La Plata Basin (LPB)
Regional Hydroclimate Project
Rethinking the design of adaptation strategies

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7th Study Conference on BALTEX
Borgholm, Island of Öland, Sweden,
10 to 14 June 2013

Outline of the presentation

- Brief Introduction
- Land surface –atmosphere processes
- Climate change assessments
- **Transformation to a vulnerability oriented approach**

CLARIS – LPB: **A Europe-South America Network for Climate Change Assessment and Impact Studies in La Plata Basin**

IAI: **Integrated research projects on land use in the La Plata basin**

IAI - Integrated research projects (10) on land use in the La Plata basin

Land use
Rural development

LCLUC | **Water** | **Climate**

Ecosystems | **Carbon**

Biofuels | **Agriculture**

Societal impacts
Human dimensions

Vulnerability - Adaptation

Capacity Building

How can we unify approaches and refine our knowledge of what drives land use change and transitions? (agent based models, stochastic techniques and scenarios)

How do LCLUCs interact with climate, Carbon balances, radiation effects, hydrological impacts and overall energy balance? Can the science of those processes be presented in a systematic way?

How did the interdisciplinary collaboration between natural and human sciences contribute to significant advances in knowledge and what did we learn in the process?

THE INTERNATIONAL SUMMER SCHOOL ON LAND COVER CHANGE AND HYDROCLIMATE OF THE LA PLATA BASIN

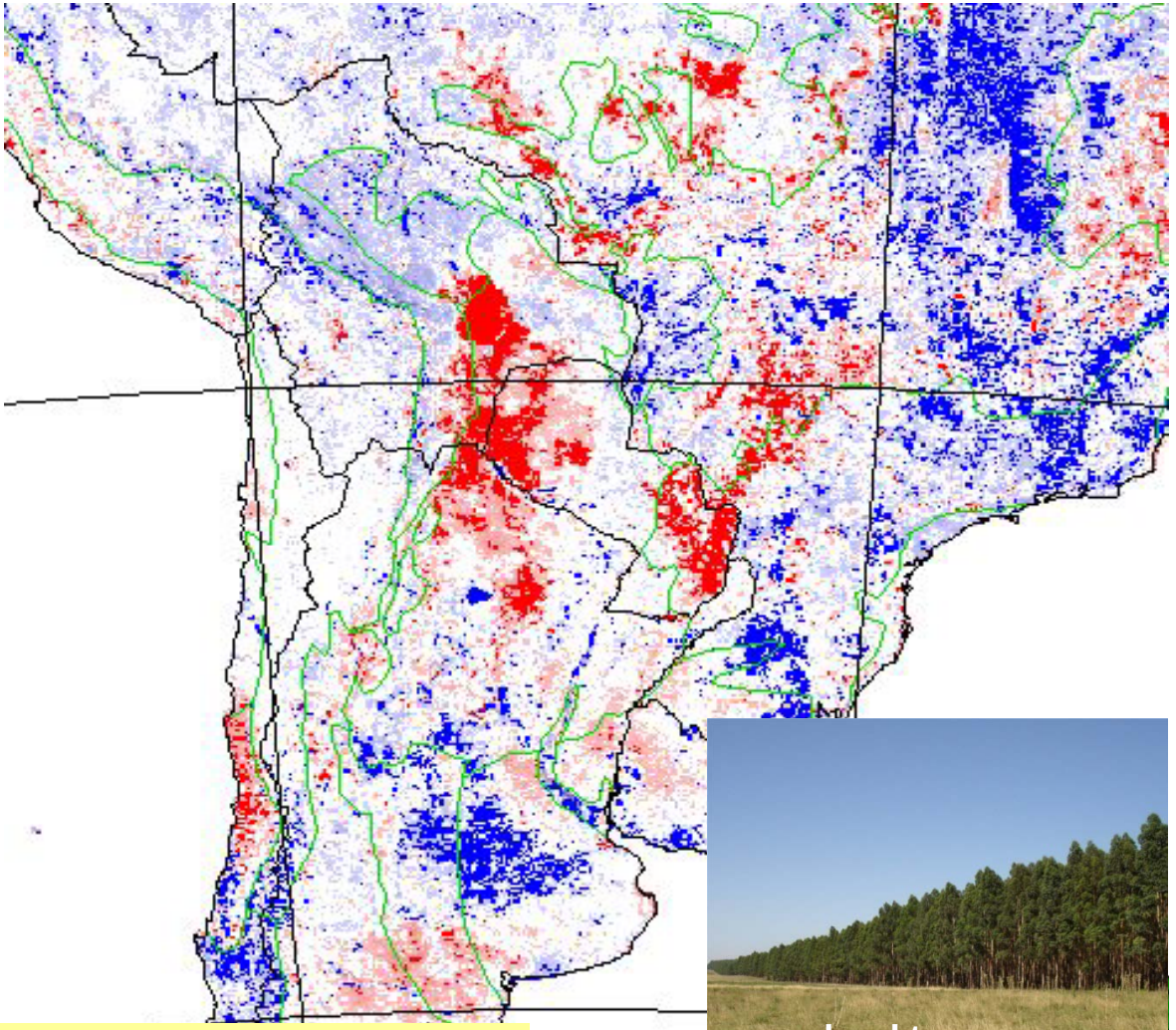
•To present the physical basis of the hydroclimate of the La Plata Basin in South America following an interdisciplinary approach

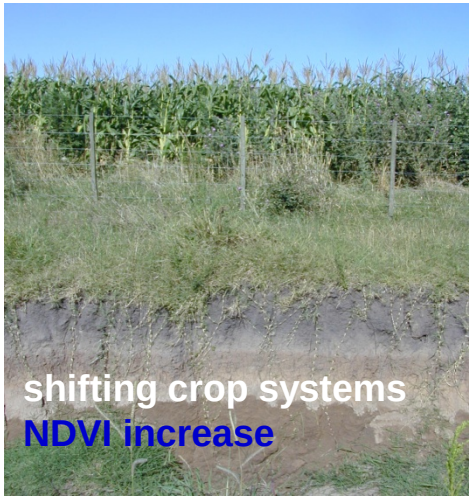
•To examine current research methods being employed, link to related activities at operational centers, and train the students in practical tools (software and data) that they will need for their future research

45 students
7 countries

Land use changes using remotely sensed biophysical variables

Normalized Difference Vegetation Index NDVI 1981-2000 trends
(surrogate for primary production)

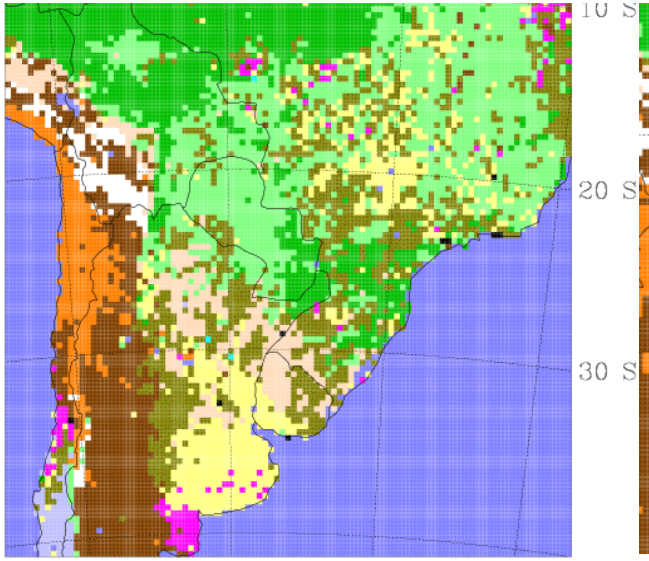




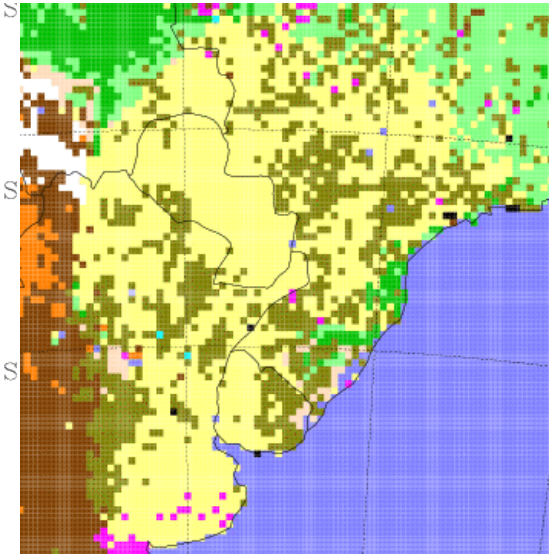
Red: decrease of NDVI
Blue: increase of NDVI

