La Plata Basin (LPB)

Regional Hydroclimate Project

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Scientific and Implementation Steering Group (SISG)

Outline

1. Motivations for LPB
2. LPB priority areas
3. Predictability / Climate Change
4. LPB observational component
5. Potential funding sources

A Little Bit of History

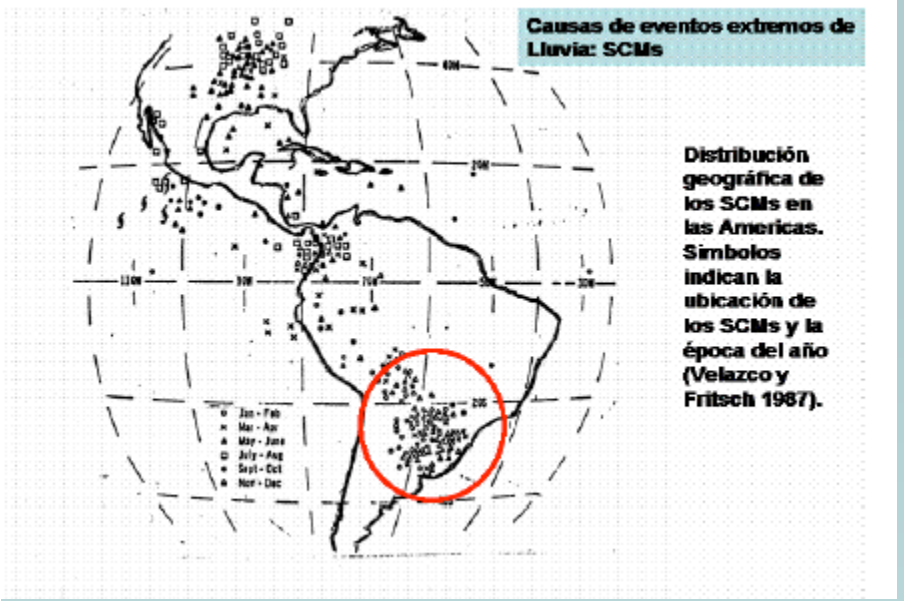
1999-2004: A study group was formed to identify the hydroclimate science questions and priorities of the La Plata basin. This group, known as Platin, was formed with support from the CLIVAR and GEWEX Panels (both of WCRP).

2002-2004: The La Plata Basin (LPB) was accepted as a “Regional Hydroclimate Experiment” endorsed by GEWEX and CLIVAR.

2005-2015: LPB is now close to finishing its implementation plan; monitoring activities, a field experiment and modeling experiments are being planned.

