MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

Use of Regional Climate Models in Impact Assessments and Adaptations Studies from Continental to Regional and Local Scales

Jose A. Marengo
CPTEC/INPE
www.cptec.inpe.br/mudancas_climaticas

Thanks to C. Nobre, E. Salati, T Ambrizzi, I. Pisnitchenko, S. Quadra, R. da Rocha,

Foreign & Commonwealth Office

UNIVERSIDADE DE SÃO PAULO

Fundação Brasileira para o Desenvolvimento Sustentável

PROBIO

GEF

CNPq

UNDP

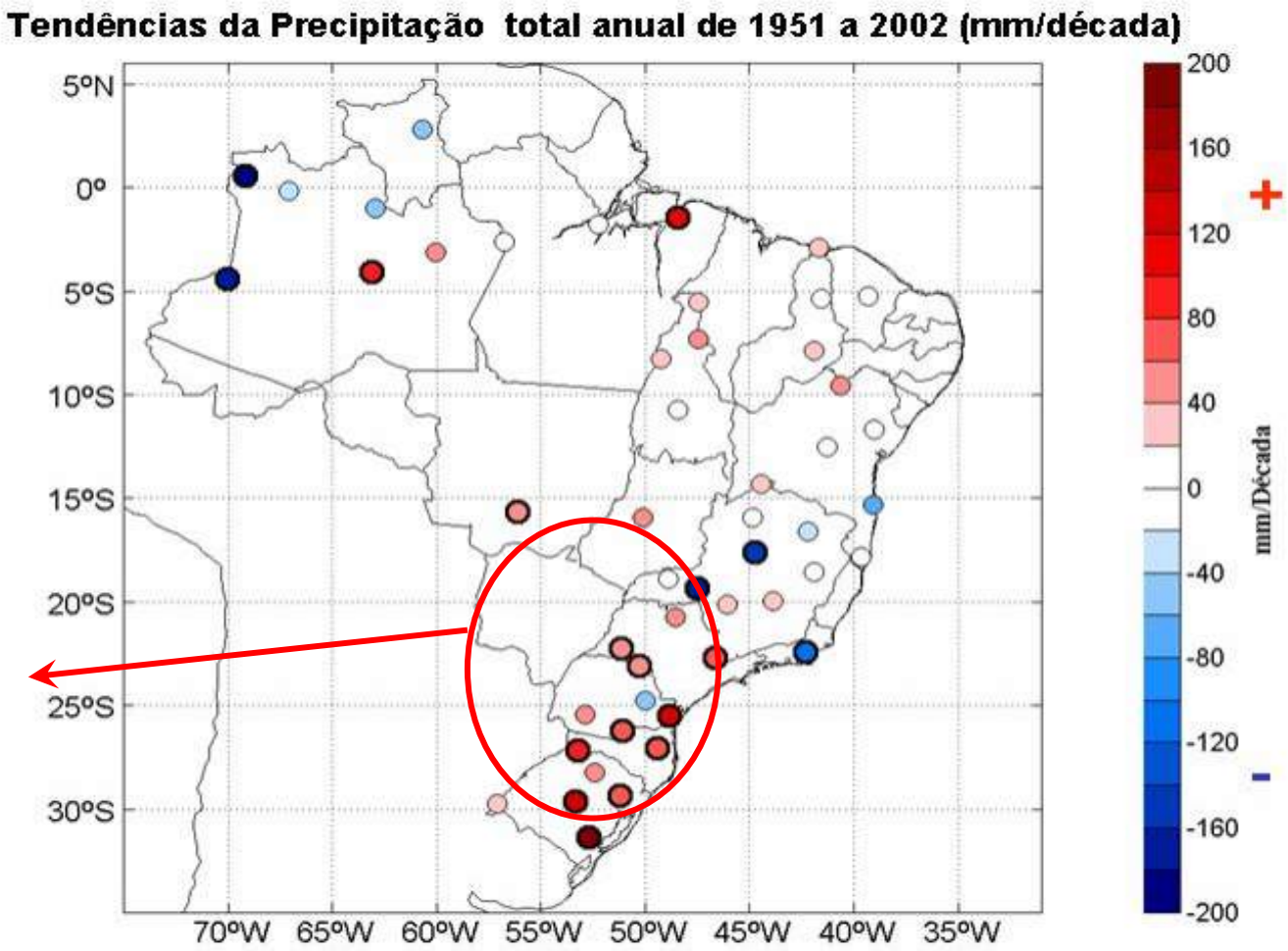
Facts from IPCC AR4

- Most of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations12. This is na advance since the TAR's conclusion that "most of the observed warming over the last 50 years is *likely* to have been due to the increase in greenhouse gas concentrations". Discernible human influences now extend to other aspects of climate, including ocean warming, continental-average temperatures, temperature extremes and wind patterns

- There is now higher confidence in projected patterns of warming and other regional-scale features, including changes in wind patterns, precipitation, and some aspects of extremes and of ice.

- Anthropogenic warming and sea level rise would continue for centuries due to the timescales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized.

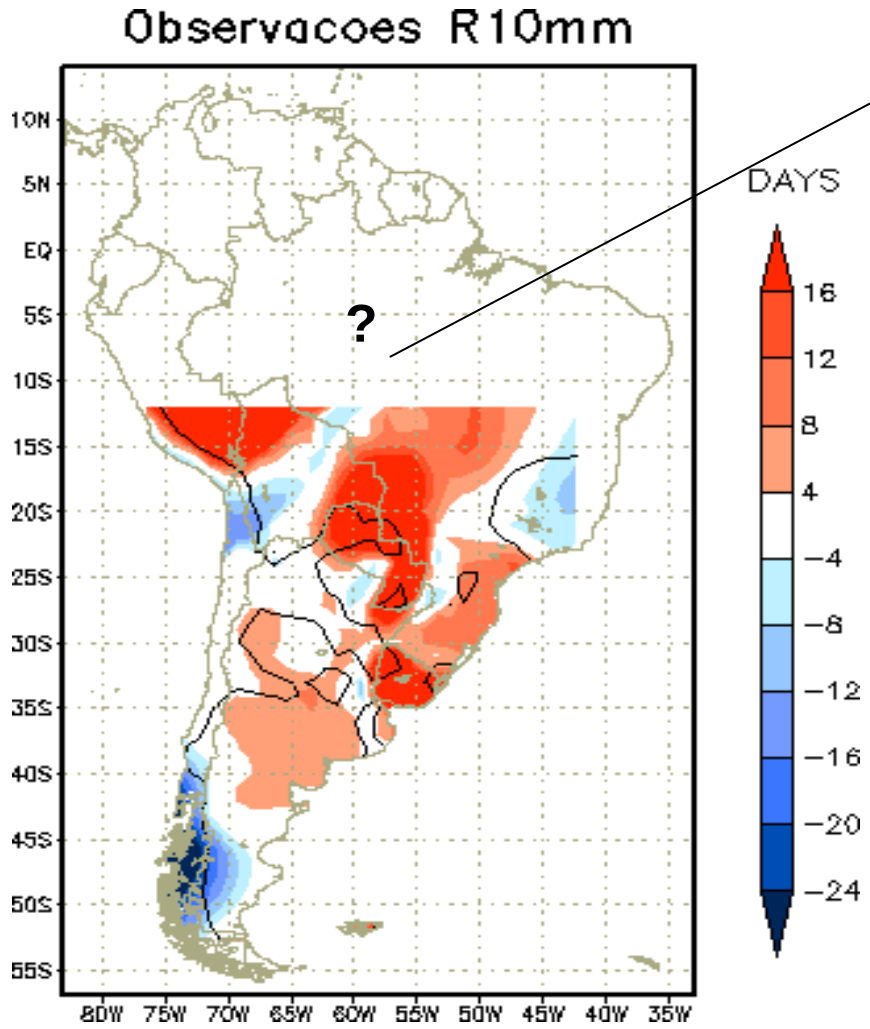
Increase in total rainfall in southern Brazil (1951-2002)



Causes: Natural climate variability? land-use changes? increase in the concentration of GHG?.

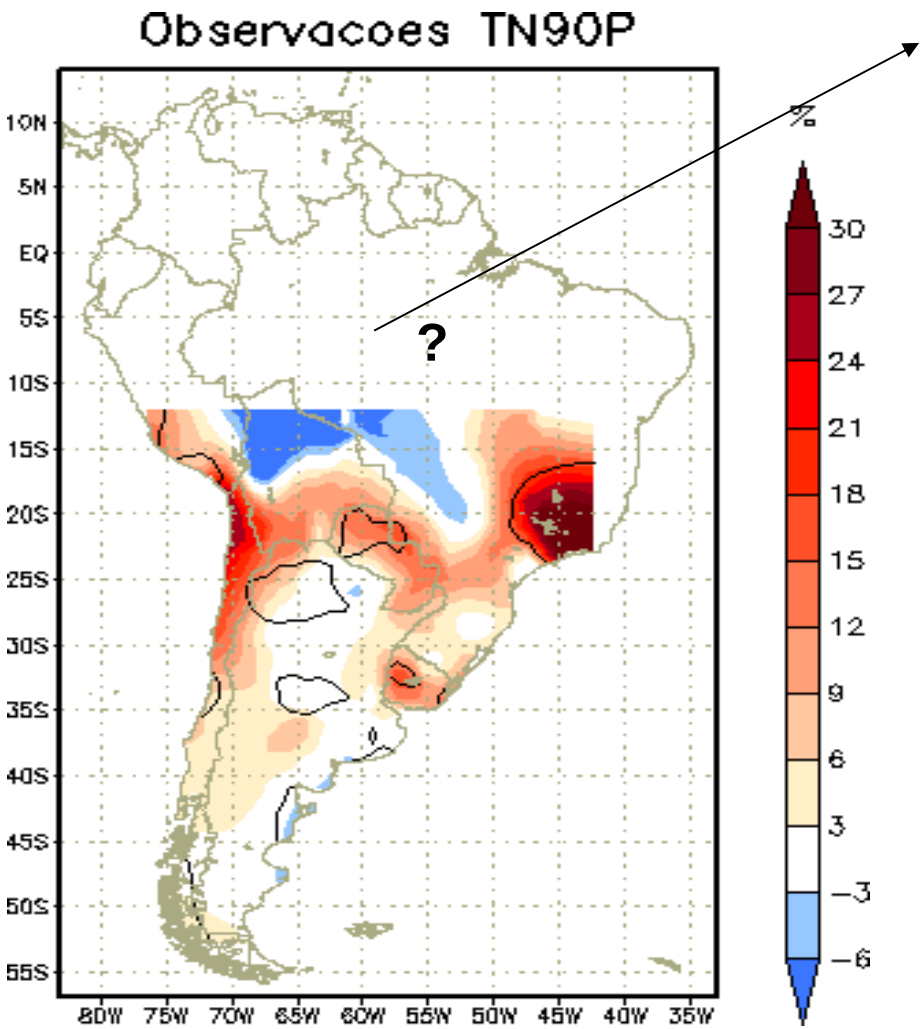
PROBIO-GOF UK project (2007)

Southeastern South America: Increase in the frequency of intense rainfall eventst (1951-2000)



R10 – Number of days with rainfall above 10 mm/day

Increase in the frequency of warm nights in Southeastern Brazil (1951-2000)



Tn90-Minimum temperature on the 90th percentile of the distribuiton

O que acontece dos extremos climáticos no presente?


UM JORNAL A SERVIÇO DO BRASIL ★ ★ ★ WWW.FOLHA.COM.BR

FOLHA DE S.PAULO

DIRETOR DE REDAÇÃO: OTAVIO FRIAS FILHO — SÁBADO, 6 DE JANEIRO DE 2007 — EDIÇÃO SÃO PAULO/DF, CONCLUÍDA ÀS 21H

esporte
Execução do Hino Nacional será obrigatória em todos os jogos paulistas

folhinha
Edição especial traz passatempos que têm o mar como tema

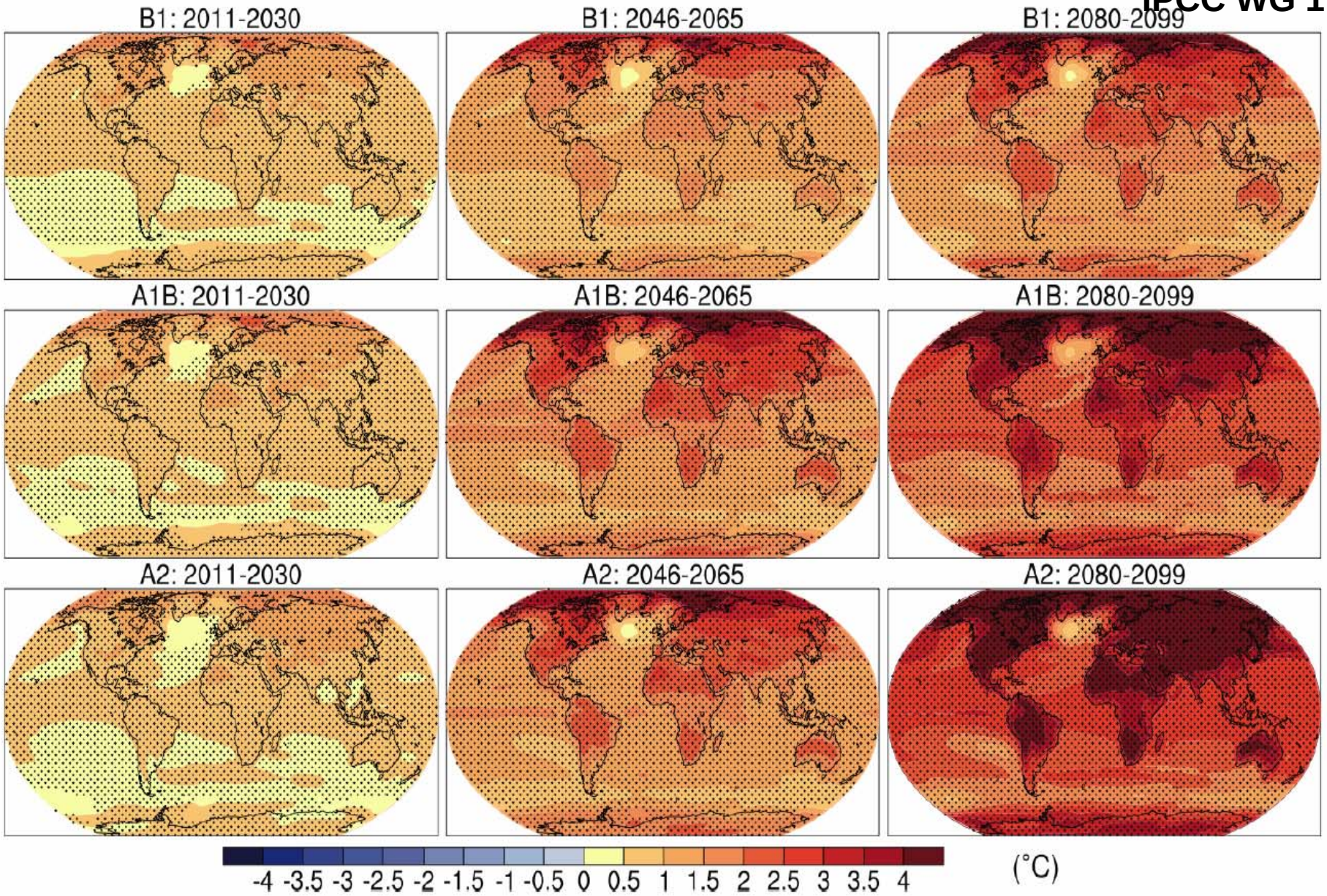
DRAUZIO VARELLA
Promessa de todo Ano Novo

Moradores caminham por bairro alagado pelas águas do rio Paraíba do Sul no município de Campos, no norte fluminense, uma das regiões mais afetadas pela chuva

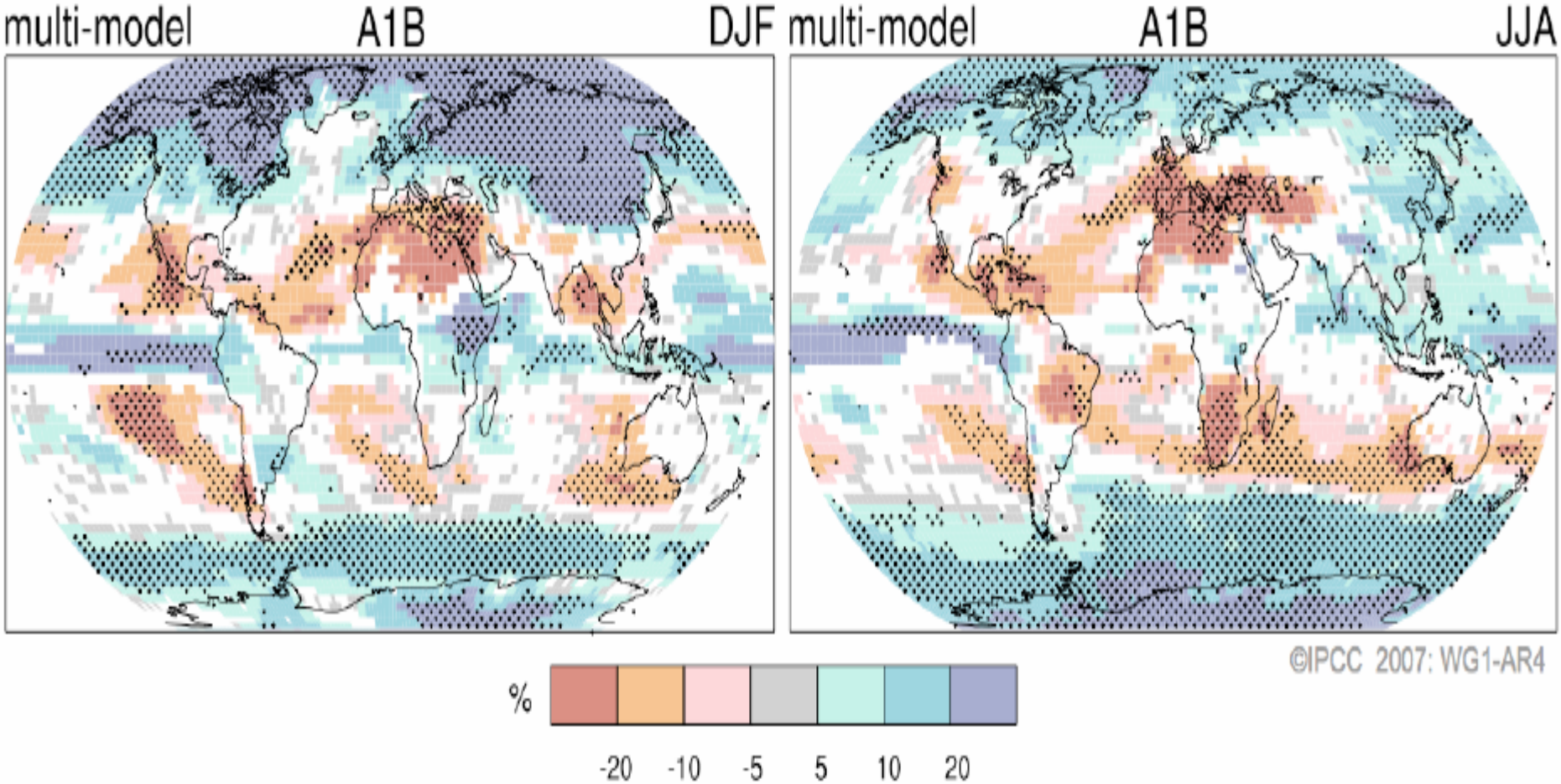
Chuvas matam 28 no Rio e SP

Projeções aumento na temperatura do ar ate 2100 em relação a 1980-99.

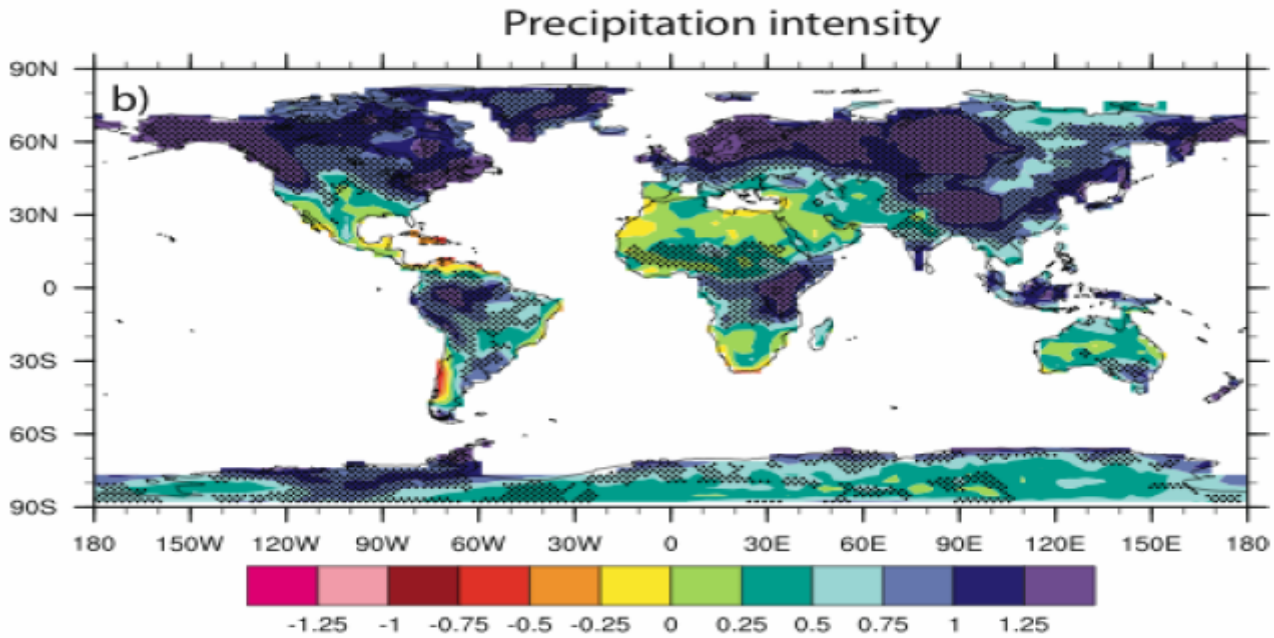
IPCC WG 1

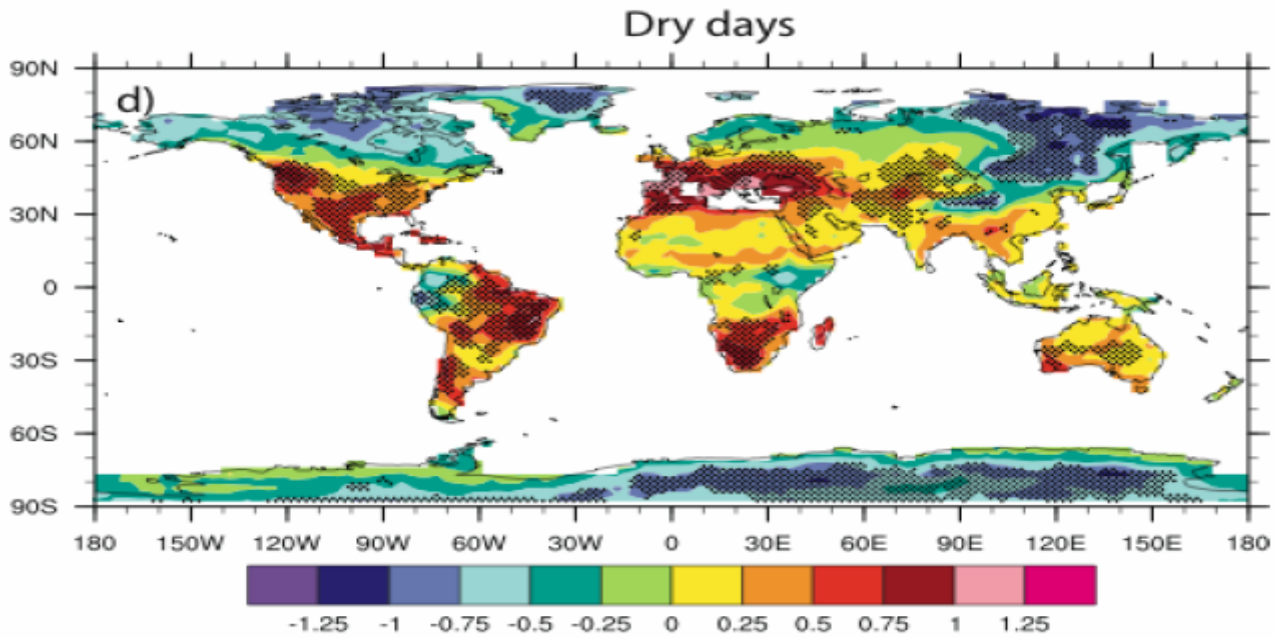


Projected Patterns of Precipitation Changes



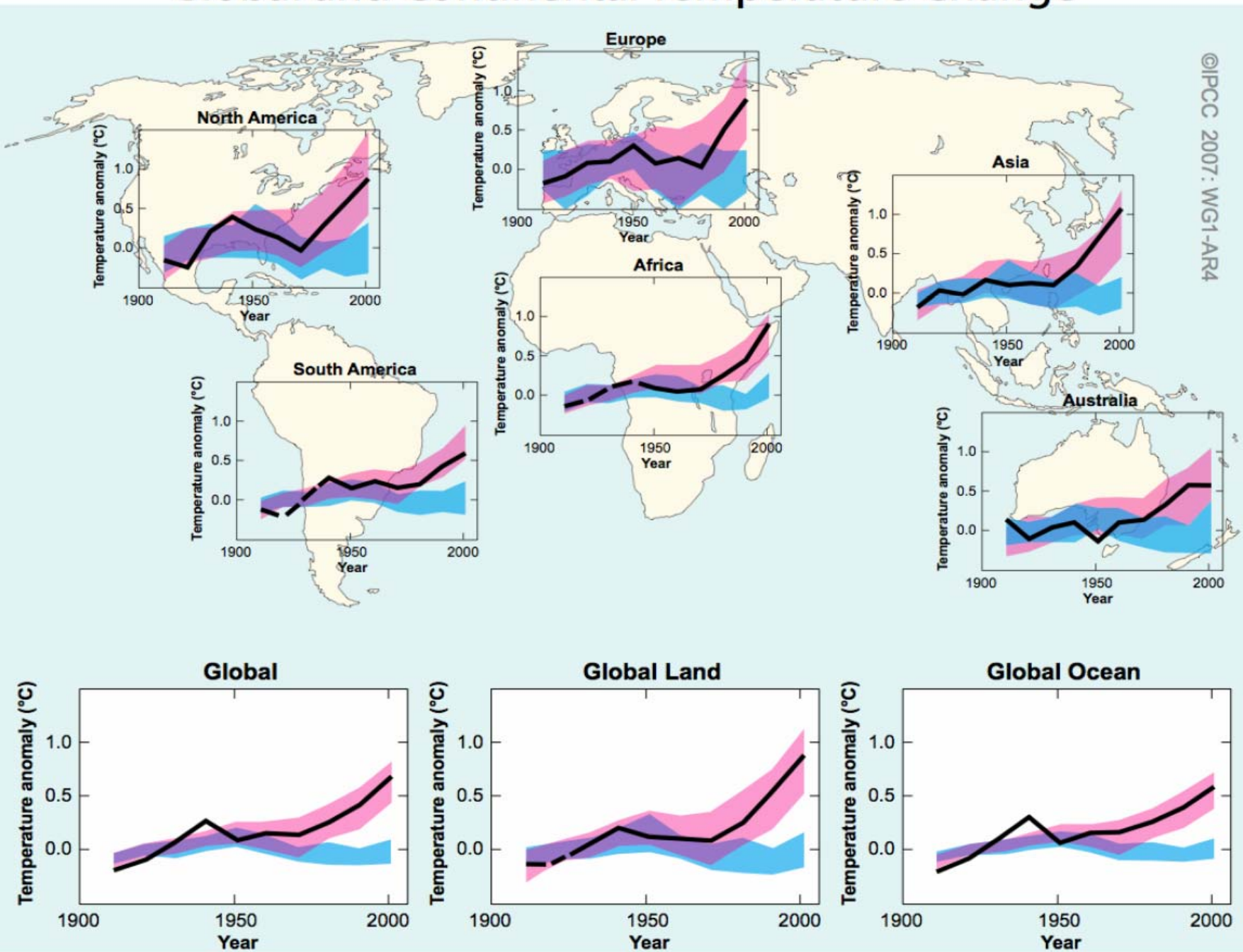
Mudanças da precipitação (%) para o período de 2090–2099, relativo a 1980–1999. Media de vários modelos e IPCC AR4.