Land cover and its changes

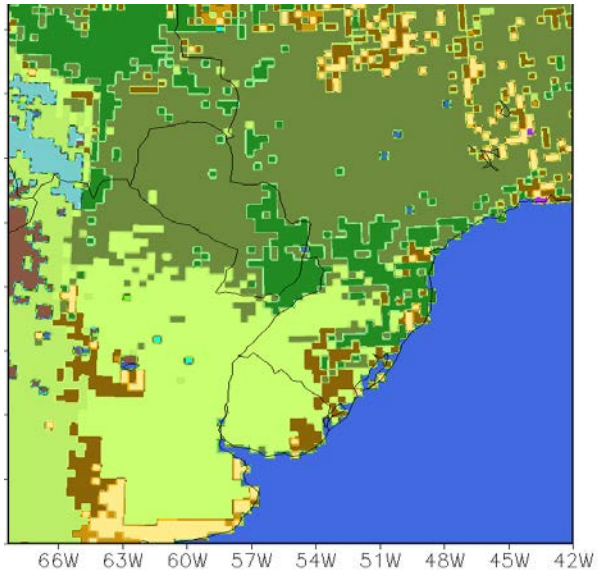
Current land cover



All crop



"Pre-colonnial"



1 Urban and Built-Up Land
2 Dryland Cropland and Pasture
3 Irrigated Cropland and Pasture
4 Mixture of 2 and 3
5 Cropland/Grassland Mosaic
6 Cropland/Woodland Mosaic
7 Grassland
8 Shrubland
9 Mixture of 7 and 8
10 Savanna
11 Deciduous Broadleaf Forest
12 Deciduous Needleleaf Forest
13 Evergreen Broadleaf Forest
14 Evergreen Needleleaf Forest
15 Mixed Forest
16 Water Bodies
17 Herbaceous Wetland
18 Wooded Wetland
19 Barren or Sparsely Vegetated
20 Herbaceous Tundra
21 Wooded Tundra
22 Mixed Tundra
23 Bare Ground Tundra
24 Snow or Ice

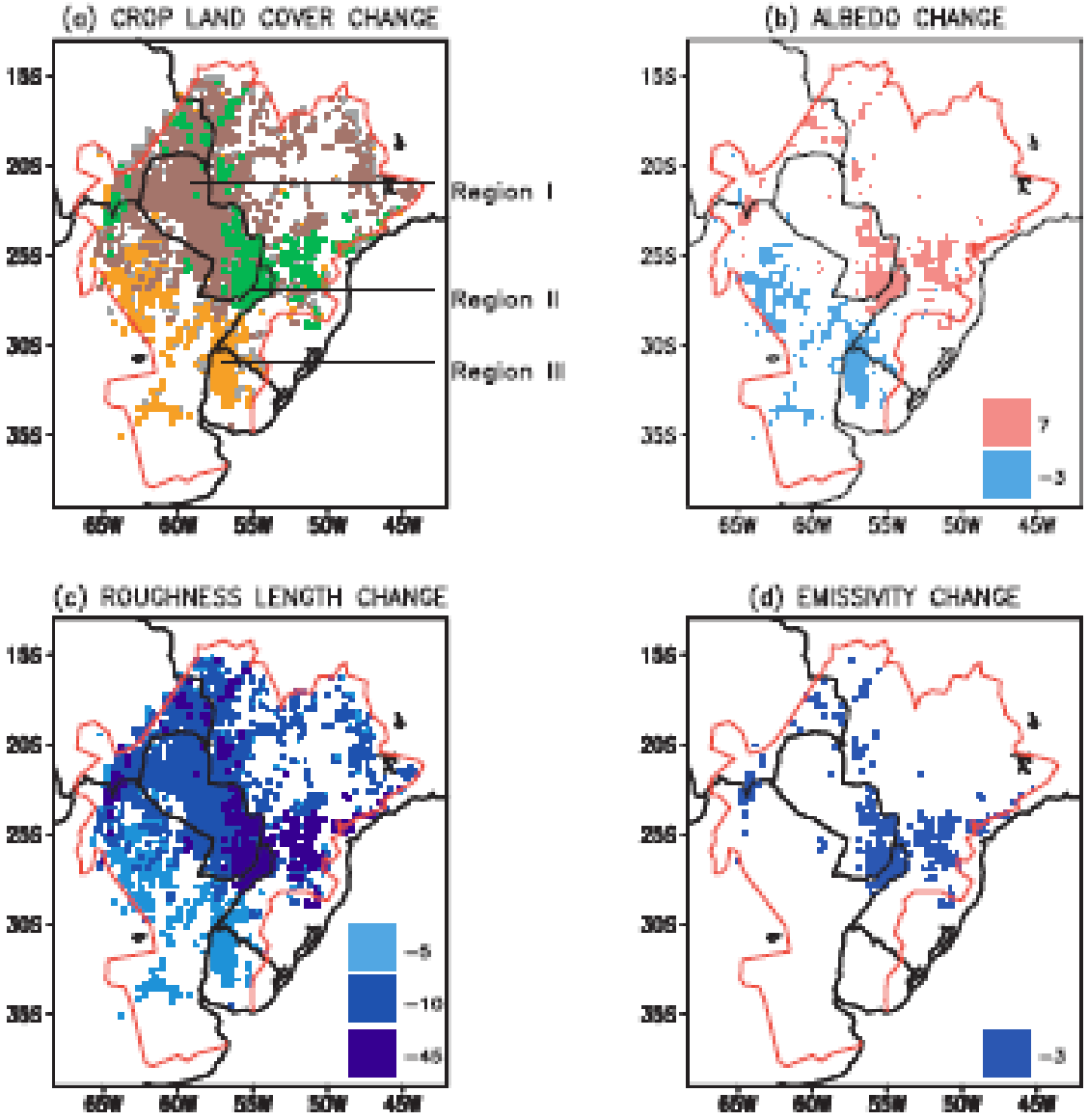
Case 1

Savanna → Dry cropland
Evergreen → Dry cropland
Grassland → Dry cropland

Case 2

Dry cropland → grassland (south)
Dry cropland → savanna (north)

Land cover changes – effect on surface parameters



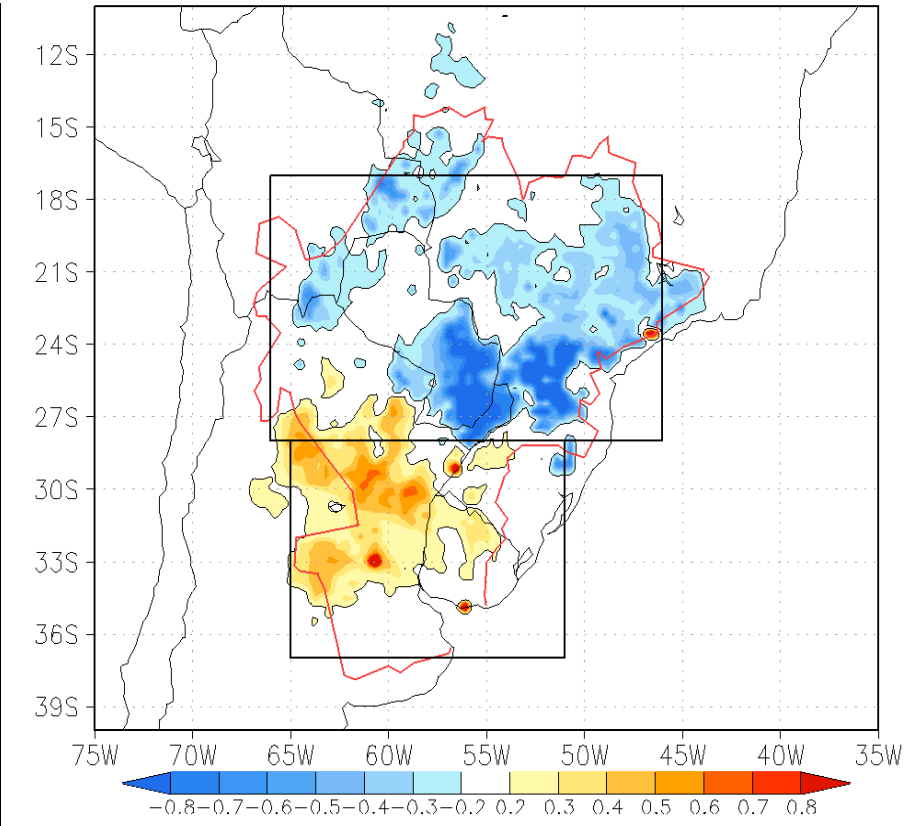
I Savanna → Dry cropland
II Evergreen → Dry cropland
III Grassland → Dry cropland

