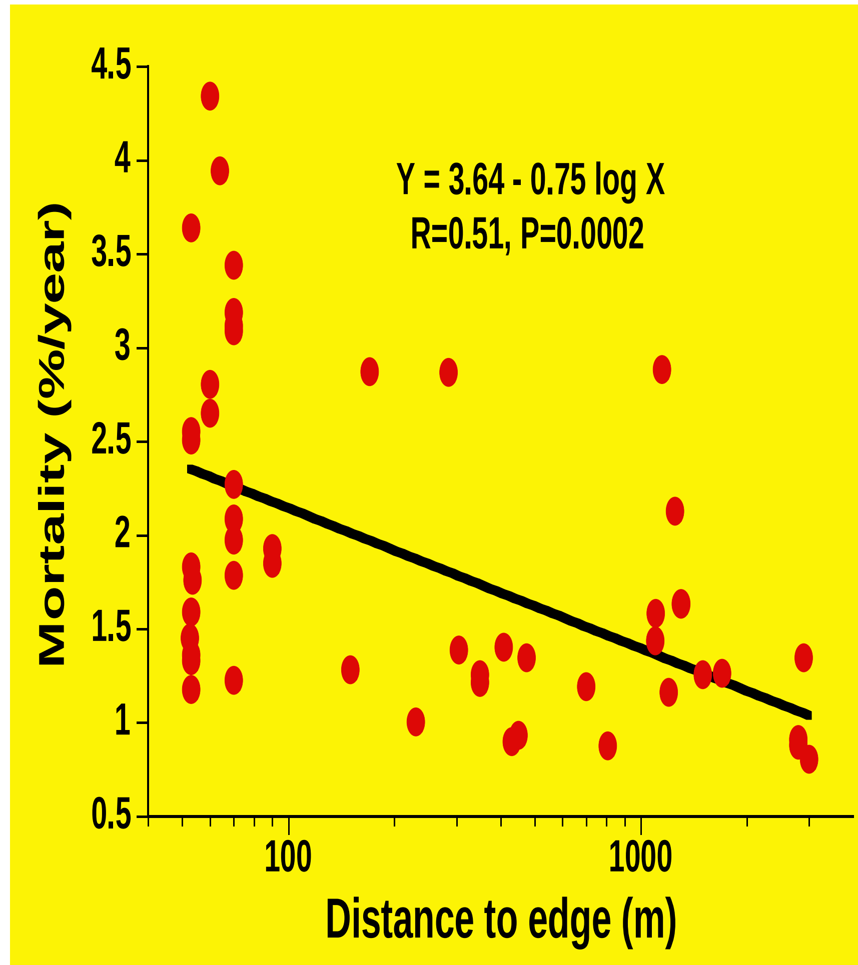
Fotos: Richard Bierregaard

Localização das Parcelas na área do PDBFF

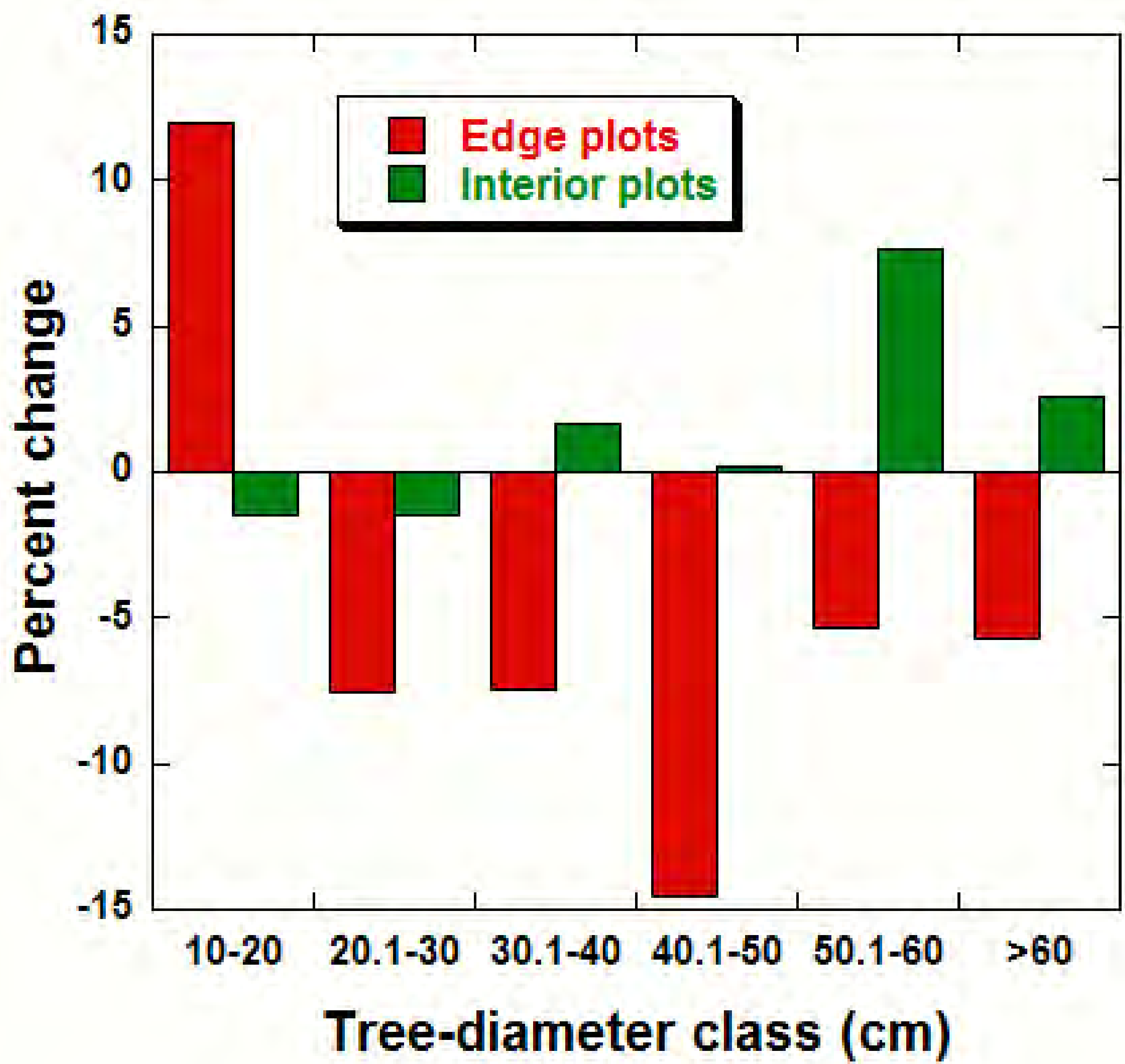


Damage and mortality of trees (%/yr)





Nascimento and Laurance, 2004 Ecol. Appl.;


Edge plots
Interior plots
Percent change
15
10
5
0
-5
-10
-15
10-20
20.1-30
30.1-40
40.1-50
50.1-60
>60
Tree-diameter class (cm)

Experimentos de exclusão de chuvas – simulando el niños de longa duração – Projetos LBA/ESECAFLOR e LBA/SECA FLORESTA

Painéis

Suportes

Calhas

Drenos

Redução de 50-60% da precipitação

GEOPHYSICAL RESEARCH LETTERS, VOL. 34, L09708, doi:10.1029/2007GL029695, 2007

Click Here for Full Article

Climate change consequences on the biome distribution in tropical South America

Luis F. Salazar,[1] Carlos A. Nobre,[1] and Marcos D. Oyama[2]

Received 15 February 2007; revised 28 March 2007; accepted 9 April 2007; published 12 May 2007.