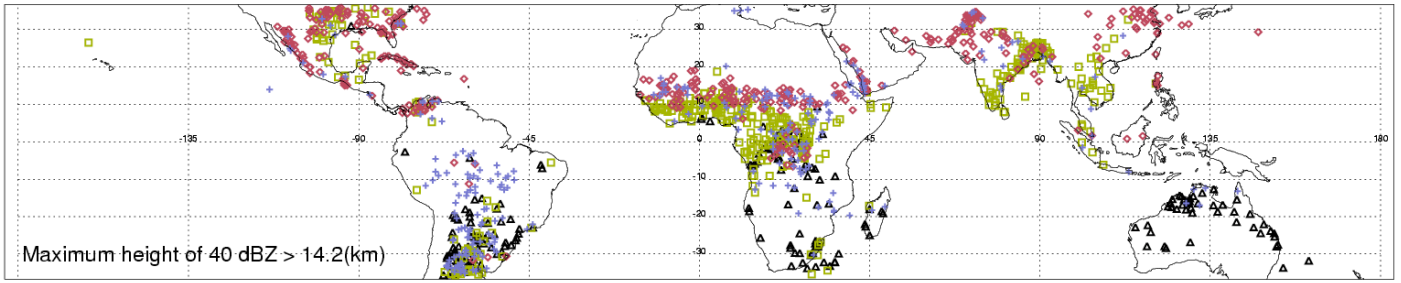
Motivation

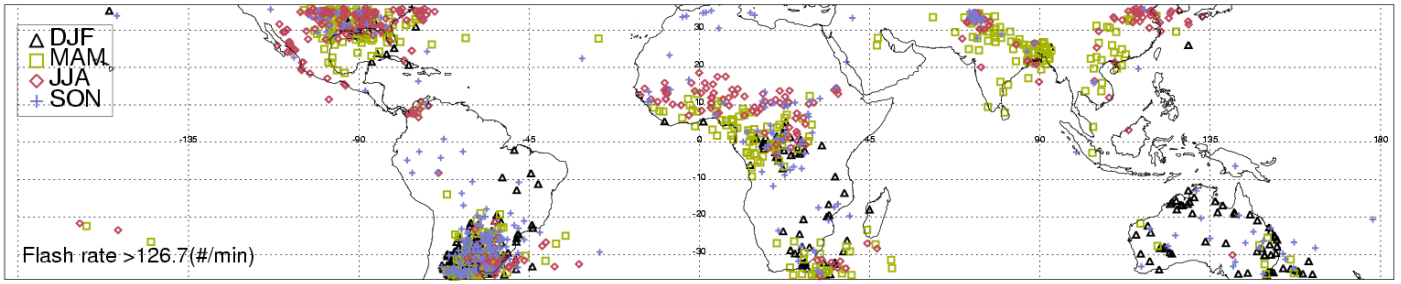
Extreme events and trends



Mesoscale Convective Systems (MCSs)

