

Assessment of Climate change impacts on grain crops for the Southern Brazil – projections from SA CORDEX

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Embrapa Temperate Climate, Embrapa

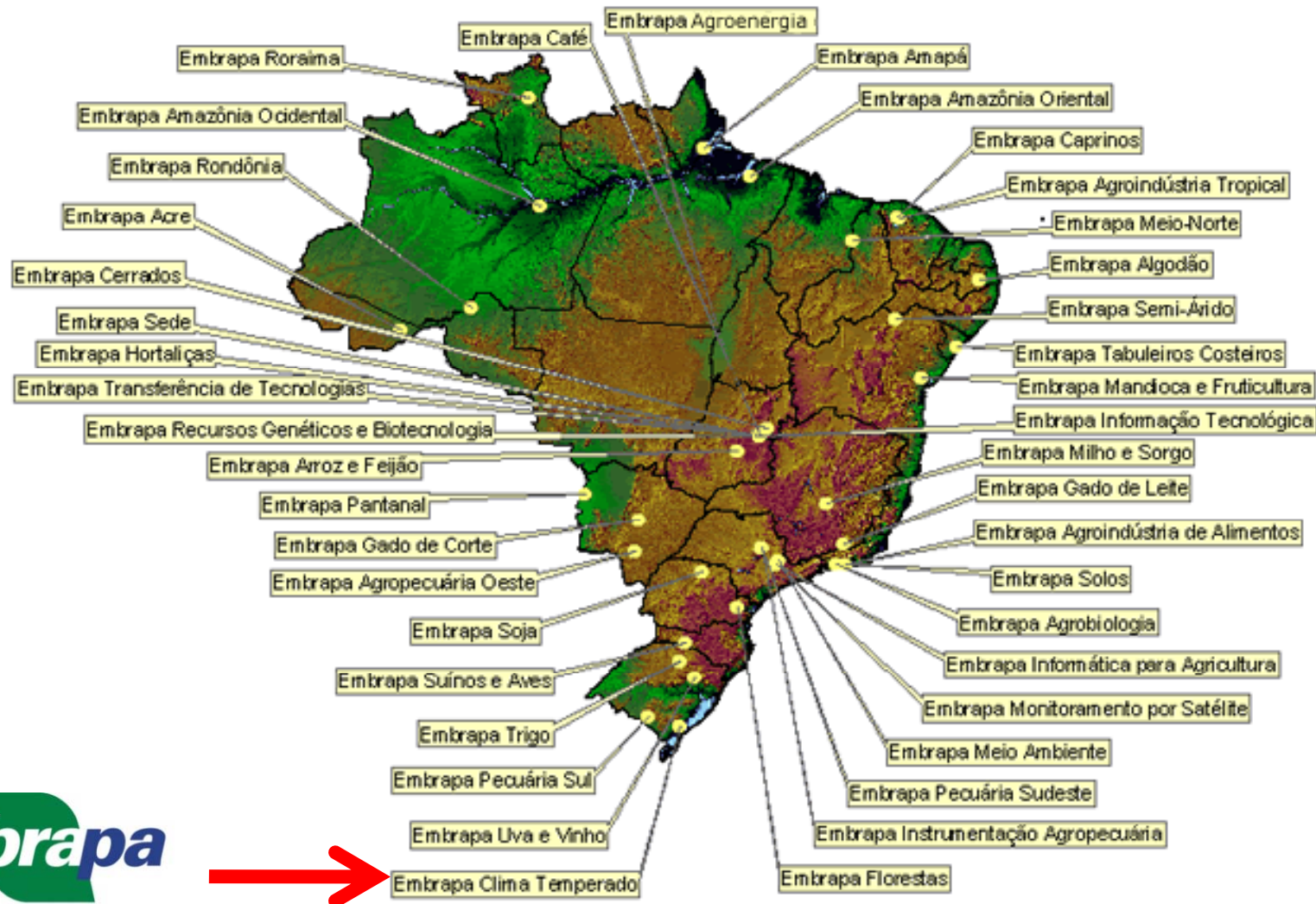
The Embrapa logo, consisting of the word "Embrapa" in a bold, blue, sans-serif font, with a green leaf-like graphic element behind the letter 'a'.

Clima Temperado




The Embrapa 40 logo, featuring the word "Embrapa" in blue, followed by the number "40" in a stylized green font with a leaf-like graphic.

Embrapa

. Help Brazil to achieve a competitive and sustainable agriculture

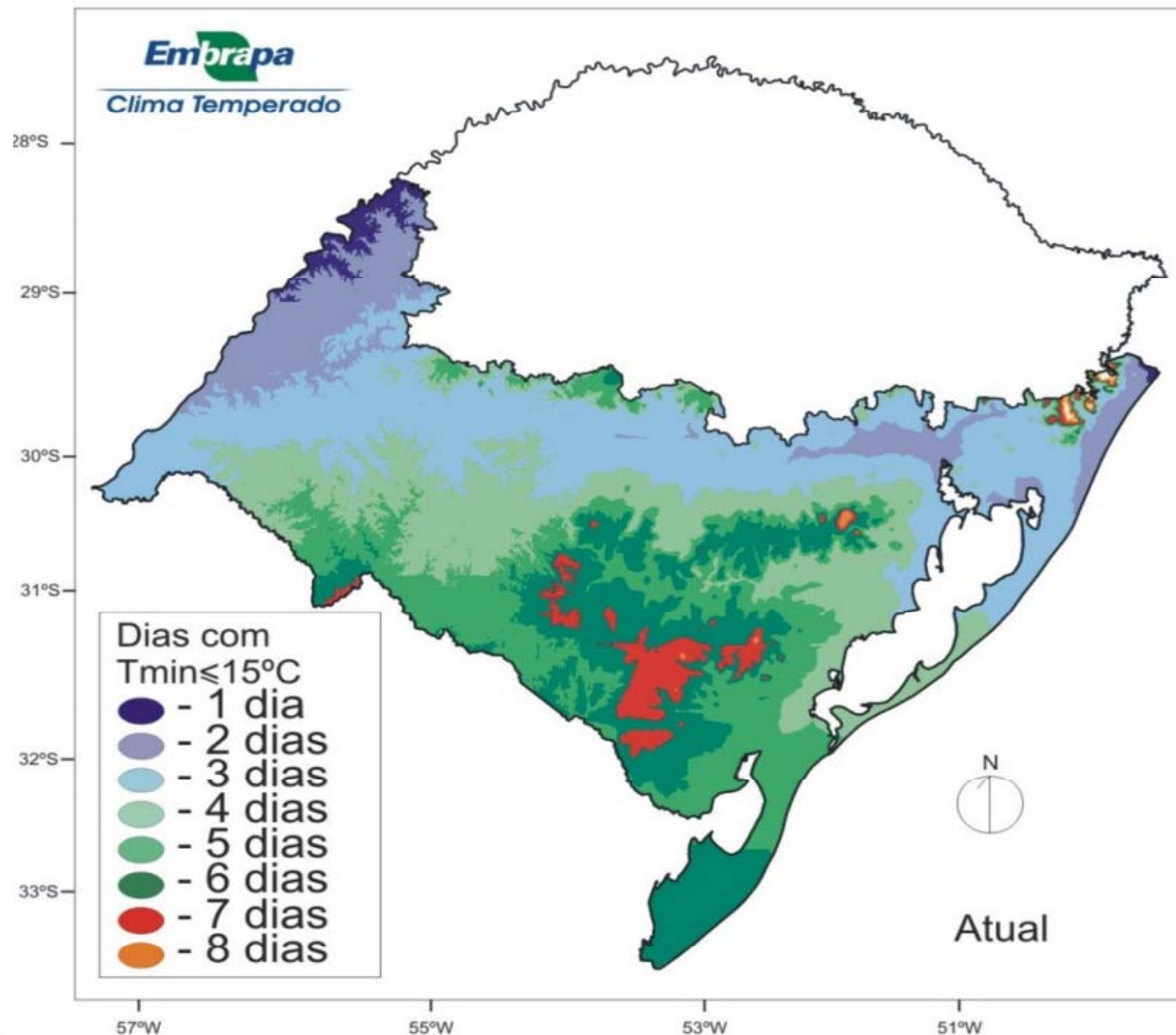


.Climate Change & Agriculture

| Mitigation (of climate change) | | Adaptation |
|--|--|---|
| A human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHG). | | Initiatives to reduce the vulnerability of natural and human systems against actual or expected climate change effects. |
| Driver (Climate Change) | Mitigation | Adaptation |
|  |  |  |