Mudanças em índices de extremos de precipitação (chuvas intensas e veranicos ou períodos secos) projetadas para o ano de 2080–2099 em relação a 1980–1999 para o cenário A1B.

Global and Continental Temperature Change



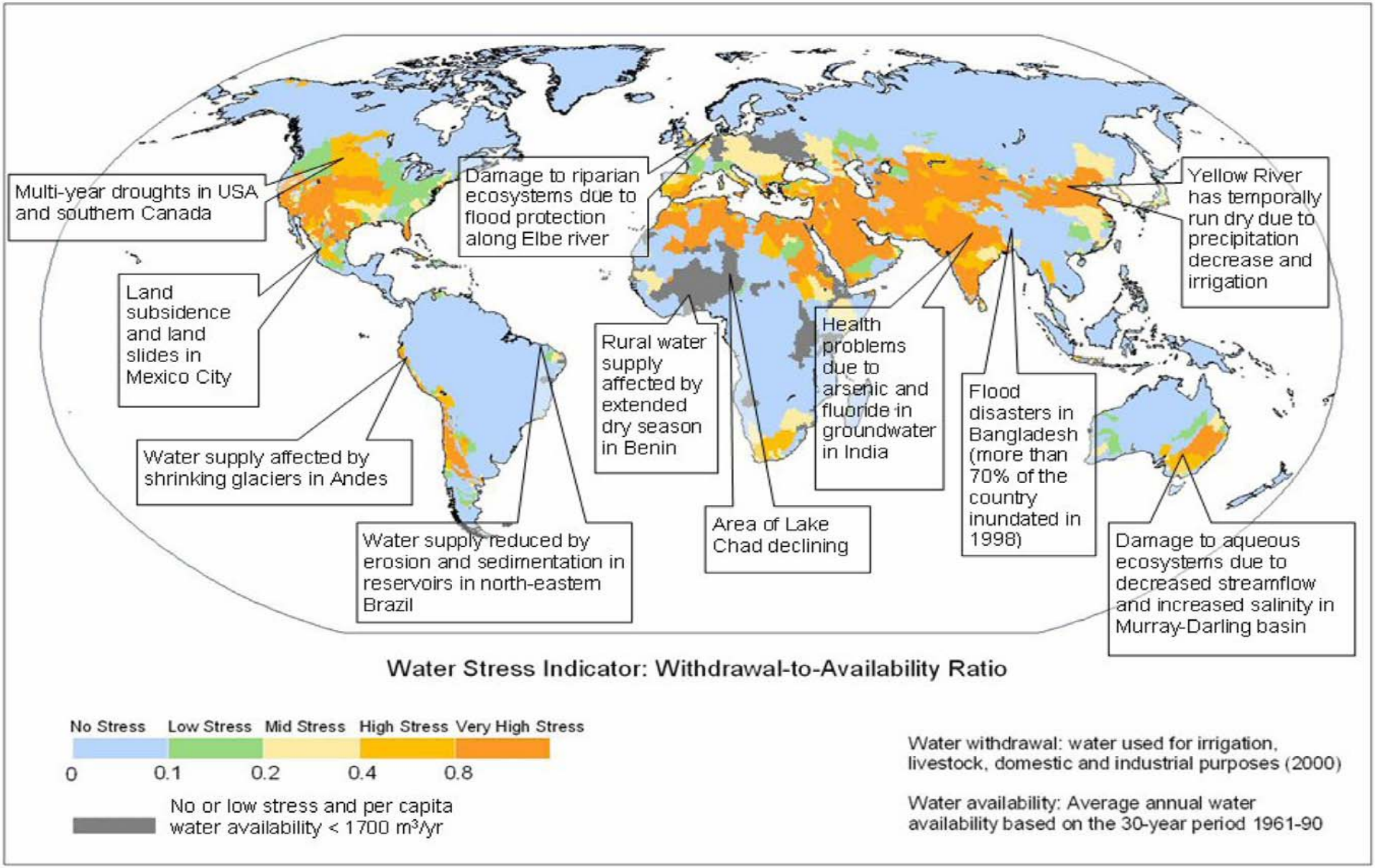


Figure 3.2: Examples of current vulnerabilities of freshwater resources and their management; in the background, a water stress map based on the 2005 version of WaterGAP (Alcamo et al., 2003a).

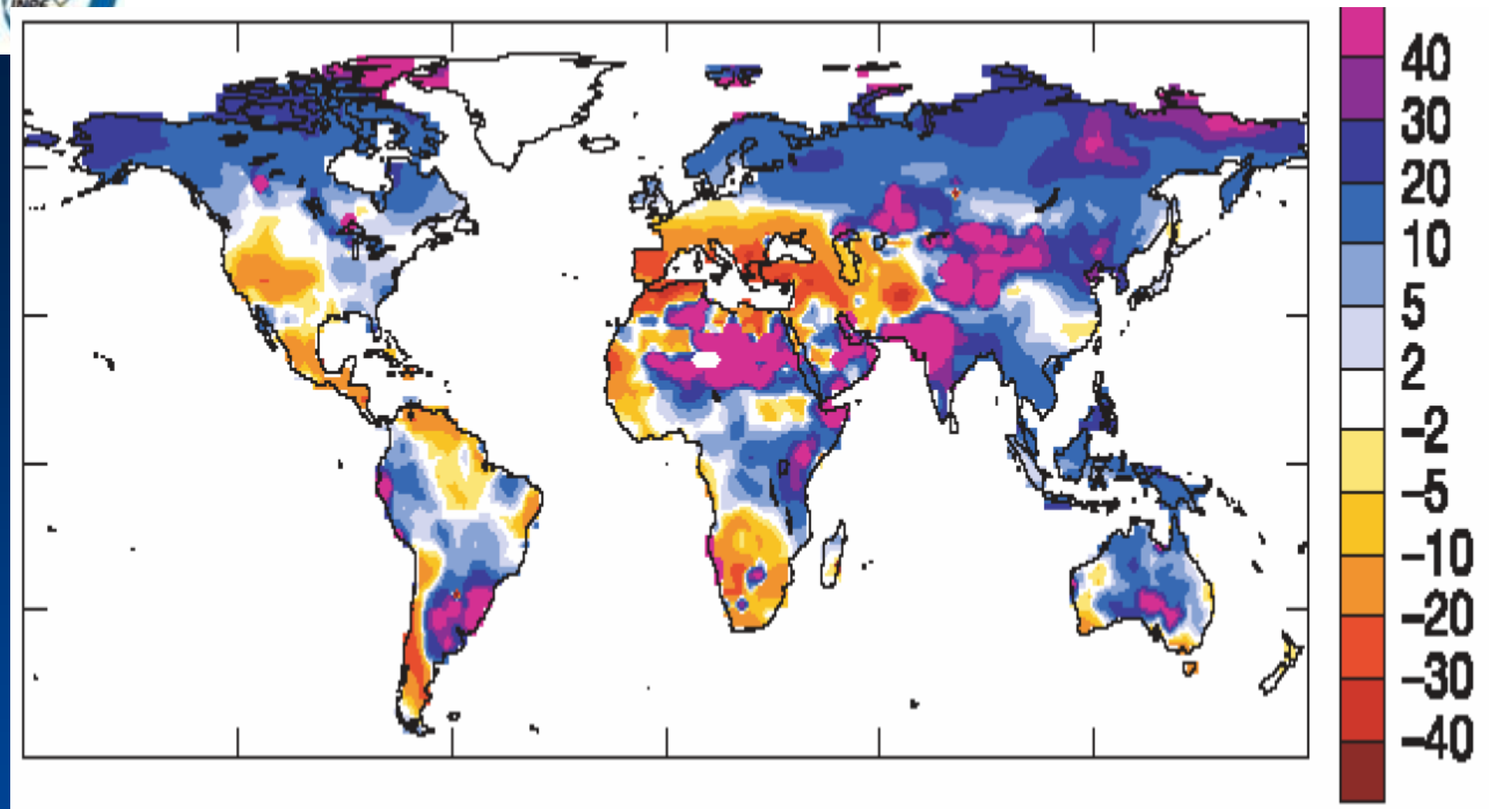


Figure 3.4: Ensemble mean change in annual runoff, in percent, by 2050 under the SRES A1B emissions scenario, based on an ensemble of 12 climate models (Milly et al., 2005).

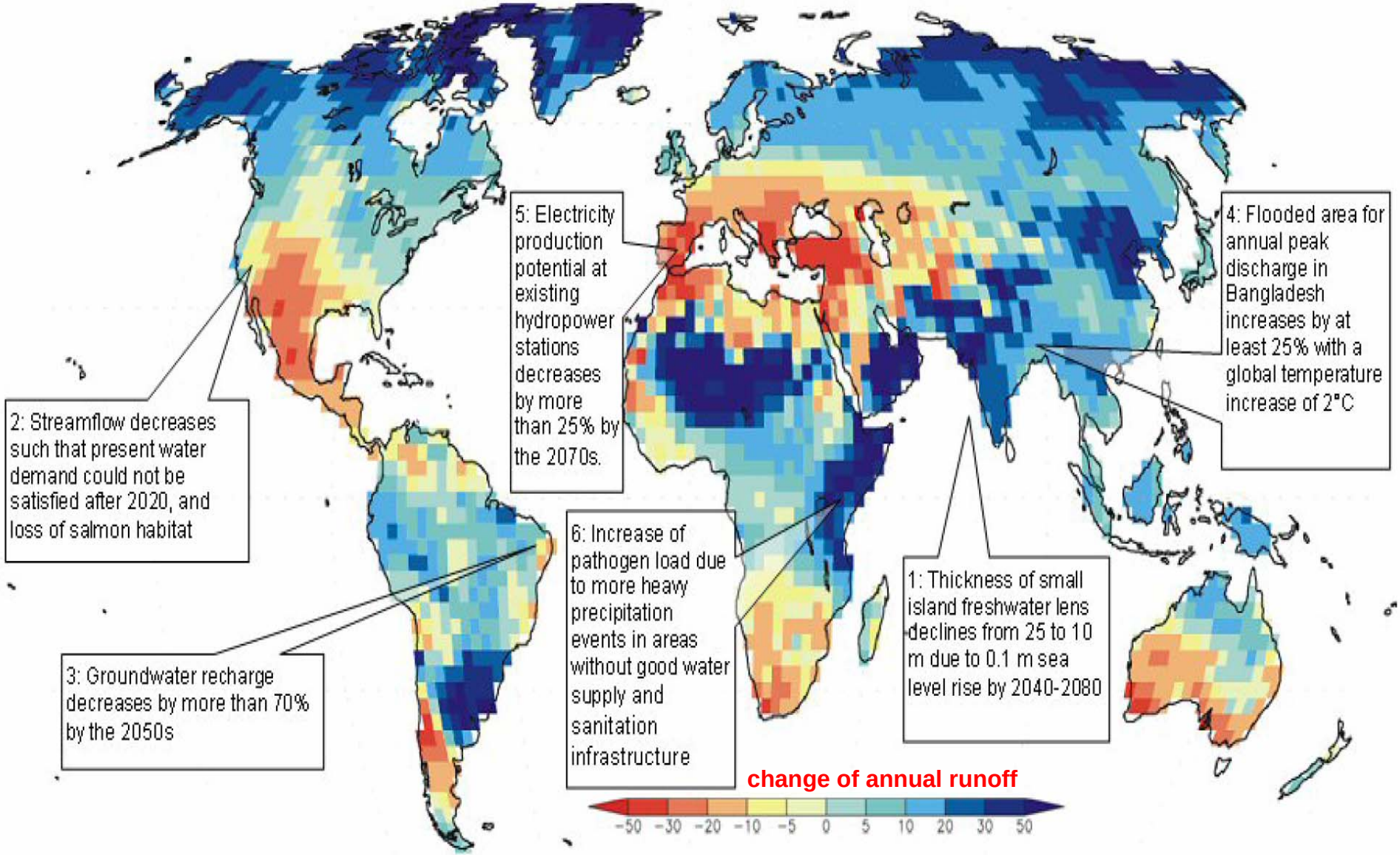


Figure 3.8: Illustrative map of future climate change impacts on freshwater which are a threat to the sustainable development of the affected regions. 1: Bobba et al. (2000), 2: Barnett et al. (2004), 3: Döll and Flörke (2005), 4: Mirza et al. (2003) 5: Lehner et al. (2005a) 6: Kistemann et al. (2002). Background map: Ensemble mean change of annual runoff, in percent, between present (1981-2000) and 2081-2100 for the SRES A1B emissions scenario (Nohara et al., 2006).

Phenomena[a] and direction of trend [WGI SPM]	Likelihood of future trend based on projections for 21st century using SRES scenarios [WGI SPM]	Examples of major projected impacts by sector			
				Impacts due to altered frequencies and intensities of extreme weather, climate, and sea level events are very likely to change	
		Agriculture, forestry and ecosystems [4.4, 5.4]		**Human health [8.2]**	**Industry/settlement/ Society [7.4]**
Warmer and fewer cold days and nights; warmer/more frequent hot days and nights over most land areas	Virtually certain[b]	Increased yields in colder environments; decreased yields in warmer environments; increased insect outbreaks		Reduced human mortality from decreased cold exposure	Reduced energy demand for heating; increased demand for cooling; declining air quality in cities; reduced disruption to transport due to snow, ice; effects on winter tourism
Warm spells/heat waves: frequency increases over most land areas	Very likely	Reduced yields in warmer regions due to heat stress; wild fire danger increase		Increased risk of heat-related mortality, especially for the elderly, chronically sick, very young and socially-isolated	Reduction in quality of life for people in warm areas without appropriate housing; impacts on elderly, very young and poor.
Heavy precipitation events: frequency increases over most areas	Very likely	Damage to crops; soil erosion, inability to cultivate land due to water logging of soils		Increased risk of deaths, injuries, infectious, respiratory and skin diseases, post-traumatic stress disorders	Disruption of settlements, commerce, transport and societies due to flooding; pressures on urban and rural infrastructures
Area affected by drought: increases	Likely	Land degradation, lower yields/crop damage and failure; increased livestock deaths; increased risk of wildfire		Increased risk of food and water shortage; increased risk of malnutrition; increased risk of water- and food-borne diseases	Water shortages for settlements, industry and societies; reduced hydropower generation potentials; potential for population migration
Intense tropical cyclone activity increases	Likely	Damage to crops; windthrow (uprooting) of trees; damage to coral reefs		Increased risk of deaths, injuries, water- and food-borne diseases; post-traumatic stress disorders	Disruption by flood and high winds; withdrawal of risk coverage in vulnerable areas by private insurers, potential for population migrations
Increased incidence of extreme high sea level (excludes tsunamis)[c]	Likely[d]	Salinisation of irrigation water, estuaries and freshwater systems		Increased risk of deaths and injuries by drowning in floods; migration-related health effects	Costs of coastal protection *versus* costs of land-use relocation; potential for movement of populations and infrastructure; also see tropical cyclones above

Limitations of climate projections from AOGCM

Coupled Atmosphere-Ocean Global Climate Models (AOGCMs) are the modeling tools traditionally used for generating climate change projections and scenarios.

The horizontal atmospheric resolution of present day AOGCMs is still relatively coarse, order of 300 km, and regional climate is often affected by forcings and circulations that occur at smaller scales. As a result, AOGCMs cannot explicitly capture the fine scale structure that characterizes climatic variables in many regions of the world and that is needed for many impact assessment studies.

Regional Climate Models (RCMs) are useful tools for generating high resolution climate change scenarios for use in climate impacts and adaptation studies.

Why regional models?

The issue of the spatial resolution in scenarios must be put in the context of other uncertainties of climate change. Studies and analyses of climate change impact and adaptation assessments recognize that there are a number of sources of uncertainty in such studies which contribute to uncertainty in the final assessment.

The importance of high resolution climate scenarios for impacts and adaptation studies remains to be thoroughly explored in Brazil and South America.

Most of these activities have been linked to implementation of scenarios for the UNFCC National Communications on Climate Change at the country level. In studies so far, mainly concerning agriculture and water resources, significant differences in the estimated impacts based on spatial resolution are found.

So far it has been explicitly demonstrated that the necessary adaptation measures varies with the spatial resolution. And of course, this point could be deduced from the fact that the level of impacts varies.

Downscaling of climate change scenarios in Brazil

An initiative from Brazil has been the implementation of CREAS (Regional Climate Change Scenarios for South America). CREAS is being established as consequence of a GEF-Ministry of Environment/PROBIO project lead by CPTEC in Brazil for studies on impacts of climate change in natural ecosystems in Brazil (PROBIO).

Additional funding for CREAS comes from the GOF-UK CLIMATE CHANGE & ENERGY PROGRAMME: Using Regional Climate Change Scenarios for Studies on Vulnerability and Adaptation in Brazil and South America, and the National Climate Change Program from the Ministry of Science and Technology.

The projects aim to provide high resolution climate change scenarios in the three most populated basins in South America for raising awareness among government and policy makers in assessing climate change impact, vulnerability and in designing adaptation measures.

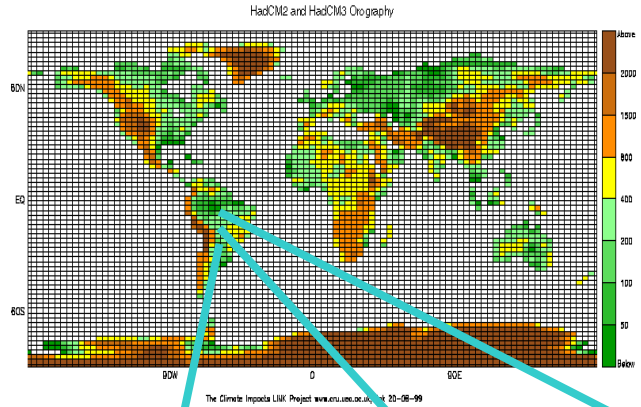
Project strategy summary

To provide high resolution future climate change scenarios in South America for development of studies that should lead to raising awareness among government and policy makers in assessing climate change impact, vulnerability and in designing adaptation measures.

PROBIO-IPCC Global models ised: IPCC TAR (HadCM3)-Version 1

Downscaling

Modelos do IPCC: HadCM3



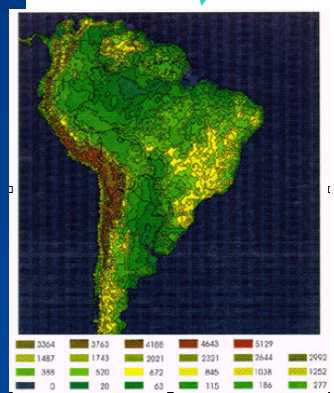
Climatology 1961-90

IPCC Scenarios A2, B2

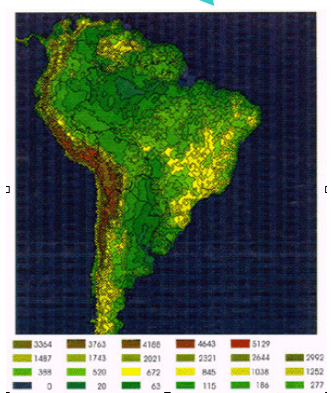
Climate anomalies (future-present), from regional mulimodel ensemble Time slices 2071-2100, A2, B2

Climatology regional model 1961-90

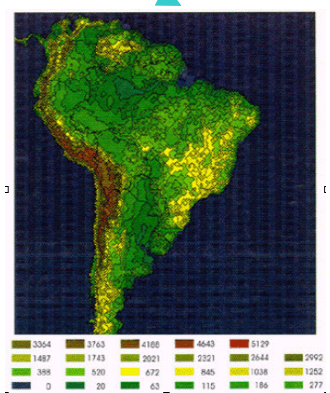
Regional models



RegCM3



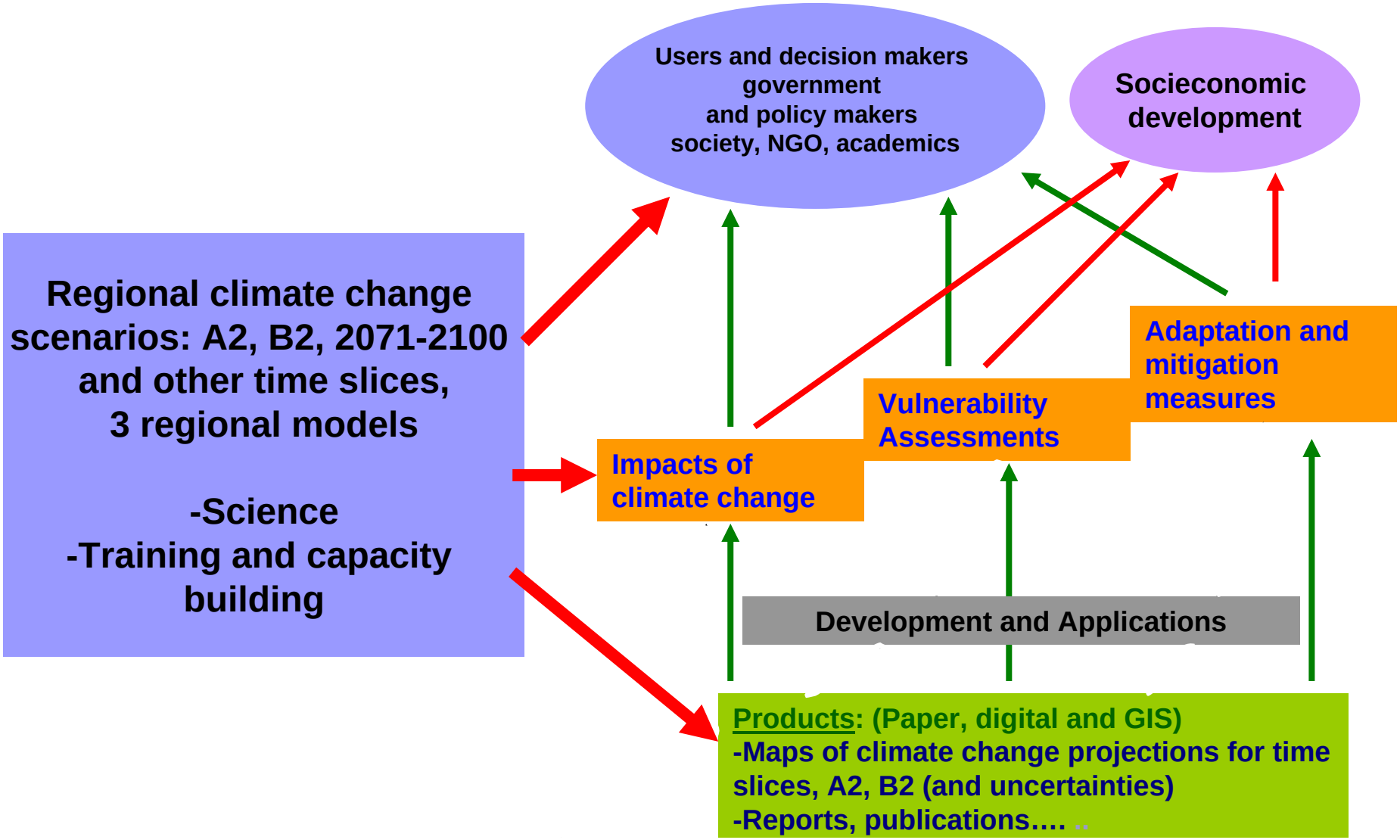
HadRM3



Eta CCS

Maps of climate anomalies, and indices of extremes (Regional multimodel ensemble) 2071-2100, A2, B2

Applications for impacts and vulnerability studies



The REGIS study (an UK experience that can serve as a paradigm for Brazil)

UKCIP is involved in developing an innovative methodology for undertaking the type of cross-sectorial research that climate change necessitates. This is being implemented through a major commitment of resources in the REGIS study in North West England and East Anglia. The study aims to improve our understanding of the linkages between water resources, agriculture, biodiversity and coastal/river defence.