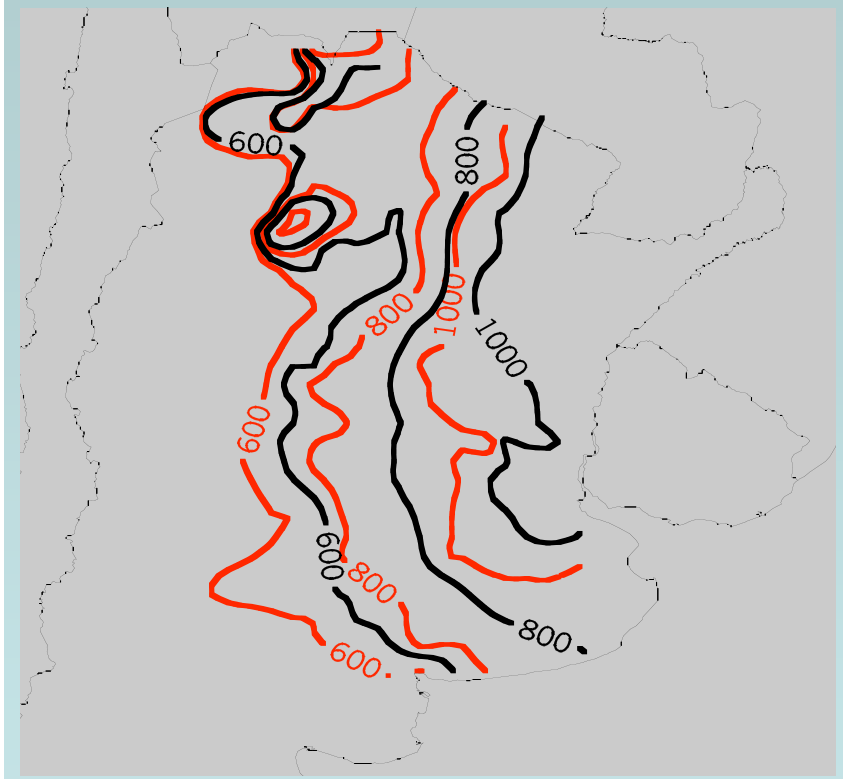
Velasco and Fritsch 1987



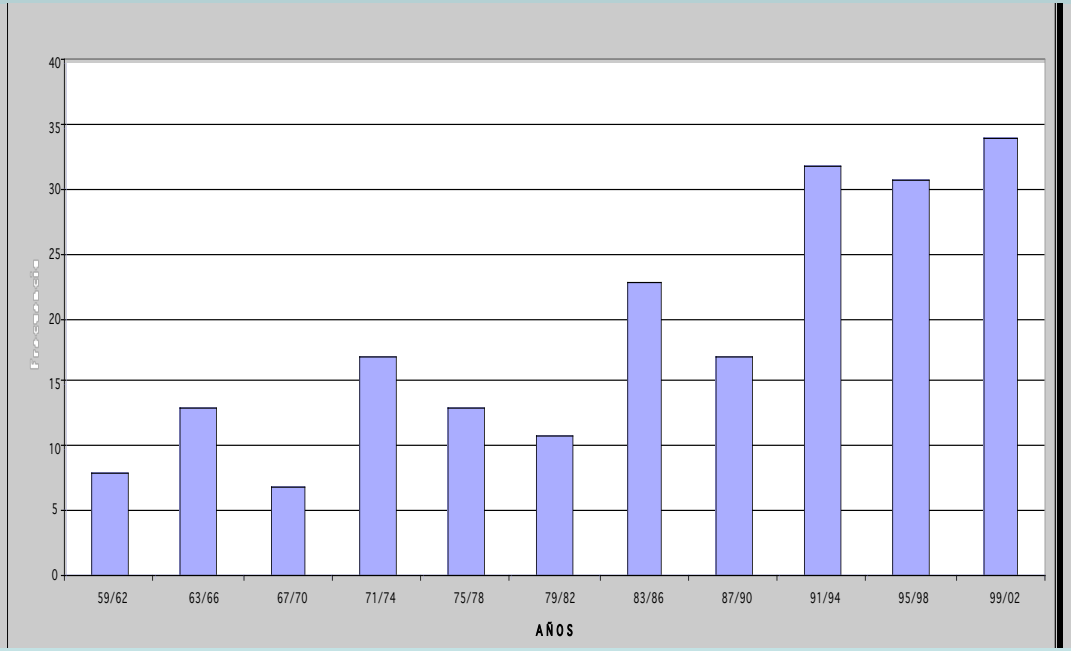


Courtesy of Zipser

black : 1950-1969
red 1980-1999



Number of cases with P> 100 mm/(2 days) for 16 gauging stations over central and northeastern Argentina