Area II: Albedo increase
Area III: Albedo decrease

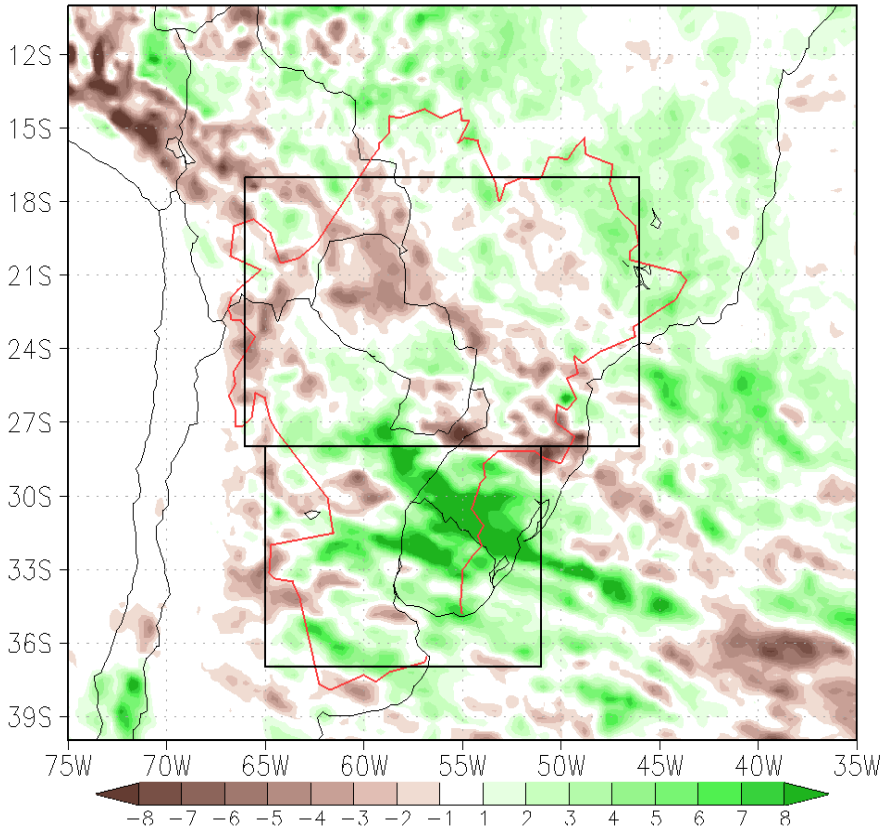
Within the La Plata basin as a whole, the roughness length (Z0) decreased.

Land cover changes

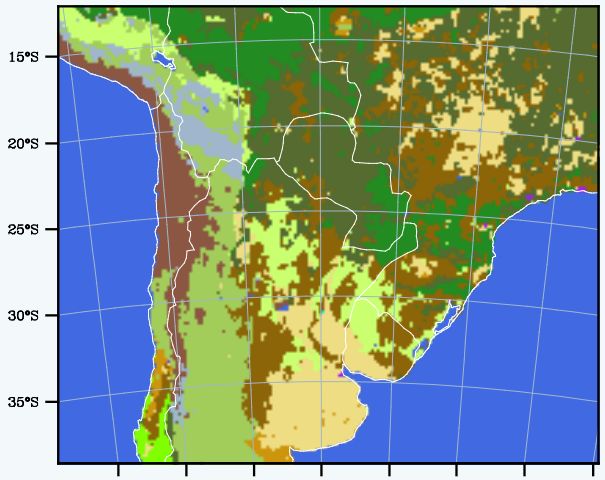
Two-meter temperature differences between CROP and NATR experiments



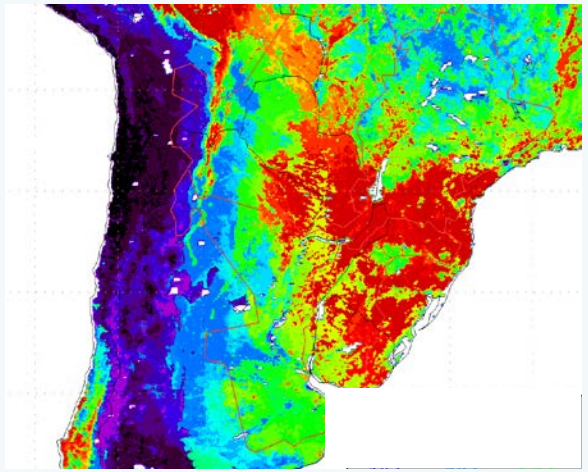
Precipitation differences between CROP and NATR experiments



Does inclusion of land cover changes in a model contribute to its predictive skill?



Land cover – constant in time



EFTs –time varying

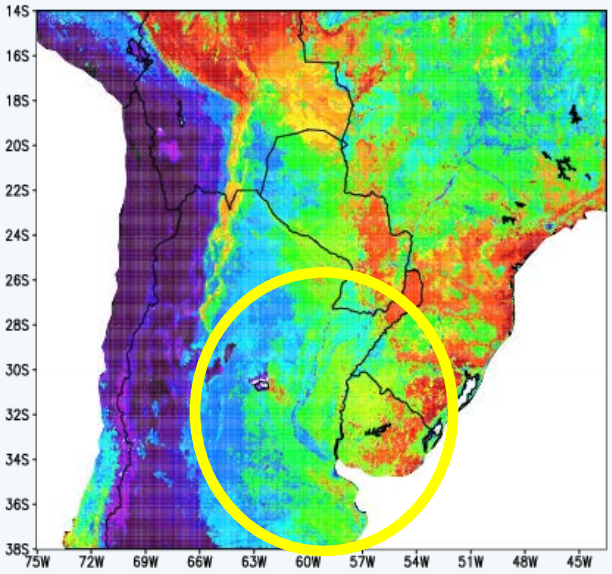
Ecosystem Functional Types are used as an alternative to Land Cover Types to define a consistent set of time varying surface biophysical properties that characterize the dynamics of land surface-atmosphere interactions

EFTs are groups of ecosystems that share functional characteristics in relation to the amount and timing of the exchanges of matter and energy between the biota and the physical environment, showing a coordinated and specific response to environmental factors.

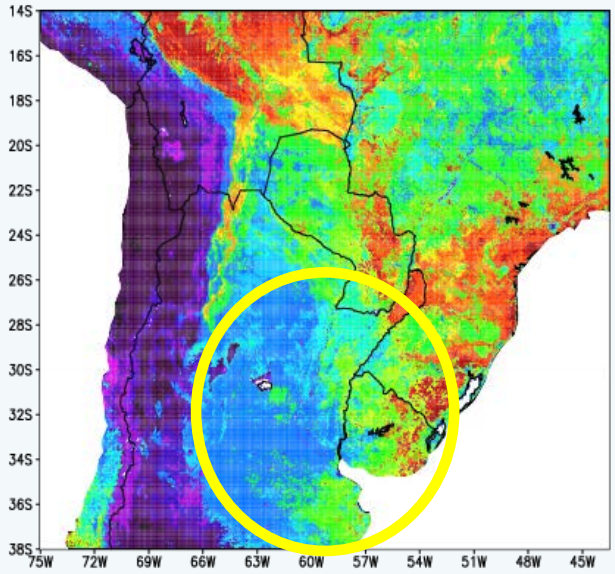
Interannual variability of the land surface biophysical properties