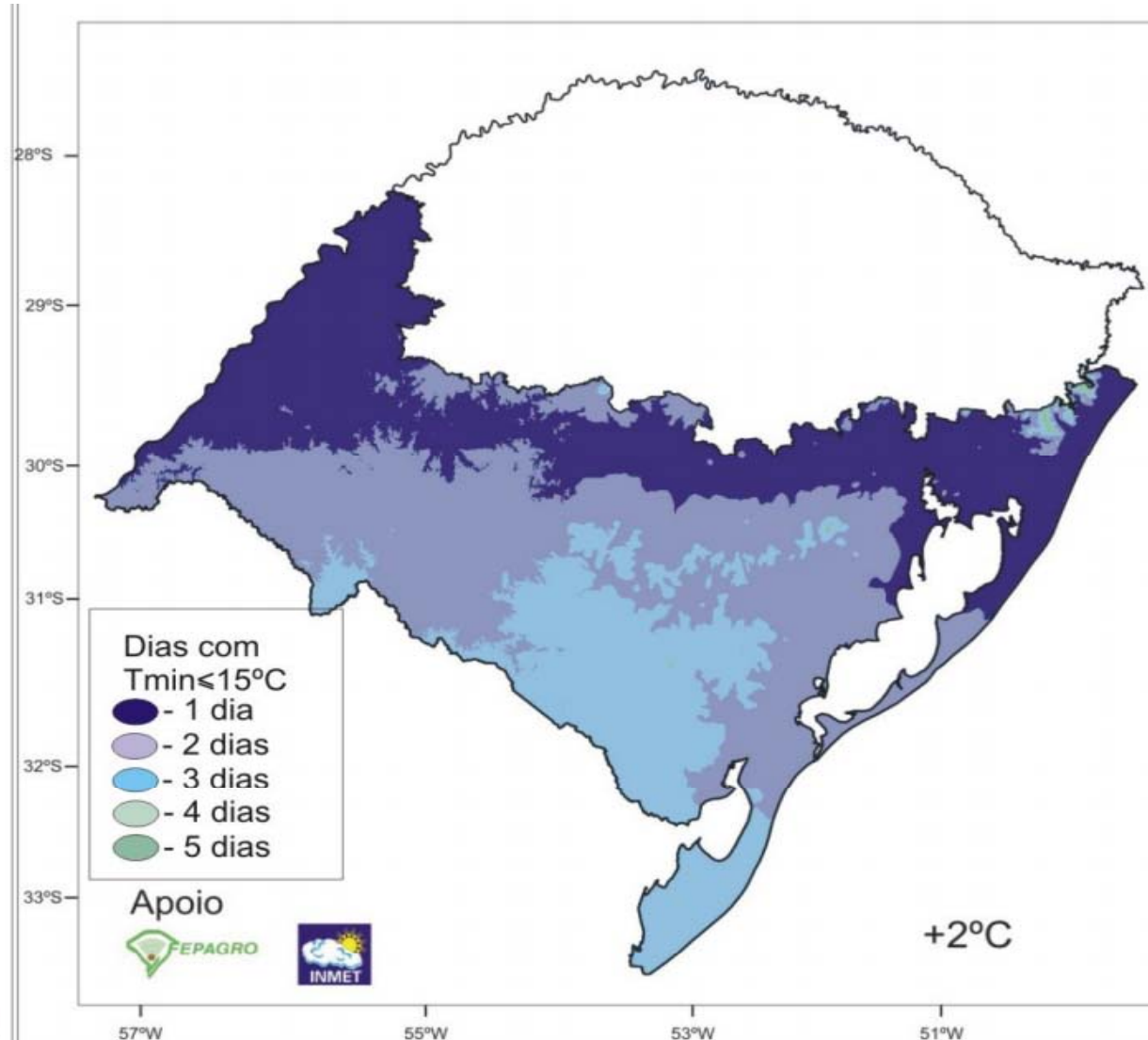
Impacts of atmosphere warming

- Risk reduction of damages associated with low temperature in Rice over RS



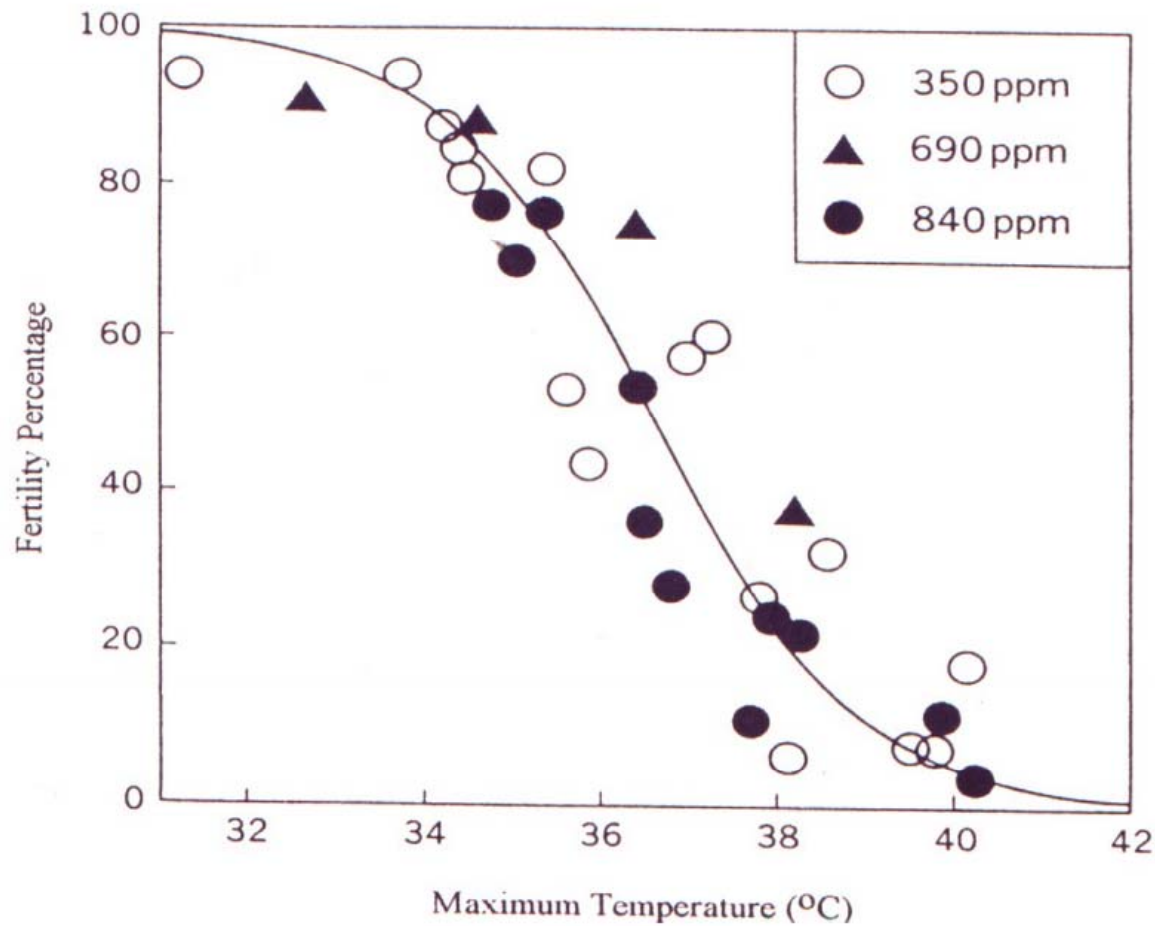
. Impacts of atmosphere warming

. Risk reduction of damages associated with low temperature in Rice over RS



Impacts of atmosphere warming

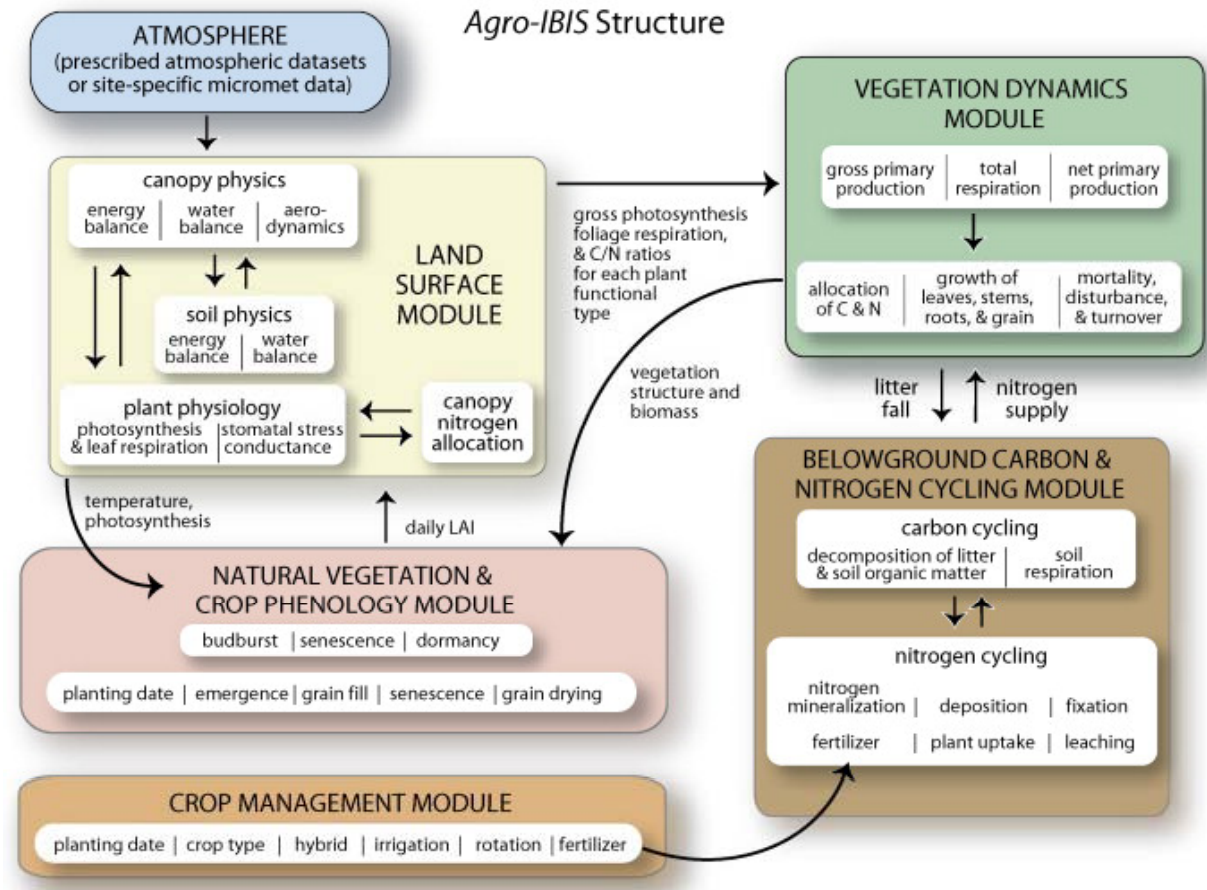
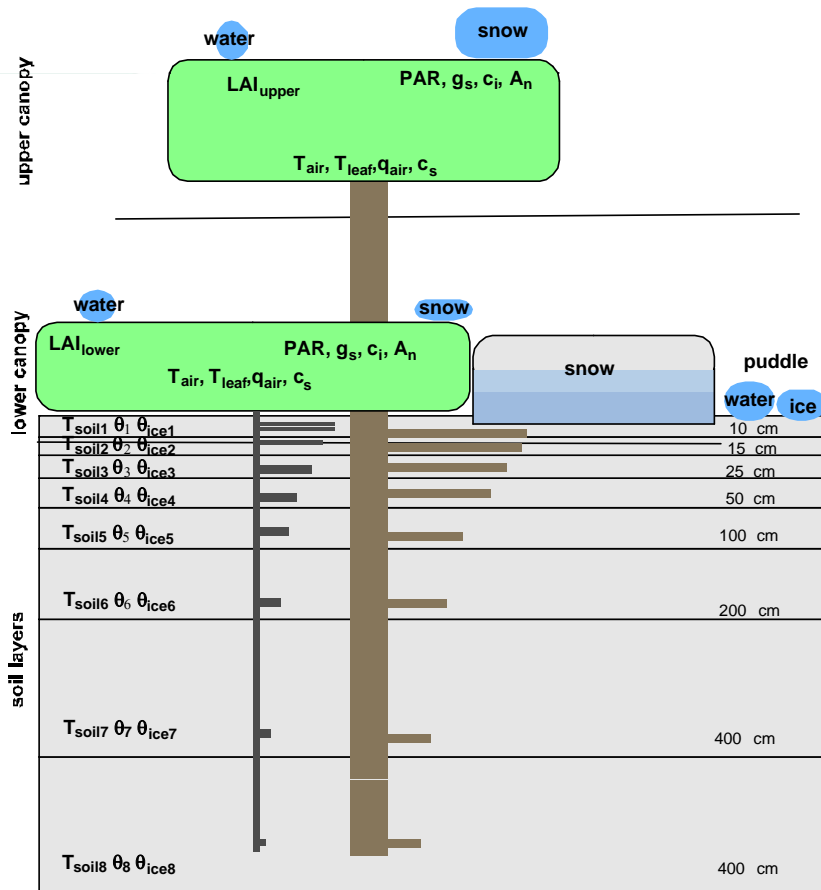
- Risk increase of damages associated with high temperature in Rice over RS



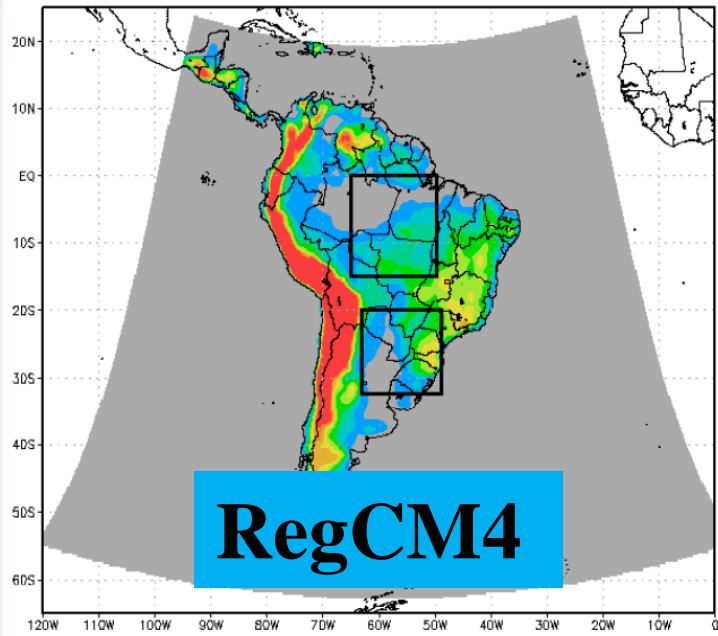
.Climate Change & Agriculture

Models as a tool to scaling-up and test hypothesis: Mitigation and Adaptation

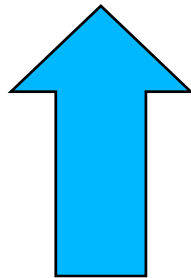
» Biophysical Models



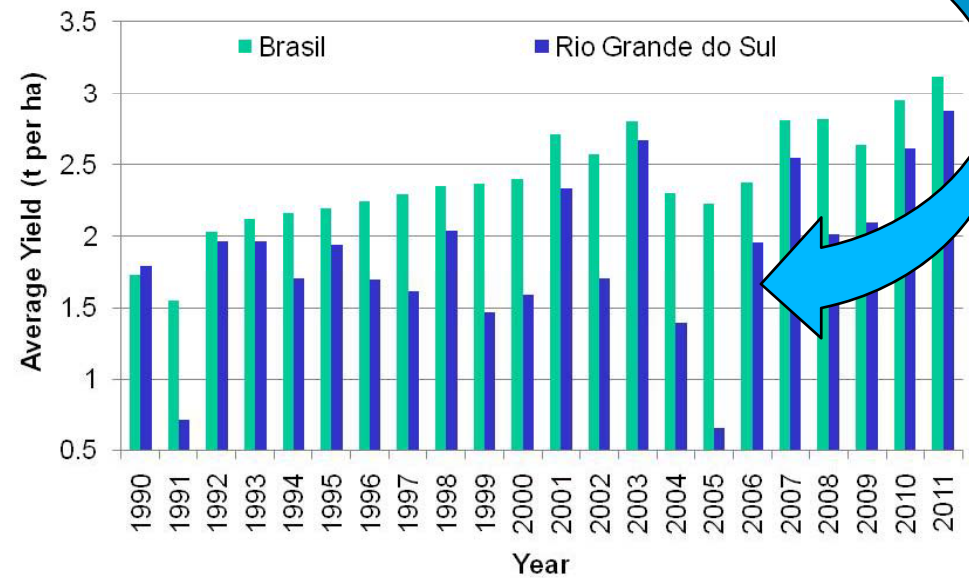
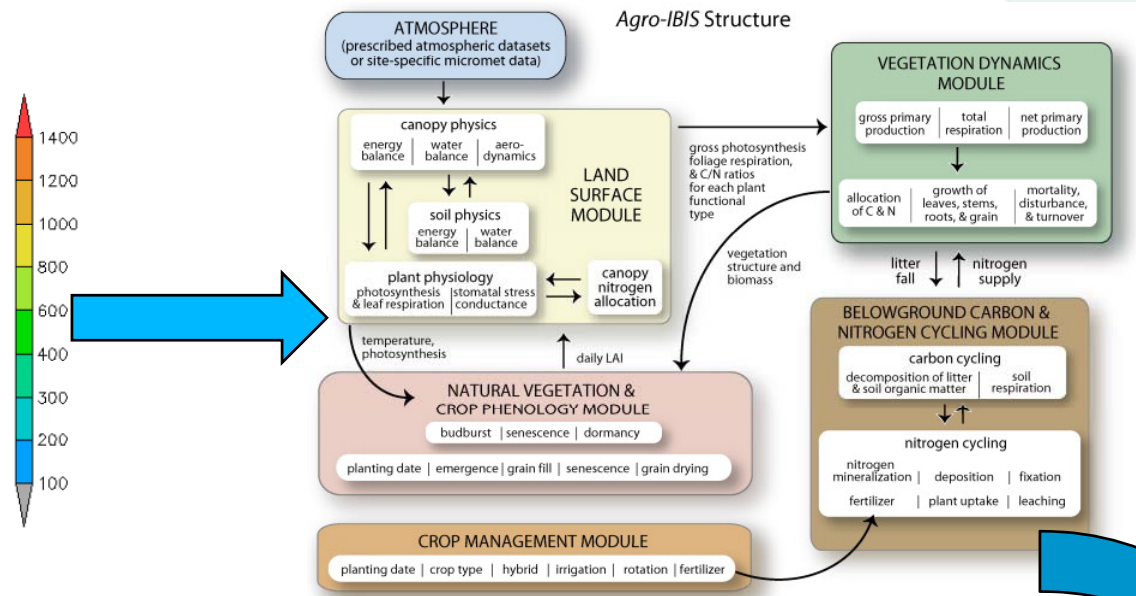
Methodology