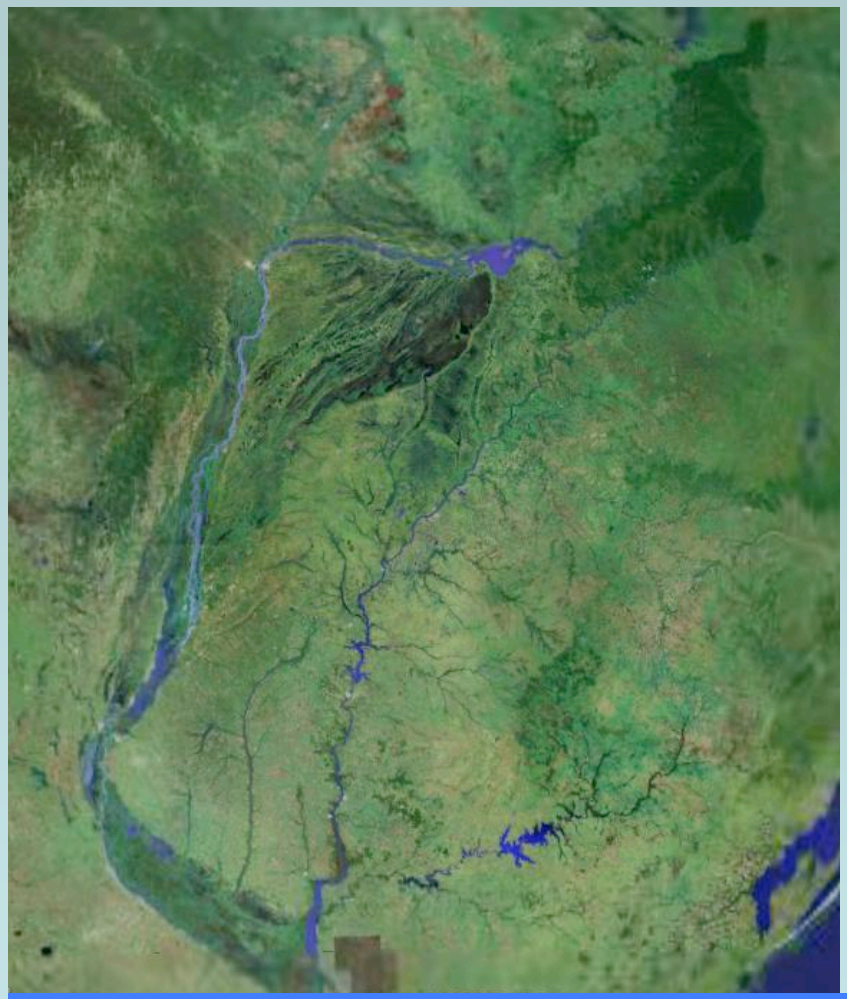


Amplification of the precipitation signal in the streamflow

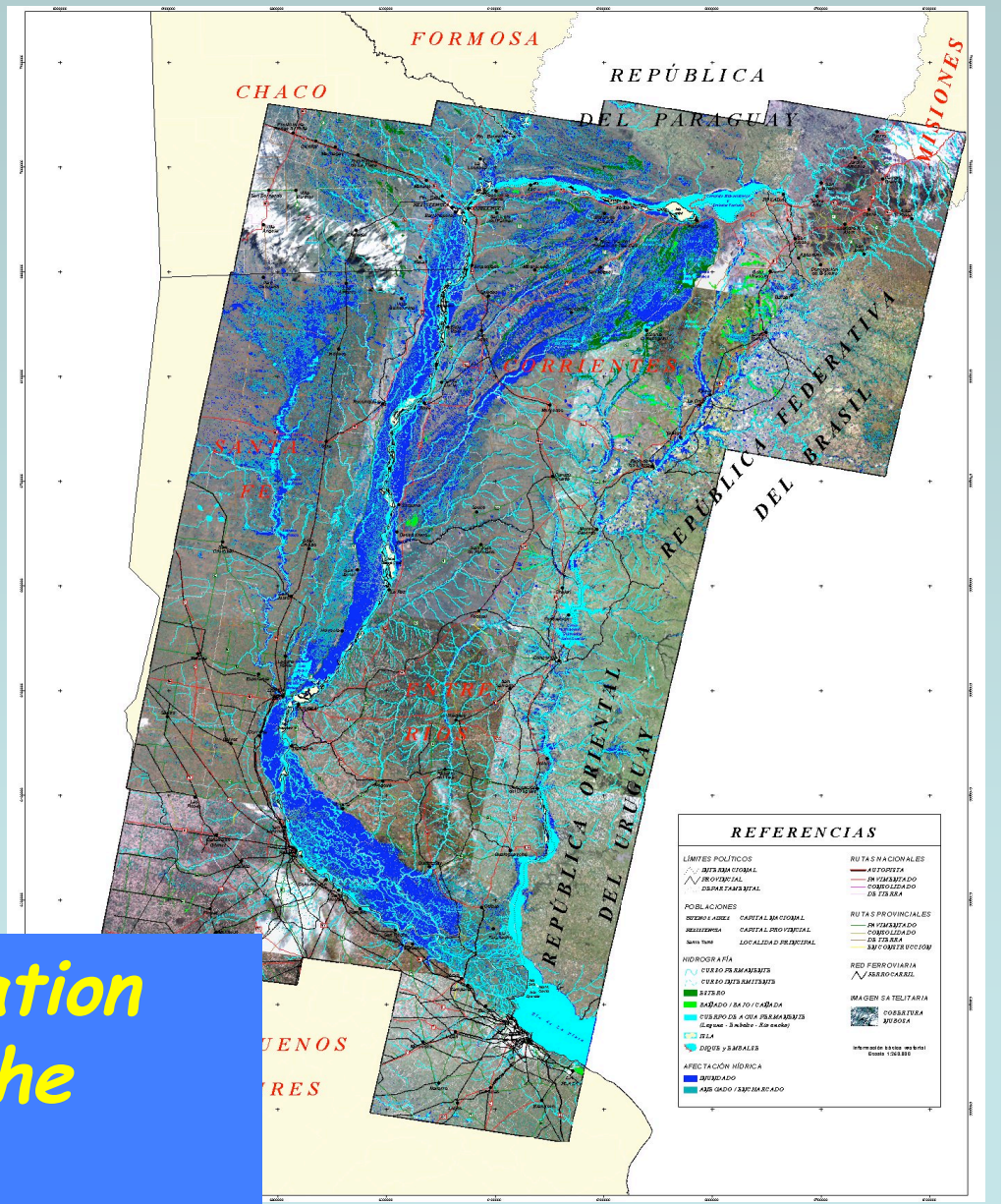
	Rainfall rate over La Plata Basin ($m^3 s^{-1}$)	Streamflow ($m^3 s^{-1}$)	Evaporation + Infiltration ($m^3 s^{-1}$)
1998	107,000	36,600	70,400
1999	81,600	20,440	61,600
Difference	*23 %*	*44 %*	*13 %*
El Niño	76,000	25,250	50,750
La Niña	71,000	21,640	49,360
Difference	*7 %*	*17 %*	*3 %*
1951-1970	72,000	19,300	52,700
1980-1999	83,500	26,000	56,500
Difference	*16 %*	*35 %*	*9 %*