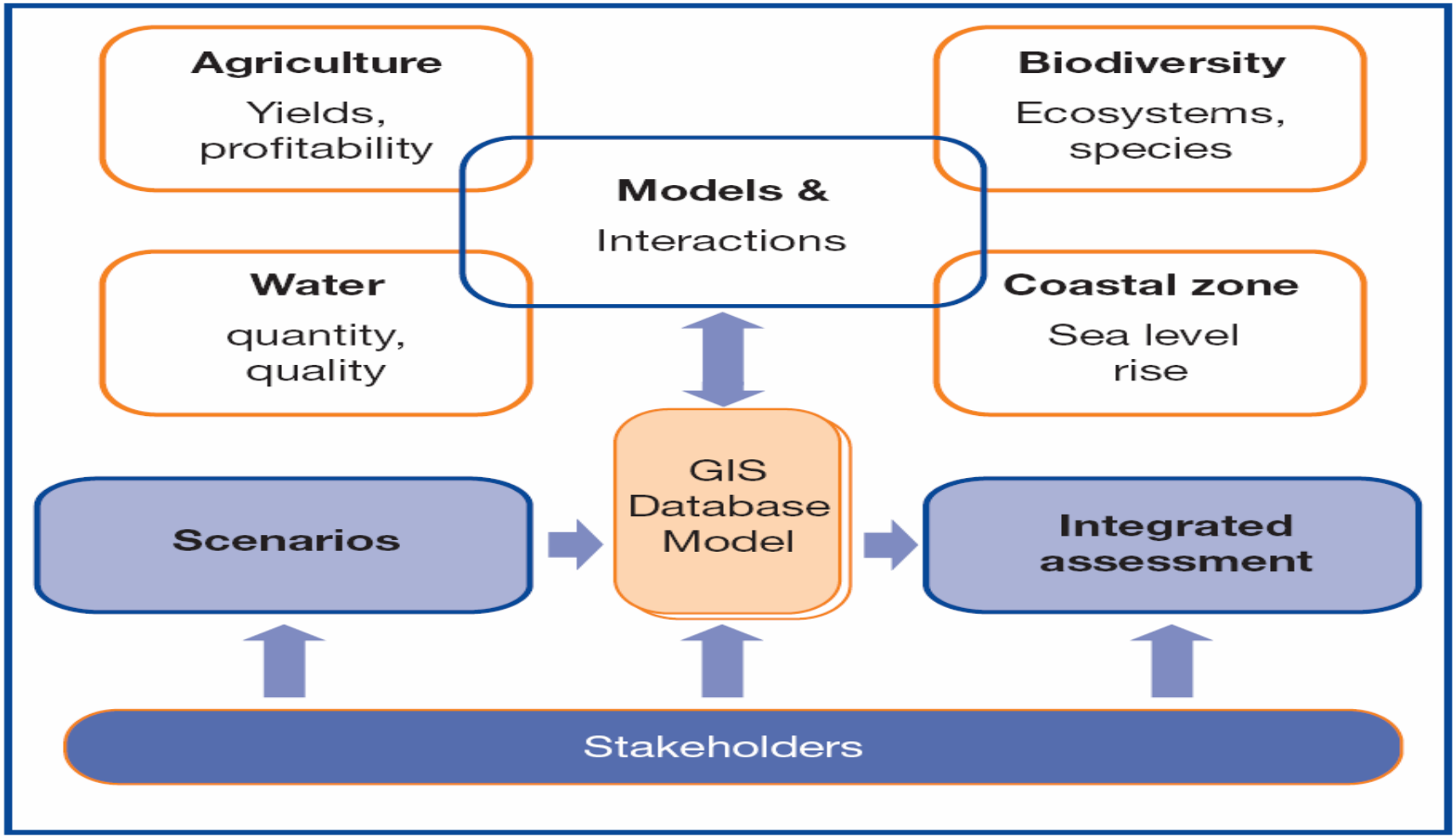
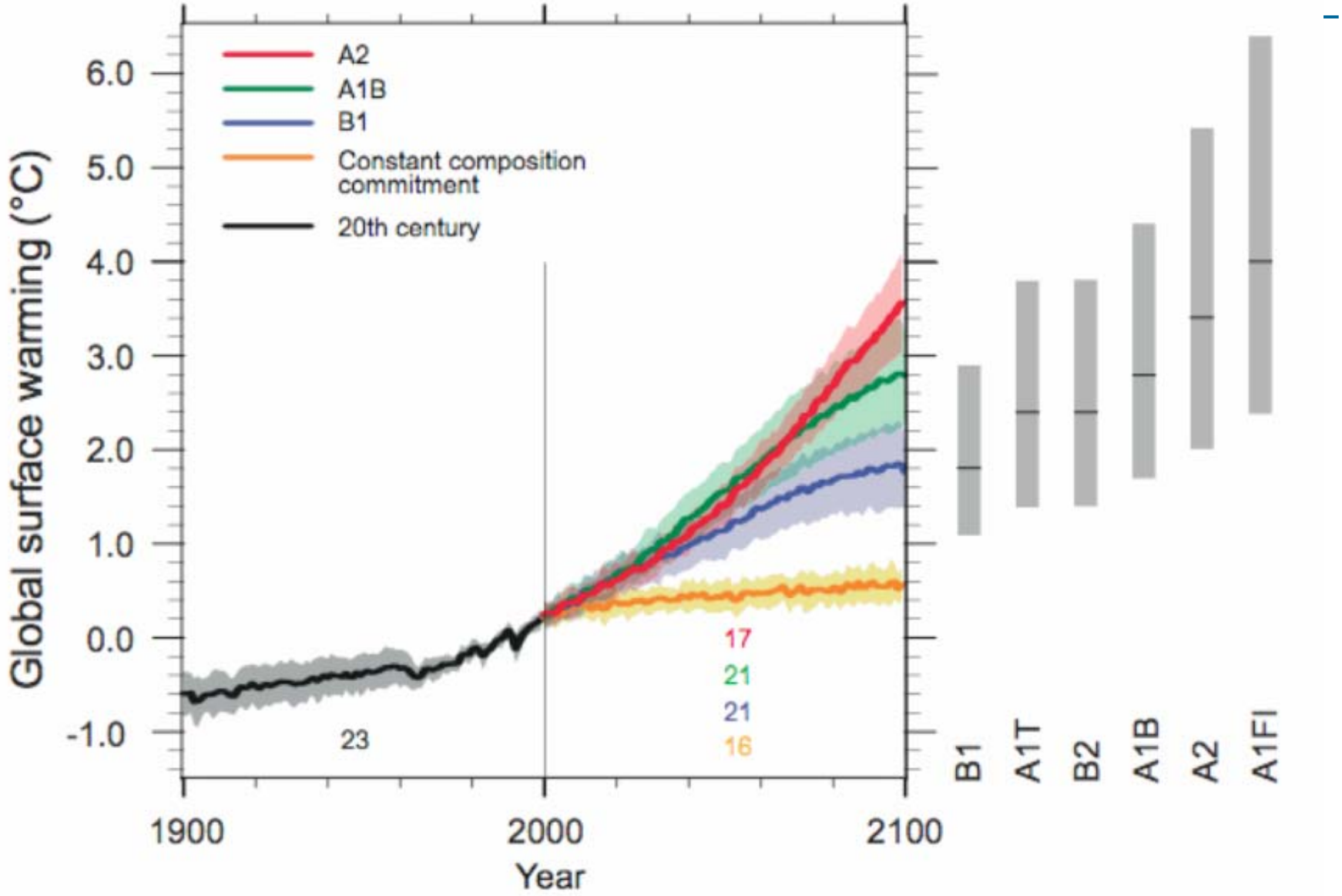
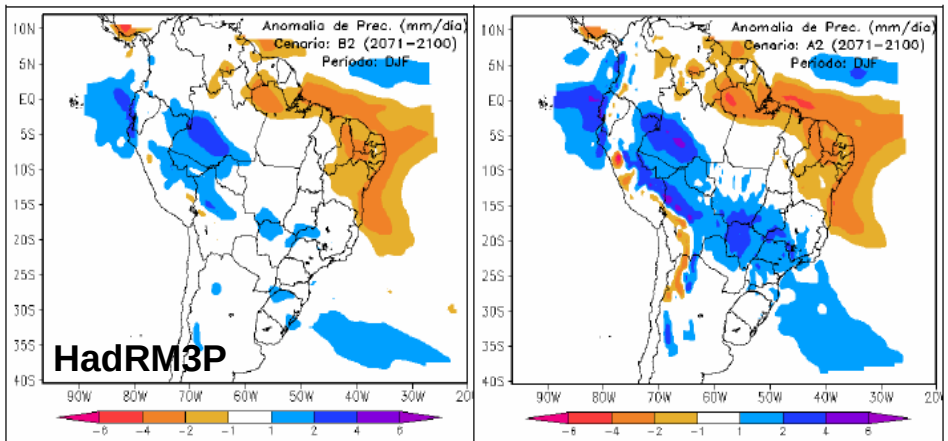


Figure 5: The integrated methodology being developed in the REGIS study.

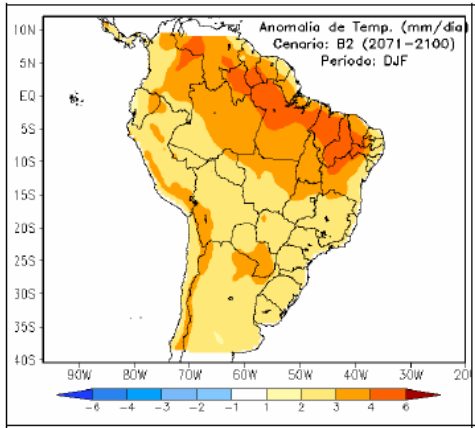


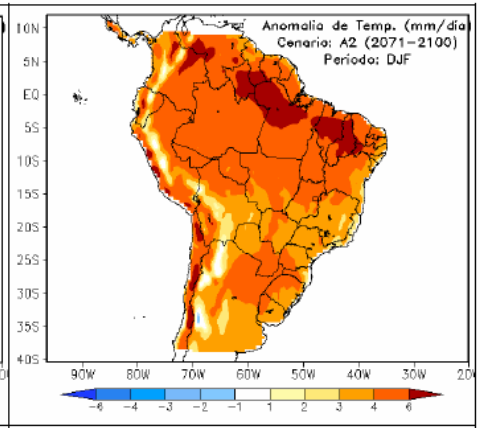
Solid lines are multi-model global averages of surface warming (relative to 1980-99) for the scenarios A2, A1B and B1, shown as continuations of the 20th century simulations. Shading denotes the plus/minus one standard deviation range of individual model annual means. The number of AOGCMs run for a given time period and scenario is indicated by the coloured numbers at the bottom part of the panel.

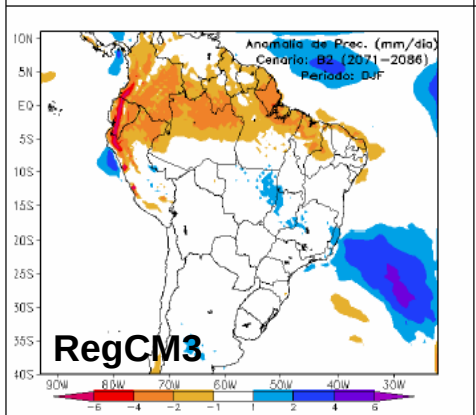
Regional climate change projections (summer DJF): Rainfall and temperature

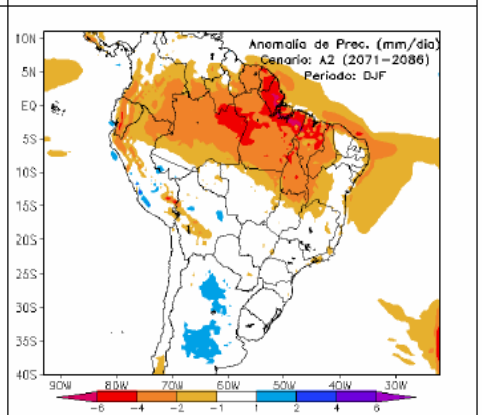


HadRM3P

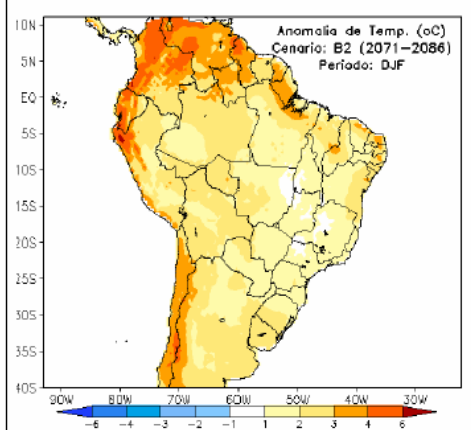


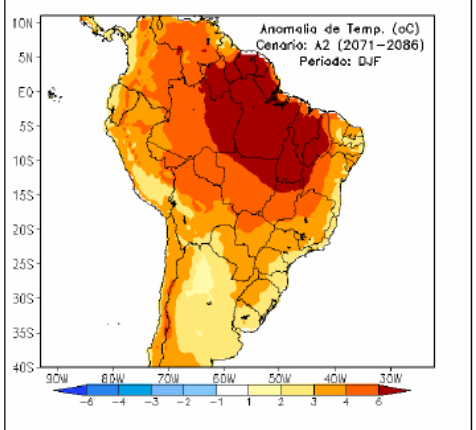


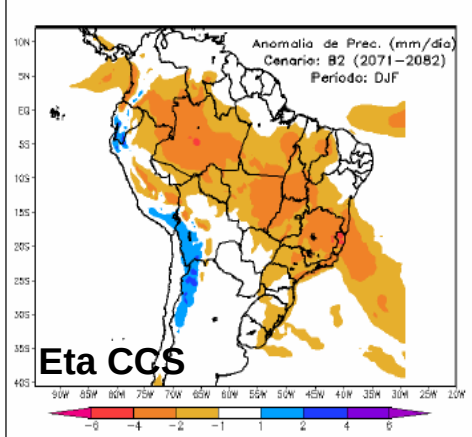


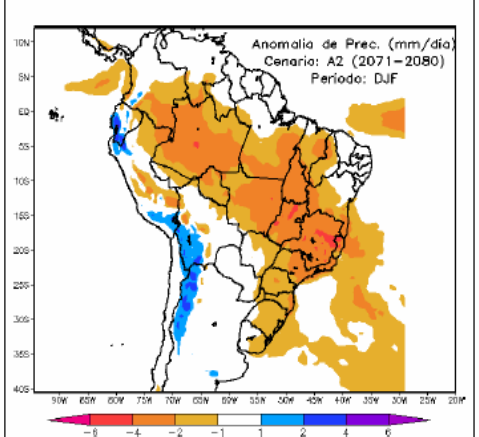


RegCM3

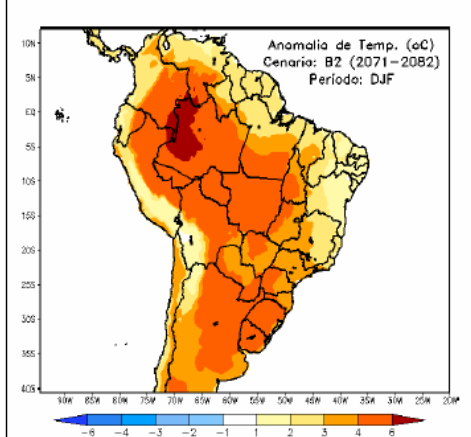


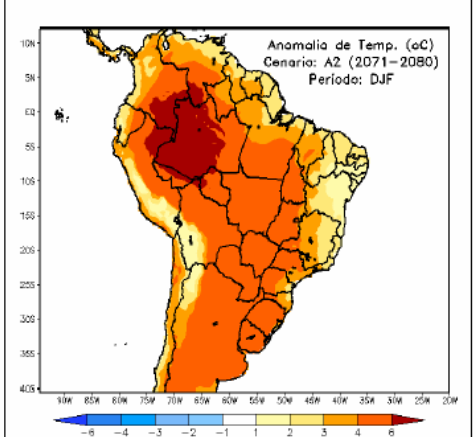




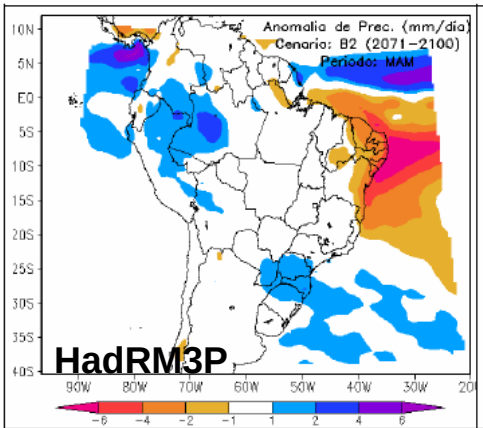


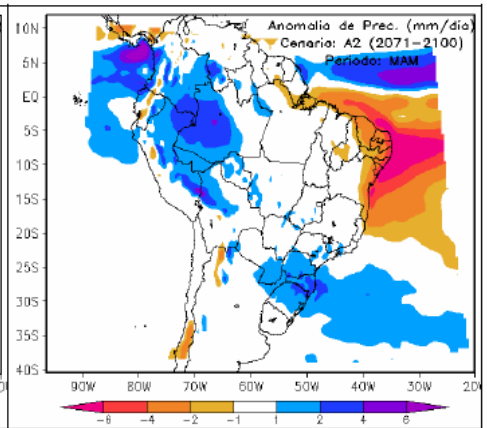
Eta CCS

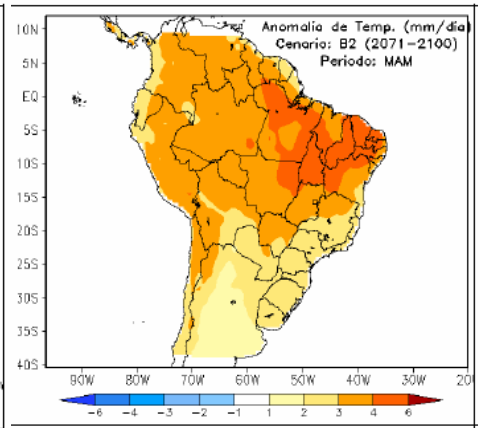


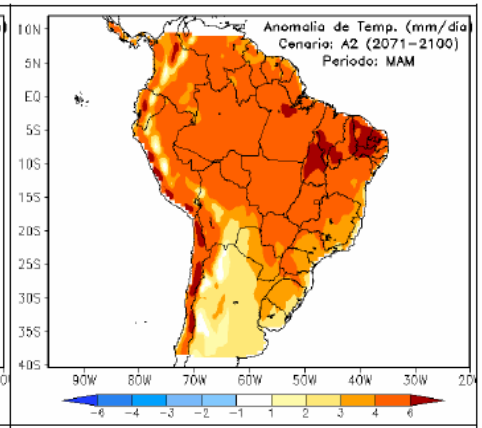


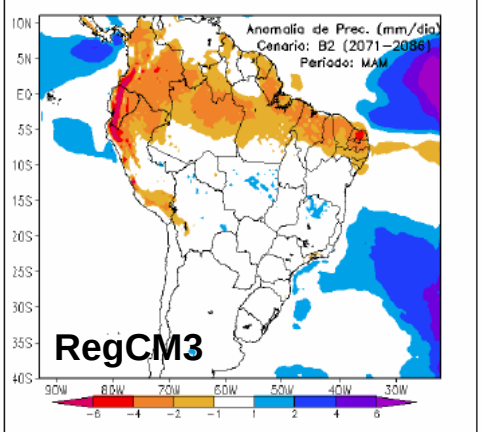
Regional climate change projections (Fall MAM): Rainfall and temperature

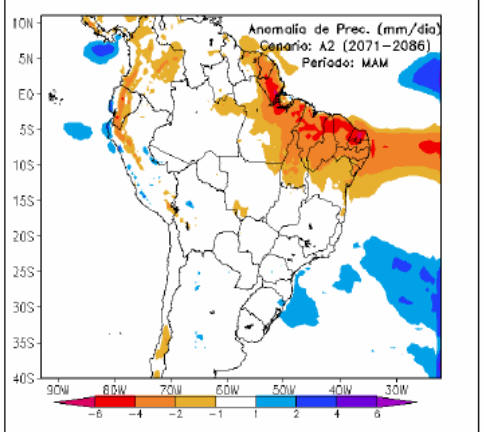


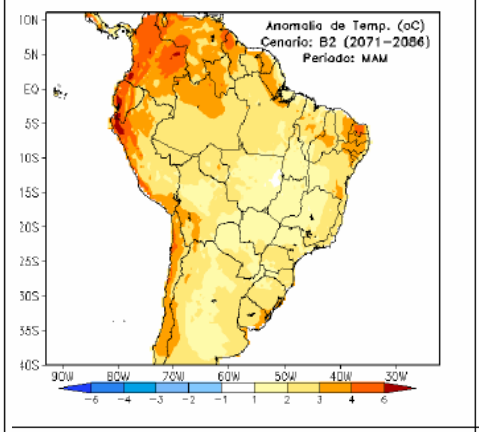


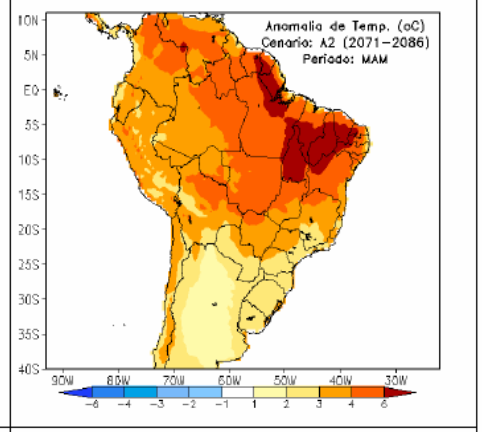


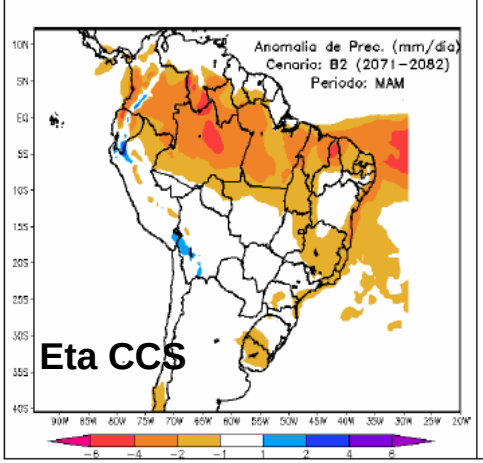


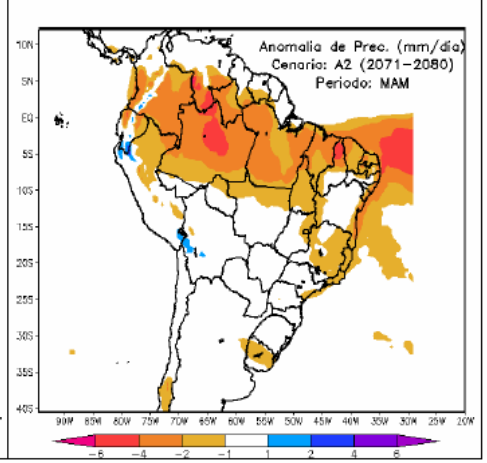


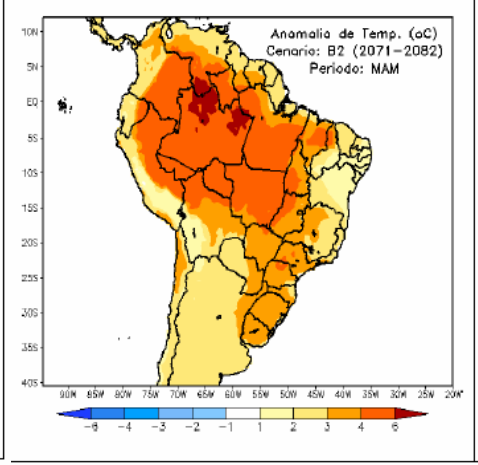


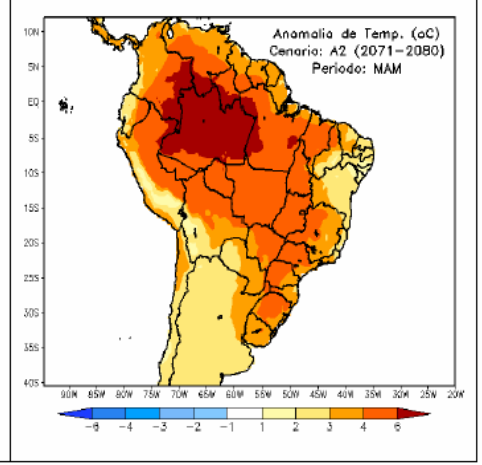




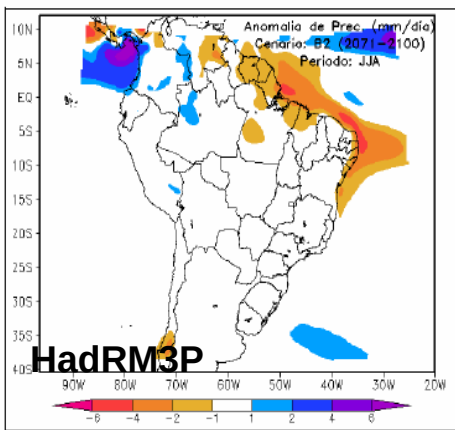


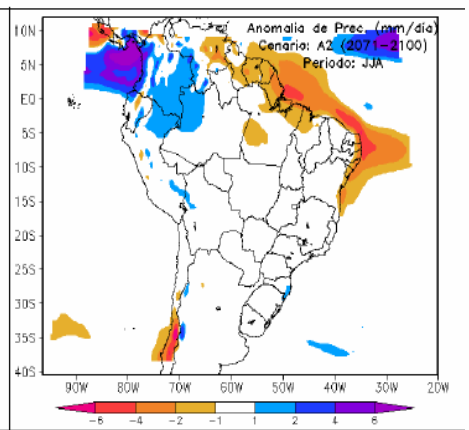




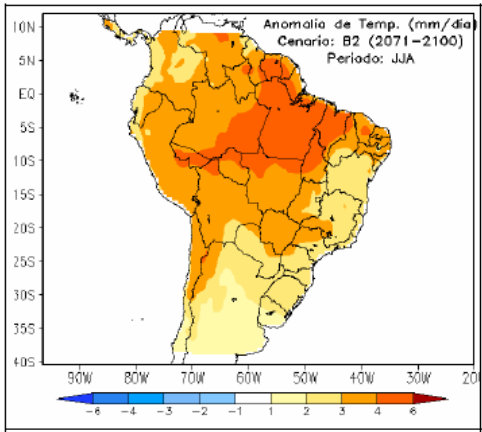


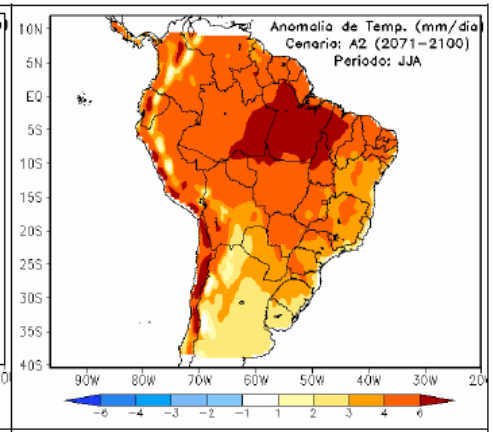
Regional climate change projections (winter JJA): Rainfall and temperature