- HadGEM
- GFDL
- MPI



Agro-IBIS

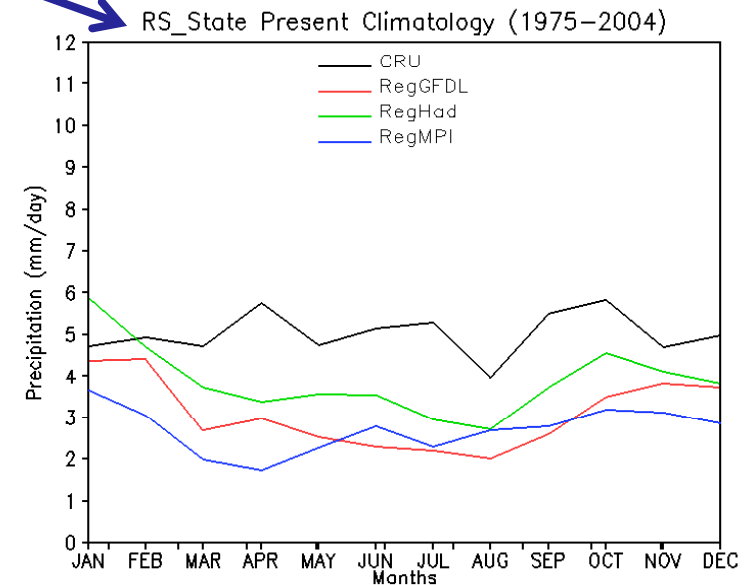
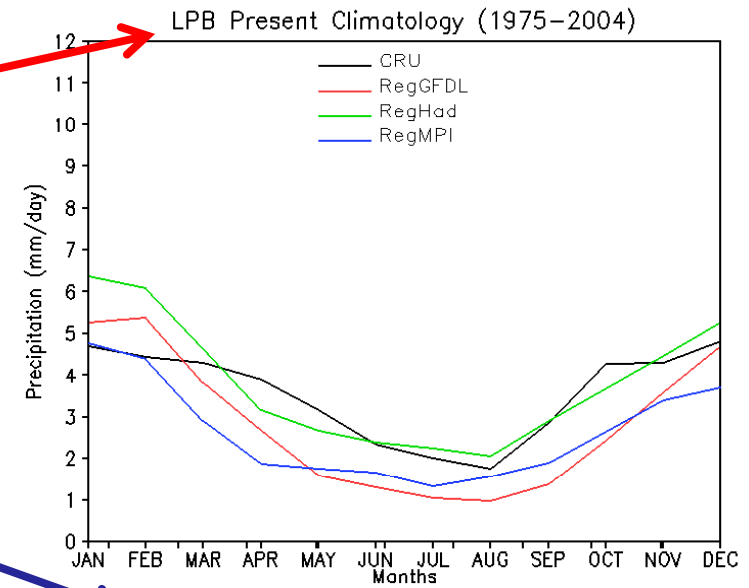
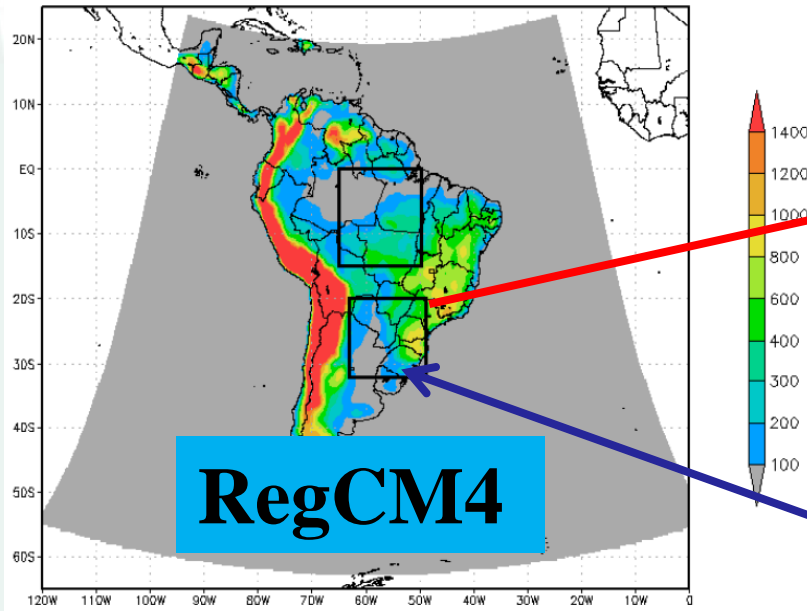


Methodology – RegCM4

Climatic Change

Climate change impact on precipitation for the Amazon and La Plata basins
--Manuscript Draft--

Marta Pereira Llopert, M.D



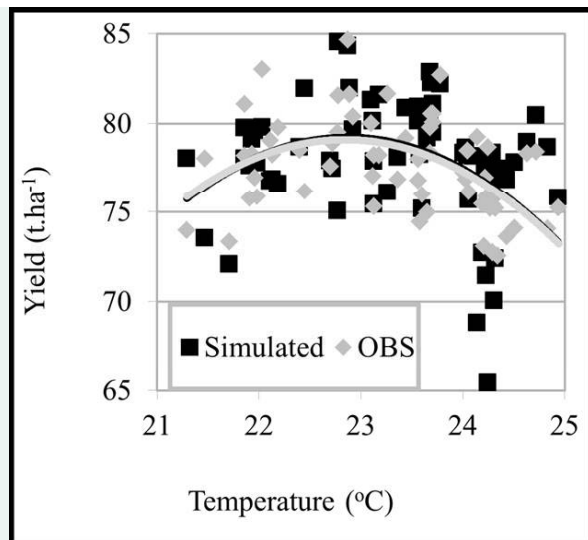
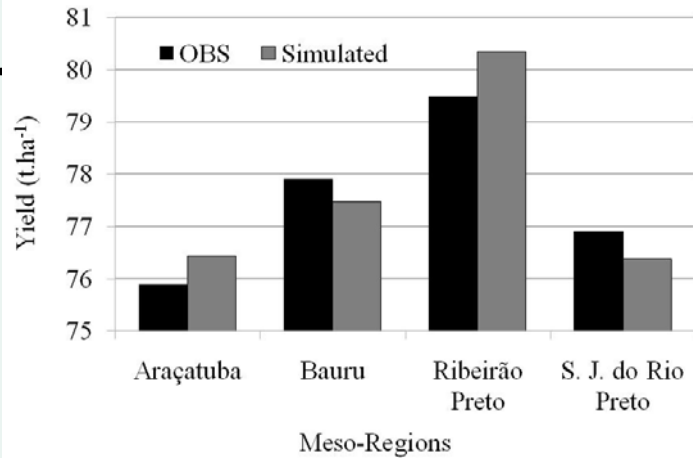
. An ensemble of four 21st century projections (1970-2100, RCP8.5 scenario) with the regional climate model (RCM) RegCM4 driven by the HadGEM, GFDL and MPI global climate models (GCMs) over the SA CORDEX domain.

.Validations of Agro-IBIS over Brazil

GCB Bioenergy (2011), doi: 10.1111/j.1757-1707.2011.01105.x

A biophysical model of Sugarcane growth

S. V. CUADRA*†, M. H. COSTA†, C. J. KUCHARIK‡, H. R. DA ROCHA§, J. D. TATSCH§, G. INMAN-BAMBER¶, R. P. DA ROCHA§, C. C. LEITE† and O. M. R. CABRAL||



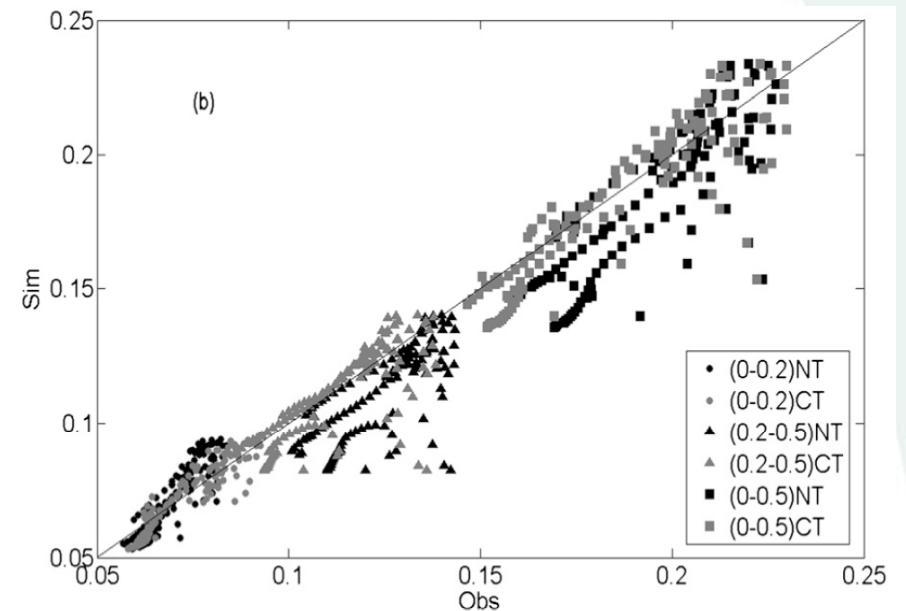
Earth Interact., **16**, 1–15.

Evaluation of a Dynamic Agroecosystem Model (Agro-IBIS) for Soybean in Southern Brazil

Geovane Webler and Débora Regina Roberti*

Physics Department, Federal University of Santa Maria, Santa Maria, Brazil

Santiago Vianna Cuadra



Scatterplot between simulated and experimental soil volumetric water content data for the 0–0.2-, 0.2–0.5-, and 0–0.5-m layers.

Applications

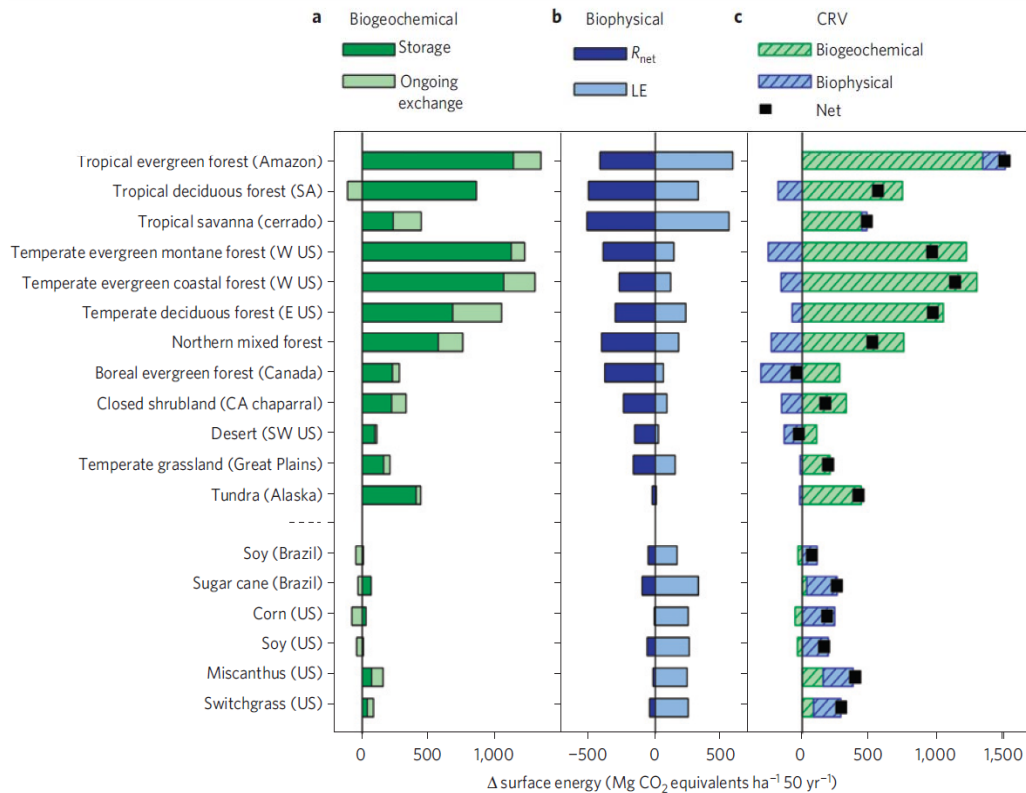
nature
climate change

LETTERS

PUBLISHED ONLINE: 10 JANUARY 2012 | DOI:10.1038/NCLIMATE1346

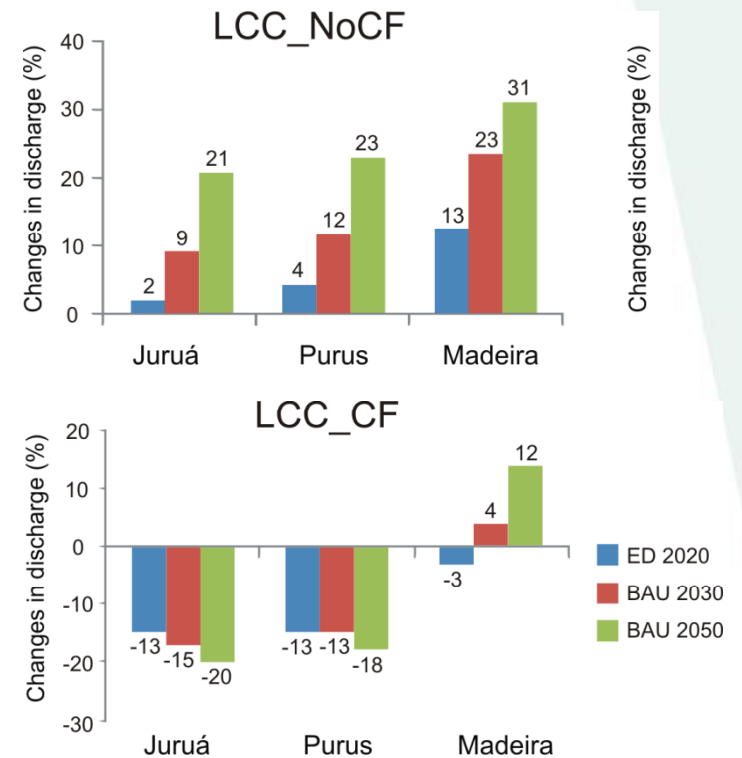
Climate-regulation services of natural and agricultural ecoregions of the Americas

Kristina J. Anderson-Teixeira^{1,2,3}, Peter K. Snyder⁴, Tracy E. Twine⁴, Santiago V. Cuadra⁵, Marcos H. Costa^{6,7} and Evan H. DeLucia^{1,2,3*}



Landscape Ecology Feedbacks between deforestation, climate, and hydrology in the Southwestern Amazon: implications for the provision of ecosystem services