Berbery and Barros (2002)

Normal conditions



1997/98 Flood of the Paraná River (Satellite images from CONAE)



"The signal of precipitation events is amplified in the river discharge"

La Plata Basin (LPB) main science questions:

- What climatological and hydrological factors determine the frequency and spatial extent of **floods and droughts**?
- How **predictable** is the regional weather and climate variability and its impact on hydrological, agricultural and social systems of the basin?
- What are the impacts of global **climate change and land use change** on regional weather, climate, hydrology and agriculture? To what extent can their impacts be predicted?

Main research areas

* Improvement of hydrologic and climate models' representation of land surface-atmosphere interactions

* Land surface contributions to hydroclimate predictive skill

* Development of coupled models at adequate resolutions for hydrologic purposes

* Better estimates of MCS precipitation

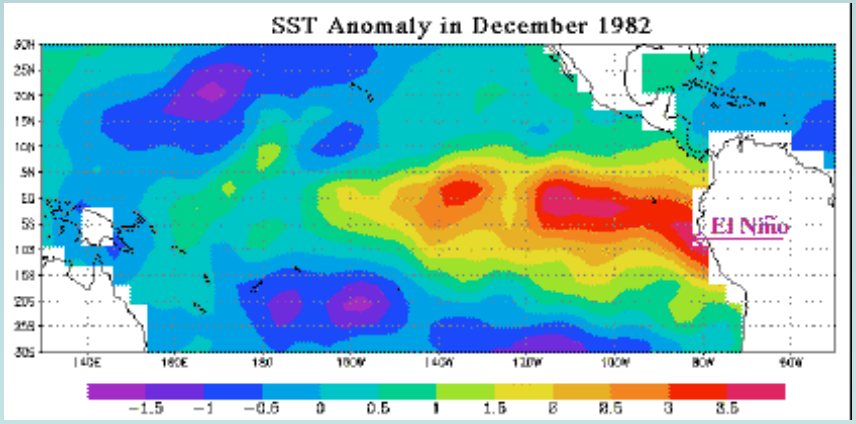
* Climate change scenarios (Vulnerability and adaptation)