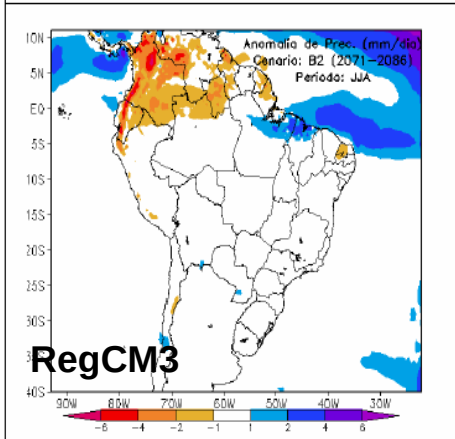


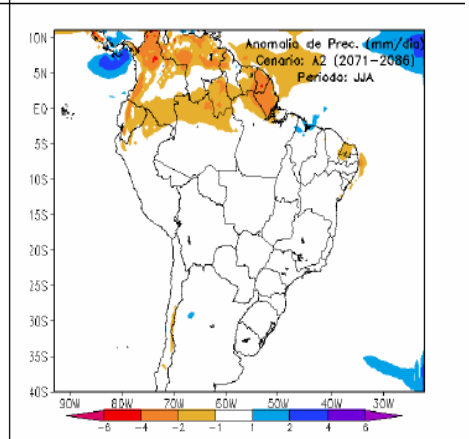


HadRM3P

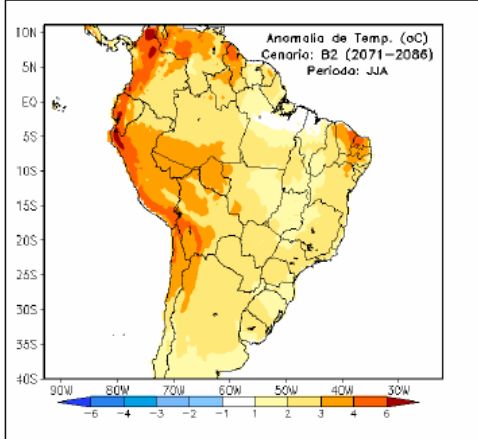


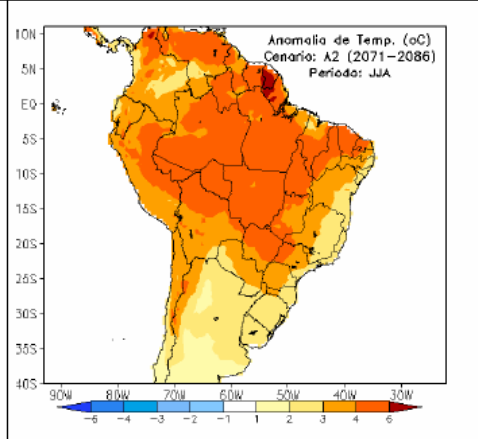


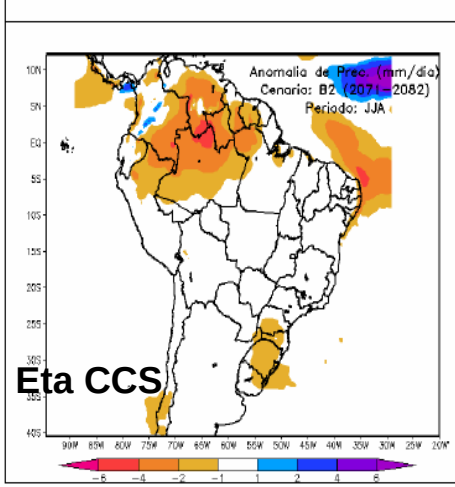


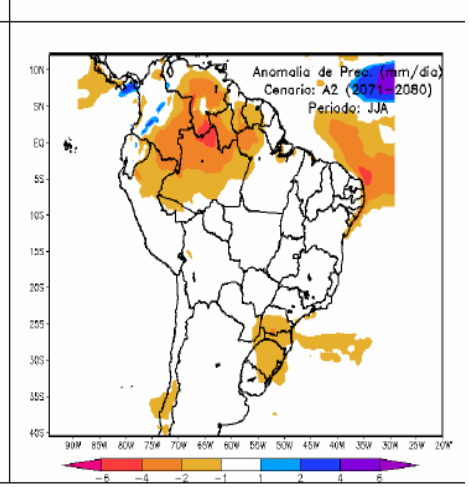


RegCM3

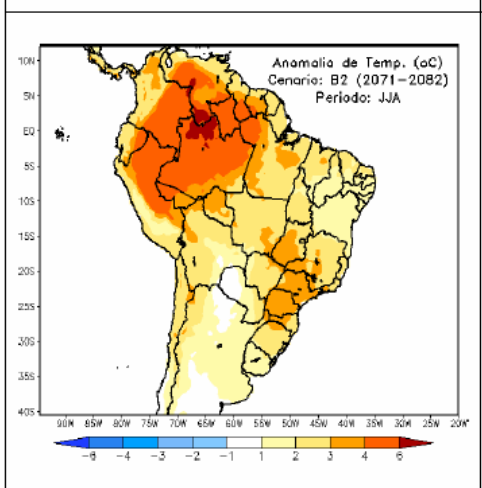


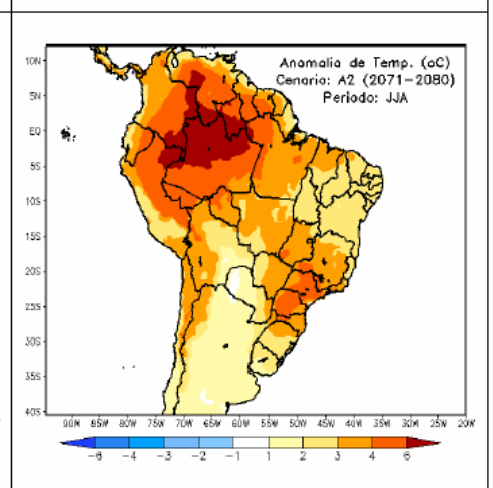




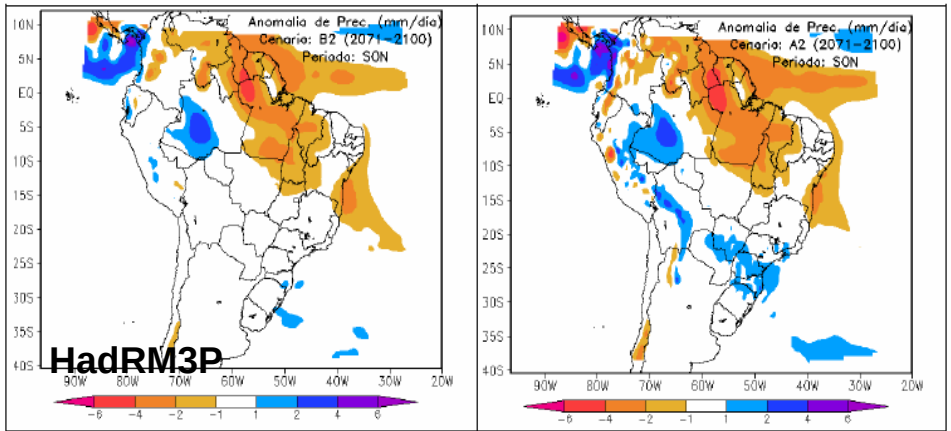


Eta CCS

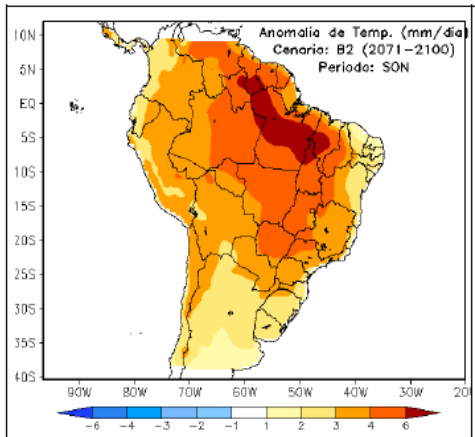


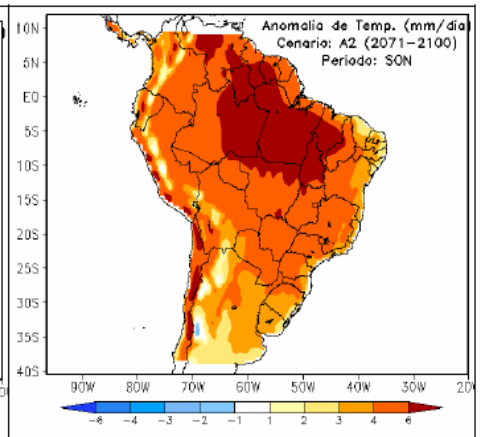


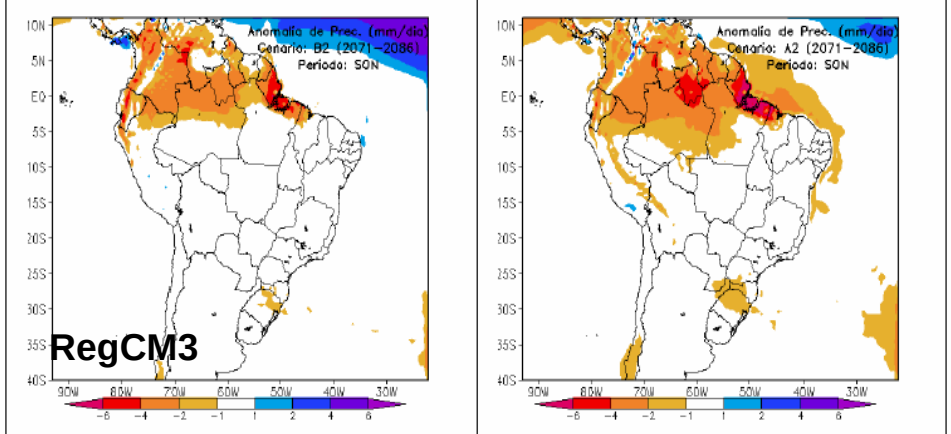
Regional climate change projections (spring SON): Rainfall and temperature



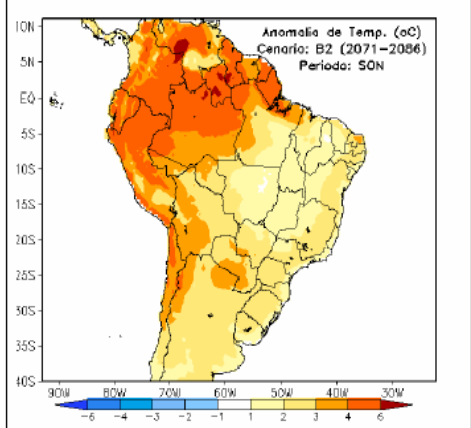
HadRM3P

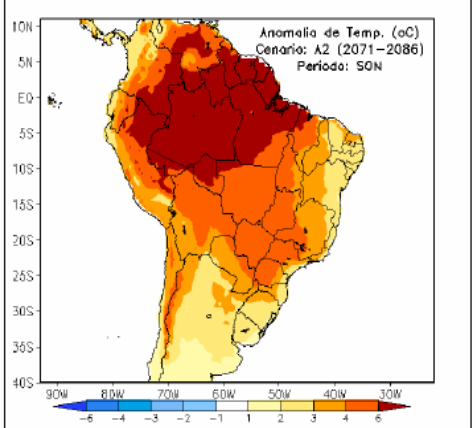


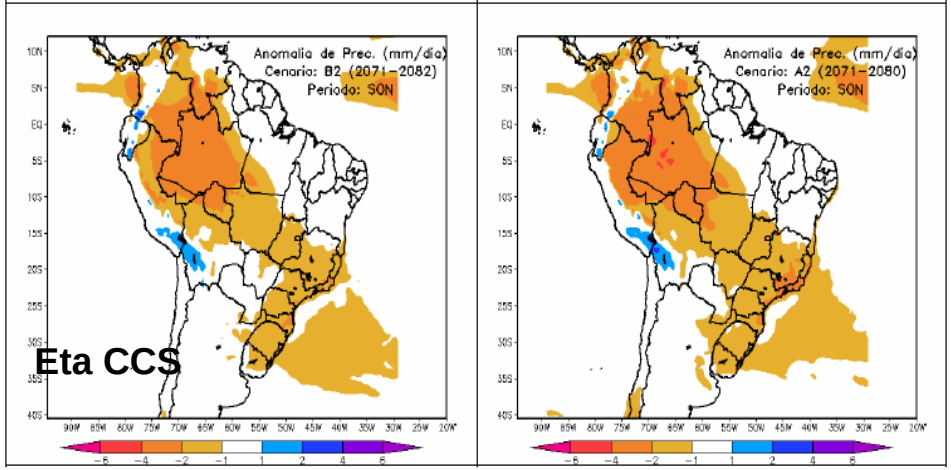




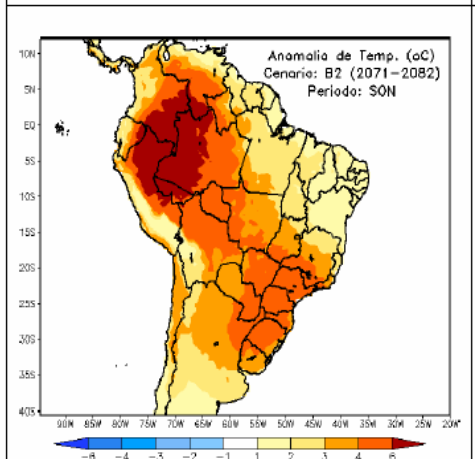
RegCM3

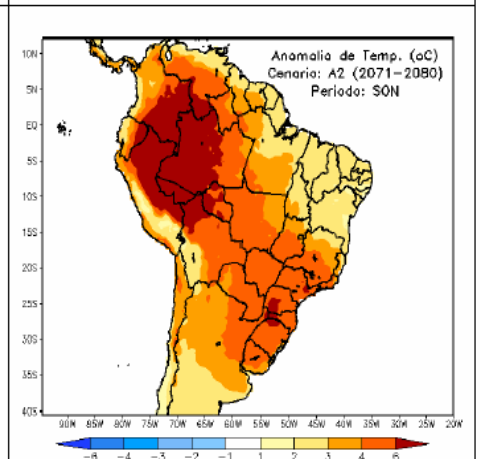






Eta CCS



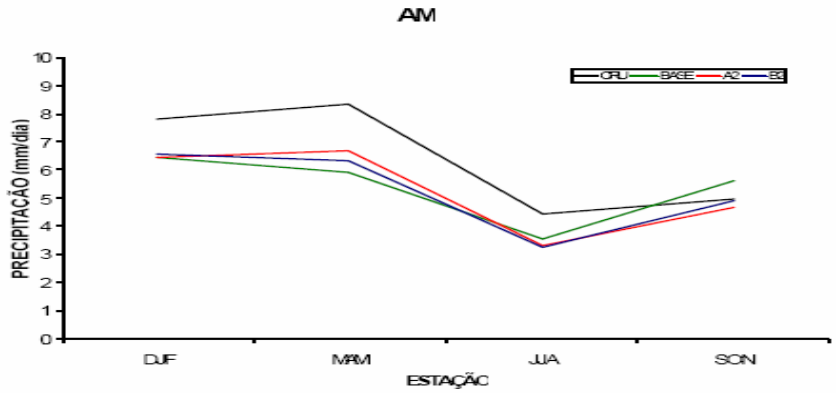


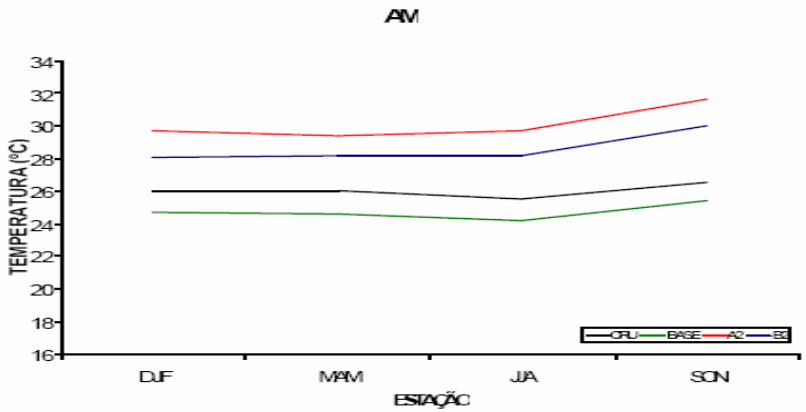
Amazonia

Precipitation

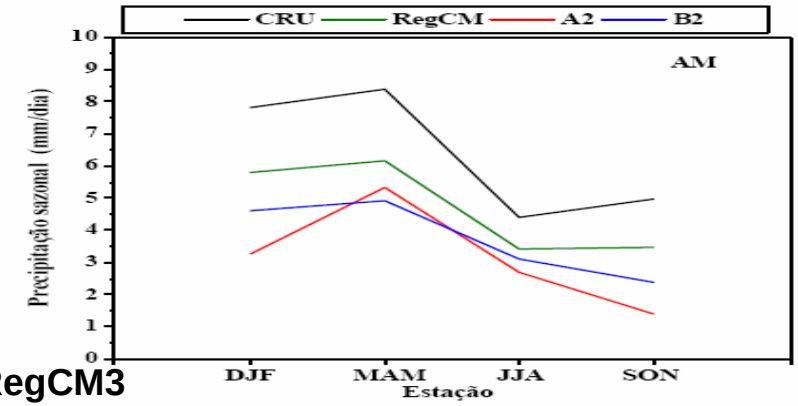
Temperature

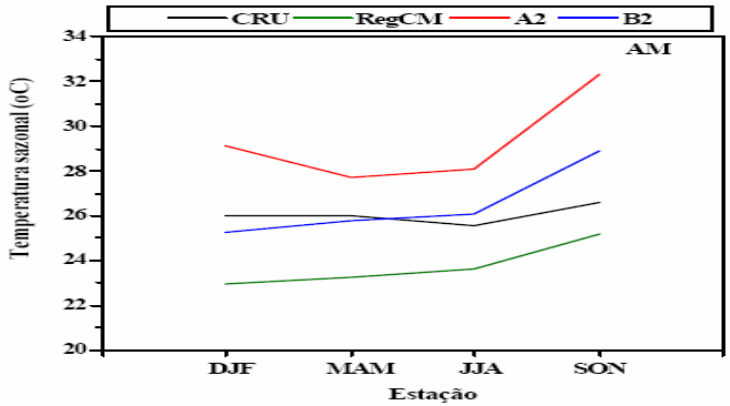
HadRM3P



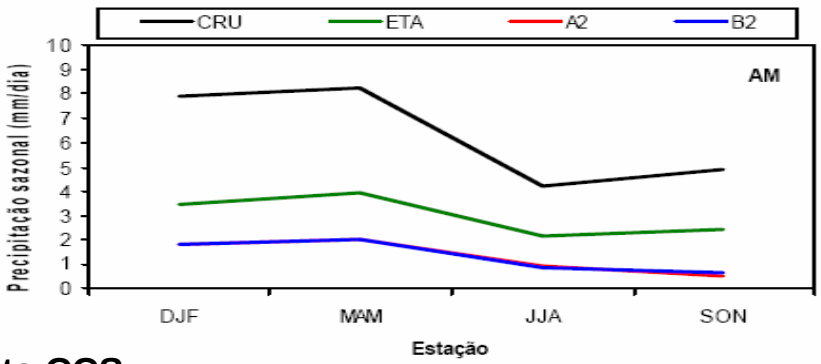


RegCM3





Eta CCS



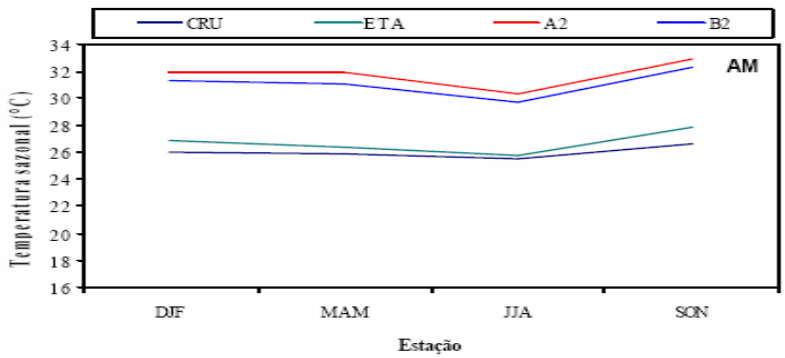
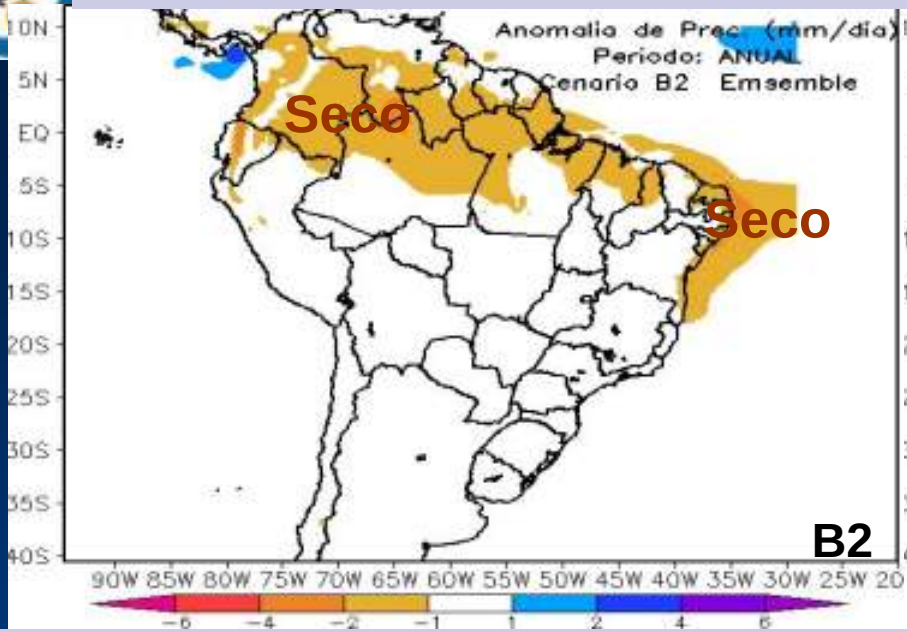
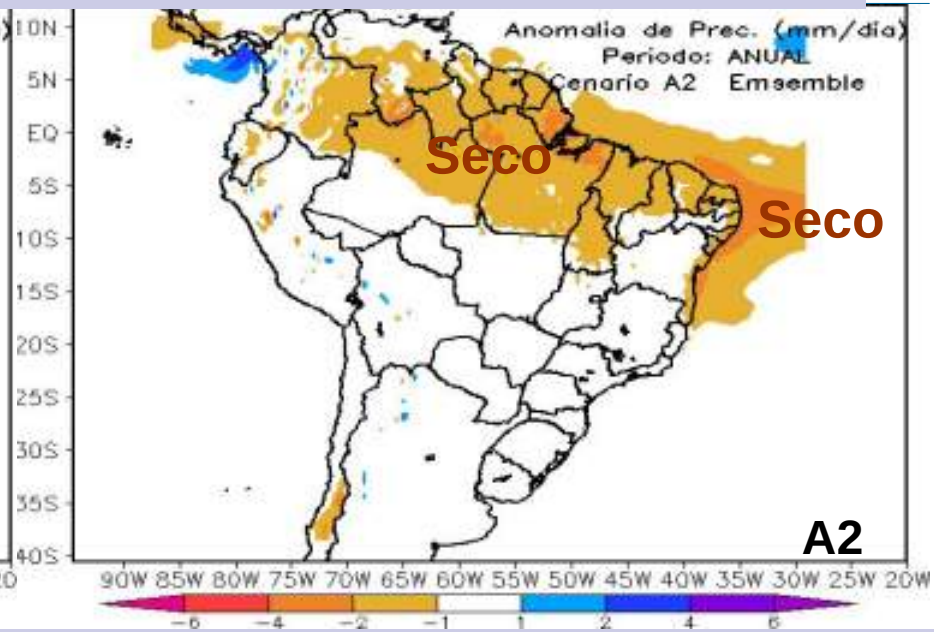


TABELA 3: Índices estatísticos mensais da precipitação calculados nos subdomínios definidos na Fig.6. São mostrados o viés, o desvio padrão (dp), o erro da raiz quadrática média (RMSE) e o coeficiente de correlação (CC) em relação aos dados climatológicos do CRU.