--Manuscript Draft--

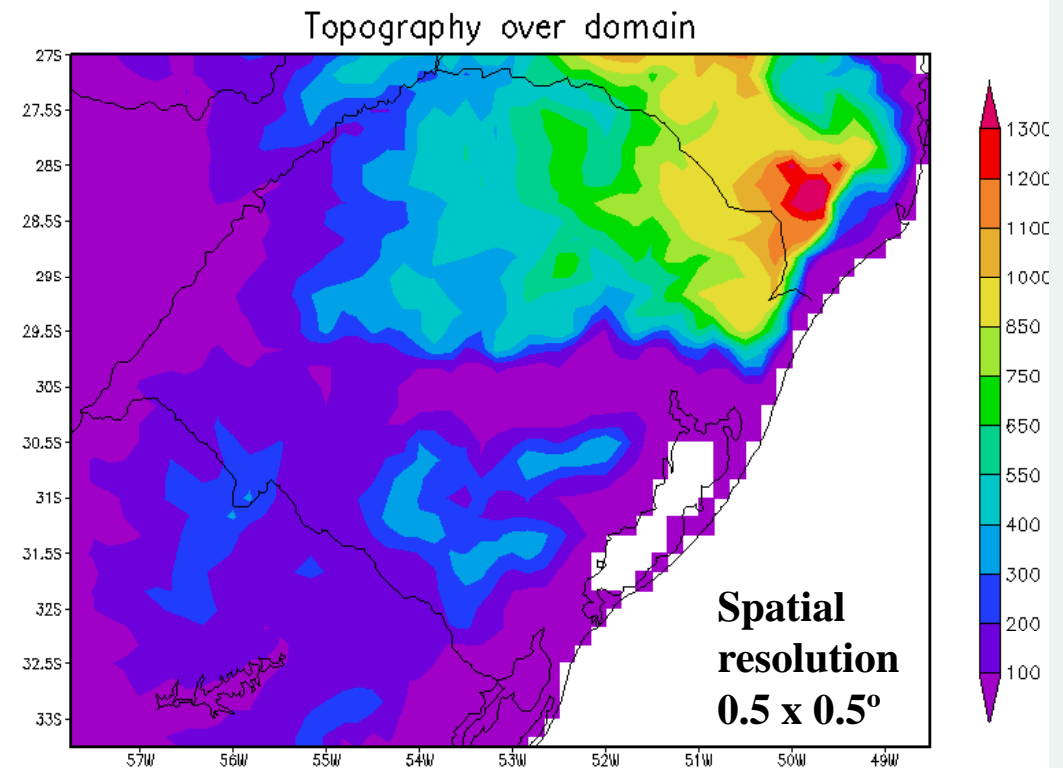


. Methodology: Simulations over Rio Grande do Sul State

- **Present Climate:**
- **CRU3.0 (1988-2006)**

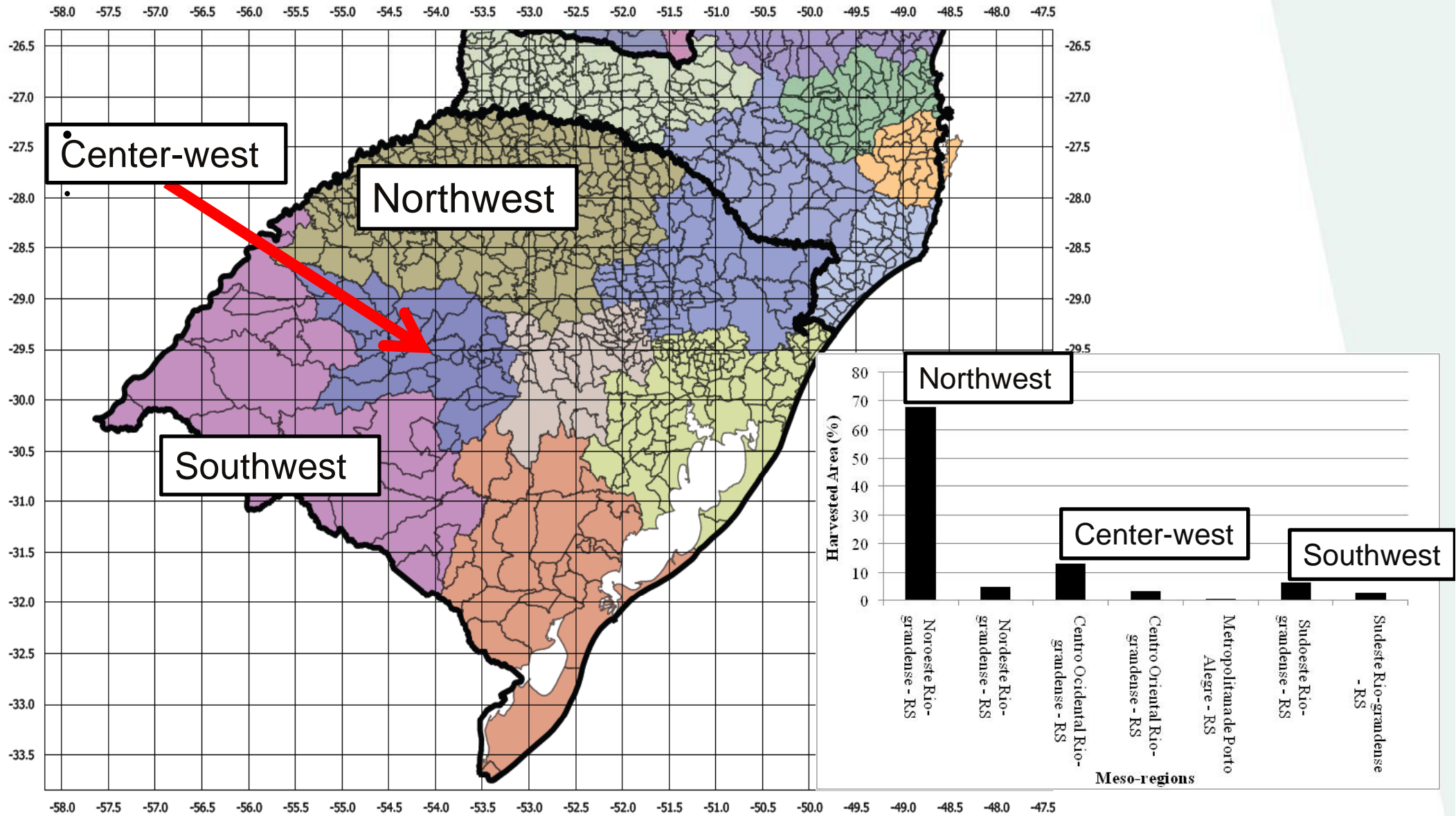
- **Future Climate:**
- **CRU3.0 + RegCM4 (Anomaly)**

$$\text{Anomaly} = T_{(2069-2098)} - T_{(1975-04)}$$



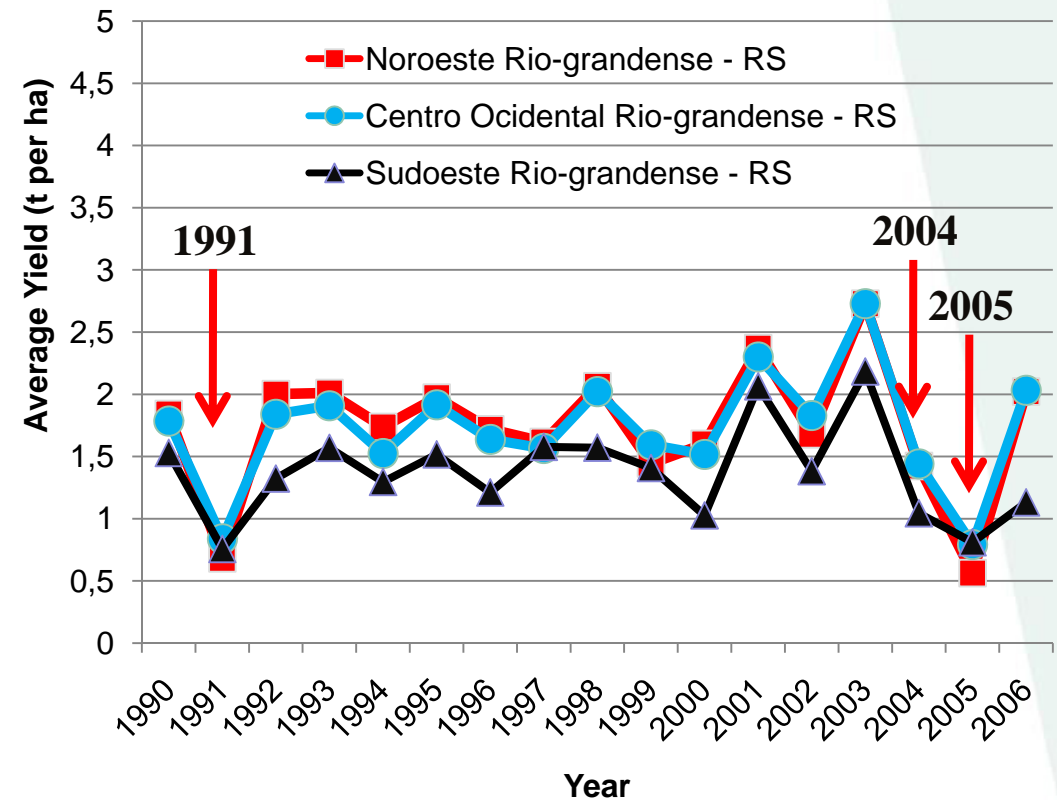
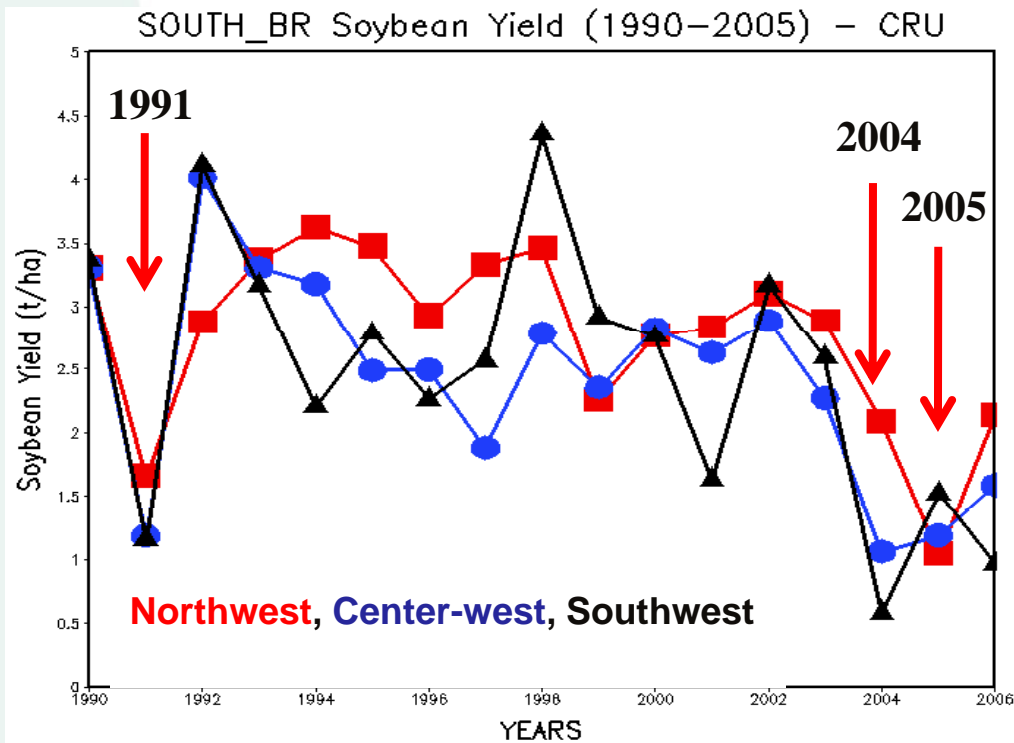
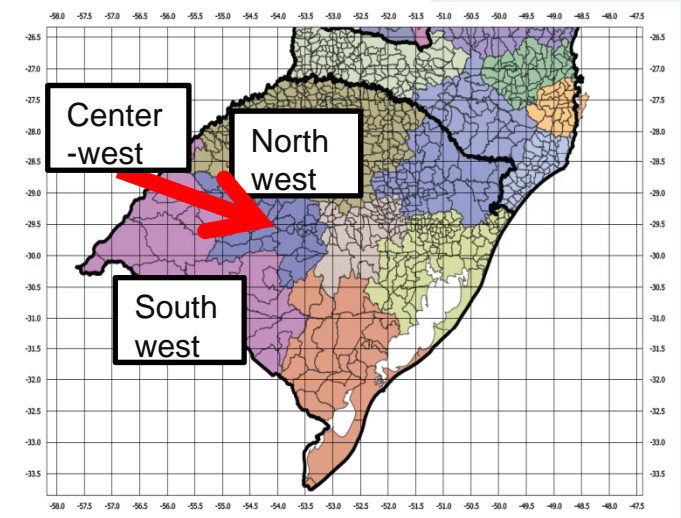
Results

Soybean Yield over the tree main meso-regions of RS state



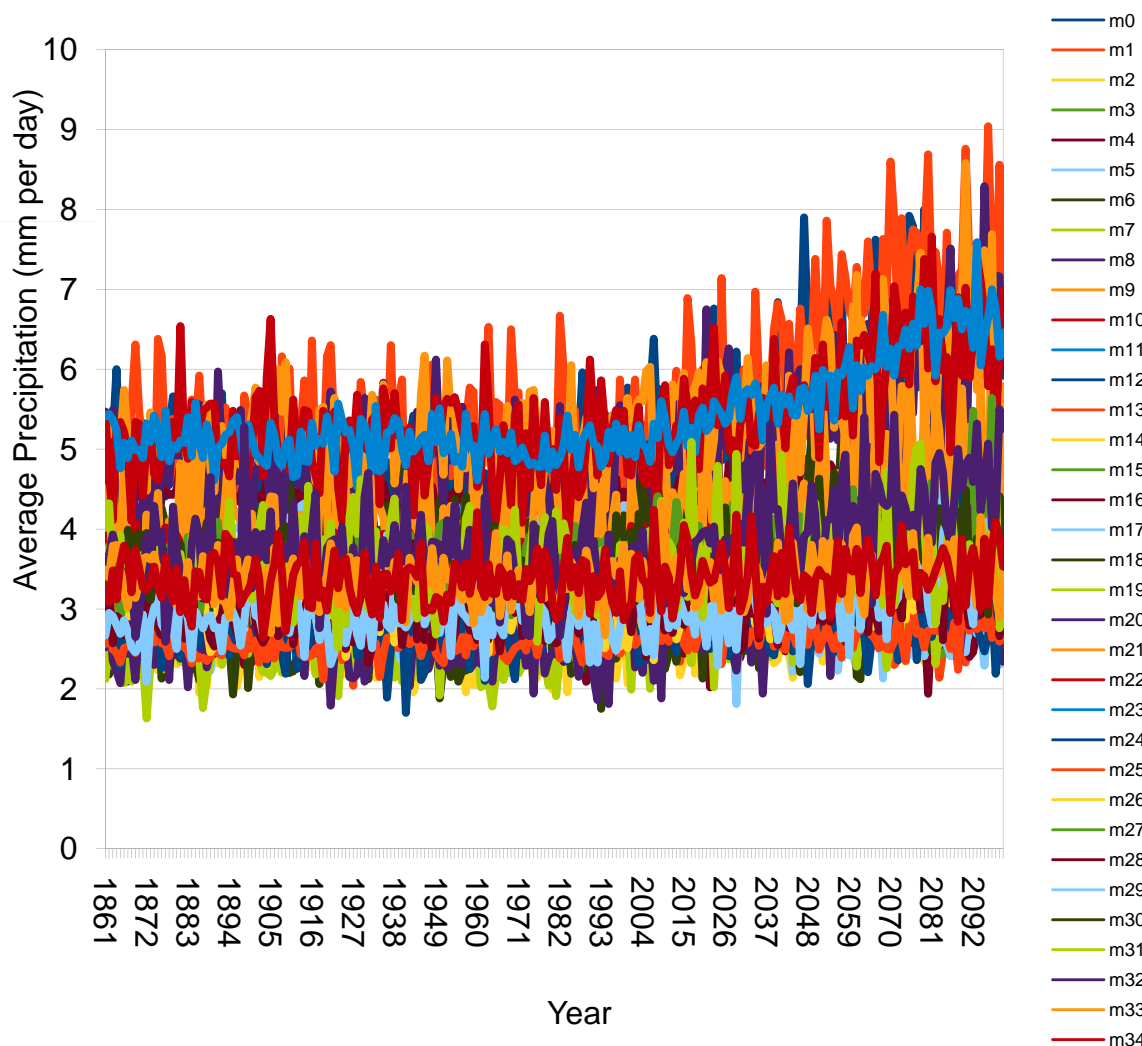
Results

Soybean Yield over the three main meso-regions of Rio Grande do Sul state

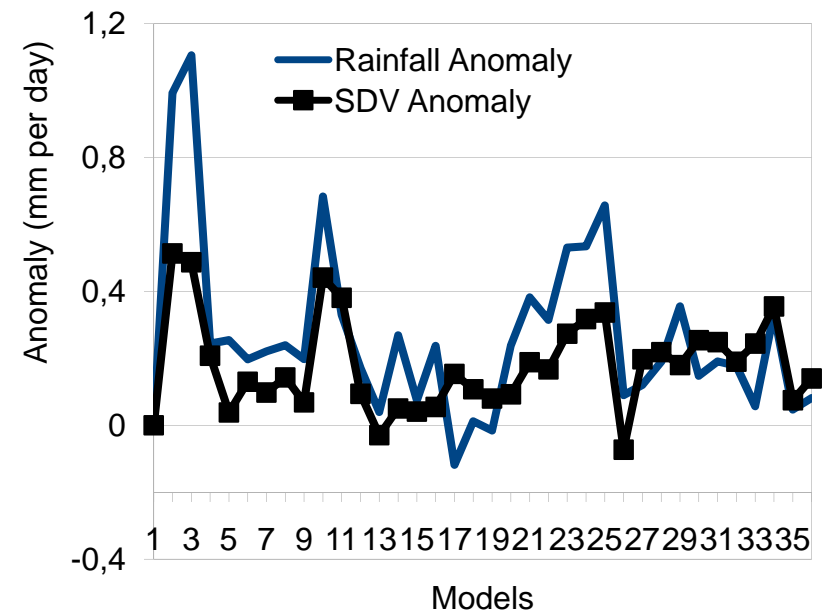


Climate Projections CMIP5 (RCP8.5)