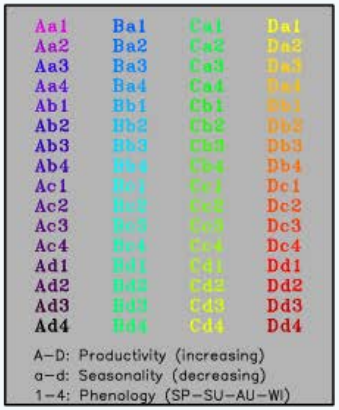
Ecosystem Functional Types

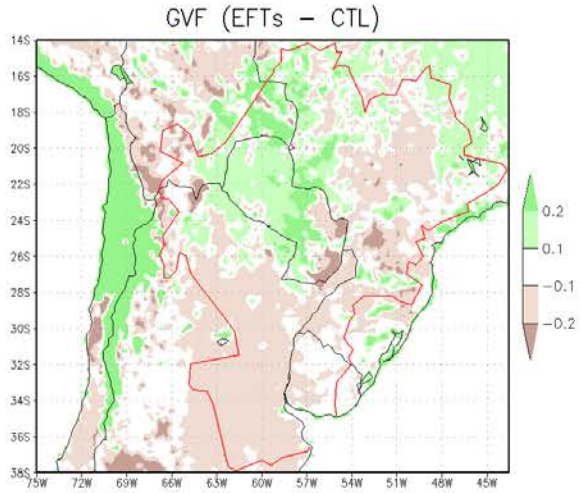
Mean

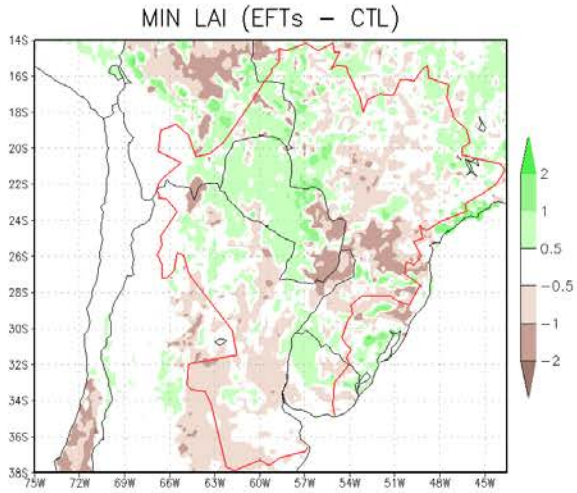


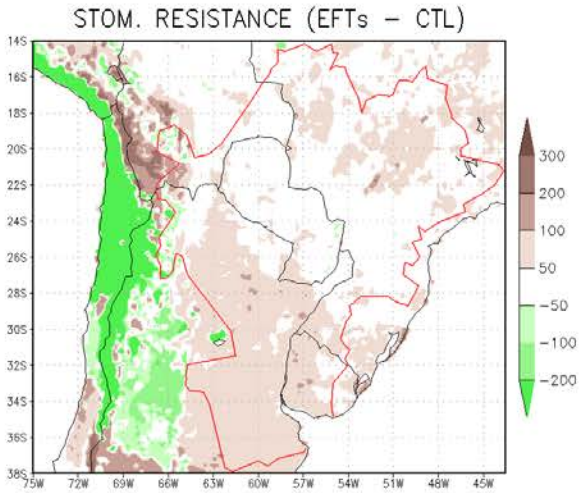
2008





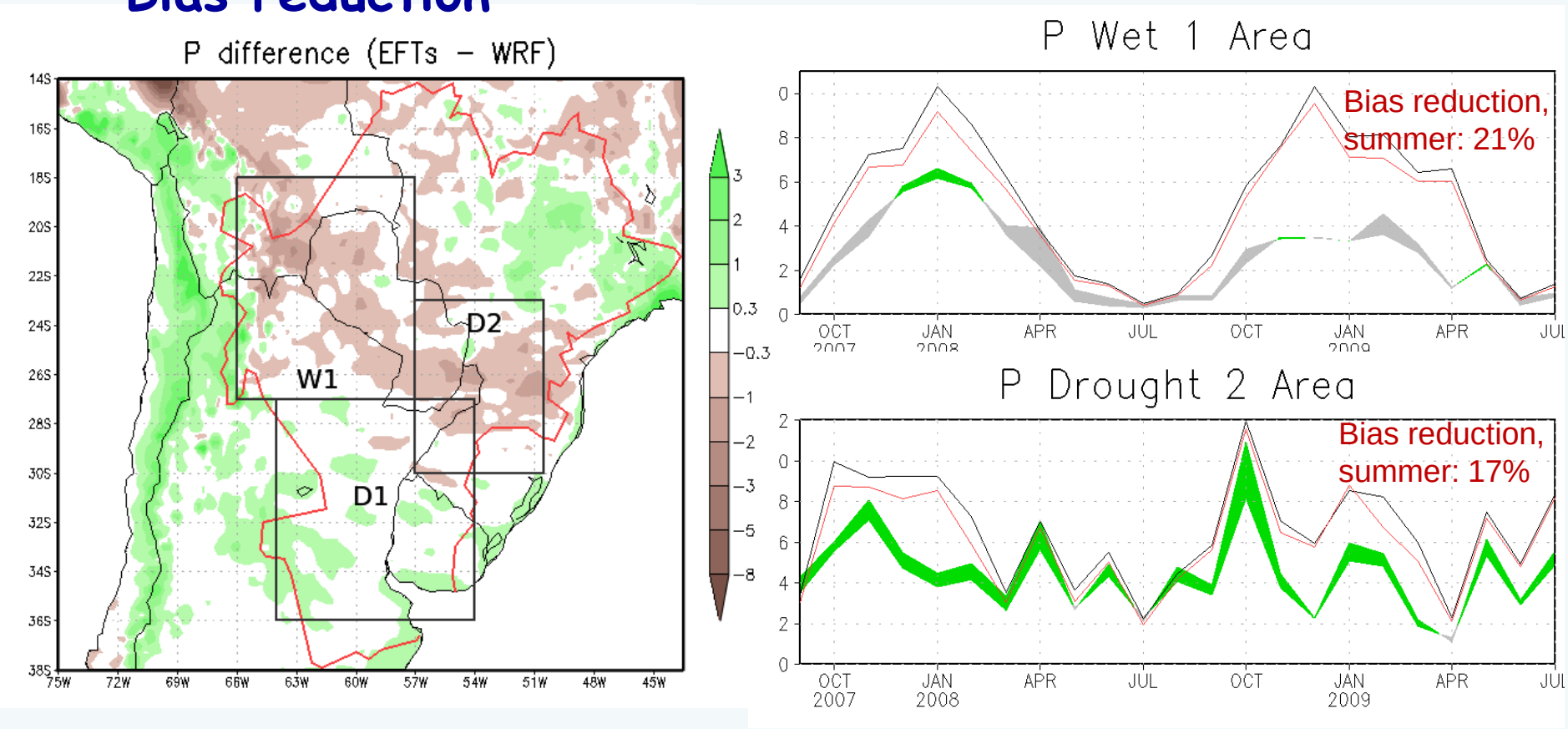






Model Biases wrt to Pobs

Bias reduction



The brown shades in areas W1 and D2 represent a reduction in the positive bias when using EFTs; during summer the bias reduction is about 15-20%

The green shades in area D1 represent a reduction in the negative bias when using EFTs

Green: $P_{trmm} > P_{obs}$
Gray: $P_{trmm} < P_{obs}$

Black: $P_{m\ (ctl)}$
Red: $P_{m\ (w/EFTs)}$

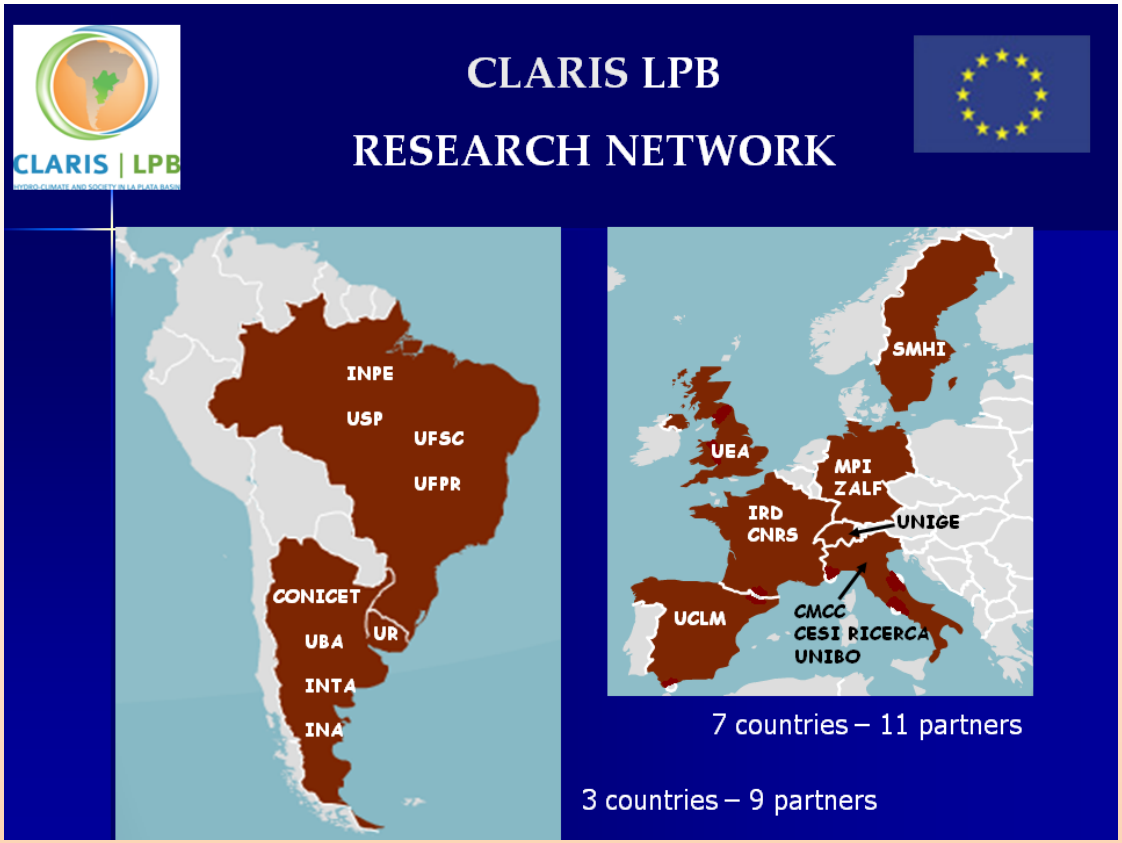
A Europe-South America Network for Climate Change Assessment and Impact Studies in La Plata Basin

A project within the EC 7th Framework Programme
1 October 2008 to 30 September 2012

Coordinator: Dr. Jean-Philippe Boulanger (IRD)

Project Management Assistant: Lic. Elvira Gentile

http://www.claris-eu.org



10 countries,
20 institutions
(including SMHI, MPI)

A Europe-South America Network for
Climate Change Assessment and Impact Studies
in La Plata Basin

CLARIS | LPB
HYDRO-CLIMATE AND SOCIETY IN LA PLATA BASIN

General objectives (which followed a top-down approach):

- To provide an ensemble of regional hydroclimate scenarios and their uncertainties for climate impact studies.
- To project possible scenarios in land-use evolution for 2010-2040 and design adaptation strategies in terms of rural development for the most vulnerable areas.
- To design strategies to adapt to the possible hydrological scenarios and their consequences (hydropower, floods, river transportation and ecological systems in wetlands) over 2010-2040.
- To ensure wide dissemination of the project results to stakeholders, to the scientific community and to the public through the project web site, the production of reports, brochures, information sheets and scientific papers, and the organization of training activities for stakeholders.