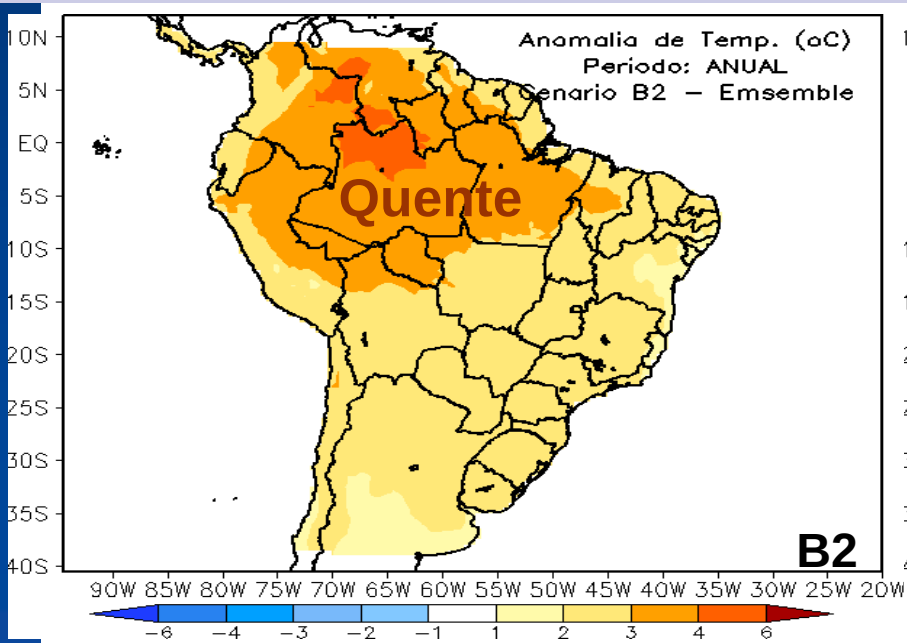
	HadRM3P	RegCM3	ETA/CPTEC
Amazonia			
Bias	-1.0	-1.70	-3.31
dp	1.82	1.40	0.78
Rmse	1.78	2.04	3.51
COR	0.77	0.91	0.97
Nordeste			
Bias	0.5	-0.67	-1.19
dp	1.98	2.20	0.67
Rmse	1.50	1.00	1.82
COR	0.92	0.91	0.49
Sul			
Bias	-0.4	-0.60	-1.21
Dp	1.85	1.07	1.27
Rmse	1.51	1.08	1.34
COR	0.95	0.79	0.96
Pantanal			
Bias	0.0	-0.62	-1.38
Dp	1.85	0.41	1.62
Rmse	1.51	1.01	1.49
COR	0.96	0.79	0.97

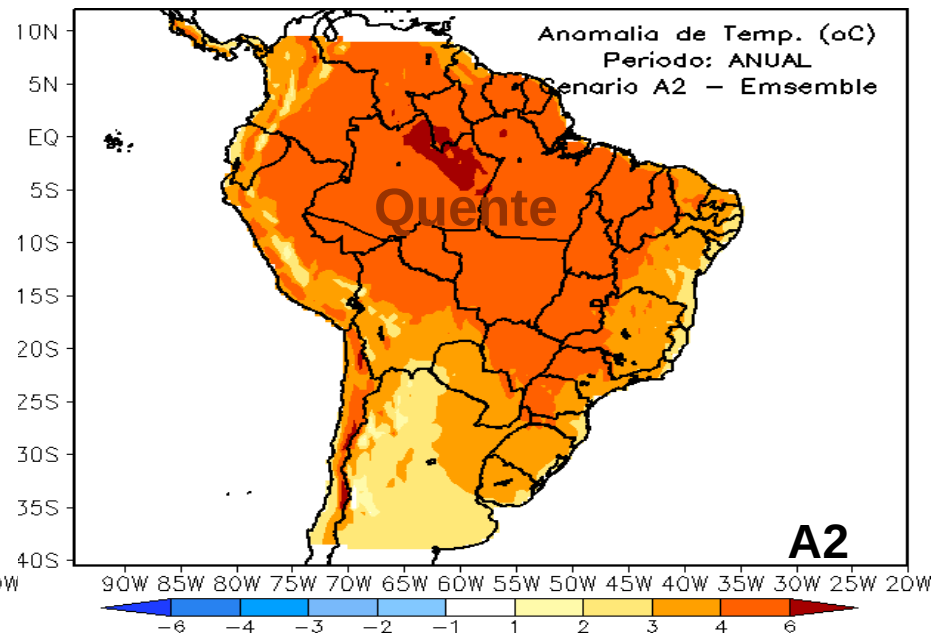
Rainfall anomalies (mm/day) (Annual) [(2071-2100)- (1961-90)]

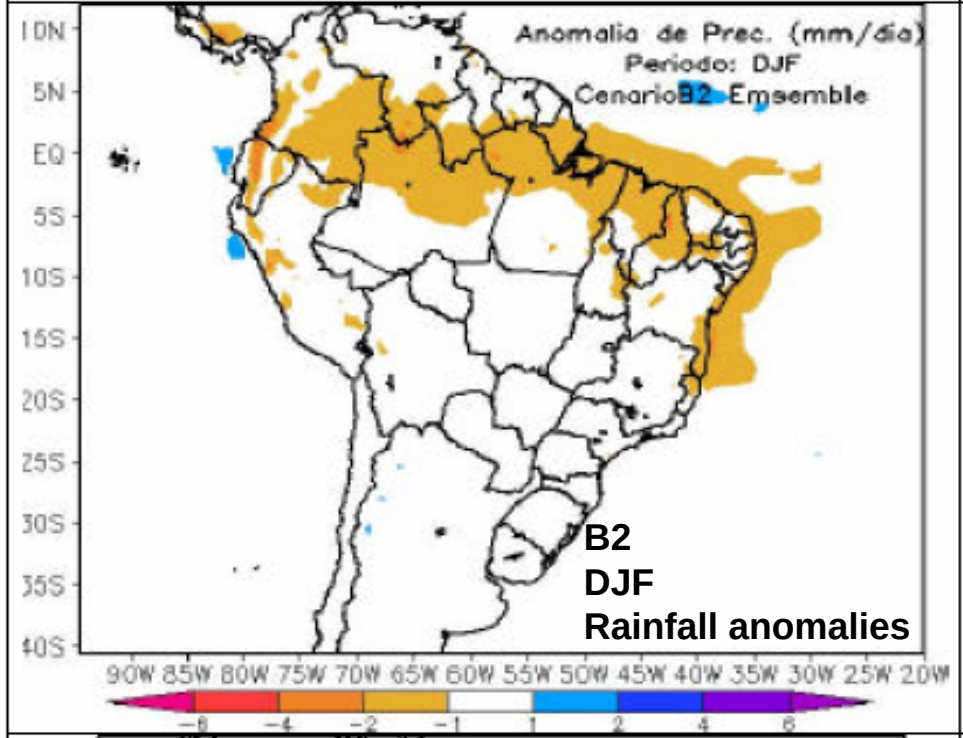


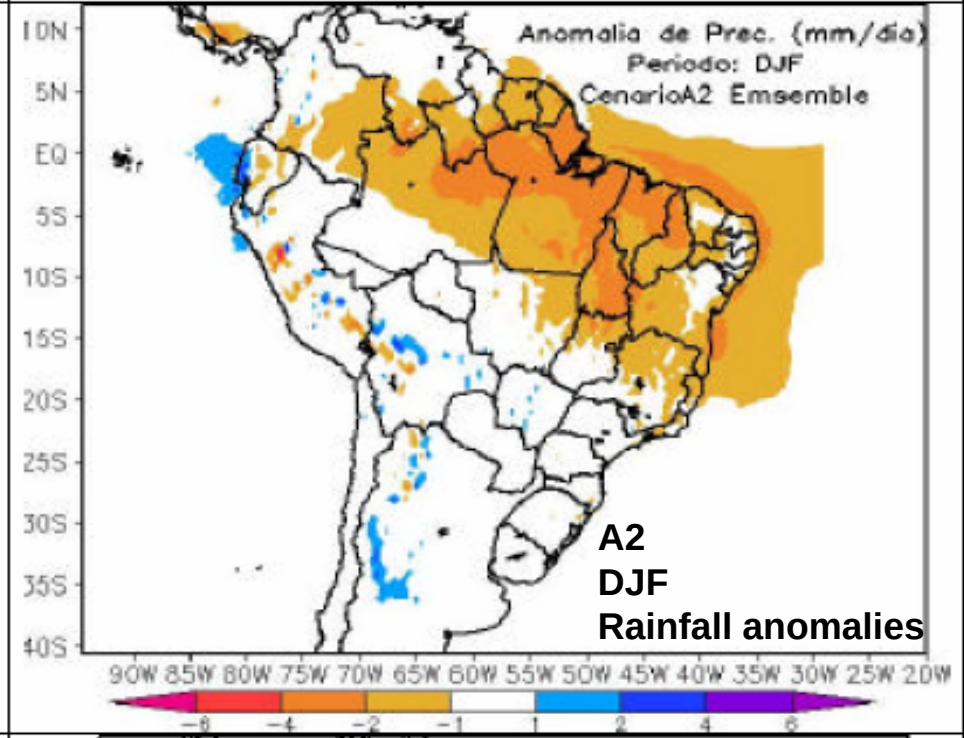


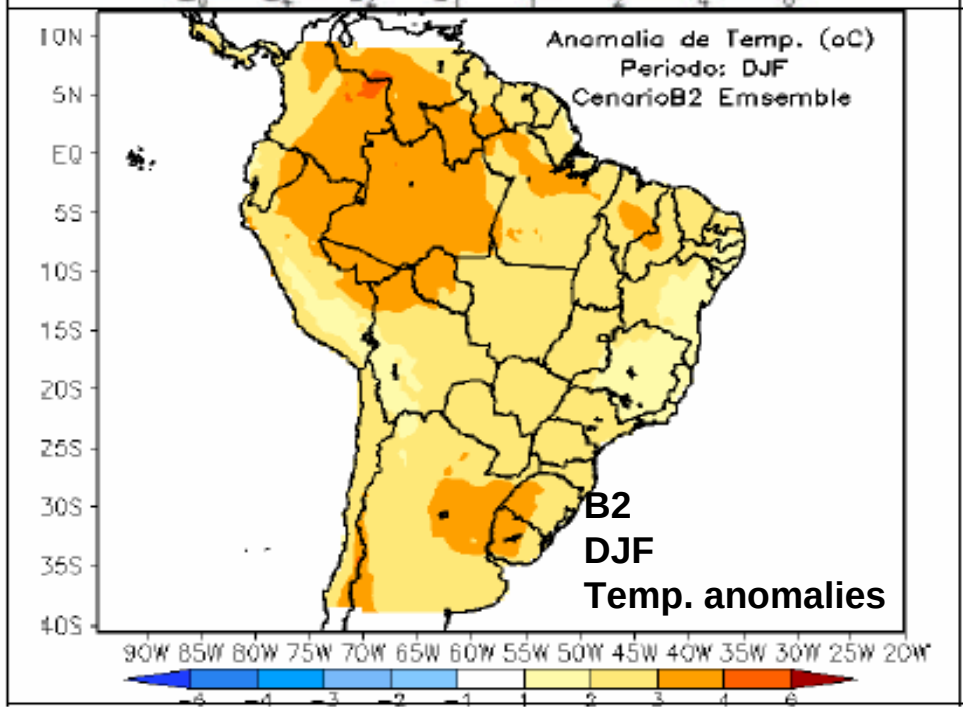
Temperature anomalies (C) Annual [(2071-2100)- (1961-90)]

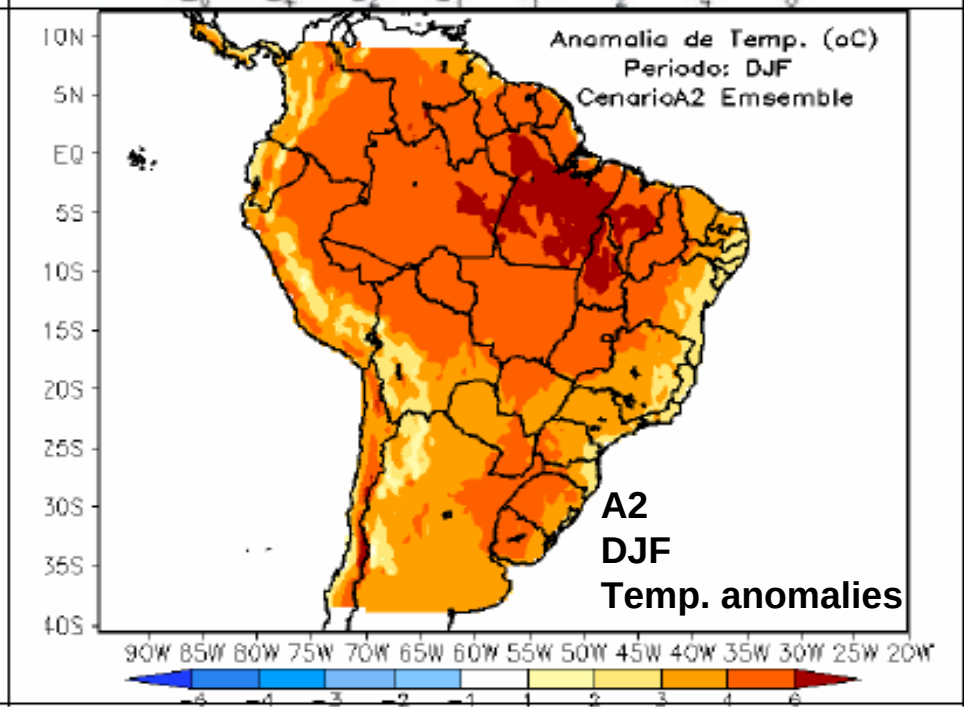


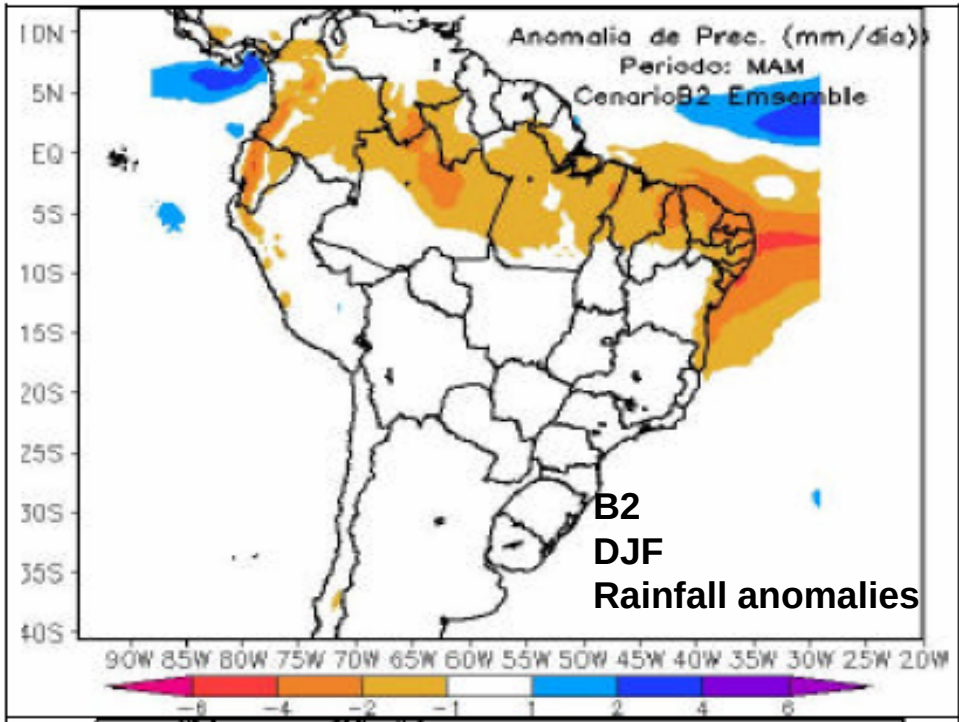


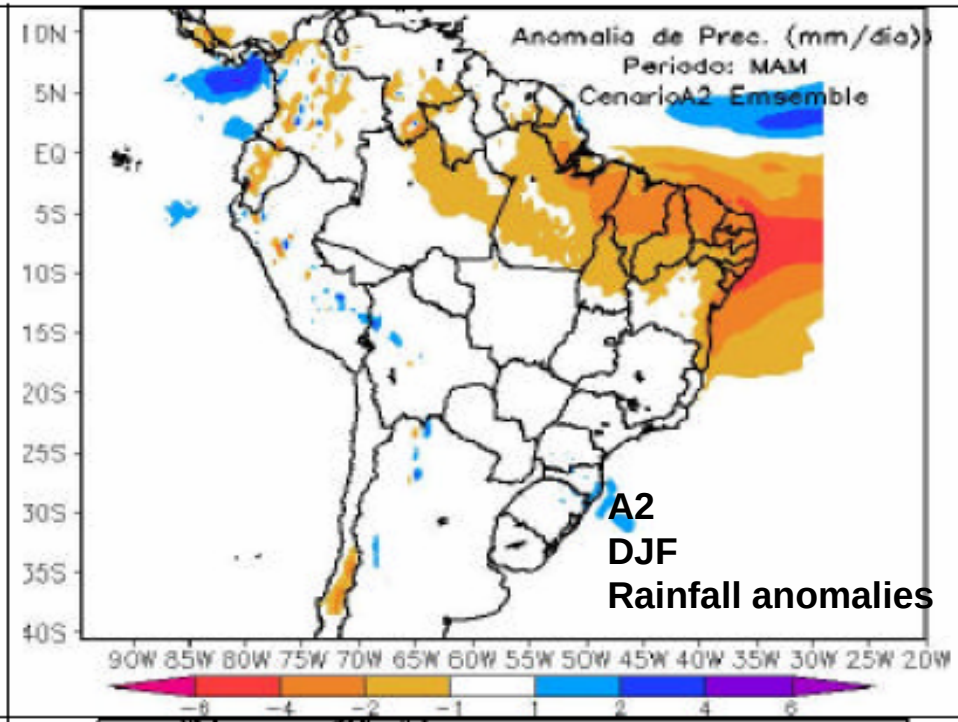

Anomalia de Prec. (mm/dia)
Periodo: DJF
CenarioB2 Emsemble
B2
DJF
Rainfall anomalies

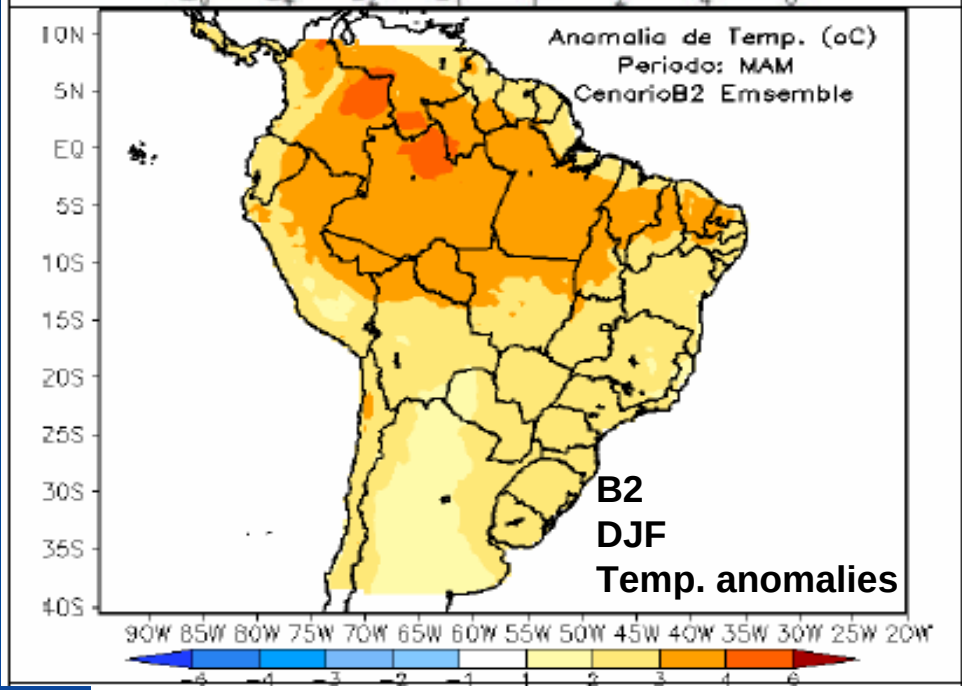

Anomalia de Prec. (mm/dia)
Periodo: DJF
CenarioA2 Emsemble
A2
DJF
Rainfall anomalies

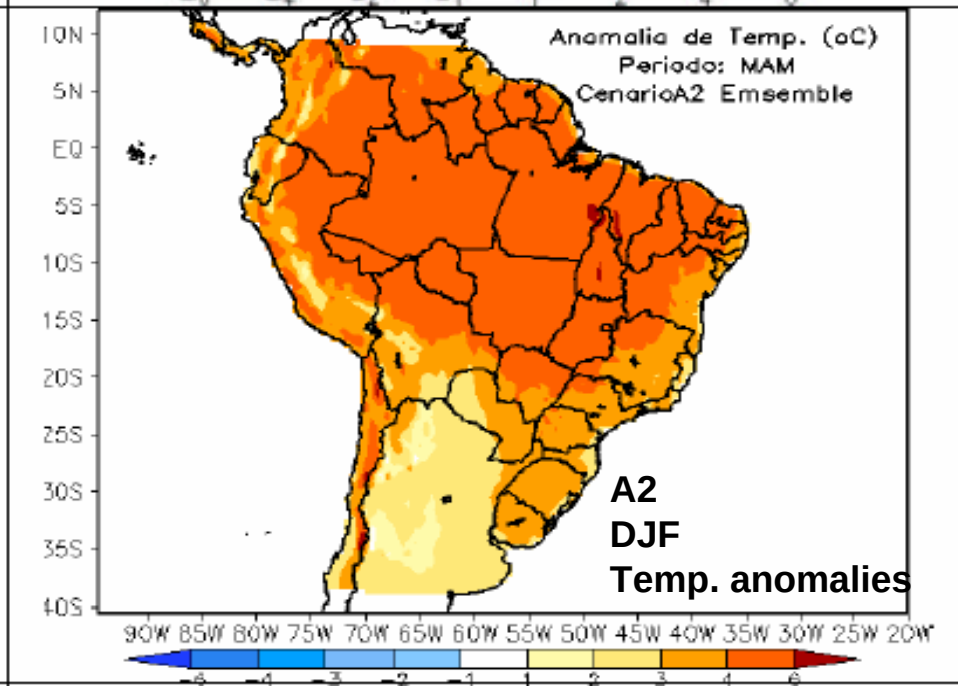

Anomalia de Temp. (oC)
Periodo: DJF
CenarioB2 Emsemble
B2
DJF
Temp. anomalies

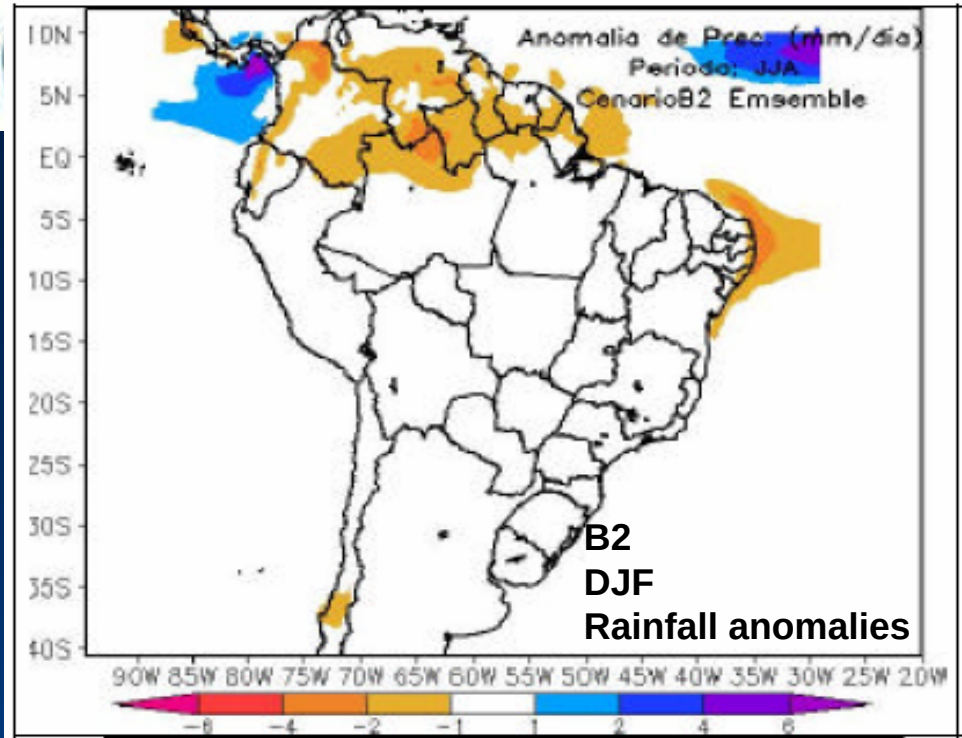

Anomalia de Temp. (oC)
Periodo: DJF
CenarioA2 Emsemble
A2
DJF
Temp. anomalies

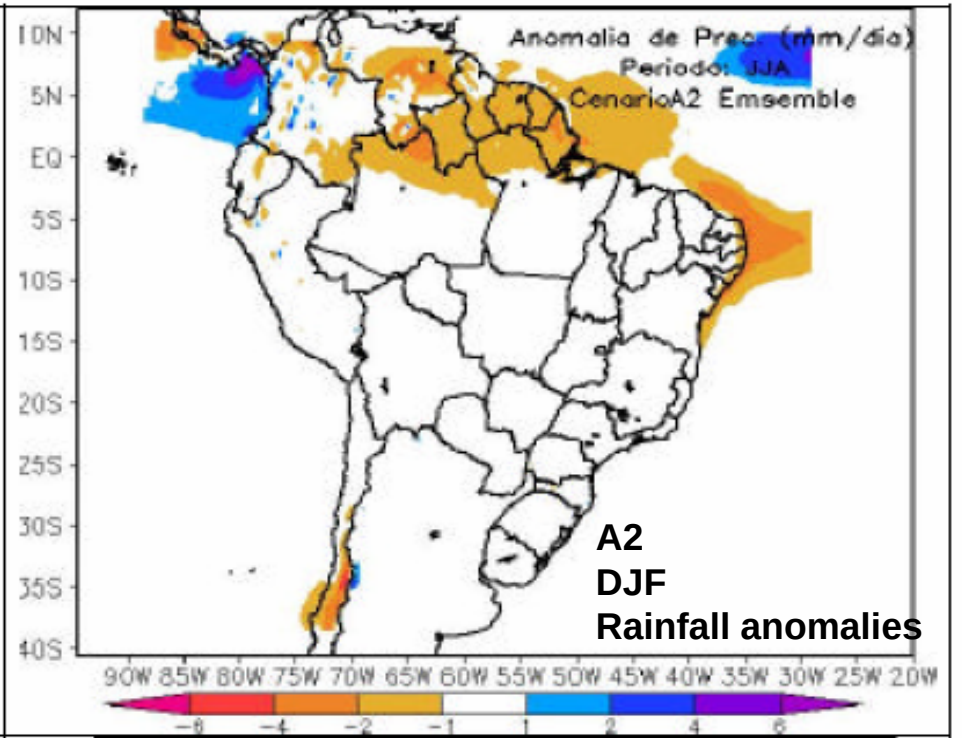

Anomalia de Prec. (mm/dia)
Periodo: MAM
CenarioB2 Emsemble
B2
DJF
Rainfall anomalies