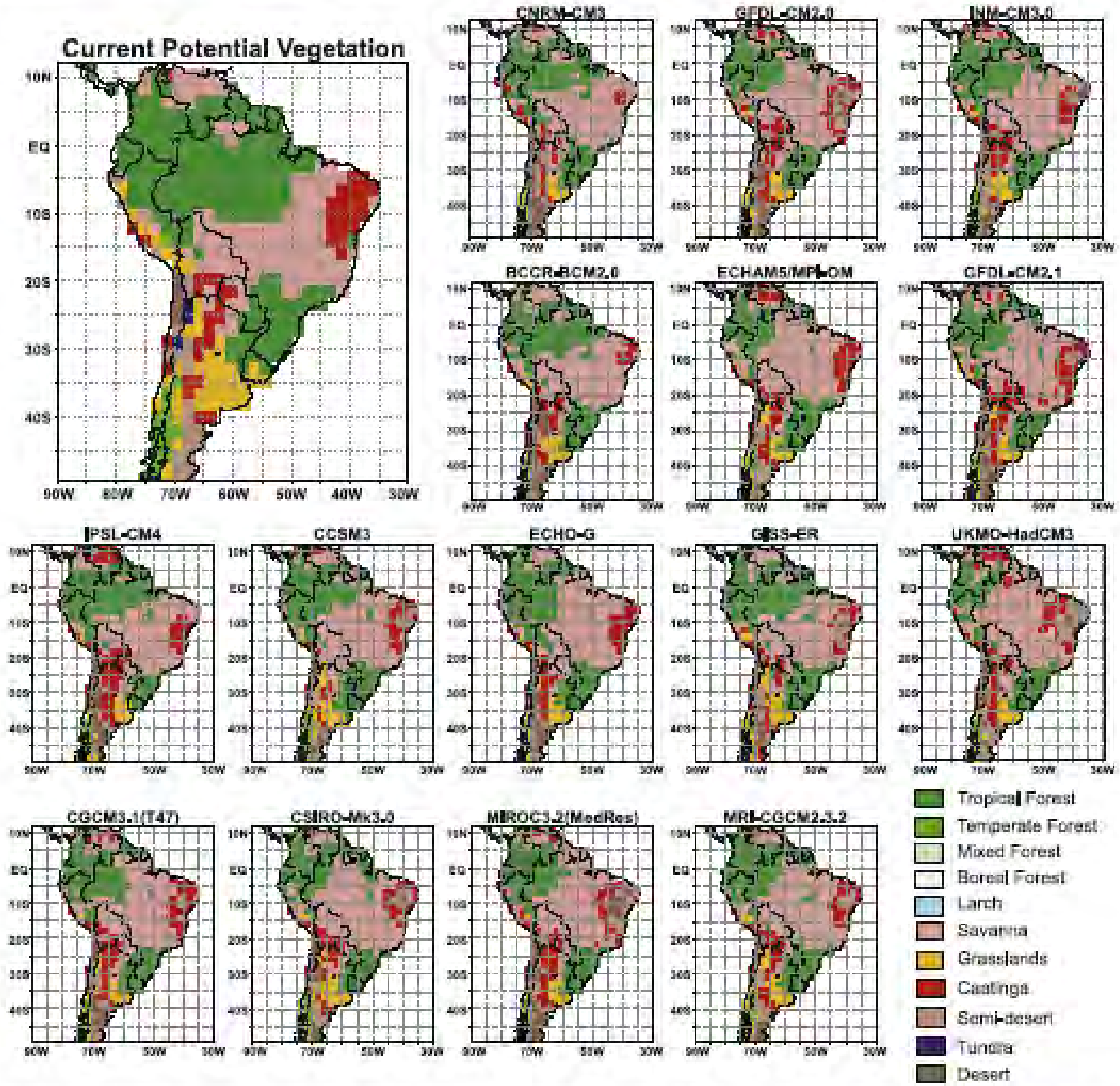
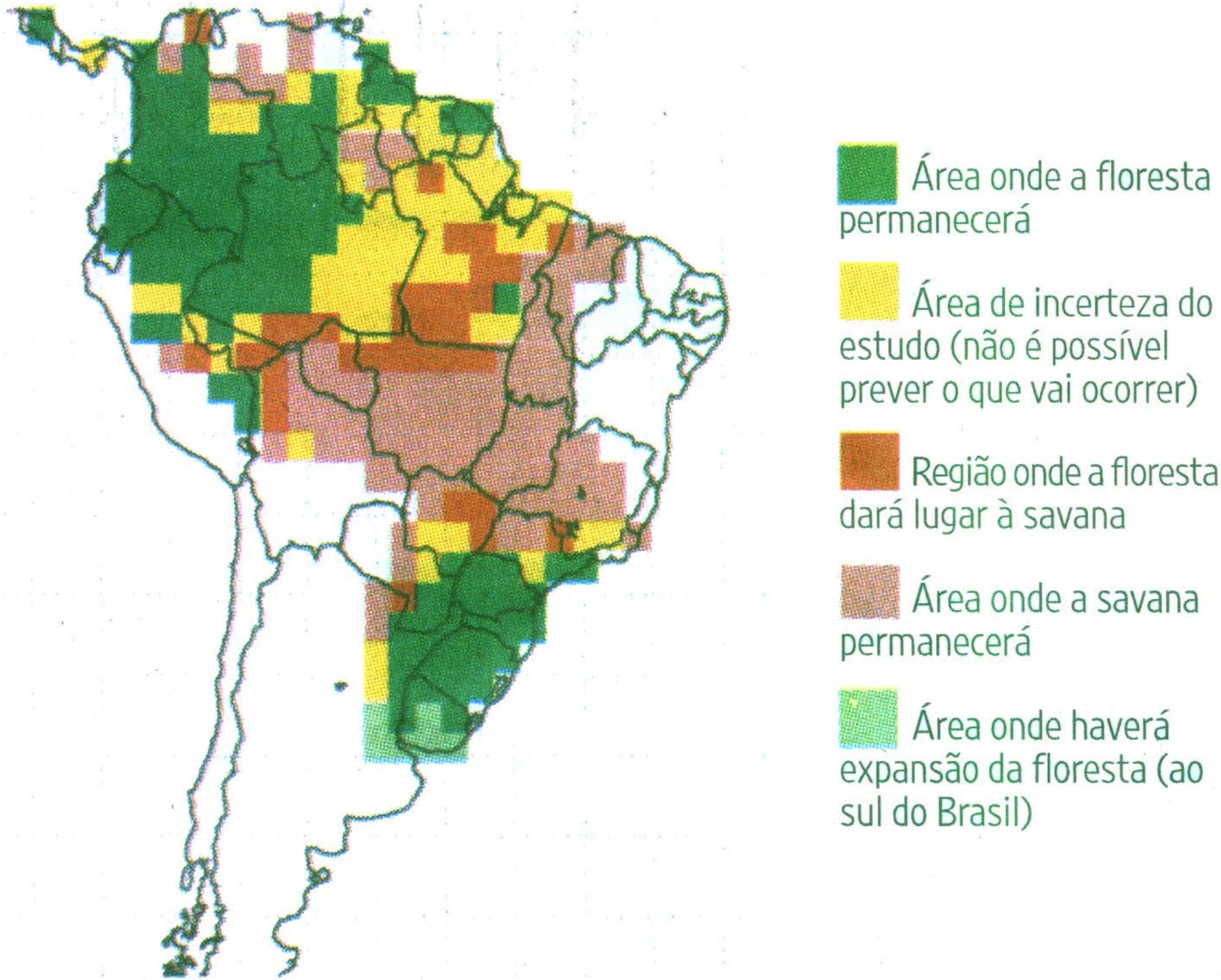