Climate Change projections for Precipitation over South Brazil

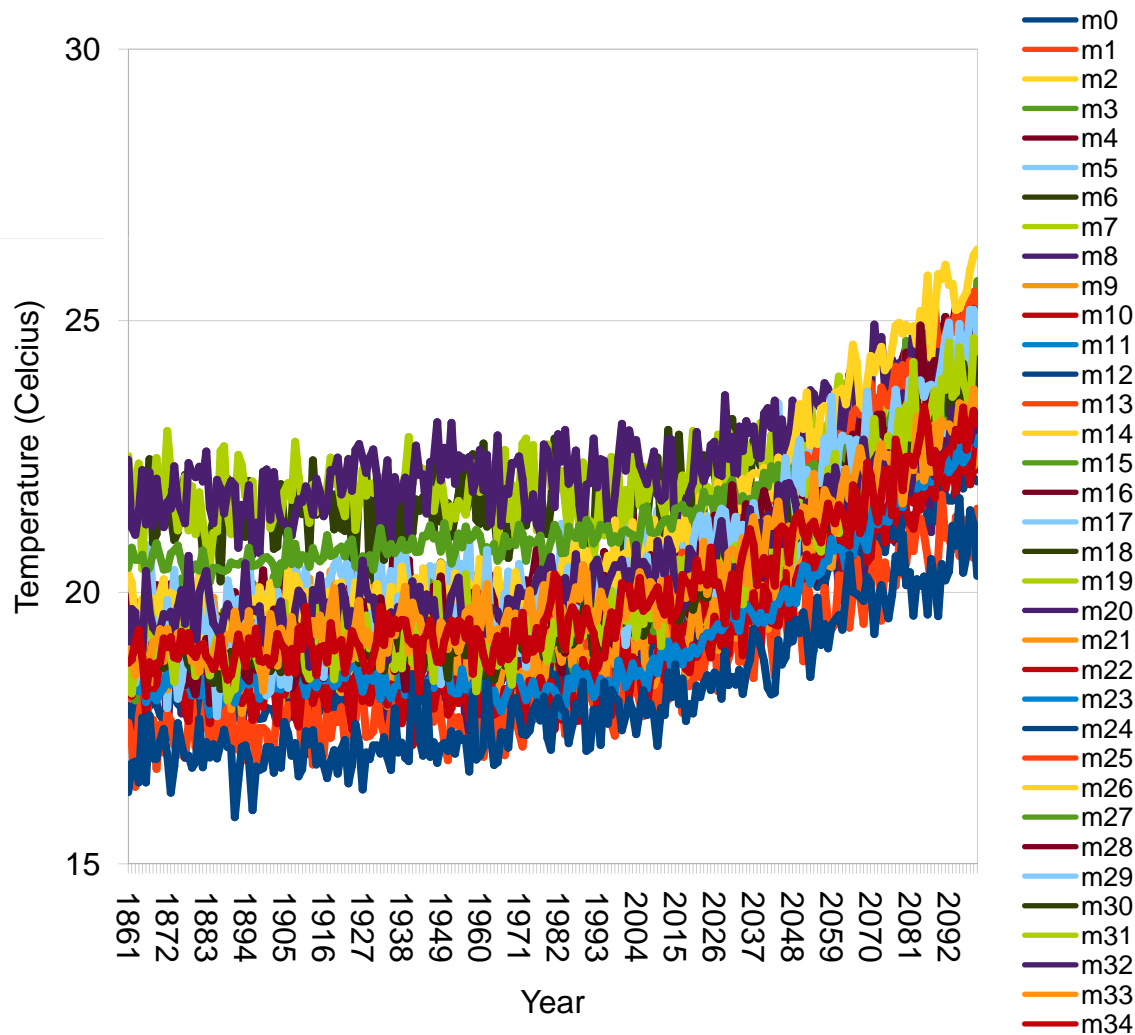


Models suggest that not only the mean is going to change, but also its variability (standard deviation)

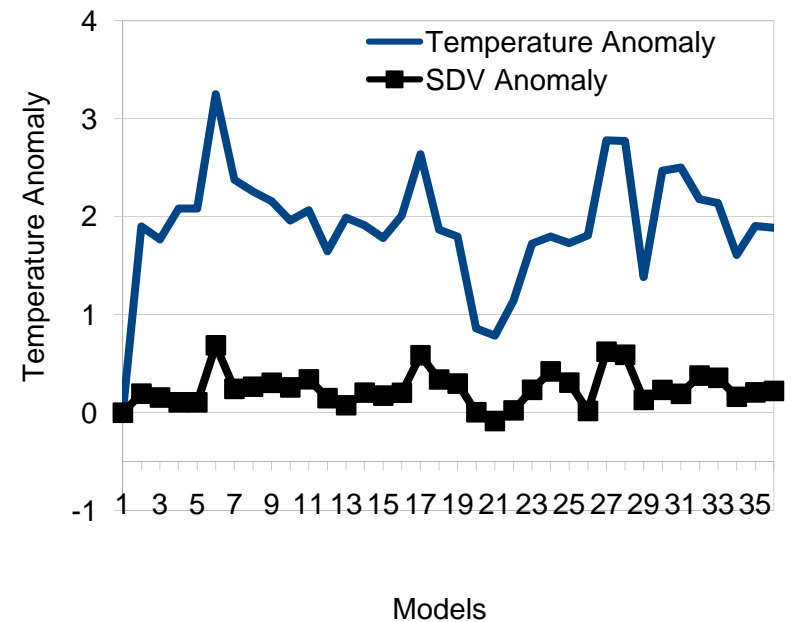


Climate Projections CMIP5 (RCP8.5)

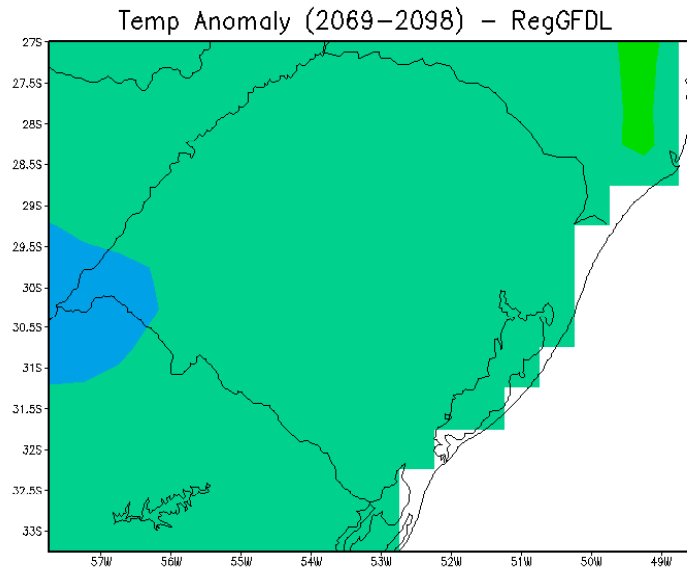
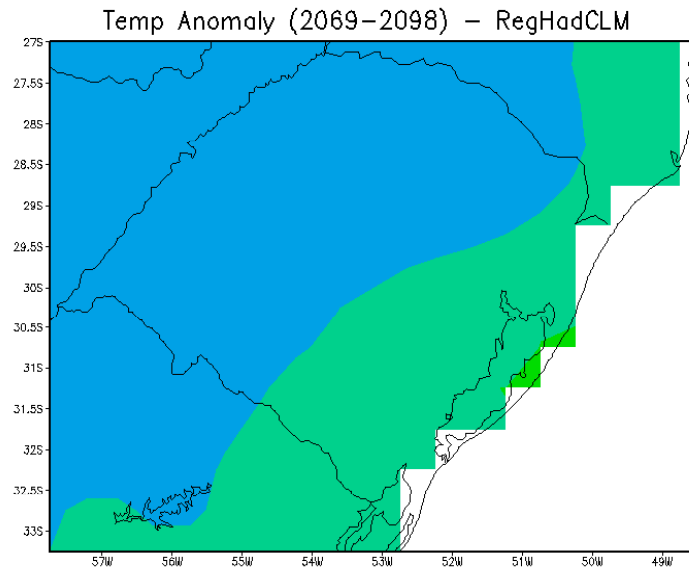
Climate Change projections for **Temperature** over South Brazil



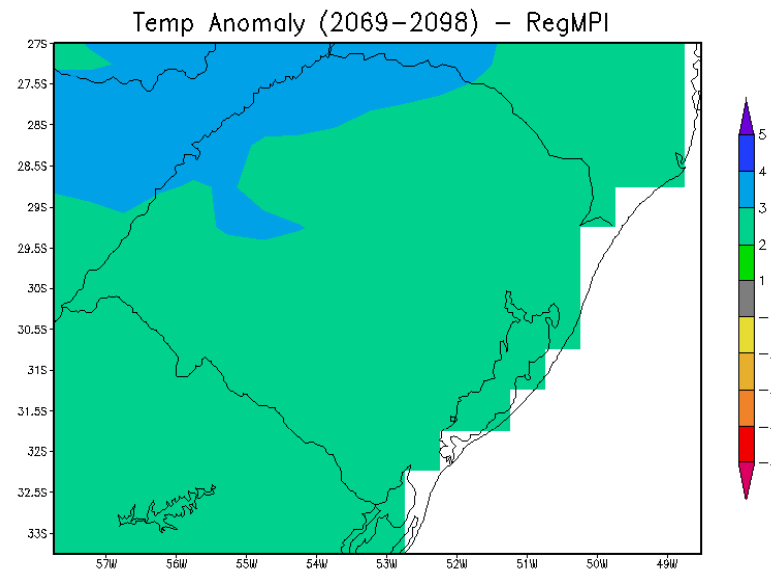
Models suggest that not only the mean is going to change, but also its variability (standard deviation)



Climate Projections (RCP8.5) RegCM4 – Temperature Anomaly

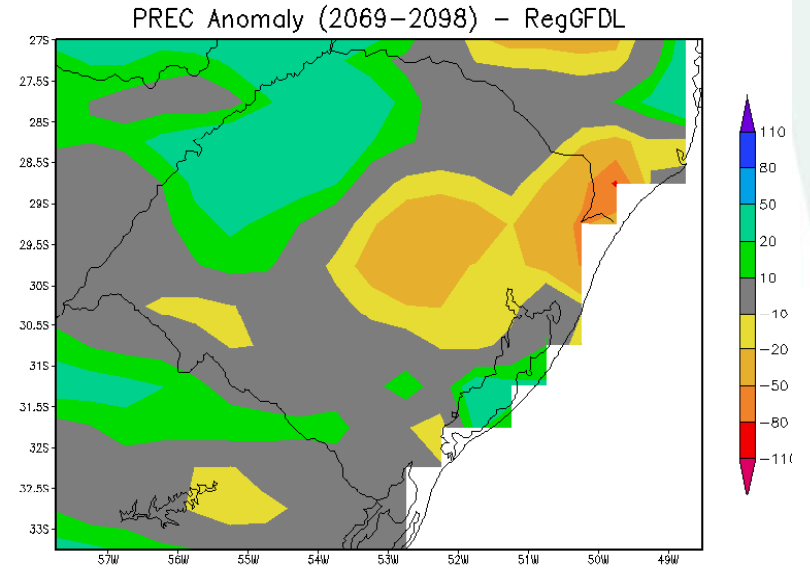
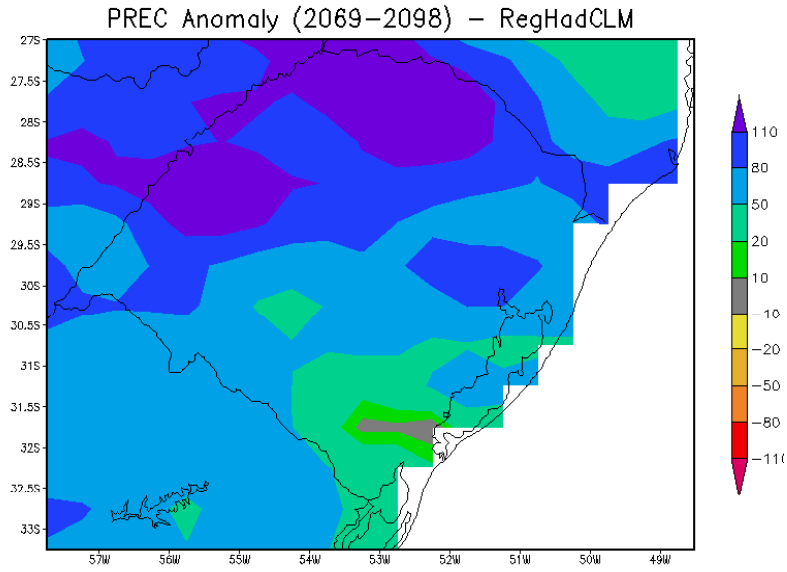