A Europe-South America Network for
Climate Change Assessment and Impact Studies
in La Plata Basin

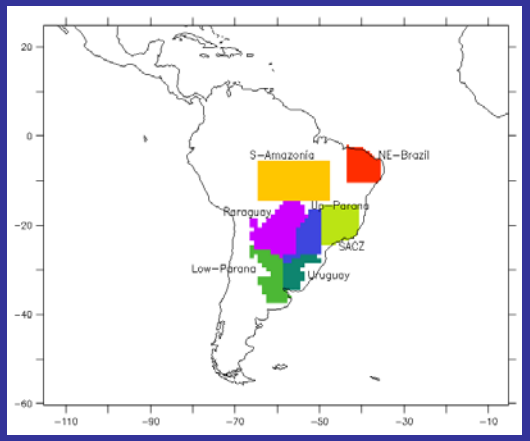
CLARIS | LPB
HYDRO-CLIMATE AND SOCIETY IN LA PLATA BASIN

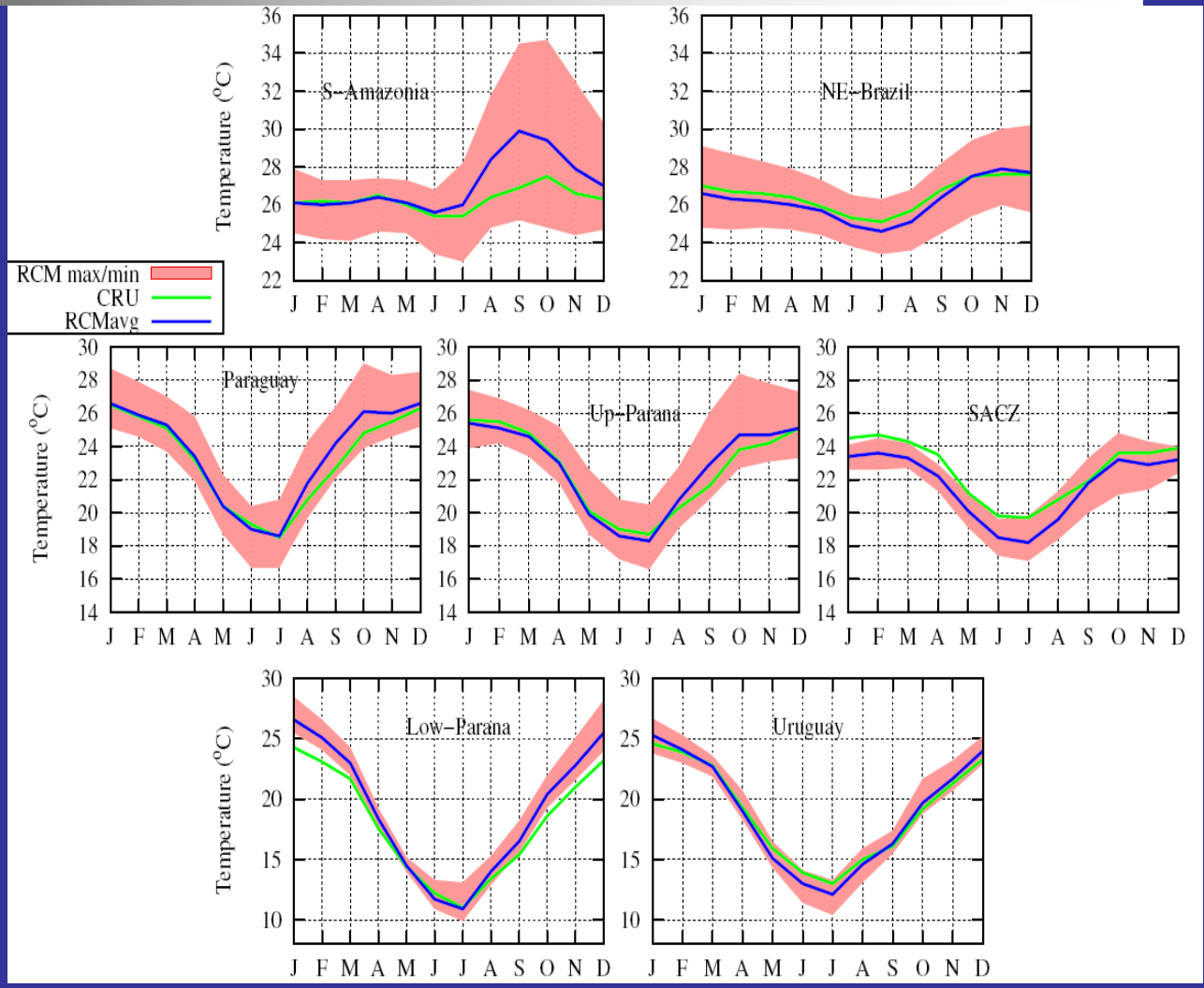
Working groups

- Improving our description of recent **past climate variability** in La Plata Basin
- Hydroclimate **past and future low-frequency variability, trends and shifts**
- **Regional Climate Change assessments** for La Plata Basin
- Processes and future evolution of **extreme climate events** in La Plata Basin
- **Land use, agriculture and socio-economic** implications
- **Hydrology** and **Water resources** in La Plata Basin in the context of climate change

ERA Interim driven simulations of seven regional models for South America:

Annual cycle of Temperature

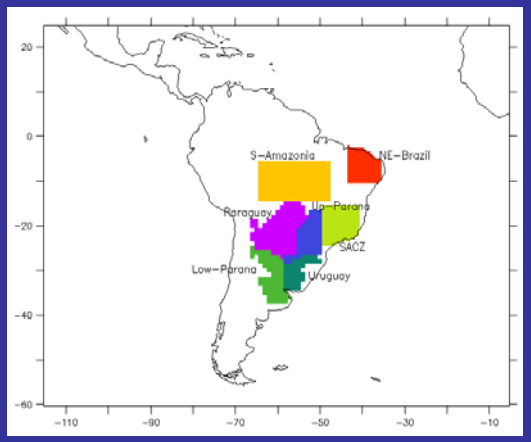


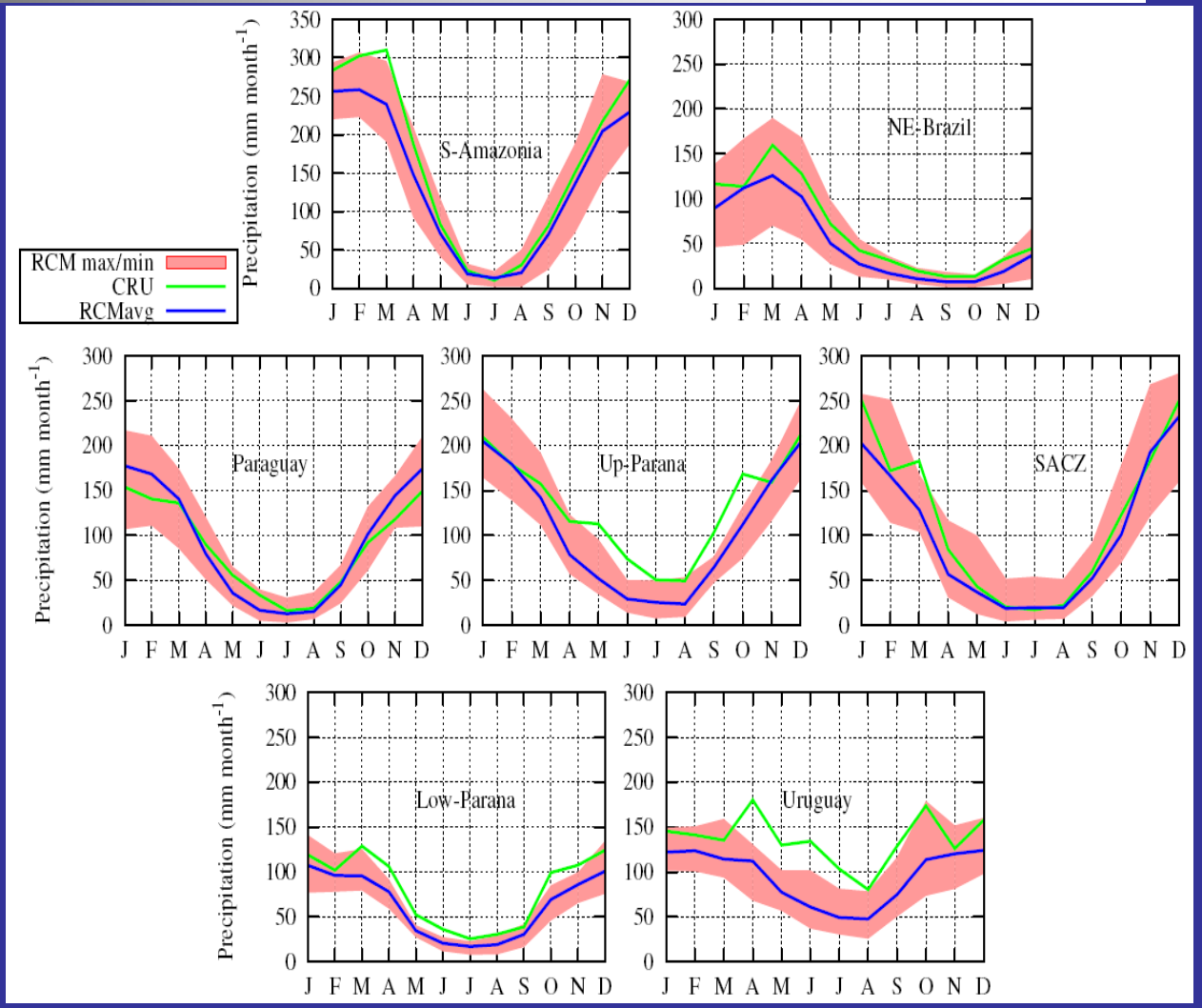


Source: Sanchez et al.

ERA Interim driven simulations of seven regional models for South America:

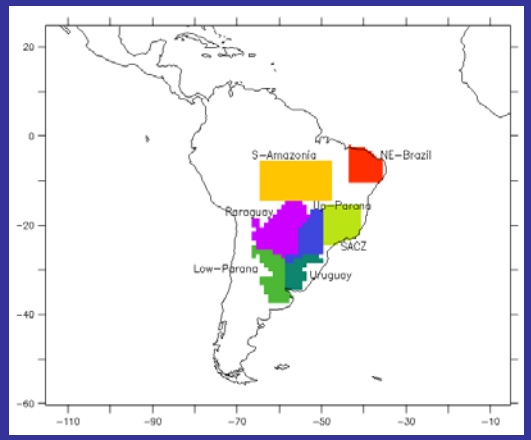
Annual cycle of Rainfall

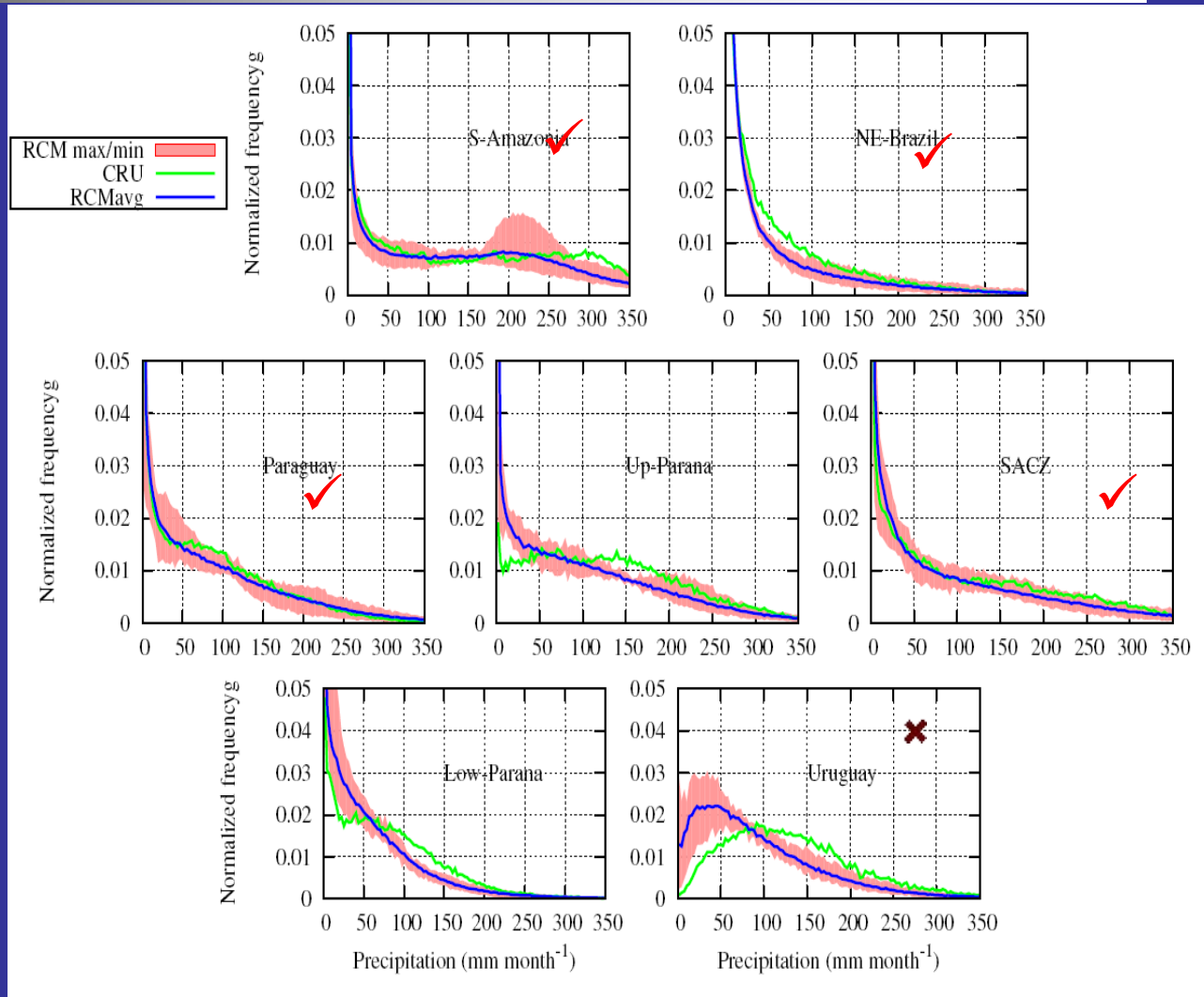




Source: Sanchez et al.

ERA Interim driven simulations for South America: Frequency distribution of Rainfall