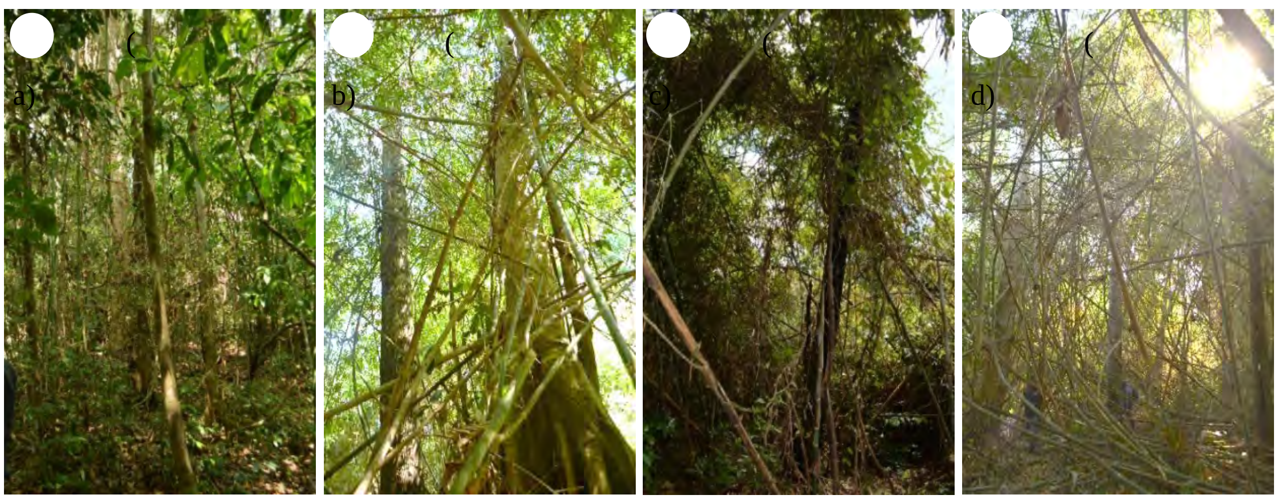