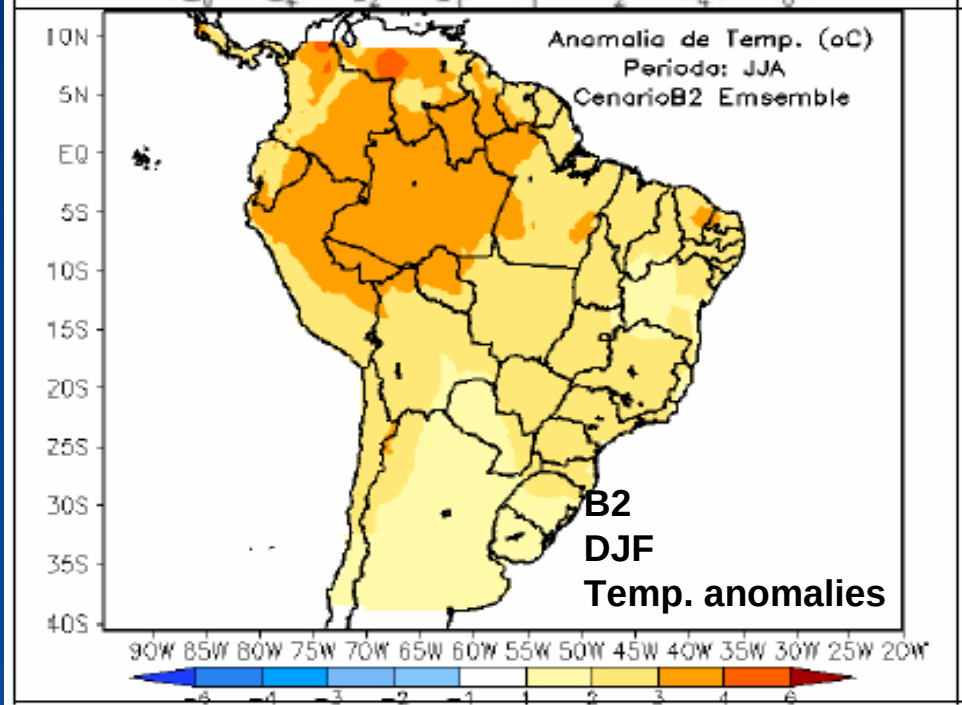

Anomalia de Prec. (mm/dia)
Periodo: MAM
CenarioA2 Emsemble
A2
DJF
Rainfall anomalies

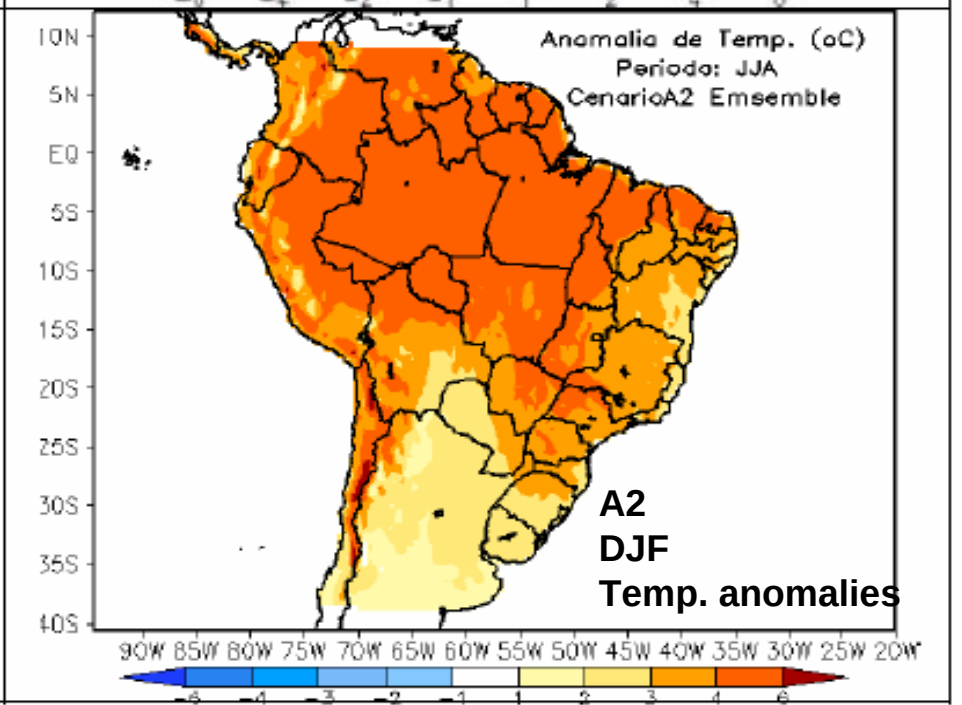

Anomalia de Temp. (oC)
Periodo: MAM
CenarioB2 Emsemble
B2
DJF
Temp. anomalies

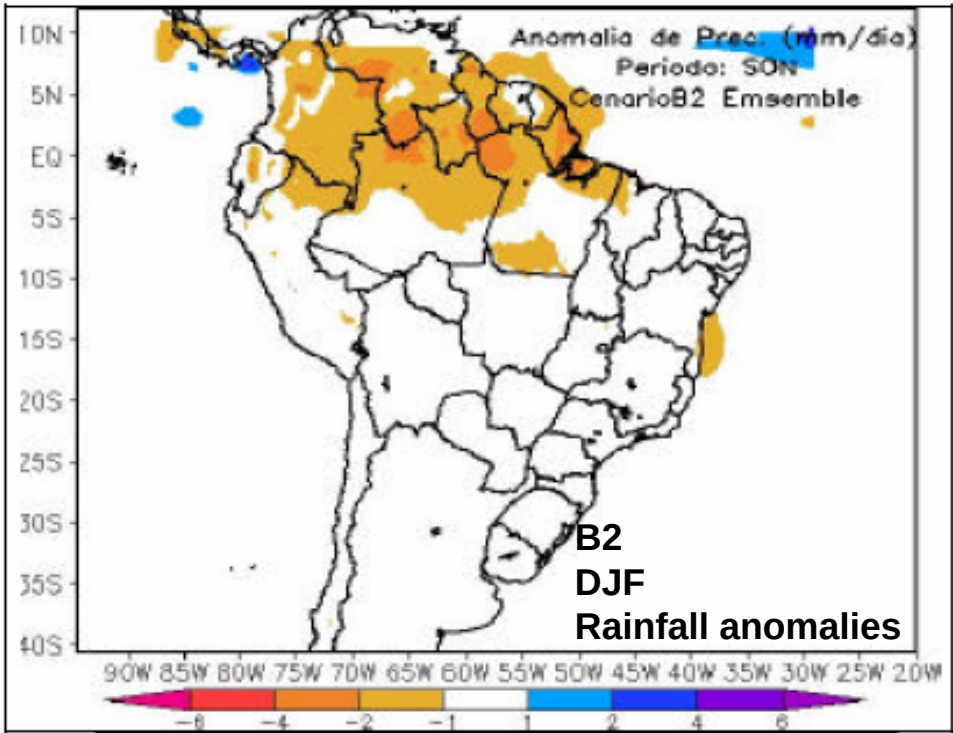

Anomalia de Temp. (oC)
Periodo: MAM
CenarioA2 Emsemble
A2
DJF
Temp. anomalies

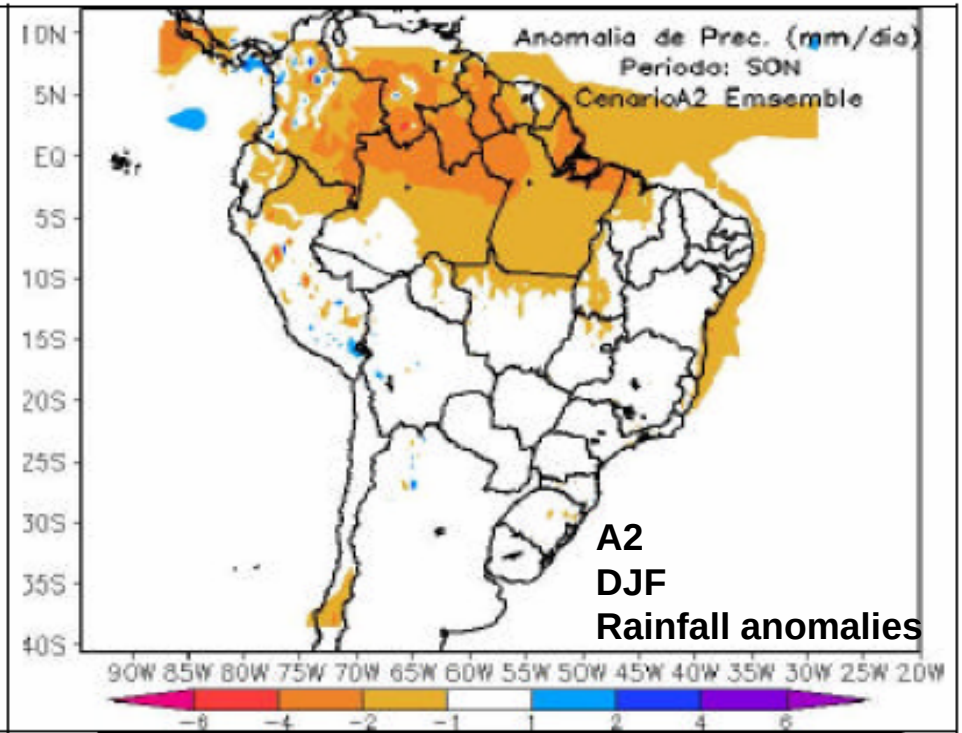

Anomalia de Prec. (mm/dia)
Periodo: JJA
CenarioB2 Emsemble
B2
DJF
Rainfall anomalies

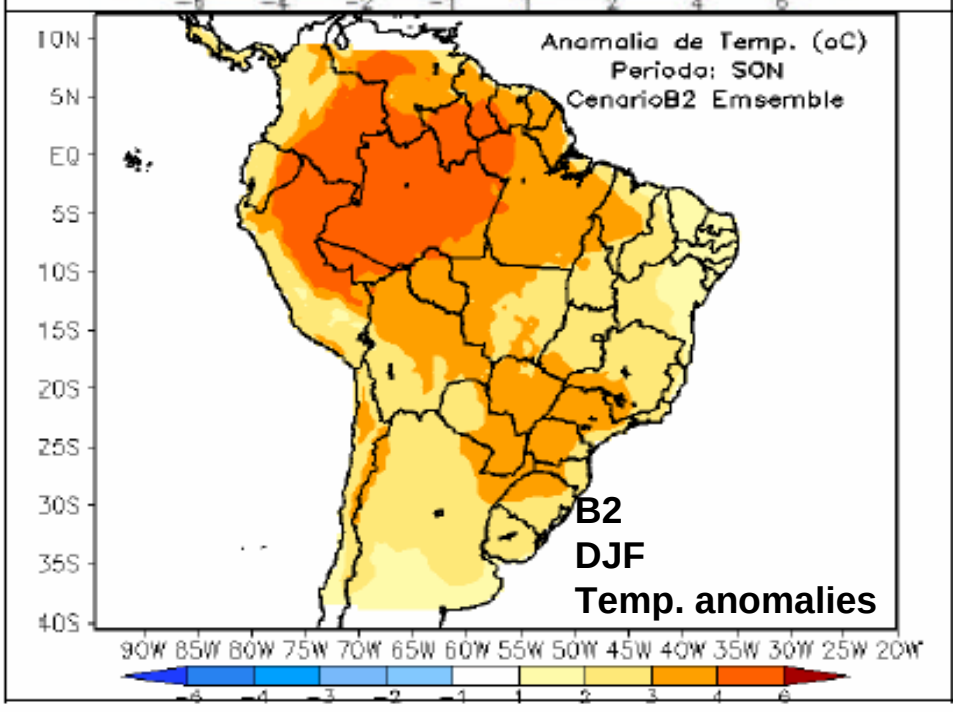

Anomalia de Prec. (mm/dia)
Periodo: JJA
CenarioA2 Emsemble
A2
DJF
Rainfall anomalies

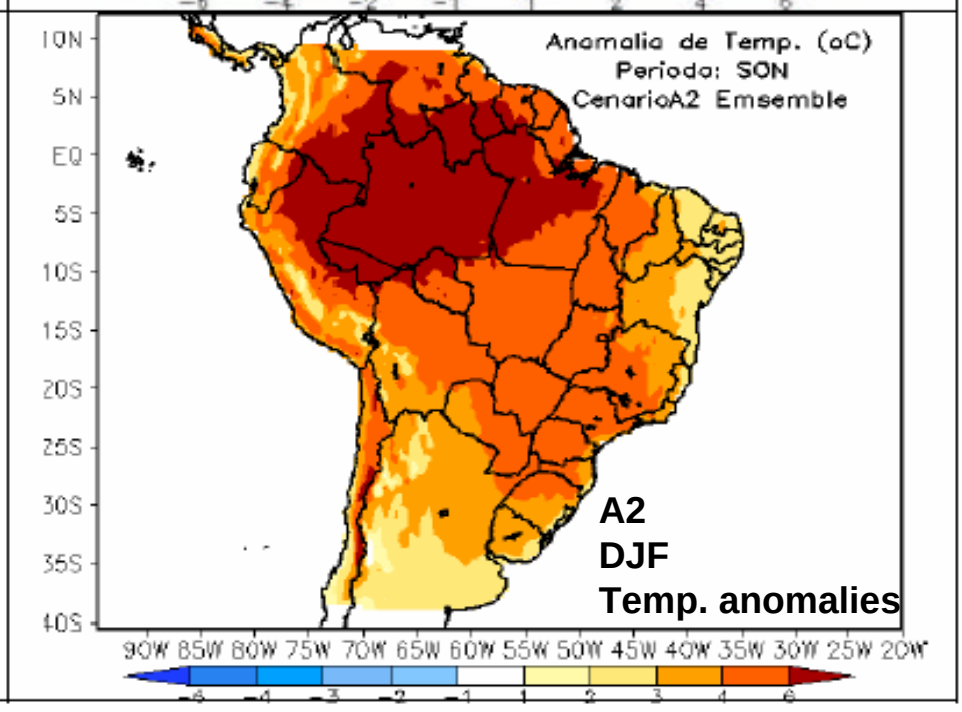

Anomalia de Temp. (oC)
Periodo: JJA
CenarioB2 Emsemble
B2
DJF
Temp. anomalies


Anomalia de Temp. (oC)
Periodo: JJA
CenarioA2 Emsemble
A2
DJF
Temp. anomalies


Anomalia de Prec. (mm/dia)
Periodo: SON
CenarioB2 Emsemble
B2
DJF
Rainfall anomalies


Anomalia de Prec. (mm/dia)
Periodo: SON
CenarioA2 Emsemble
A2
DJF
Rainfall anomalies

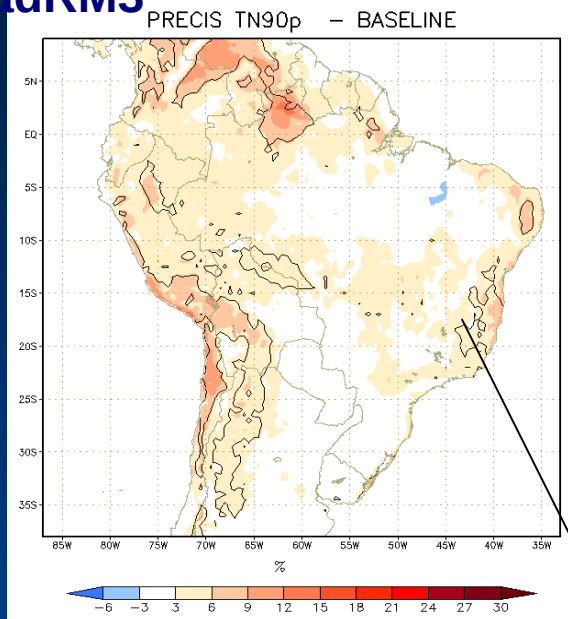

Anomalia de Temp. (oC)
Periodo: SON
CenarioB2 Emsemble
B2
DJF
Temp. anomalies


Anomalia de Temp. (oC)
Periodo: SON
CenarioA2 Emsemble
A2
DJF
Temp. anomalies

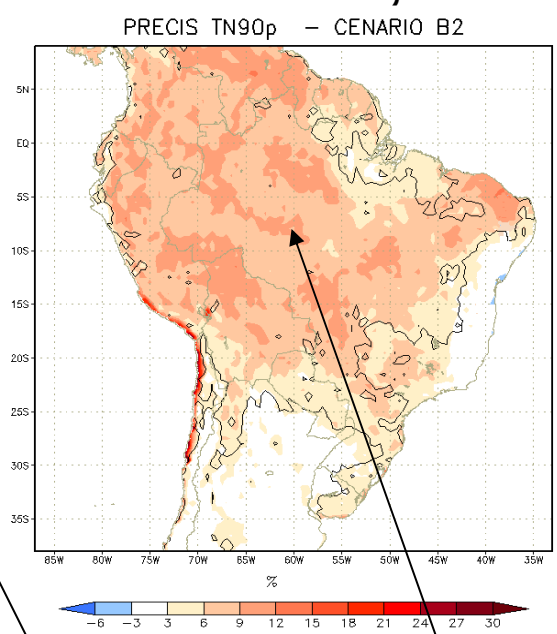
Warm nights index (TN90) [(2071-2100)- (1961-90)]

HadRM3

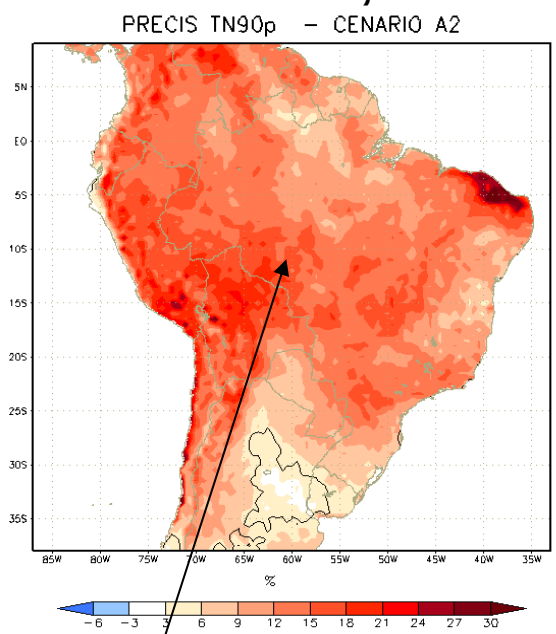
1961-90



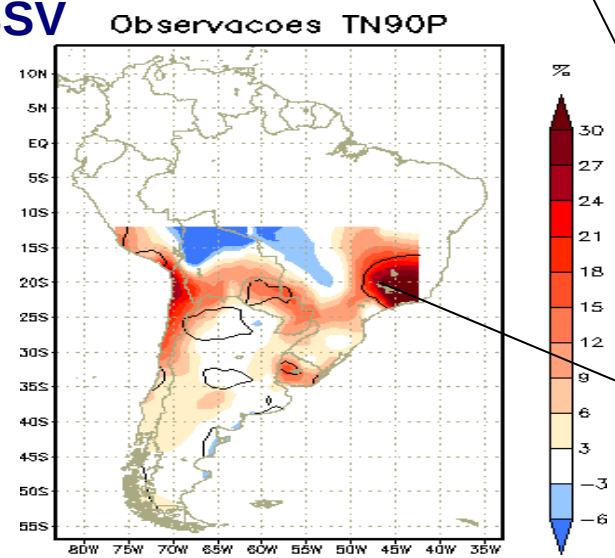
2071-2100, B2



2071-2100, A2



OBSV



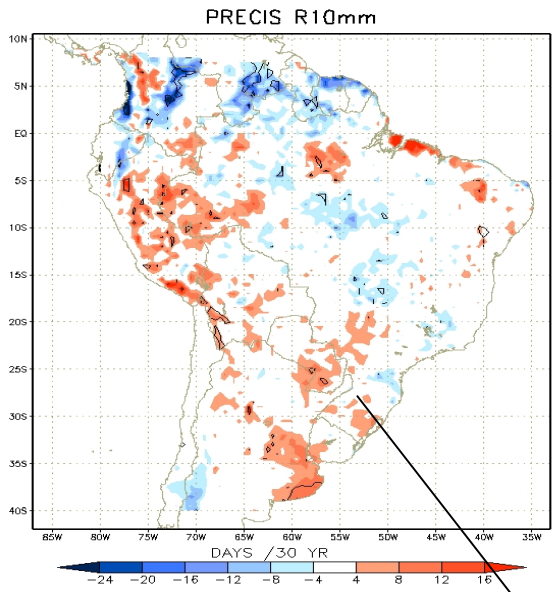
Increase in the frequency of warm nights until 2100

Increase in the frequency of warm nights during 1961-2000

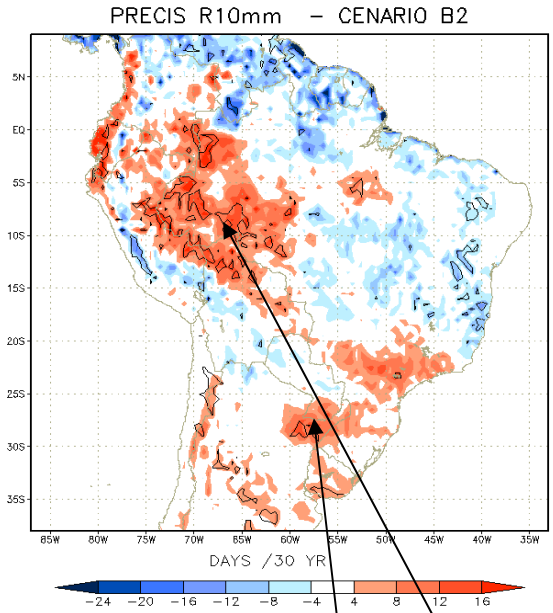
Intense rainfall index (R10) [(2071-2100)- (1961-90)]

HadRM3

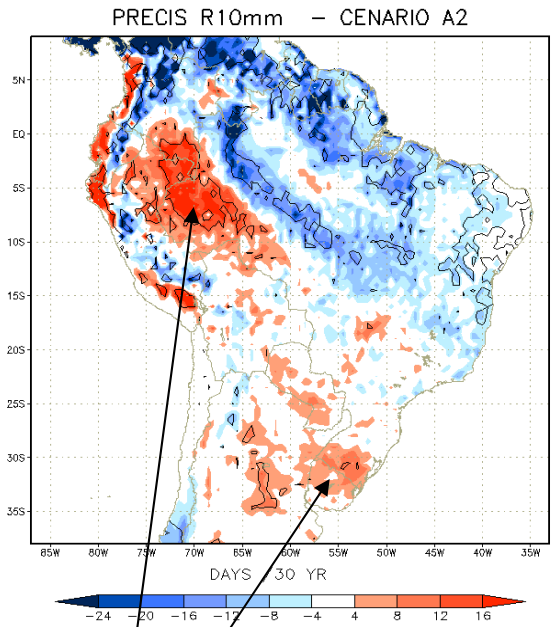
1961-90



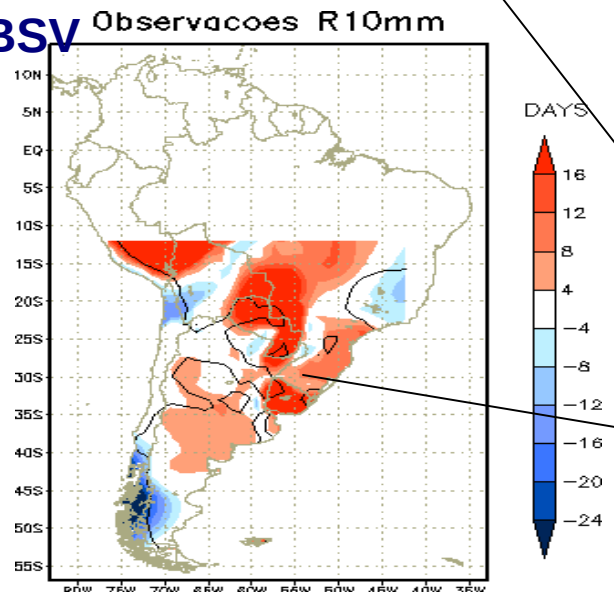
2071-2100, B2



2071-2100, A2



OBSV



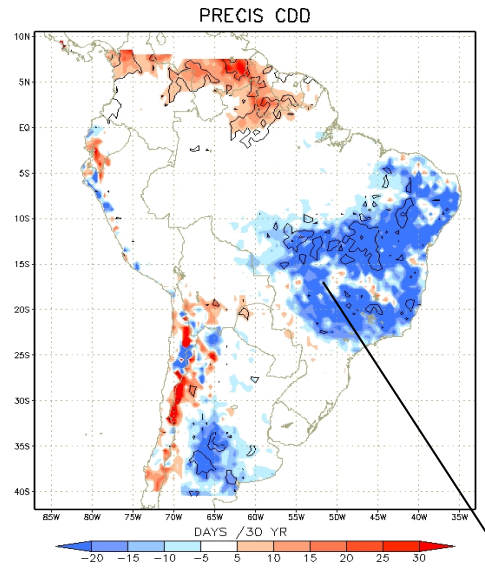
Increase in the frequency of intense rainfall events until 2100