GrADS: OOLA/IGES

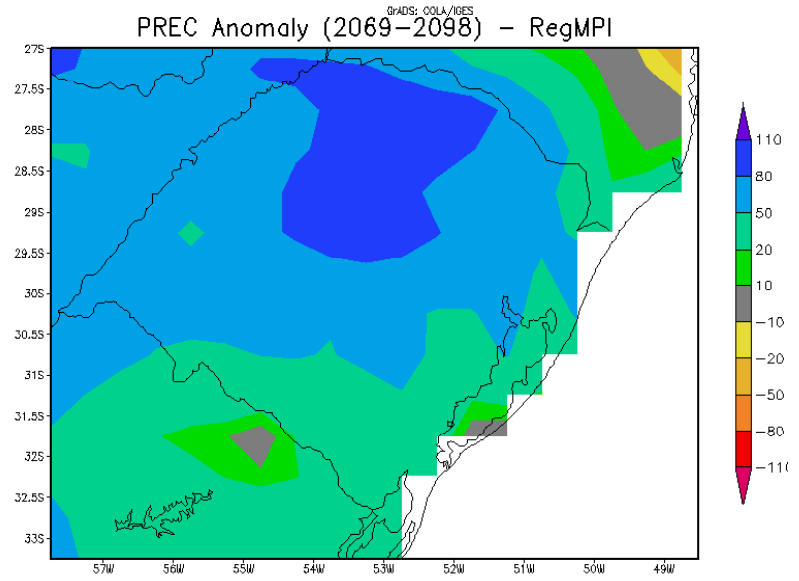


GrADS: OOLA/IGES

Climate Projections (RCP8.5) RegCM4 – Precipitation Anomaly



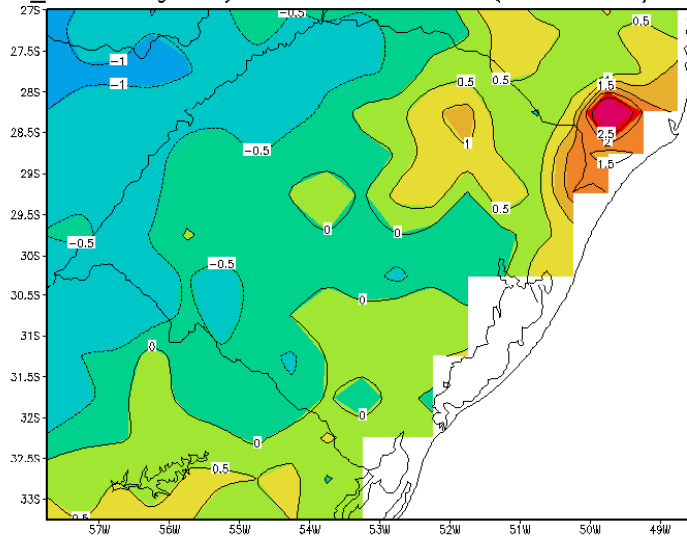
GRADS: OOLA/IGES



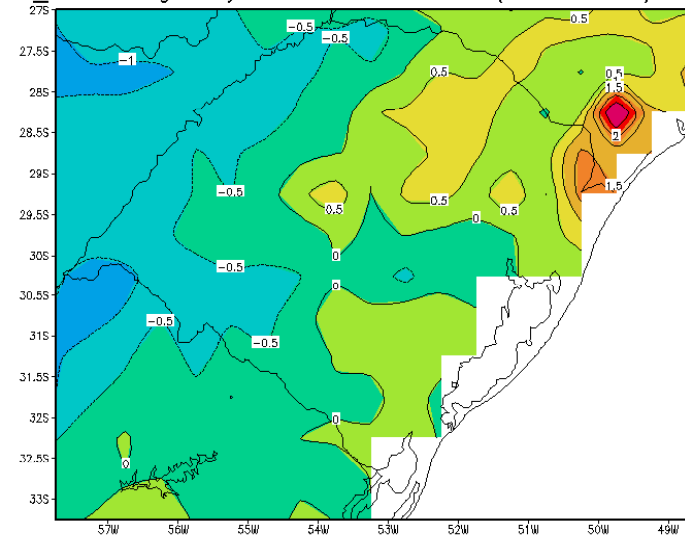
GRADS: OOLA/IGES

Climate Projections (RCP8.5) RegCM4 – Soybean Yield Anomaly

SOUTH_BR Average Soybean Yield ANOMALY (2069–2098) – RegHAD SOUTH_BR Average Soybean Yield ANOMALY (2069–2098) – RegGFDL

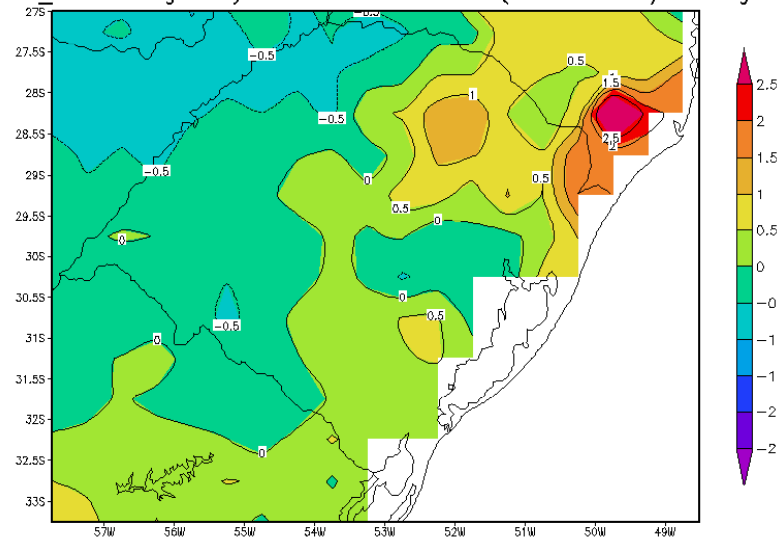


GRADS: OOLA/IGES



GRADS: OOLA/IGES

SOUTH_BR Average Soybean Yield ANOMALY (2069–2098) – RegMPI

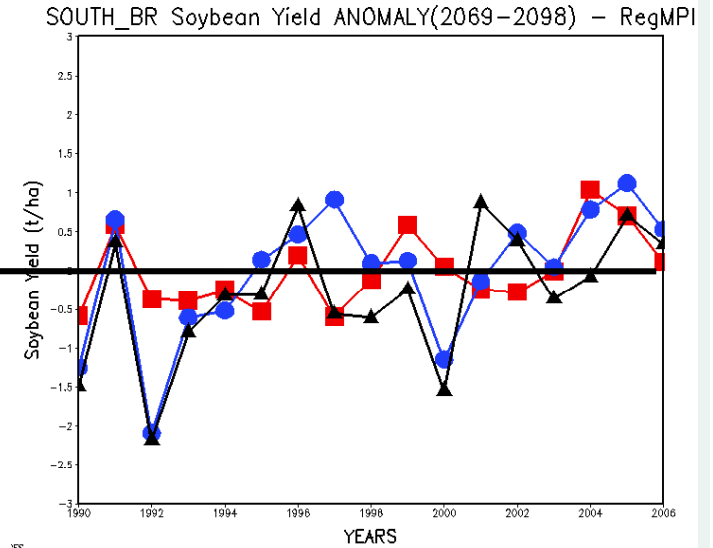
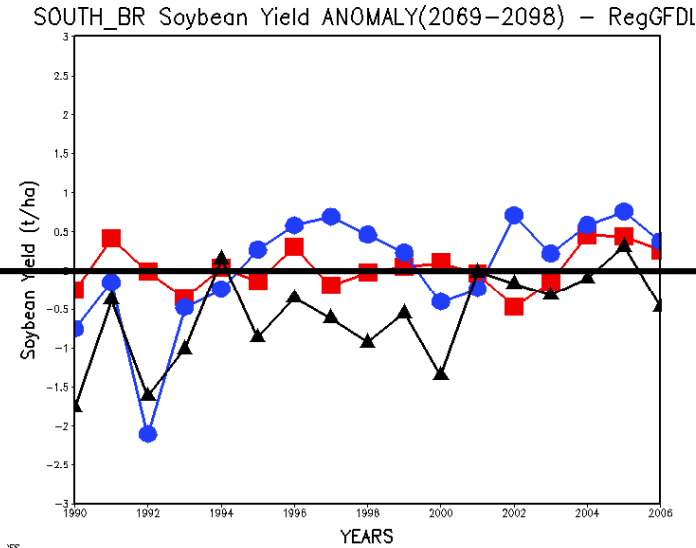
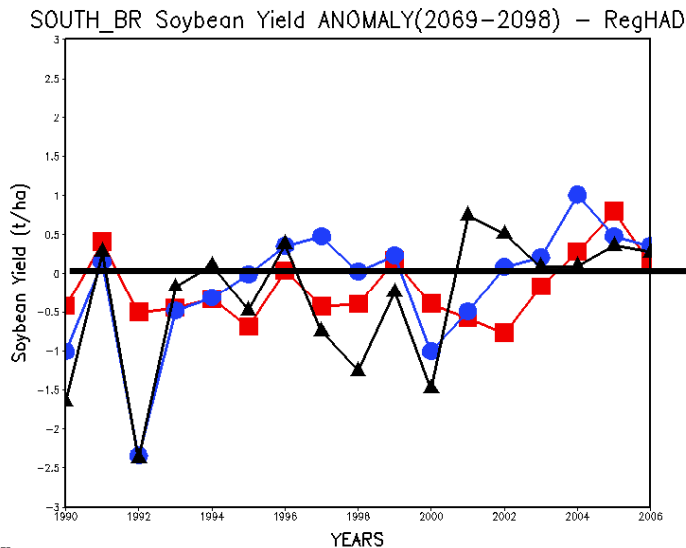
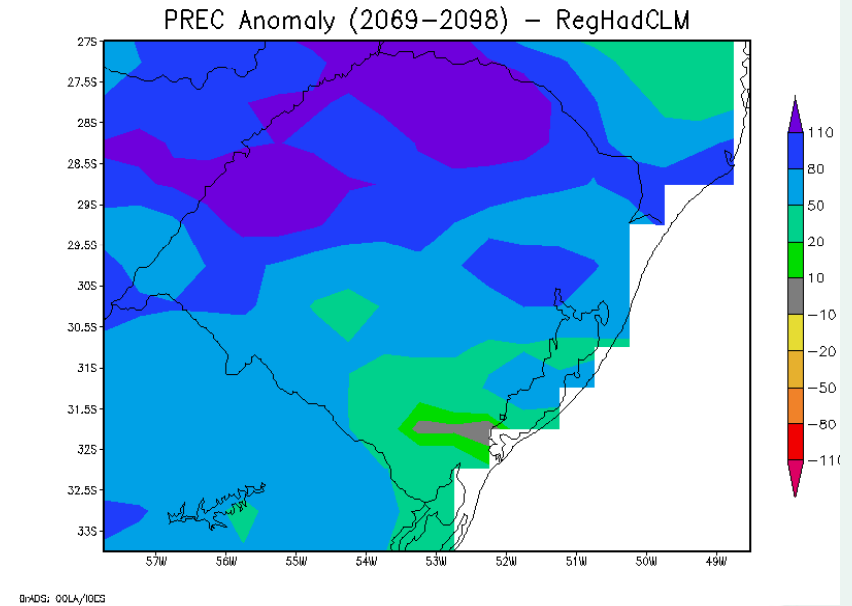


GRADS: OOLA/IGES

Soybean Yield Anomaly (2069-98)

Results summary

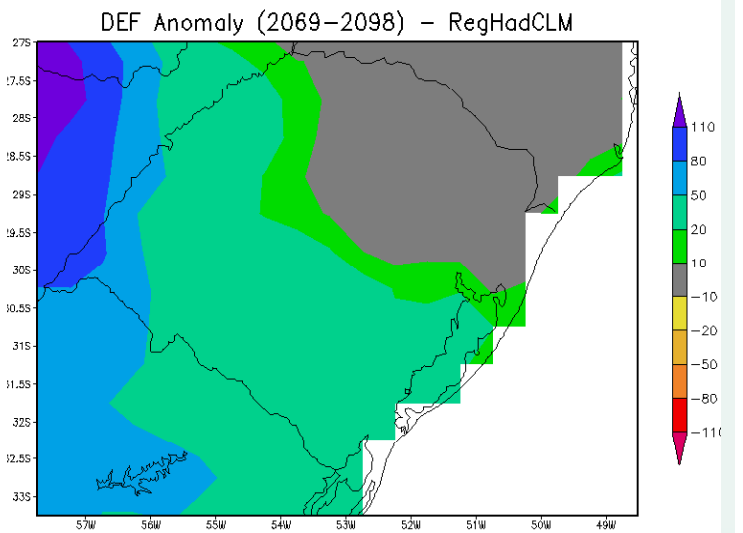
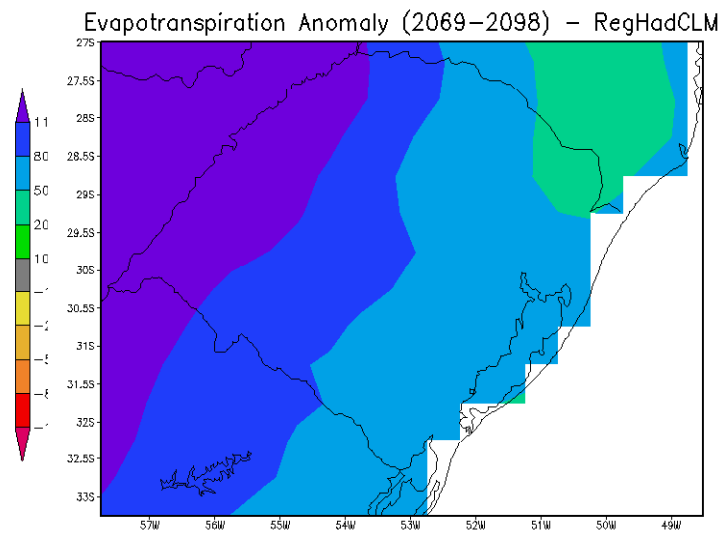
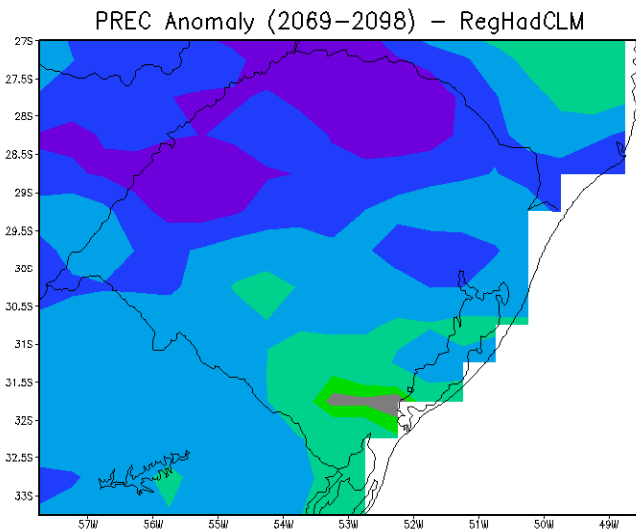
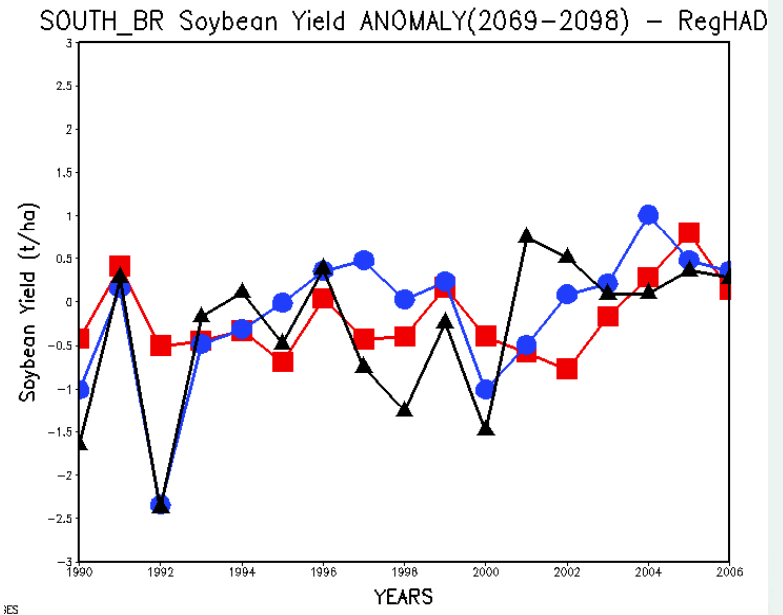
- » Although P INCREASE over west RS, there is a water balance deficit., over the west meso-regions – where almost all soybean is cultivated nowadays