Figure 1. Projected distribution of natural biomes in South America for 2090–2099 from 15 AOGCMs for the A2 emissions scenario. The top left plot represents the current potential biomes (they represents the potential biomes, but not the actual vegetation distribution, which is a result of historical land use and land cover change).


Área onde a floresta permanecerá
Área de incerteza do estudo (não é possível prever o que vai ocorrer)
Região onde a floresta dará lugar à savana
Área onde a savana permanecerá
Área onde haverá expansão da floresta (ao sul do Brasil)

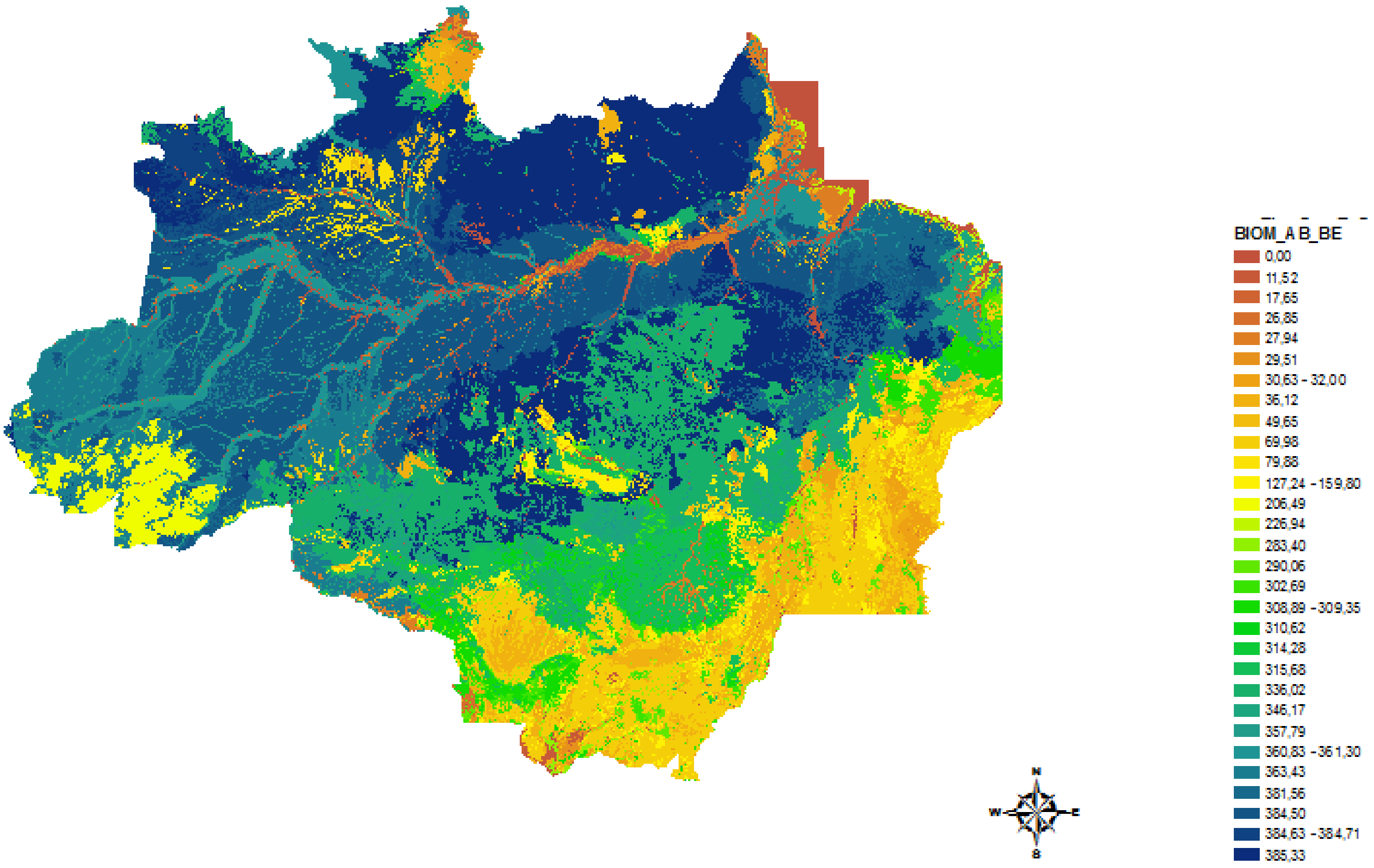