Increase in the frequency of intense rainfall events during 1961-2000

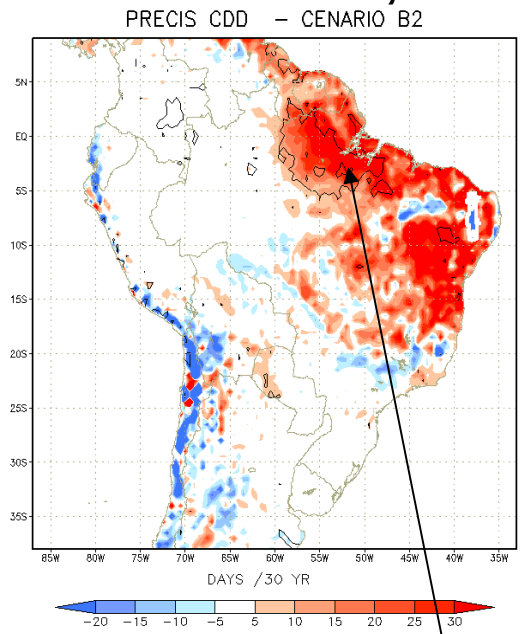
Consecutive dry days index (CDD) [(2071-2100)- (1961-90)]

HadRM3

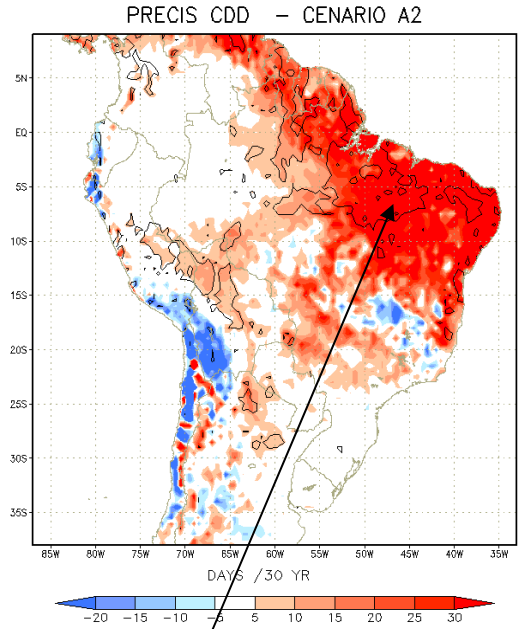
1961-90



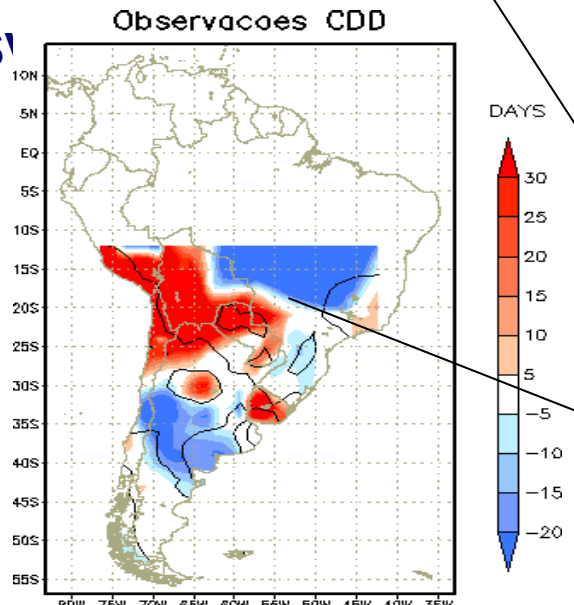
2071-2100, B2



2071-2100, A2



OBS

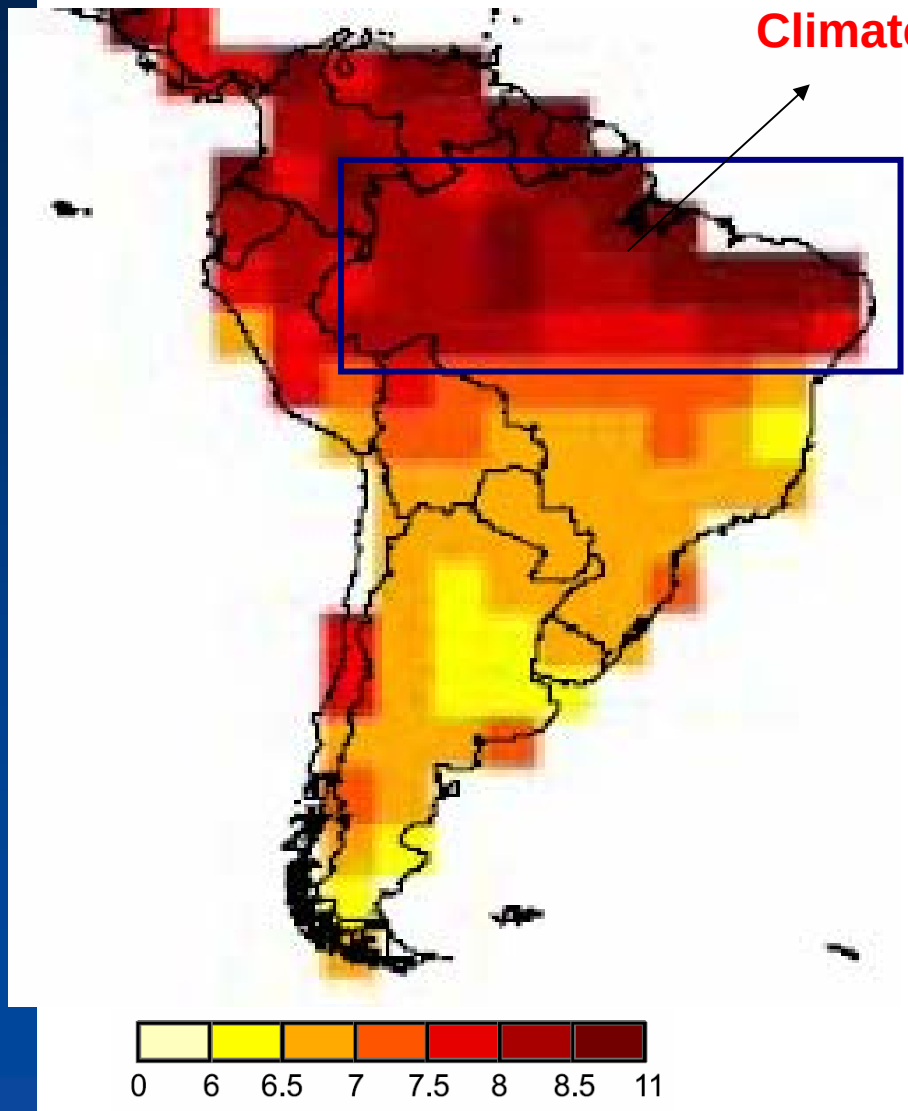


Increase in the frequency of consecutive dry days until 2100

Reduction in the frequency of consecutive dry days during 1961-2000

The aggregated CCI (Climate Change index) on a grid basis for South America, for the 2071-2100 period in relation to 1961-90. (Baettig et al. 2007).

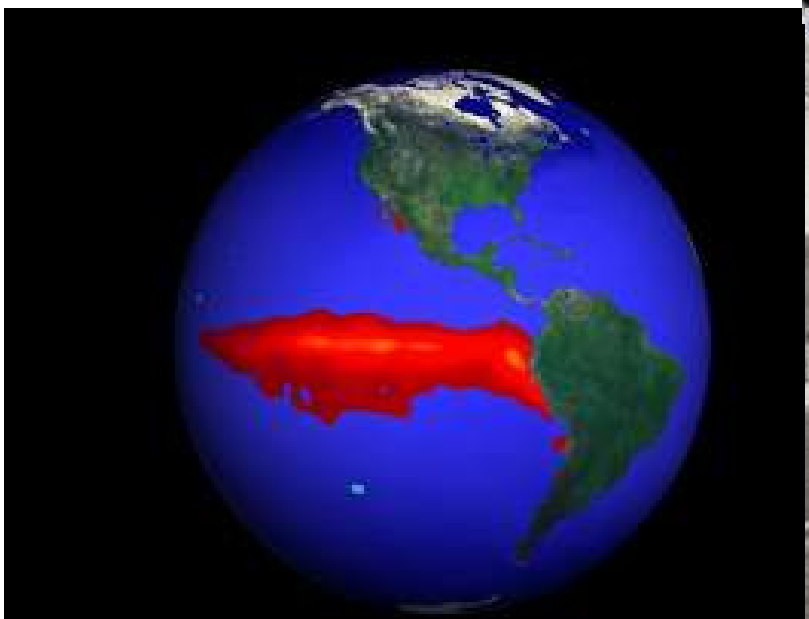
Regions more vulnerable to Climate Change



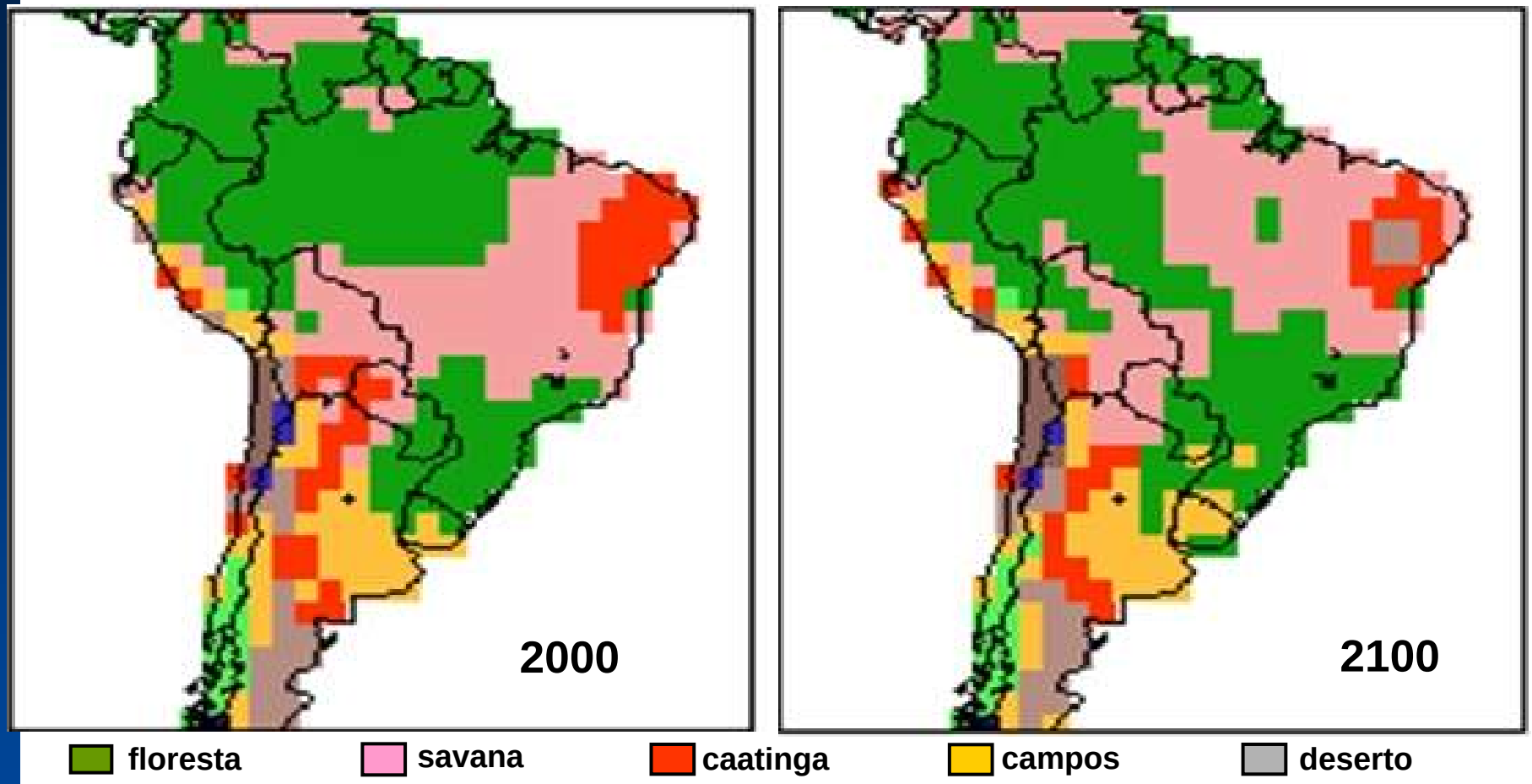
The CCI indicates that climate will change most strongly relative to today's natural variability in the tropics. The high CCI-values in the tropics are caused by precipitation changes but also seasonal temperature events. Concerning strong temperature changes, it has to be noted that in the tropics the hot temperature indicator responds more strongly to absolute changes in mean than elsewhere, because natural temperature variability is much smaller in the tropics than in higher latitudes.

According to the CCI, climate is expected to change more strongly relative to today's natural variability in these more vulnerable countries than in many countries with a high HDI and thus lower vulnerability.

Fenômeno El Niño, as projeções climáticas mostram poucas evidências de mudanças na amplitude do fenômeno nos próximos 100 anos. Porém, há possibilidades de uma intensificação dos extremos de secas e enchentes que ocorrem durante eventos quentes de El Niño.



Futuro dos Biomas Amazônicos?

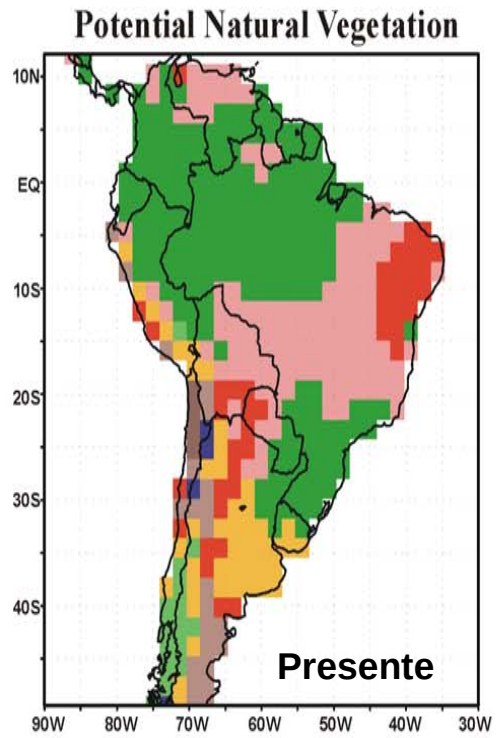


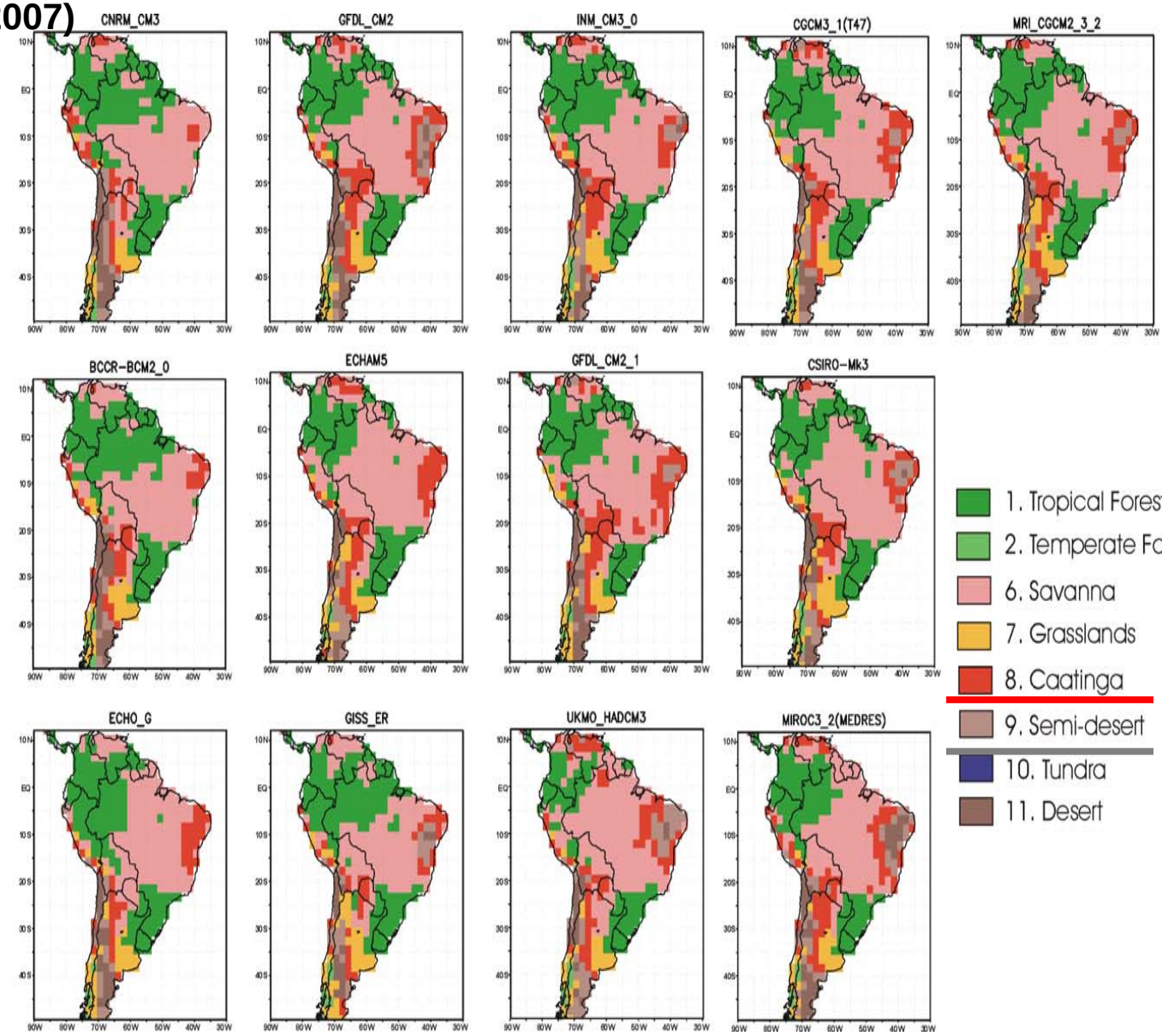
Savanização da Amazônia: um estado de equilíbrio na relação bioma-clima?

fonte: Oyama and Nobre, 2003

Vegetação natural projetada pelos modelos de IPCC AR4 – ano 2100

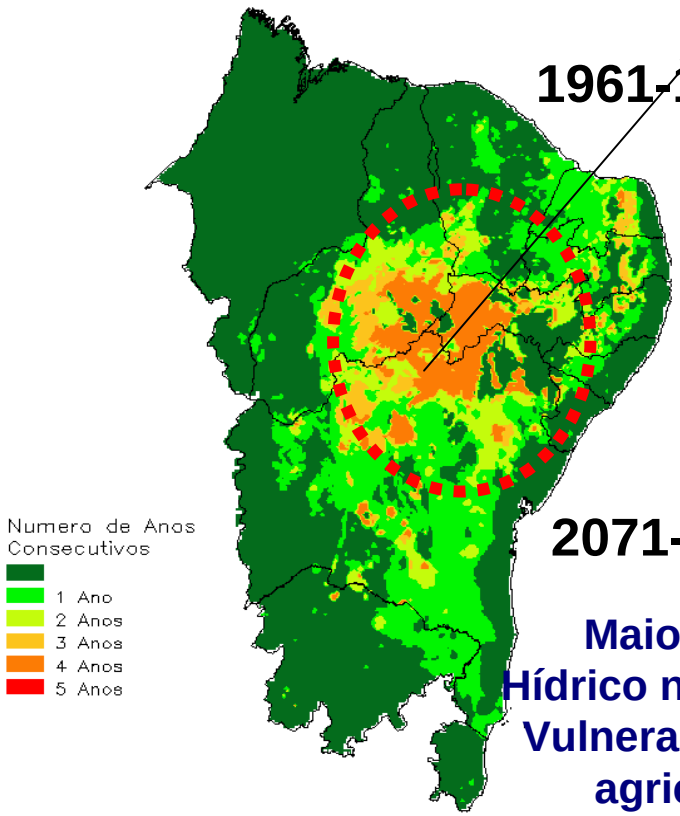
Impactos da mudança de clima na vegetação natural da America do Sul . Projeções de cenários de biomas para 2090-2100, derivados de 15 modelos de IPCC para o cenários A2 (Salazar et al. 2007)





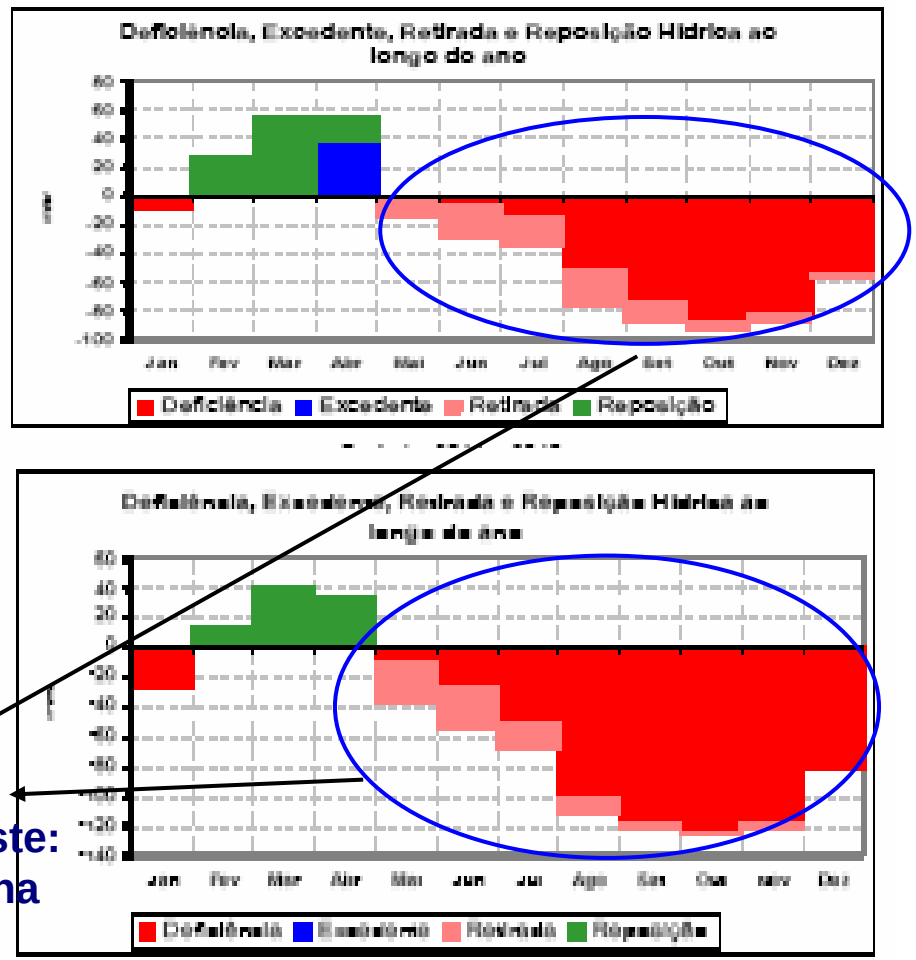
Impactos Severos nos Recursos Hídricos do Nordeste. Tendência a "aridização" da região semi-árida do Nordeste até final do Século XXI

Relevante ao:
PROGRAMA NACIONAL DE COMBATE À DESERTIFICAÇÃO E MITIGAÇÃO DOS EFEITOS DE SECA (PAN-Brasil)



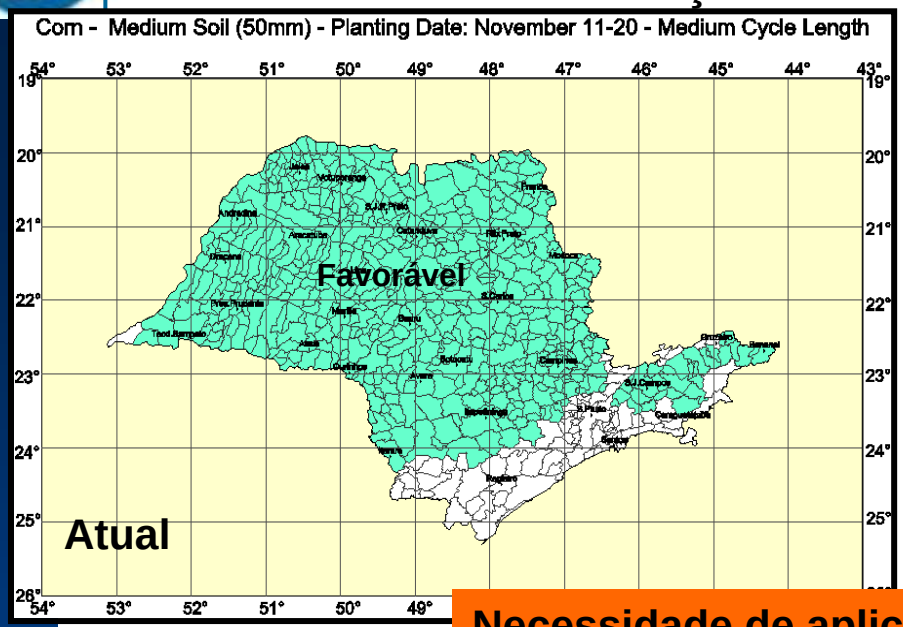
Maior Déficit Hídrico no Nordeste: Vulnerabilidade na agricultura!