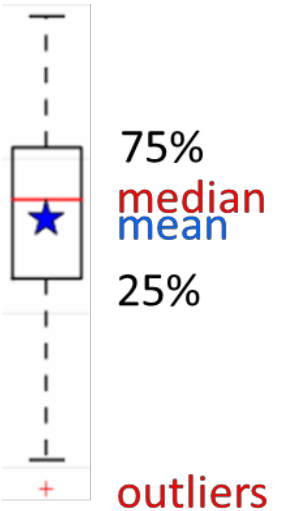


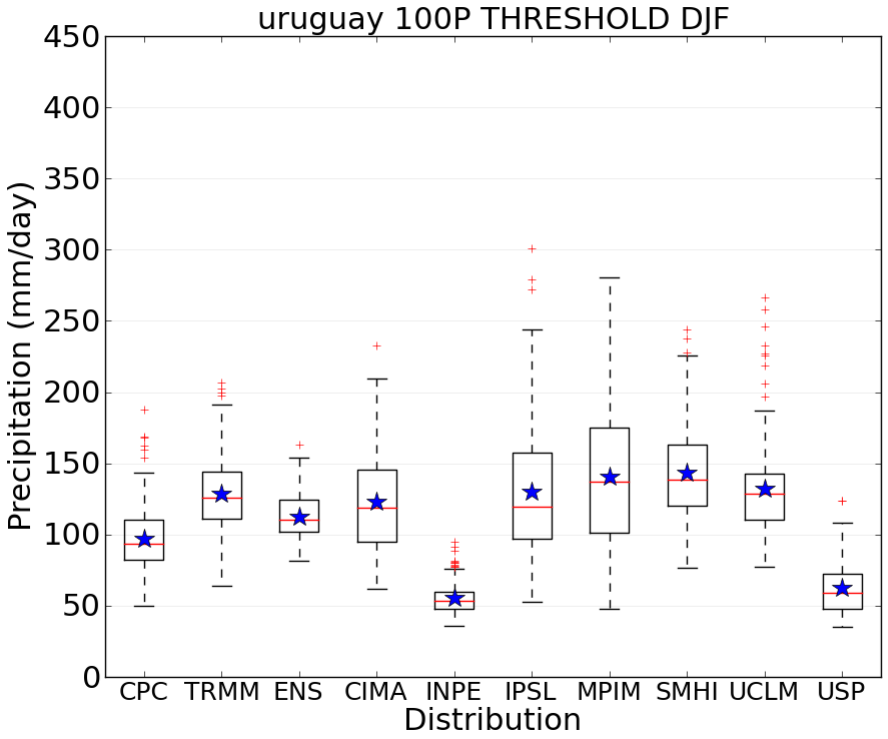


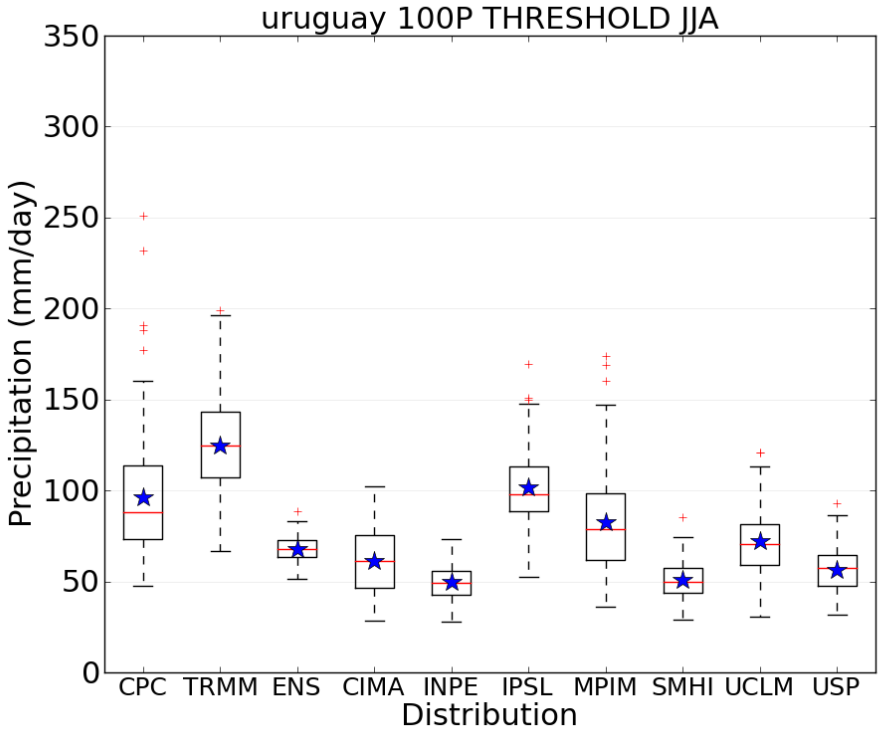
Source: Sanchez et al.

Boxplots of indices over selected regions

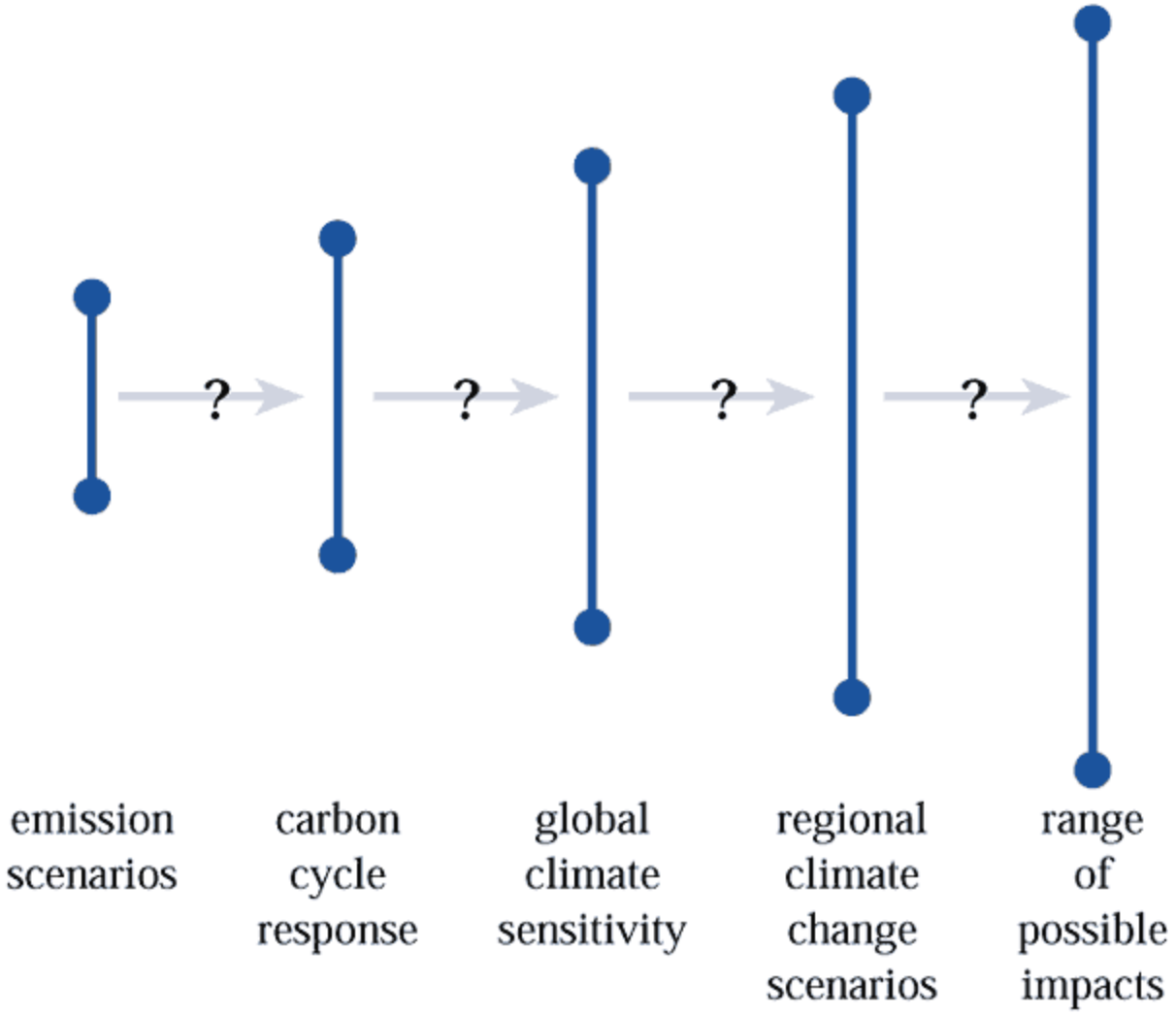
1. Calculate the seasonal indices (e.g. 99th percentile threshold over summer) of CPC, TRMM, models and the ensemble mean (ENS) over each 12 regions
2. Compare the distribution of each regions using boxplots (IQR, median)
3. Calculate the mean value of each regions (blue star)
4. Relative high skill is indicated by the similarity of IQR, median and mean





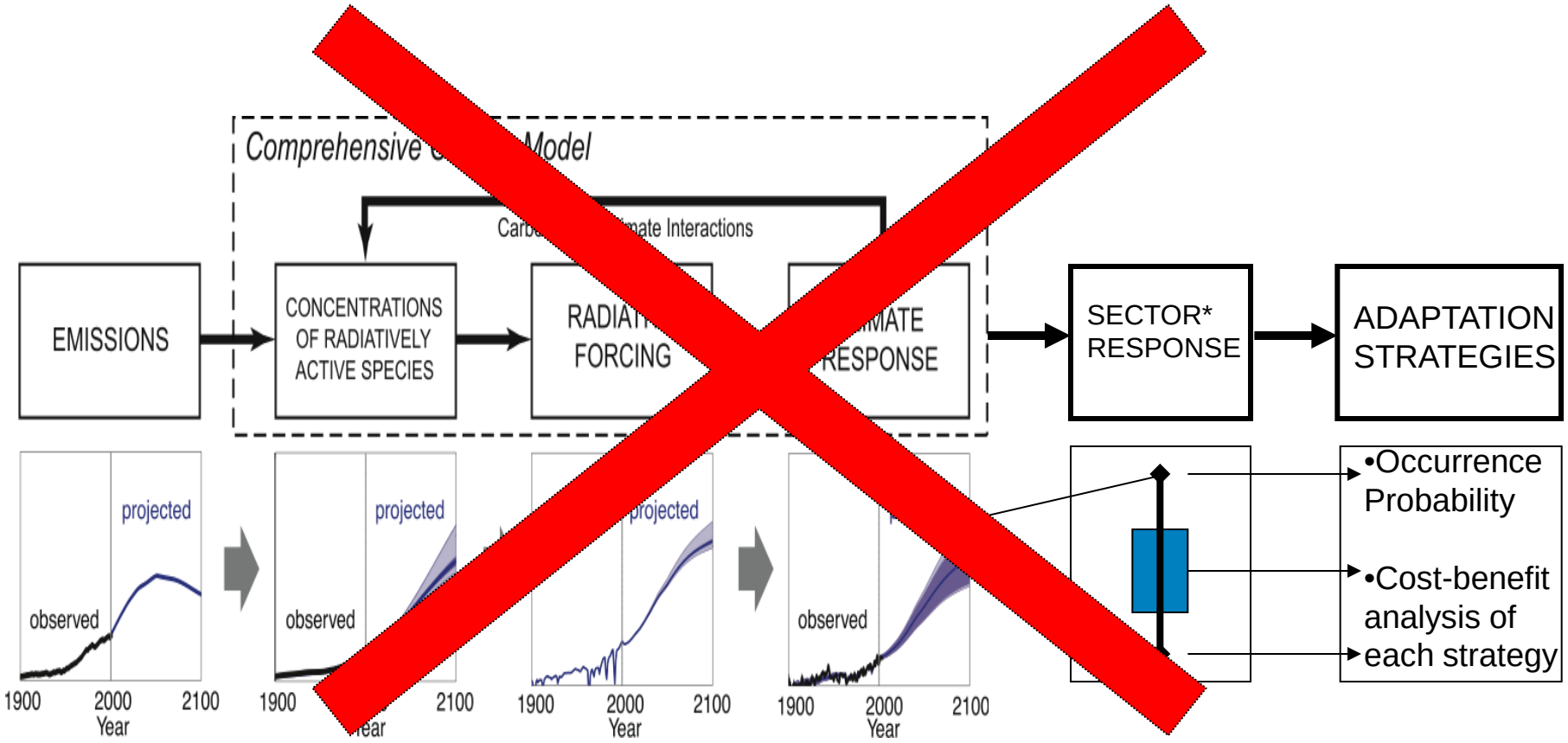


Cascade of Uncertainty



UNEP

Cascade of Uncertainty



* Sectors: crop yields, floods, hydropower production, ecosystems, river transportation, health,…