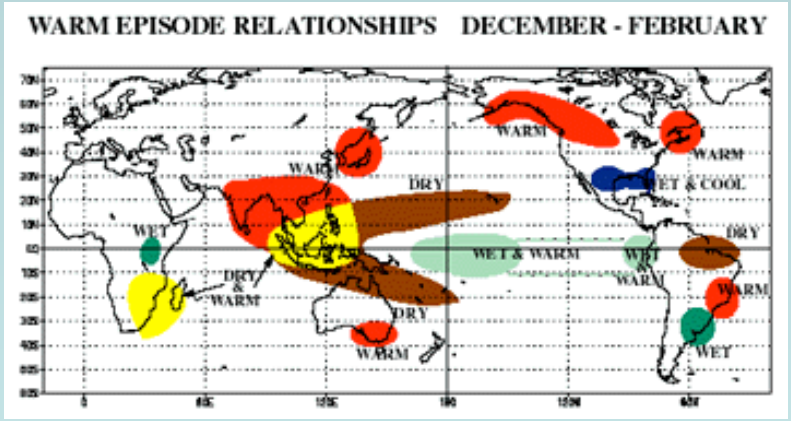
* Impacts on the system's hydrology

Scientific Motivations

Predictability and the role of surface effects

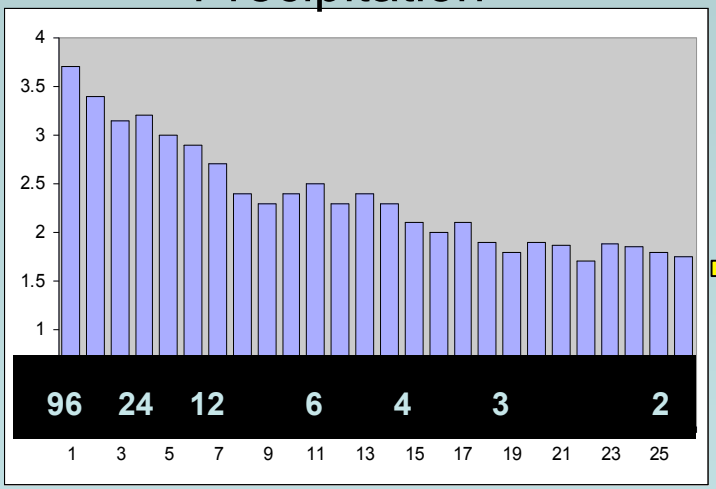
Slowly evolving lower boundaries:
Sea surface Temperatures





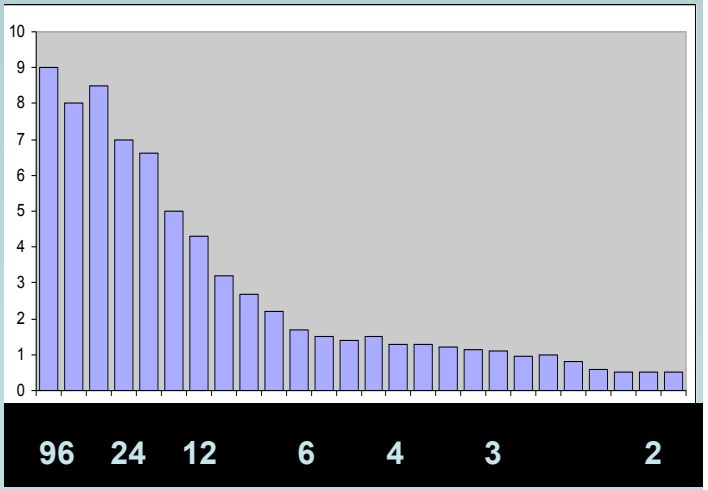
Slowly evolving lower boundaries: Soil moisture