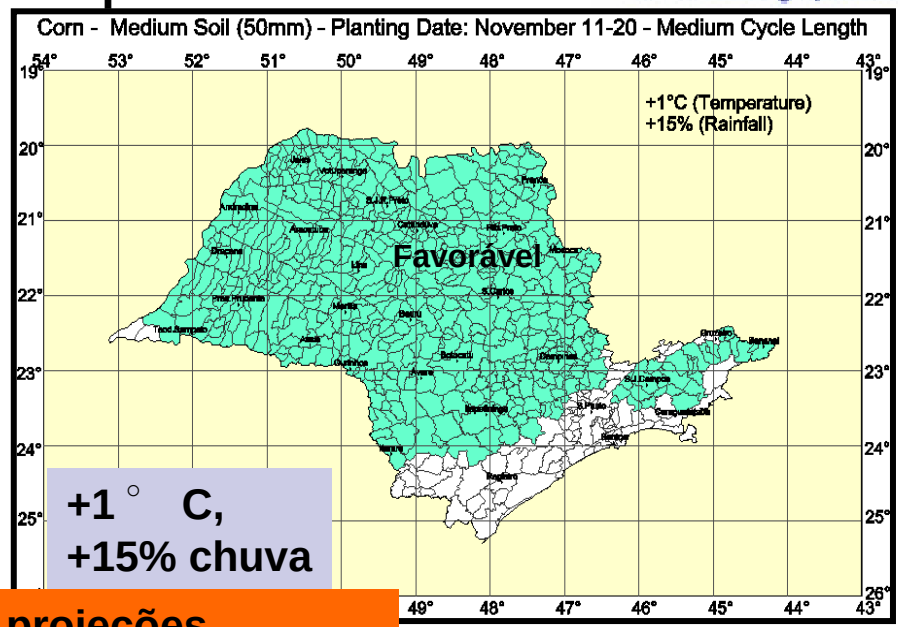
Balanço Hídrico-Nordeste



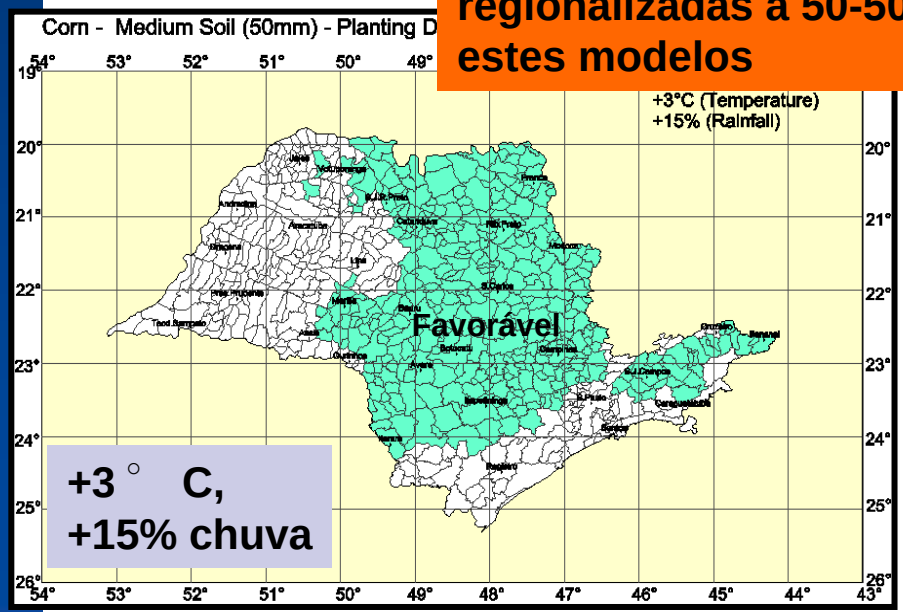
Fontes de dados: CMCD/INPE-INMET-FUNCEME/CE-LMRS/PB-EMPARN/RN-DMRH/PE SRH/BA-NMRH/AL-SEAAB/PI-SRH/SE-CEMIG/SIMGE/MG-SEAG/ES

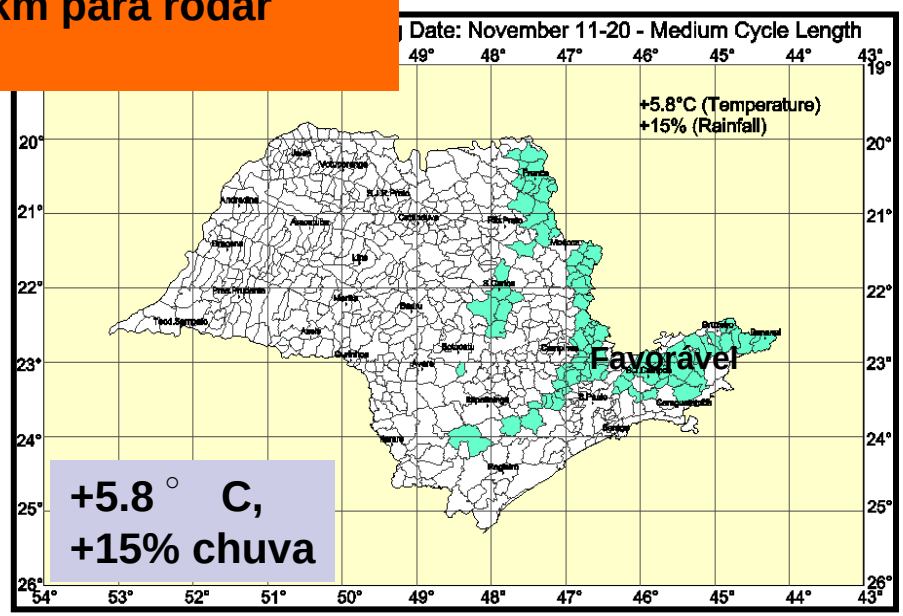
Mudança de clima e impactos no café





Necessidade de aplicar projeções regionalizadas a 50-50 km para rodar estes modelos





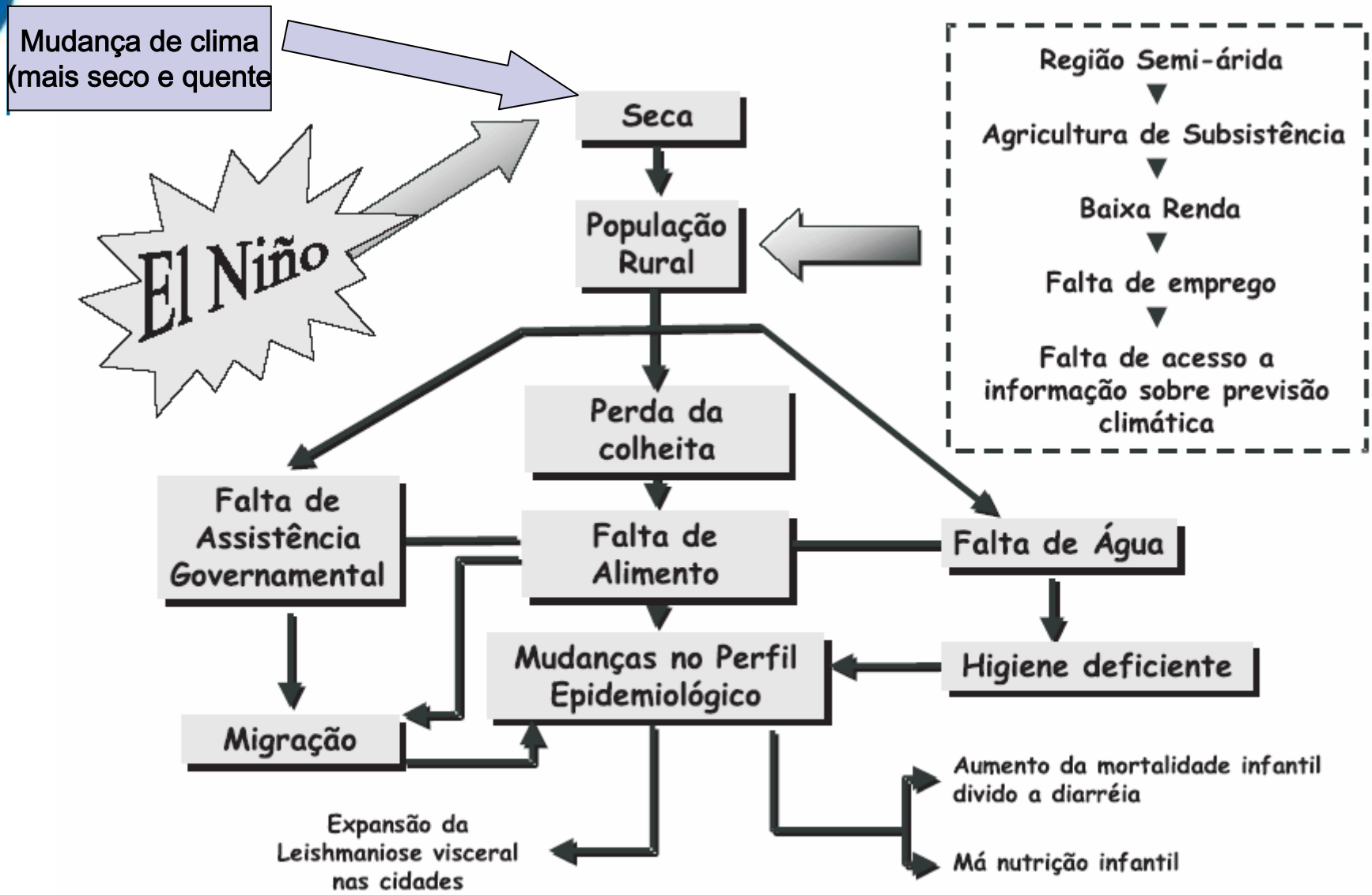


Figura 7. Vulnerabilidade social à seca no Nordeste brasileiro.

(NAE. 2005)

Cidade Maravilhosa sem praias

AQUECIMENTO GLOBAL ■ Especialistas traçam cenário de catástrofe para o Rio de Janeiro com a subida da temperatura e do nível do mar

Juliana Anselmo da Rocha

Até o ano 2100, a Cidade Maravilhosa pode perder um de seus maiores encantos: as praias. A partir da opinião de especialistas, o JB projetou um cenário crítico para o futuro da cidade com o aquecimento global.

Pesquisas sobre o impacto do efeito estufa no Brasil divulgadas pelo ministério do Meio Ambiente colocam o Rio de Janeiro entre as áreas mais vulneráveis à subida do nível do mar – entre 40 centímetros e 1,5 metro.

– O Rio é particularmente frágil pela número de atividades na costa – observa o professor de meteorologia da UFRJ, Isimar Santos. – Suas montanhas restringem a faixa de terreno que pode ser ocupada. A produção industrial e a população se concentraram à beira-mar.

Prainha, Macumba, Praia da Barra, São Conrado, Leblon, Ipanema e Arpoador sofrerão mais com a erosão. Grandes ressacas – hoje a cada dois ou quatro anos – se tornarão anuais e "comerão" a faixa de areia. Em anos atípicos, a fúria do mar ocorrerá de duas a três vezes.

– Ressacas violentas como a de 2002, que tomou a praia da Barra, se tornarão freqüentes – garante o professor do departamento de análise geoambiental da UFF, Júlio César Wasserman. – A água avançará até duas quadras em bairros como Leblon e Ipanema, alcançando vias principais como a Ataulfo de Paiva e a Visconde de Pirajá.

Mais freqüentes serão as tempestades. Os ventos atingirão velocidades de ciclones. O professor do programa de engenharia oceânica da Coppe-UFRJ, Paulo Cesar Rosman, acredita que "as janelas dos prédios na orla serão arrebentadas".

Uma mureta de contenção com cerca de 40 centímetros de altura seria necessária para assegurar o passeio tranqüilo em torno da Lagoa Rodrigo de Freitas daqui a 100 anos. Mas estragaria a vista do espelho d'água.

– A proteção não precisaria ser muito alta porque nas lagoas a força das ondas é pequena – explica Wasserman.

As mudanças se somarão à poluição do despejo irregular de esgoto na Lagoa Rodrigo de Freitas para causar um aumento da mortandade de peixes. Mas, para o especialista, mais afetada seria a Lagoa da Barra.

– Os manguezais do entorno serão dizimados – aposta. – Os pescadores, que já reclamam da escassez de peixes, terão ainda mais dificuldade.

Enise Valentim, da Coppe-UFRJ, completa que as ressacas poderão provocar o rompimento do cordão frontal de areia da Lagoa da Barra, "permitindo que o mar galgue para dentro e altere sua salinidade".

Sem a cobertura vegetal nos morros ocupados pelas favelas, a terra das encostas fica fofa, e os deslizamentos "matarão centenas", para Wasserman. O alerta vale para quedas constantes de barreiras em estradas da Região Serrana por causa das chuvas.

Mas a água não é o único problema. Com o calor, aumentam os mosquitos e os surtos de dengue e até de febre amarela.

Embora admitam os impactos na geografia carioca, os pesquisadores divergem quanto à sua intensidade.

– Não é como se o mar fosse engolir as cidades litorâneas – alerta o pesquisador Instituto Nacional de Pesquisas Espaciais, José Antônio Marengo.

– Apenas a faixa de areia das praias encurtará.

Dúvidas também surgiram na divulgação em janeiro na França do relatório do Painel Internacional do Clima. Só há um consenso: as mudanças serão lentas, com tempo para criação de estratégias que reduzam os prejuízos.

Copacabana e a Baía serão menos afetadas

Quem gosta de praia contará com a so… Baía de G… nuar a jog… lhar nas … Botafogo … das na ba… frerão co… cas. A fa… Copacaba… neráveis, Rosman sugere o "en… pois mudam o traçado do lito… ação da areia. tanto, estruturas devem ser empre… s em último caso, visória – aos quebra-mares.

Para os morros, reflorestamento e retirada das casas das áreas de risco seriam as opções.

Rio estuda ação preventiva

De acordo com o presidente do Instituto Municipal Pereira … sadas pelo plantio de árvores em vias urbanas e o aumento … restas… …o em …an. …etário …restas …Am… …obian… …ão do presidente Lula – esperada para este ano – o primeiro esboço do plano nacional de ação ficaria pronto em quatro meses.

…cimento global – revela.

As emissões de dióxido de carbono durante o Pan 2007, por exemplo, serão recompen-

Necessidade de projeções de elevação do nível no mar de uma forma mais quantitativa com estimações da incerteza

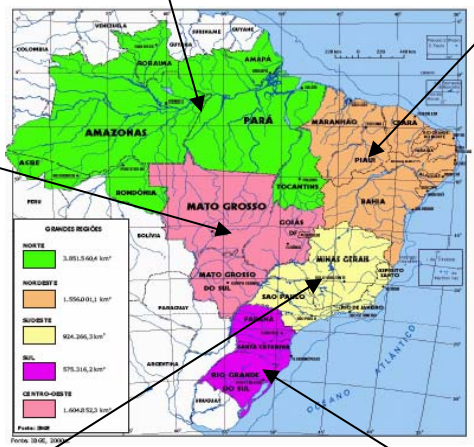
EM DIAS DE CALMARIA GALERIAS PLUVIAIS

Summary of future climate change scenarios for the end of the XXI Century and possible impacts in Brazil

AMAZON REGION
A2: 4-8 C warmer, 15-20% less rainfall
B2: 3-5 C warmer, 5-15 % less rainfall
Possible impacts: High frequency of dry spells in eastern Amazonia and intense rainfall events in western Amazonia, losses in natural ecosystems, rain forest and biodiversity. Low river levels affecting transportation and commerce. Possible impacts on moisture transport and rainfall in Southeastern South America. Impacts on hydroelectric generation. More favorable conditions for spread of forest fires. Impacts on health and commerce due to smoke.

NORTHEAST BRAZIL
A2: 2-4 C warmer, 15-20% less rainfall
B2: 1-3 C warmer, 10-15 % less rainfall
Possible impacts: High frequency of dry spells and evaporation rates and low soil moisture levels affecting levels of channels and reservoirs. Losses in natural ecosystems caatinga.Tendency towards aridization and desertification in the semiarid region. Water scarsity. Waves of climate refugees migrating towards large cities agravating social problems. Impacts on human health

WEST CENTRAL BRAZIL
A2: 3-6 C warmer,
B2: 2-4 C warmer,
Possible impacts: High frequency of intense rainfall events and dry spells. High evaporation rates and lower soil moisture can affect agriculture (coffee) and hydroelectric generation. Soil erosion due to high temperatures and intense dry spells can affect agriculture and natural ecosystems Pantanal and cerrado.



SOUTHEASTERN BRAZIL
A2: 3-6 C warmer,
B2: 2-3 C warmer,
Possible impacts: High frequency of intense rainfall events. High evaporation rates and lower soil moisture can affect agriculture (coffee) and hydroelectric generation. High temperatures and intense rainfall can affect human health. Possible sea level rise.

Sources: INPE, MMA-PROBIO, EMBRAPA, CEPAGRI

SOUTHERN BRAZIL
A2: 2-4 C warmer, 5-10% more rainfall
B2: 1-3 C warmer, 0-5 % more rainfall
Possible impacts: High frequency of intense rainfall events, increase in warm nights frequency (reduction of cold nights). Intense rainfall and high evaporation due to dry spells can affect agriculture (weath and soybean). Losses in natural ecosystems. High temperatures and intense rainfall can affect human health

Mudanças Climáticas

Home | Visão | Missão | Pessoal | Pesquisa | Publicações | Parcerias | Contato

Projetos

GOF-UK-CPTEC

PROBIO

Protocolos Climáticos

Protocolo de Quioto

Protocolo de Montreal

Agenda 21

Destaques

Stern Review

Links Úteis

Internacionais

América Latina e Caribe

Contato

Grupo de Pesquisa em Mudança Climática (GPMC)

Enchente em SP - dez/2006
Fonte: Jornal Folha de S.Paulo

O GPMC tem como objetivo o desenvolvimento de pesquisas relacionadas ao tema da mudança climática, incluindo estudos obser- vacionais para caracteri- zar o clima do presente e sua variabilidade em longo prazo, assim como estudos de projeções de cenários climáticos futuros para caracterizar o clima no que resta do Século XXI para vários cenários de emissões de gases de efeito estufa. O GPMC é liderado pelo CPTEC/INPE. Entre os membros há pesquisadores que trabalham nas áreas de mudanças de clima, análises de vulnerabilidade, estudos de impactos, de instituições do calibre da Universidade de São Paulo-IAG (www.iag.usp.br), Fundação Brasileira de Desenvolvimento Sustentável (www.fbds.org.br), e futuras colaborações incluem interações com instituições do Governo Federal como EMBRAPA, INMET, FIOCRUZ, ANA, ANEEL, ONS entre outras, assim como com os centros estaduais de meteorologia, universidades, o FBMC e organizações não governamentais como a WWF, IMAZON e Greenpeace. O grupo também trabalha em conjunto com o Programa Nacional de Mudanças Climáticas do Brasil (www.mct.gov.br/index.php/content/view/3881.html), e com programas nacionais de alguns países da América do Sul.

O trabalho que está sendo desenvolvido pretende fornecer informação e projeções climáticas de forma a serem divulgadas e disponibilizadas pelos grupos de pesquisa climática e aplicada, assim como de apoiar os tomadores de decisão na formulação de políticas sobre o impacto das mudanças climáticas, a vulnerabilidade e as medidas de adaptação. Além disto, construir uma rede de pesquisadores, na procura de uma permanente cooperação entre os produtos da pesquisa científica e o processo de formulação e tomada de decisões.

Seca na Amazônia - maio/2005
Fonte: Ag. Reuters

Programas e Fóruns

Site de Mudanças Climáticas do MCT

IPCC

Fórum Capixaba de Mudanças Climáticas e Uso Racional da Água

Núcleo e Assuntos Estratégicos da Presidência da República

Eventos

IPCC-TGICA Regional Meeting Integrating Analysis of Regional Climate Change and Response Options. Nadi, Fiji. 20-22 June 2007.... **leia mais**

Climate Change and Hydrology Congress. - From 2007-03-27 to 2007-03-28. Venue: Lyon, France. **... leia mais**

Eventos Anteriores

Próximos Eventos

Publicações

Para Crianças

» ABC da Mudança Climática

Notícias

28/11/2006 - 22 March - World Day for Water 2007: Coping with Water Scarcity
World Water Day (WWD) 2007 will be guided by the theme 'Coping with Water Scarcity' under the leader » Notícia Completa

28/11/2006 - La Conferencia de las Naciones Unidas sobre Cambio Climático concluyó con decisiones de apoyo a países en vías de desarrollo
La Conferencia de las Naciones Unidas sobre Cambio Climático concluyó el pasado viernes 17 de noviem » Notícia Completa

28/11/2006 - Climate insurance urged for poor
The UN wants insurance companies to help protect the world's poor against the impacts of climate cha » Notícia Completa

Todas as Notícias »

Maiores informações a acesso aos dados

http://www.cptec.inpe.br/mudancas_climaticas/

Future activities

Applications:

-Use of Version 1 products for studies of impacts of climate change in agriculture (GOF-EMBRAPA-UNICAMP CEPAGRI-INPE)

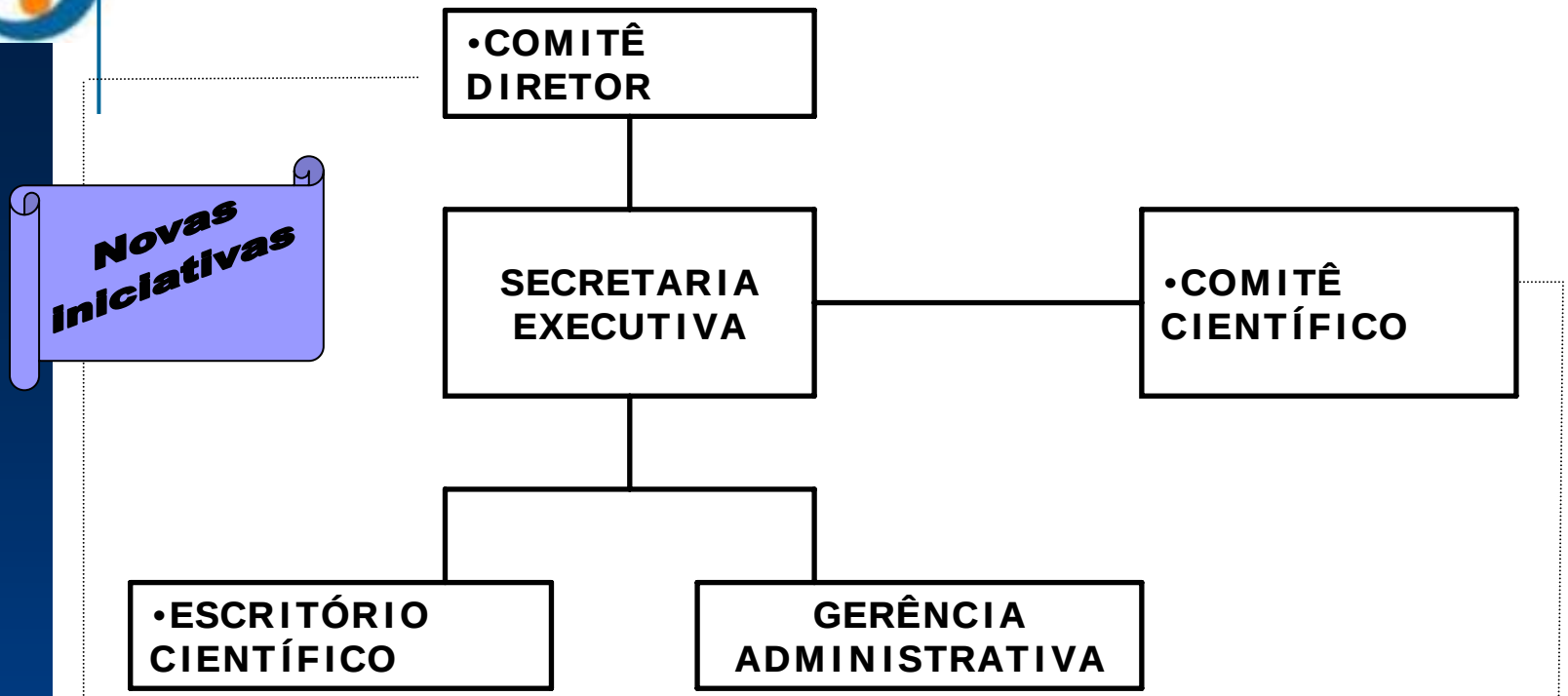
-Use of Version 1 products for assessmets of impacts of climate change in the hydroelectric matrix in Brazil: Madeiras, Xingu, Parana, Tocantins and São Francisco River Basins (GOF-WWF-INPE)

-Use of Version 1 products for studies and assessments on Migration, public health and security (GOF-UNICAMP-FIOCRUZ)

New developments (Version 2)

-Second National Communication of Brazil to UNFCCC-Generation of Version 2 of the climate change scenarios using 3 global models CCSM3, HadCM3 and ECHAM 5 and the Eta model at 40 km (UNDP-MCT-INPE)→South and Centra america→ Collaboration of the Hadley Centre

Rede Brasileira de Pesquisa em Mudanças Climáticas RBPMC



MEMBROS DO COMITÊ DIRETOR
Presidente: **MCT**
Ministérios: Saúde, Agricultura, Meio-Ambiente, Itamaraty, Educação, Integração Nacional, Defesa, Cidades, Educação
Estados: FAPESP e outras FAPs (a critério do Comitê Gestor)
Sociedade civil: ABC, SBPC
Fórum Brasileiro de Mudanças Climáticas

SUBREDES (Inst. Coordenadora)
Ciência do Sistema Terrestre (INPE) Energia (COPPE) Agricultura (EMBRAPA) Biodiversidade (MPEG) Saúde (FIOCRUZ) Cidades (UNICAMP) Políticas Públicas (IEA-USP) Amazônia (INPA) Negociações Internacionais (MCT)


O que fazer?
Comissão Mista Especial do Congresso Nacional para Mudanças Climáticas; CONAMA
Detecção e Atribuição (IPCC WG1, Relatório do INPE)
Avaliação de impactos e vulnerabilidade (IPCC WG2)
Rede Brasileira de Pesquisa em Mudanças Climáticas
Plano Nacional de Mudanças Climáticas
Brasil-Programa de Impactos Climáticos
Medidas de adaptação (IPCC WG2)
Estratégias de mitigação (IPCC WG3)
Políticas publicas ambientais (combate a desmatamento, desertificação...)
Combatir a aquecimento global
Enfrentar mudanças climáticas