Source: IPCC; J.-P. Boulanger

Source: IPCC. Figure 10.1

An early field work in CLARIS LPB

Adaptation strategy design process

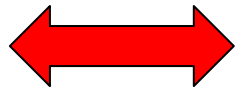
Sector

1- Analyze its vulnerability to **present** climate

2- Identify the socio-economic **causes** of this vulnerability

Participatory task

- What actions can be implemented to reduce the vulnerability (climate-independent)?
- What actions can be implemented to reduce climate-related vulnerability?
- Seek for multiple/complementary strategies
- Are the strategies coherent with development actions?
- Are they consistent with future risk evolution?
- Are they contrary to mitigation objectives?
- Do they have negative side-effects on other sectors?



Climate Models

Source: J.-P. Boulanger

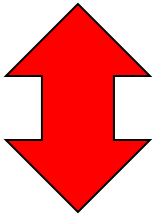
Climate and Society: A complex relationship

Extreme climate events highlight **social structural inherent tensions** of the modern agricultural production model that are absent during high economic yields times.

If the occurrence of extreme climate events increases, the **socioeconomic differences** between different actors will express vigorously by introducing a dynamic of social conflict.

In this context, the Government could anticipate and regulate this intrinsic conflictive trend by designing sectorial **public policies** that incorporate a complex analysis integrating all factors (climatic, agro-ecological, social, economic, political and symbolic).

Adaptation to climate change is ***not a climate issue anymore but has become an economic-social-political issue*** *where climate scenarios provide important information on trends and risks in climate vulnerability*



Climate change scenarios <u>uncertainty</u> is therefore not a crucial issue for making decisions

Source: J.-P. Boulanger

CLIMATIC FACTOR

INTERDISCIPLINARY AND TRANSECTORIALITY

MITIGATION STRATEGIES

AGRICULTURAL SECTOR

Expert knowledge

Policy makers

Agriculture community

Model of ruralized agriculture

Socio.productive profiles

Cognitive capital
Socio-productive habits
Political capital

Economic market logics
Socio-economic position
Agroecological features

In CLARIS-LPB, ***the usual top-down approach*** *of climate change impact investigation (from climate as an external driver down to society)* ***was replaced by a multi-disciplinary regional approach of land use, hydrology and climate issues****.*

Conclusions
A transformation process

Boulanger, Schlindwein and Gentile (WCRP, 2011)

Impact-oriented approach of climate change impacts

Vulnerability-oriented approach of climate change challenges

Sectoral quantitative impacts based on a cascade of model outputs

Mainly "climate" expert studies and reports

Multi-sectoral/territorial vulnerability to climate (actual and future)

Participative, multi-disciplinary activities

Climate and Society

Agriculture/Land-use (WP8)

Projects of Impact and Adaptation

1.Land-use in Brazil: Contrasted analysis of Cotrijal and Anchieta
2.Agro-systems and rural development in Argentina (San Justo, Junín and Balcarce)
3.Pastures in Uruguay
4.Fire risks

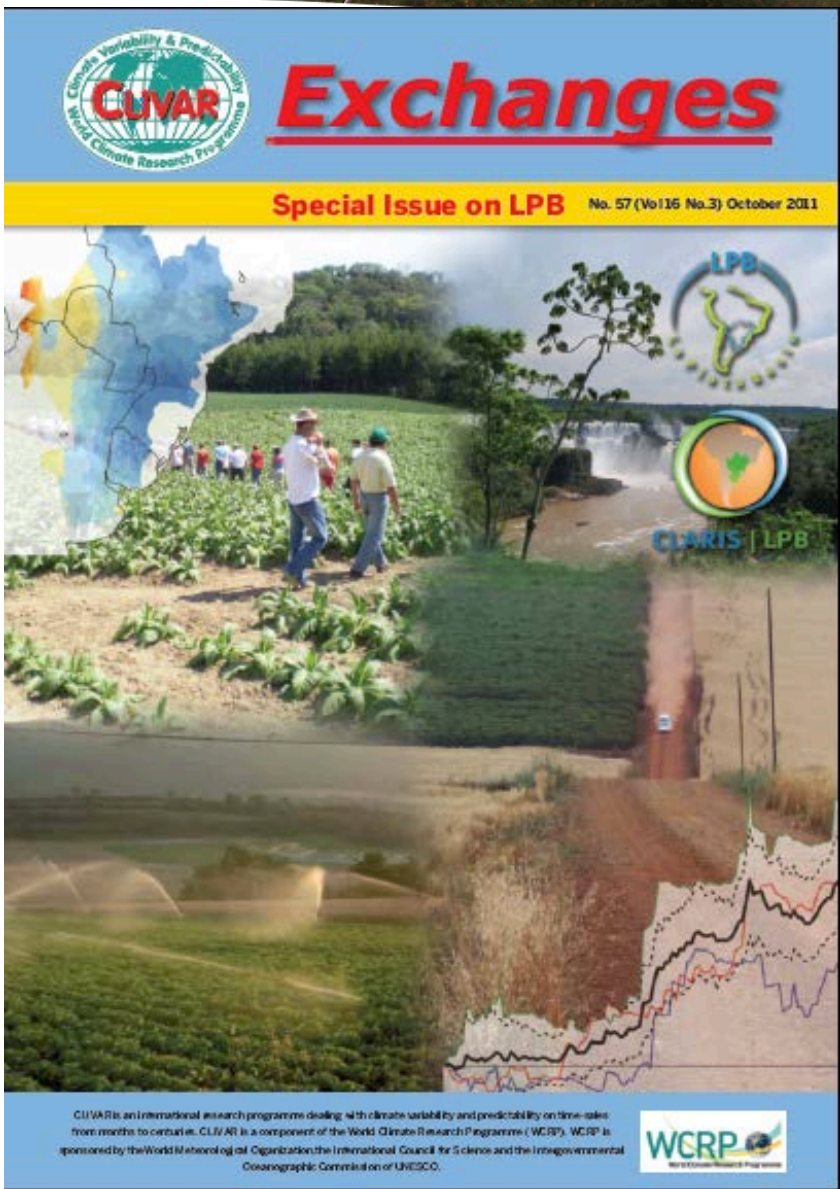
Hydrology (WP9)

Projects of Impact and Adaptation

1.Floods in LPB
2.Climate Change impacts on river morphologies (erosion, sediment, river transportation)
3.Hydroelectric production in LPB
4.Iberá wetland ecosystem

WCRP CLIVAR Special Issue

- **Rich and comprehensive synthesis of CLARIS LPB first years of activities**



What next?
Motivation for the
WCRP Conference for Latin America and the Caribbean

Improving our knowledge on the climate system, the interactions among its components and the limits of predictability,

- (but also!) Enhancing our ability to interact with other disciplines, particularly decision makers and social scientists in order to translate basic climate knowledge into actionable science.

In this context, a ***Latin American and Caribbean Conference on Climate and Society is being organized (April 2014)*** with the objective of identifying new programmatic priorities to address said challenges.

Goals

Identify gaps and ways to overcome limitations in the chain of knowledge going from basic to applied climate science and to informing policy and decisions that are particularly relevant for LA&C.

Build interdisciplinary capacity, fostering the participation of decision and policy makers, climate and social scientists and key intermediary institutions.

Contribute to further develop the emerging provision of regional Climate Services.

Concept document

The *LAC Conference* should aid in **defining the research agenda needed to support the provision of effective, problem-oriented and demand-driven climate services**.

This will necessarily require a balance between

(i) **research focused on improving climate monitoring and predictions** at regional and local scales;

(ii) **research oriented by the demands of socio-economic sectors** sensitive to climate, and

(iii) **research on the process of informing policy and decision-making** in the different socioeconomic sectors.