Fotos: H. Barros

Aspecto de *"Florestas degradadas em transformação"* em diferentes estágios de transformação.



Visualização das florestas inventariadas: (a) floresta não afetada pelo fogo, (b) floresta queimada em 2005, (c) floresta queimada em 2010 e (d) floresta queimada em 2005 e 2010. Fotos: Sonaira S. da Silva, 2016 e 2017.

Foto I. Vale

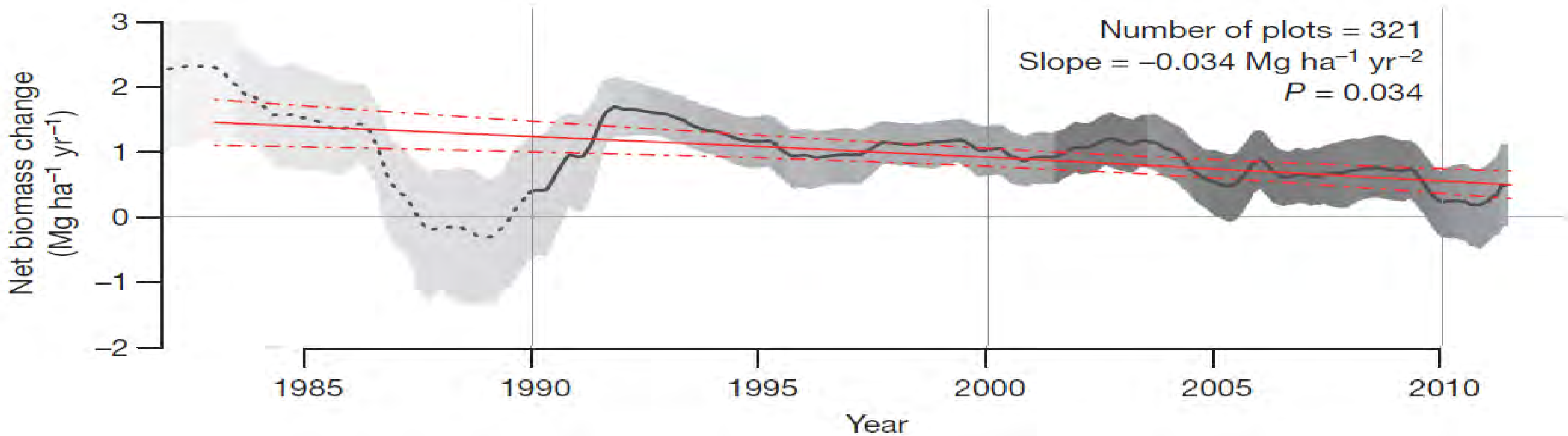


Nogueira, E.M., Yanai, A.M.; Fonseca, F.O.R.; Fearnside, P.M. 2015. Carbon stock loss from deforestation through 2013 in Brazilian Amazonia. *Global Change Biology* 21: 1271–1292. doi: 10.1111/gcb.12798