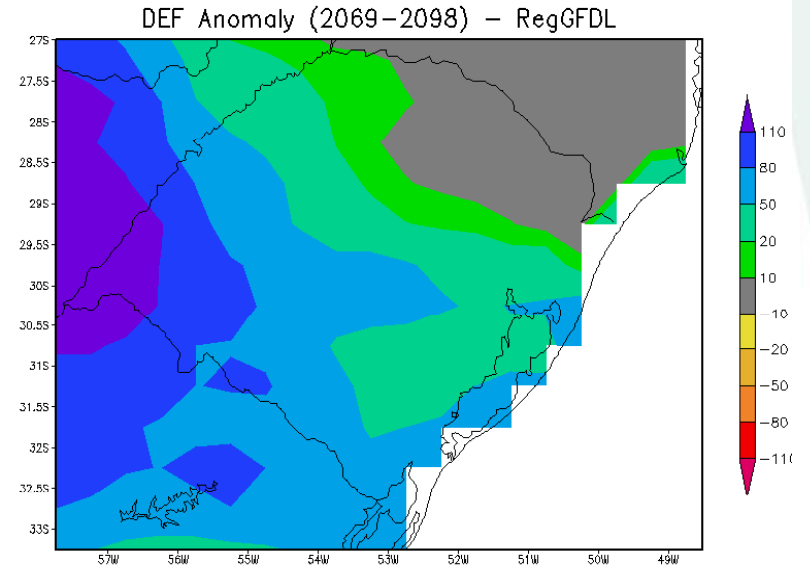
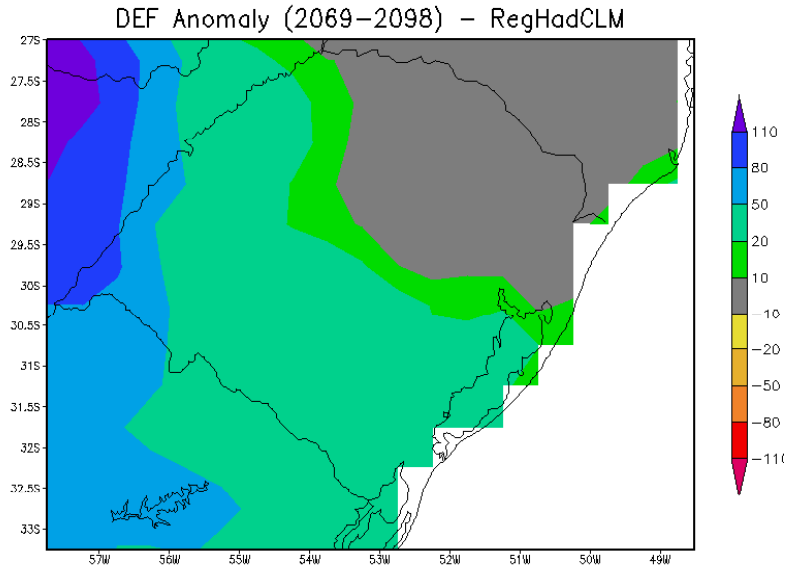
Soybean Yield Anomaly (2069-98)

Results summary

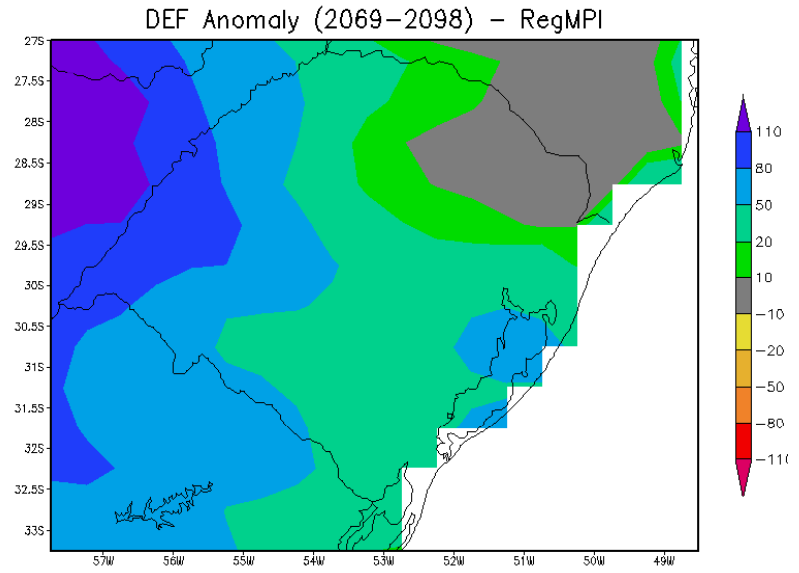
- » Although **P INCREASE** over west RS, there is a water balance deficit., over the west meso-regions – where almost all soybean is cultivated nowadays
- » This is result of temperature increase, and, consequently, ETP



Climate Projections (RCP8.5) RegCM4 – Precipitation Anomaly



GrADS: OOLA/IGES



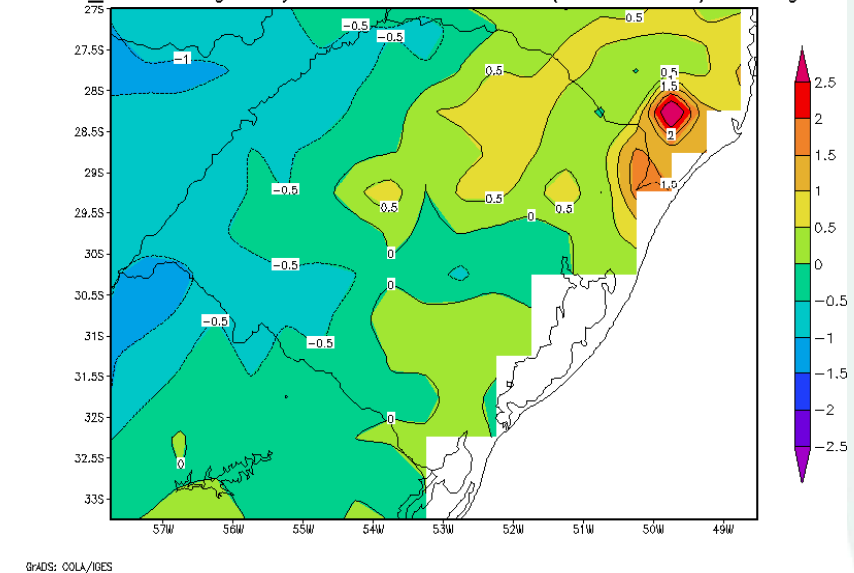
GrADS: OOLA/IGES

Soybean Yield Anomaly (2069-98)

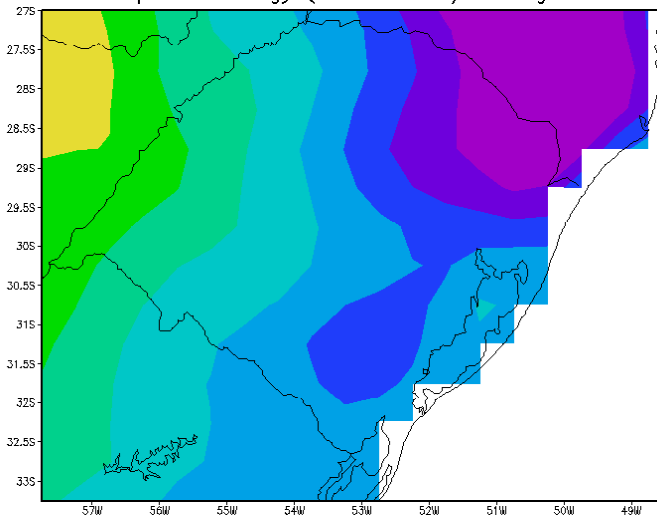
Results summary

- » Although **P DECREASE** over northeast RS, crop yield increase
- » This may be associated with **temperature increase**

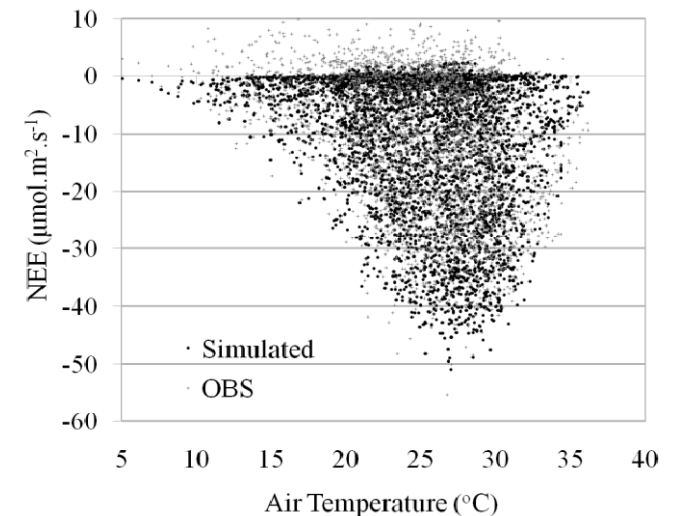
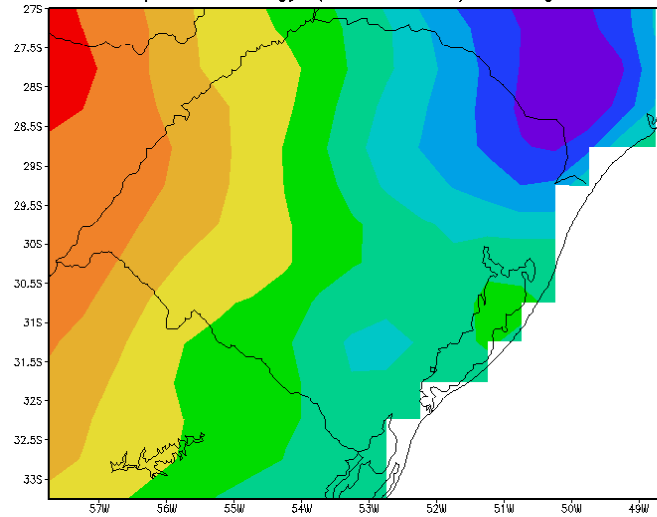
SOUTH_BR Average Soybean Yield ANOMALY (2069-2098) - RegGFDL



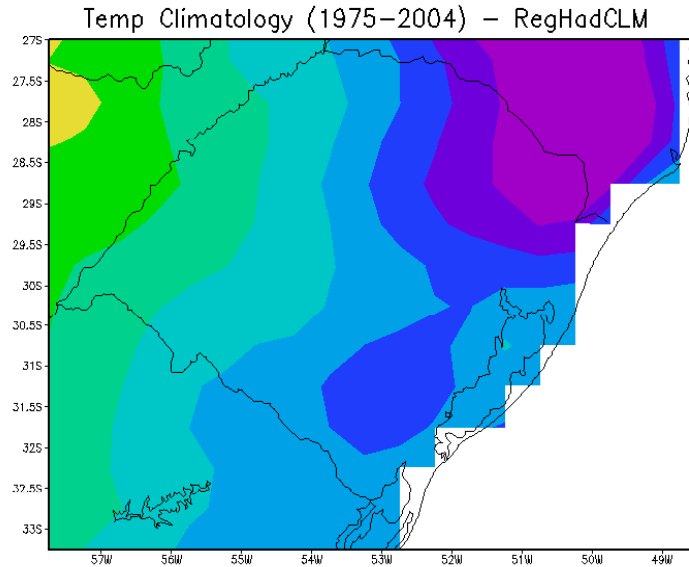
Temp Climatology (1975-2004) - RegGFDL



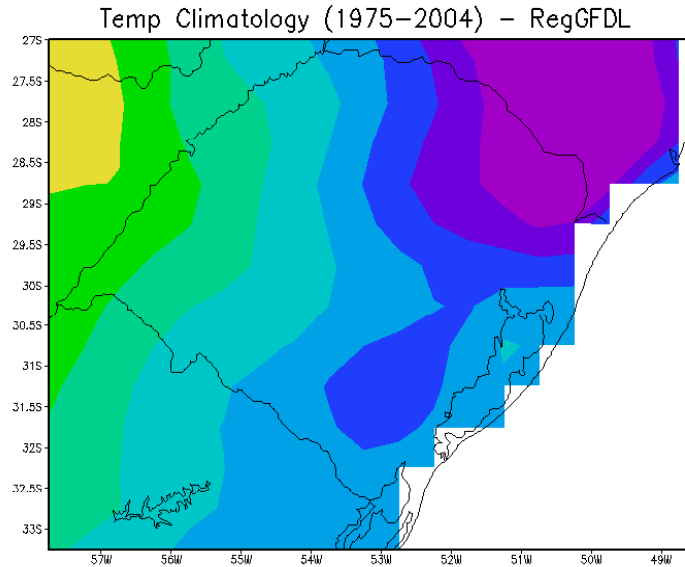
Temp Climatology (2069-2098) - RegGFDL



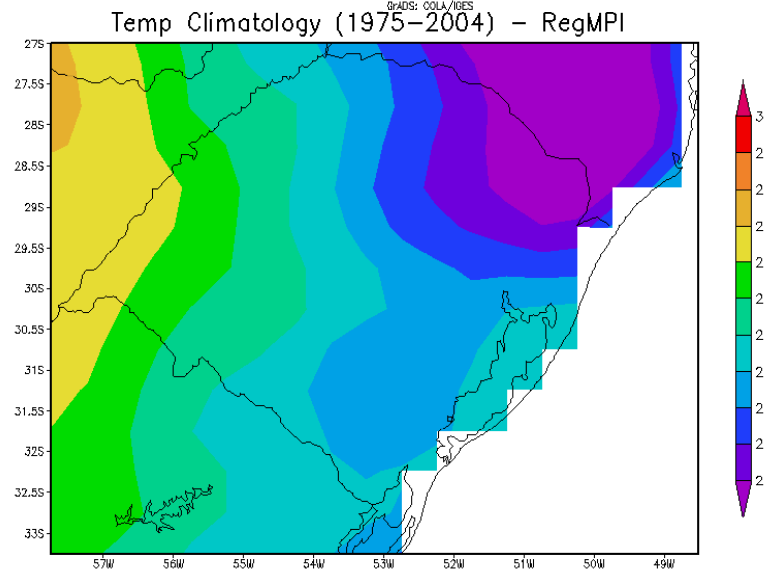
Climate Projections (RCP8.5) RegCM4 – Temperature Present