Power spectrum of Precipitation



Land processes

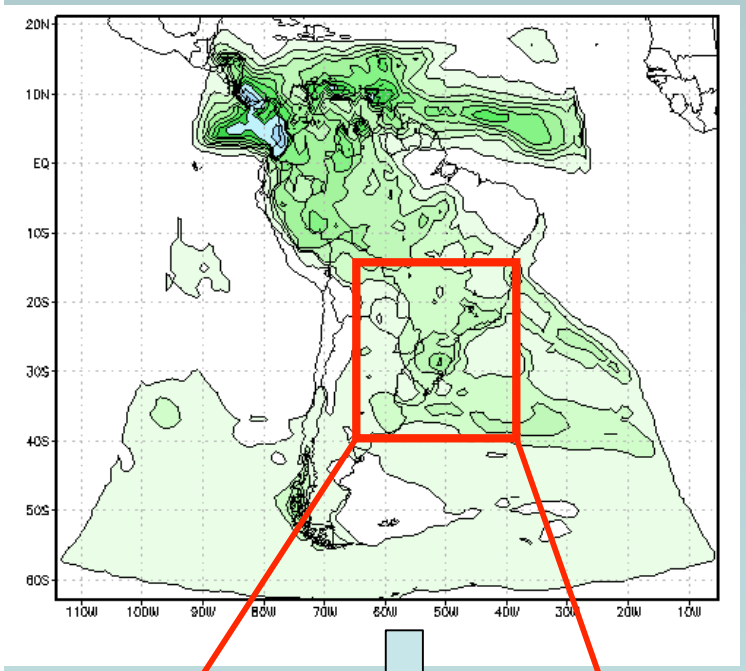
Power spectrum of Soil moisture

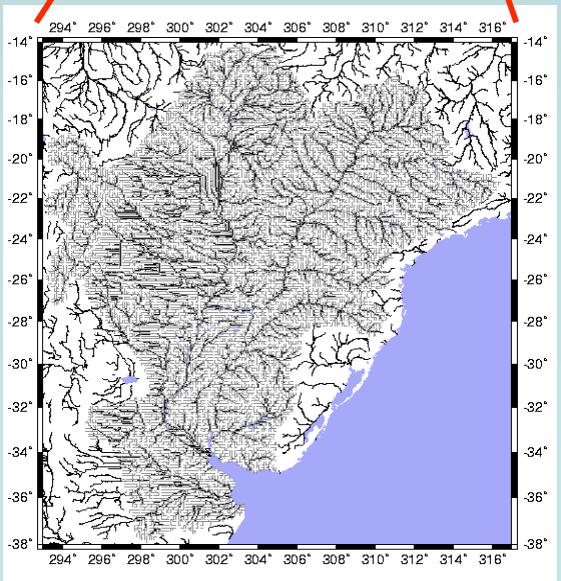


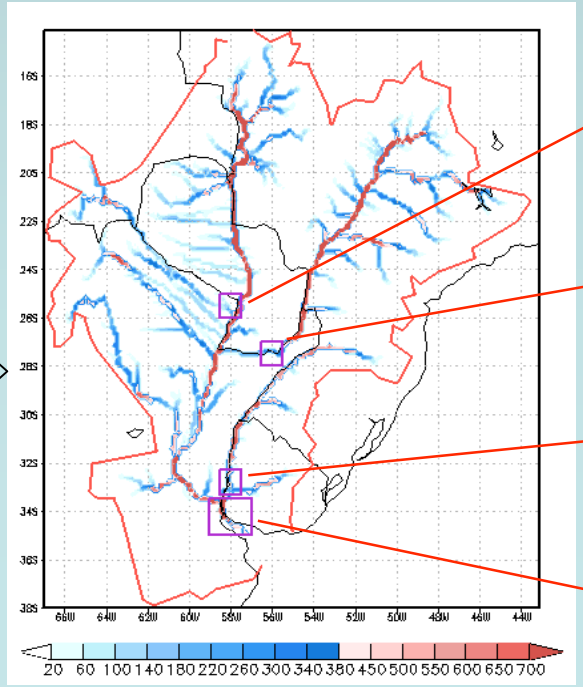
Land-Atmosphere Coupled Models

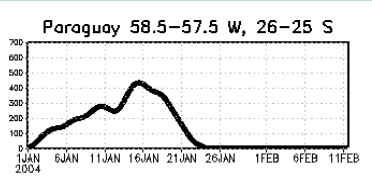
Can we take advantage of this information to assess in an integrated manner the hydroclimate system?