Estoques de Carbono na Panamazônia em 2013

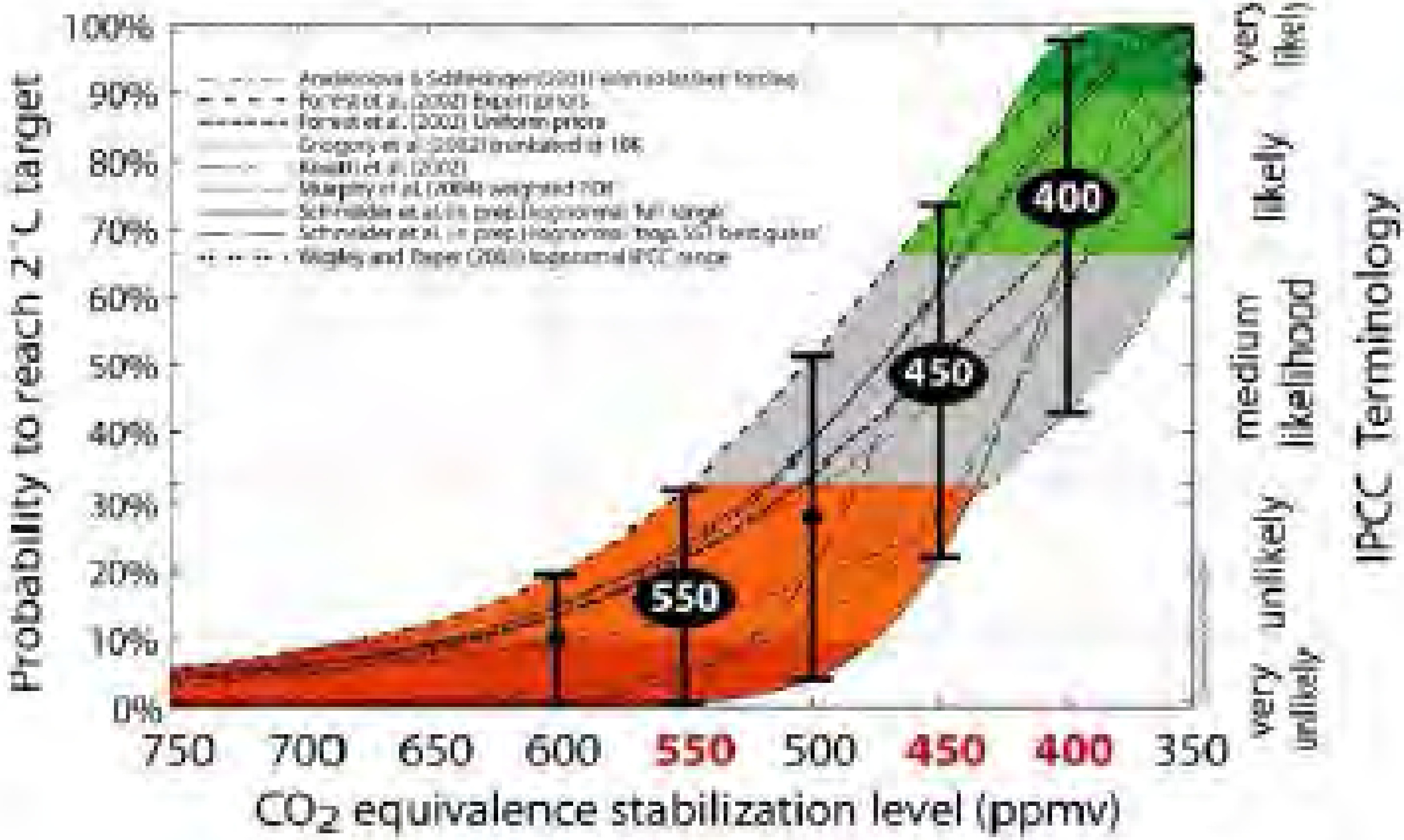
	PgC
Vegetação	
Amazônia Legal brasileira	58,6 [a]
Restante da Panamazônia	~ 20 [b]
Solos	
0-20 cm	33,8 [c]
20-100 cm	59,1 [c]
100-800 cm	251,1 [c]

a) Nogueira et al., 2015
b) Considerando biomassa por hectare do Brasil.
c)Baseado em Quesada et al. (2011, p. 1418).



Brienen et al. 2015. ***Nature***

Probability of reaching a 2° C target by CO_2 stabilization level



Hare and Meinshausen (2006)

Curso para técnicos do Acre, Pando, Madre de Dios, 18fev11, Cobija, Pando. Foto: J. Messias

http://philip.inpa.gov.br