GrADS: OOLA/IGES

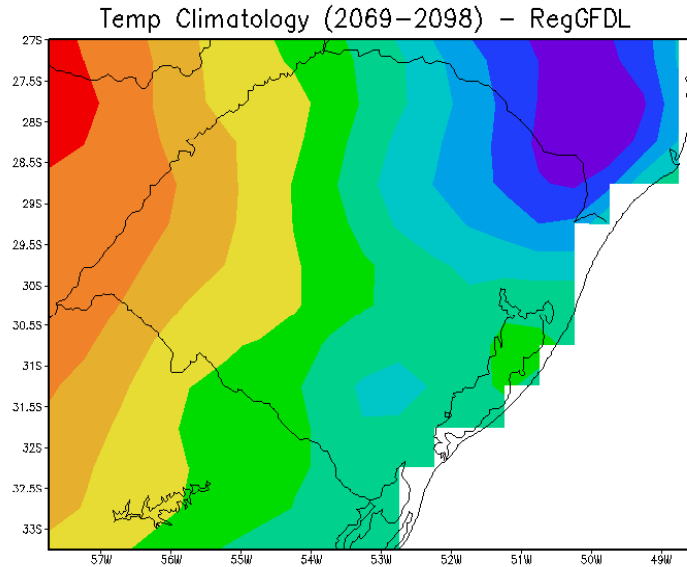
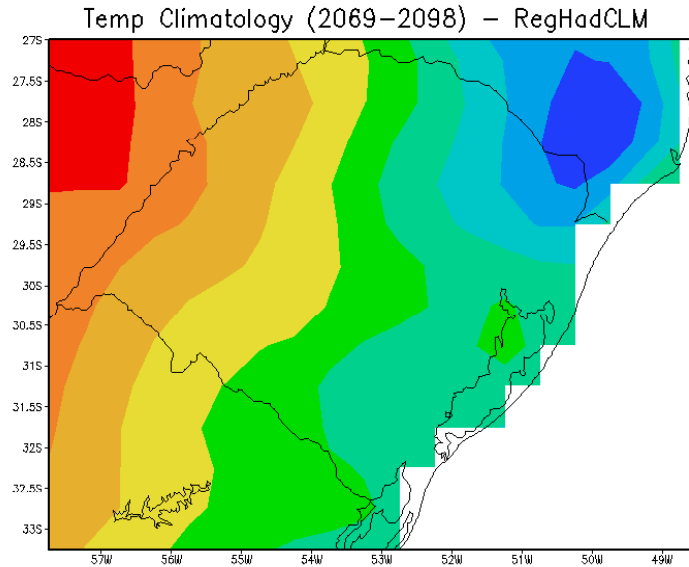


GrADS: OOLA/IGES



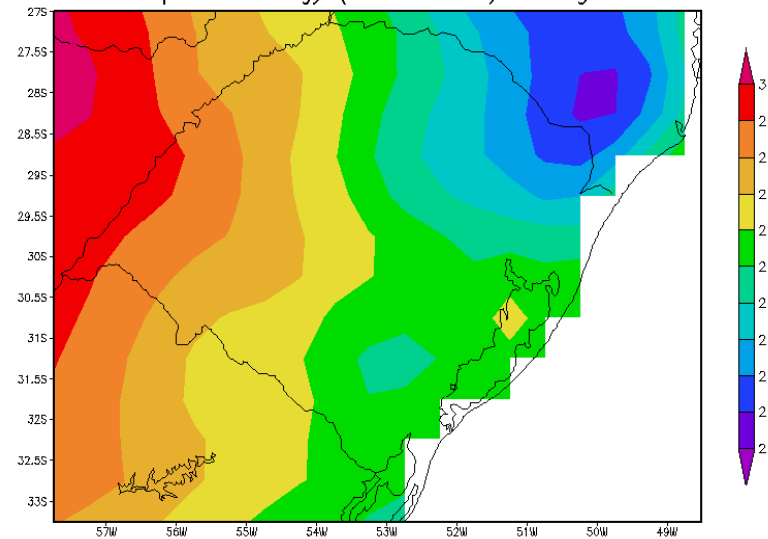
GrADS: OOLA/IGES

Climate Projections (RCP8.5) RegCM4 – Temperature Future



GRADS: OOLA/IGES

Temp Climatology (2069–2098) – RegMPI



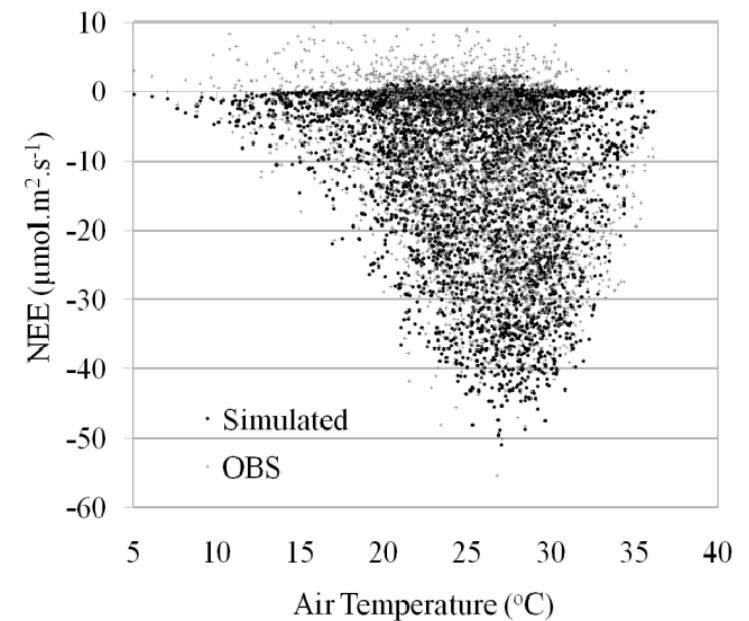
GRADS: OOLA/IGES

. Next Steps

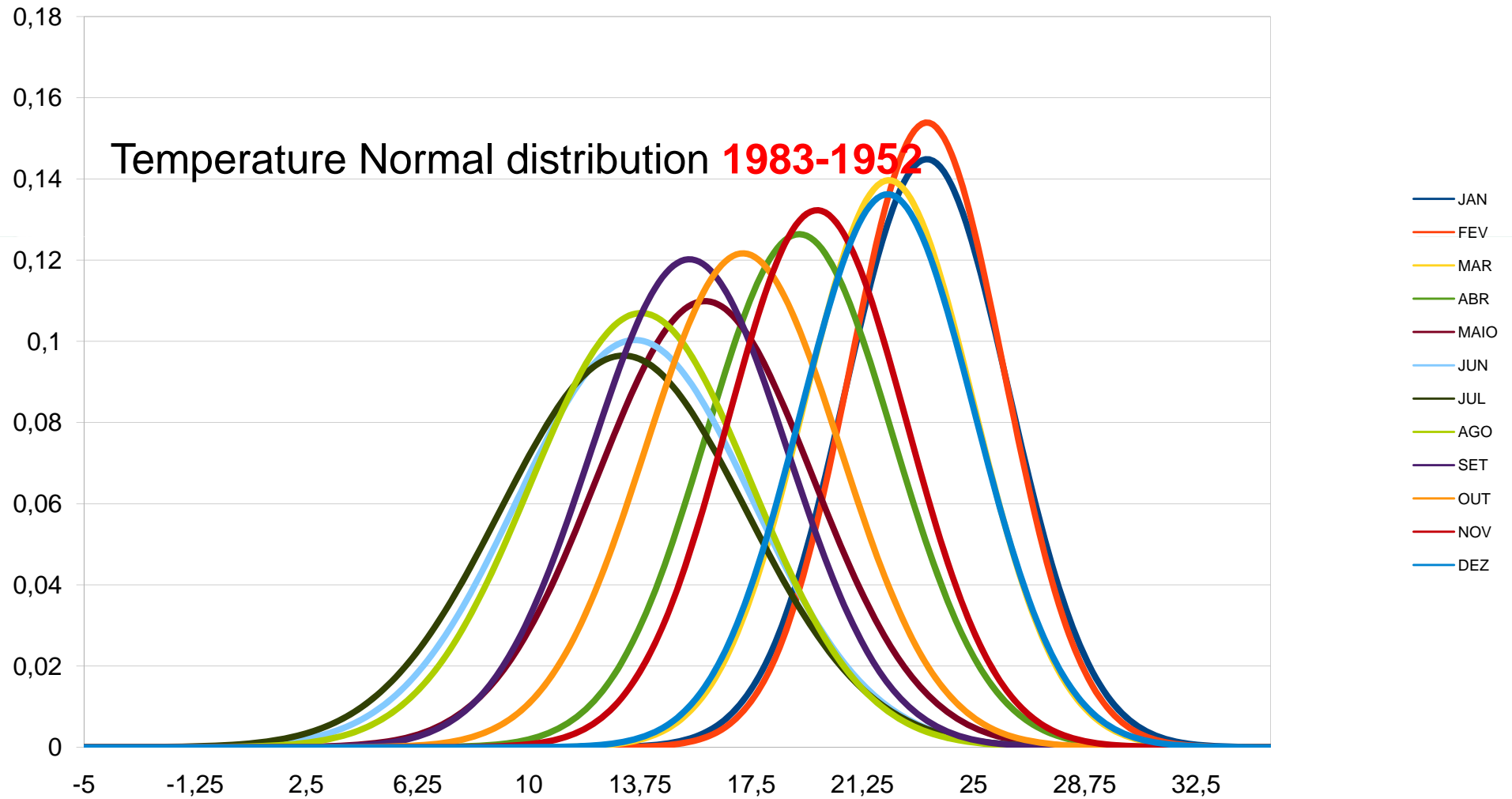
Climate Change: Average & Variability

- » Crop development is affected not only by the mean atmospheric conditions (average climate), but also by the frequency of extreme events such as frost, heat waves, floods, and droughts; or even recurrent conditions unfavorable to crop growth.

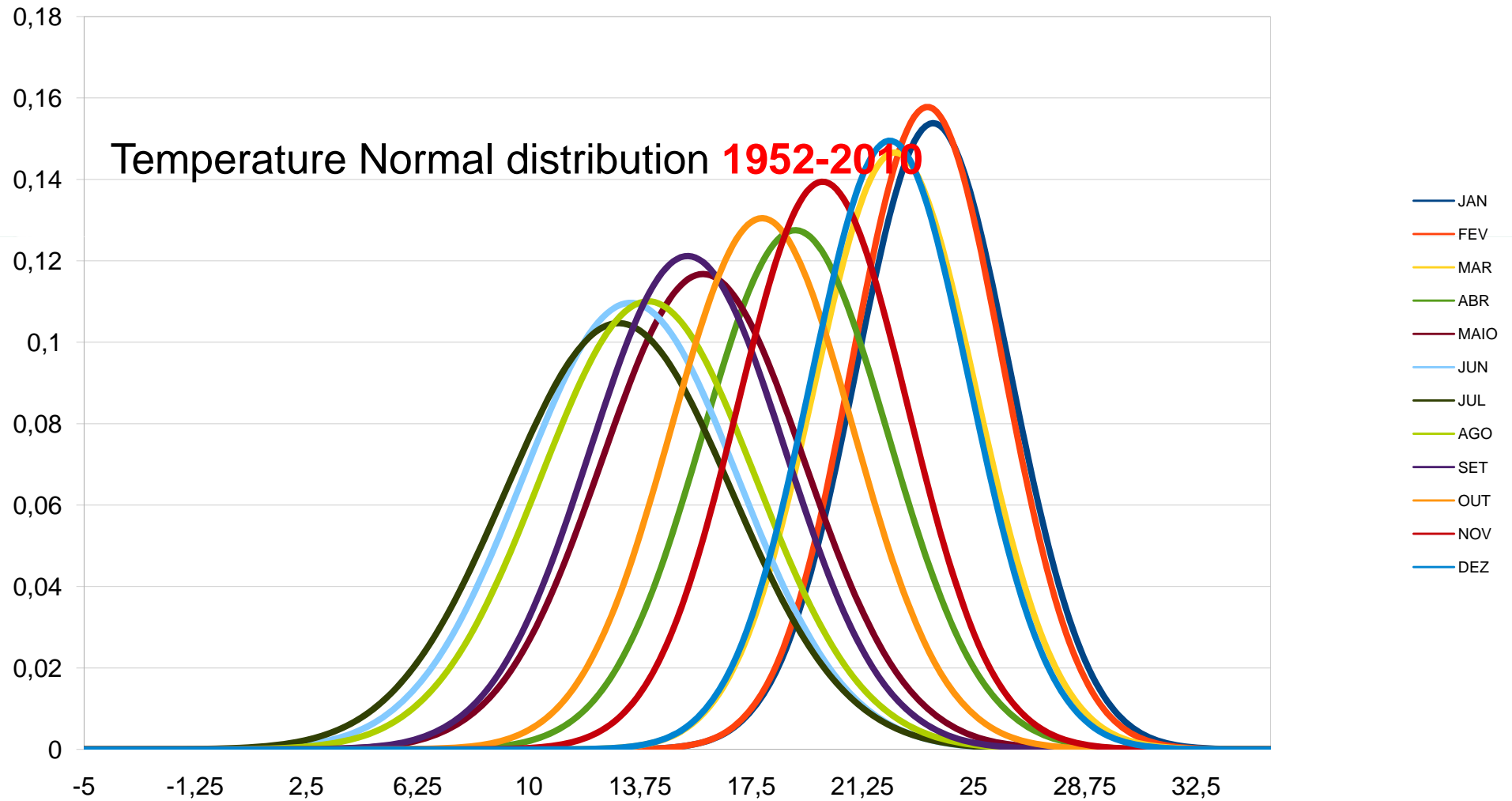
Photosynthesis is not linear related with temperature



. Climate: Average & Variability



. Climate: Average & Variability



. Future Steps

Work on models Limitations

- » Representing crops into RegCM4 – consider not only the biochemical, but also the biophysical impacts of land use and cover changes (include crops).
- » Include other processes into Agro-IBIS - It is always important to be aware that some physical processes are well formulated, others very uncertain, and **some are not considered!**



Many Thanks.

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