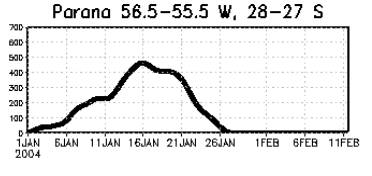
An integrated system of coupled global, regional and hydrologic models

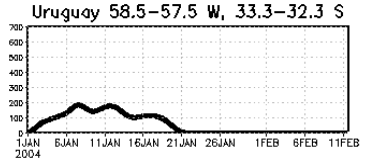


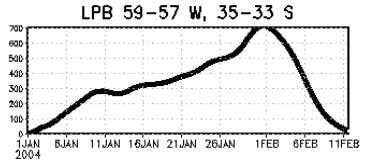




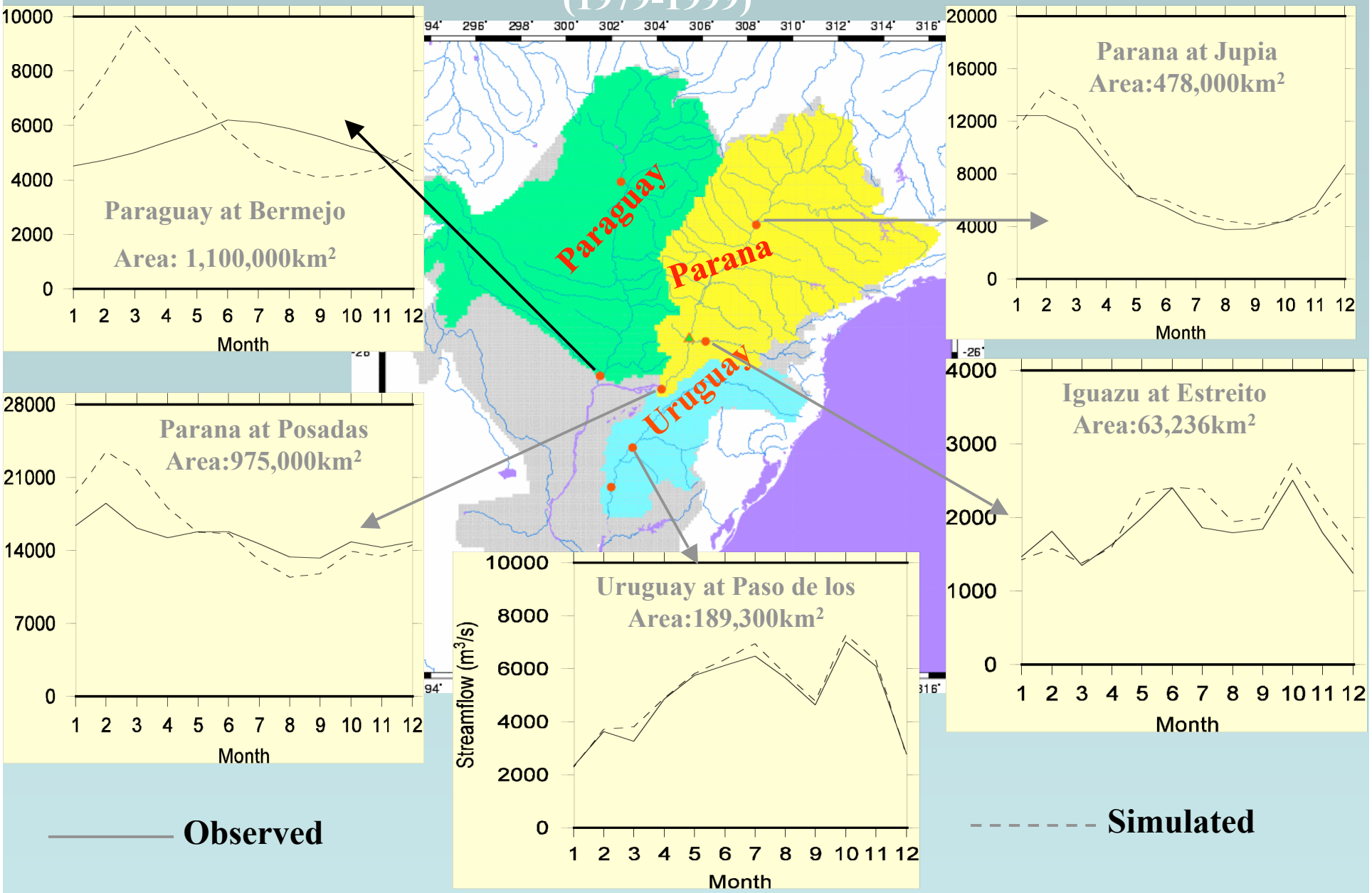




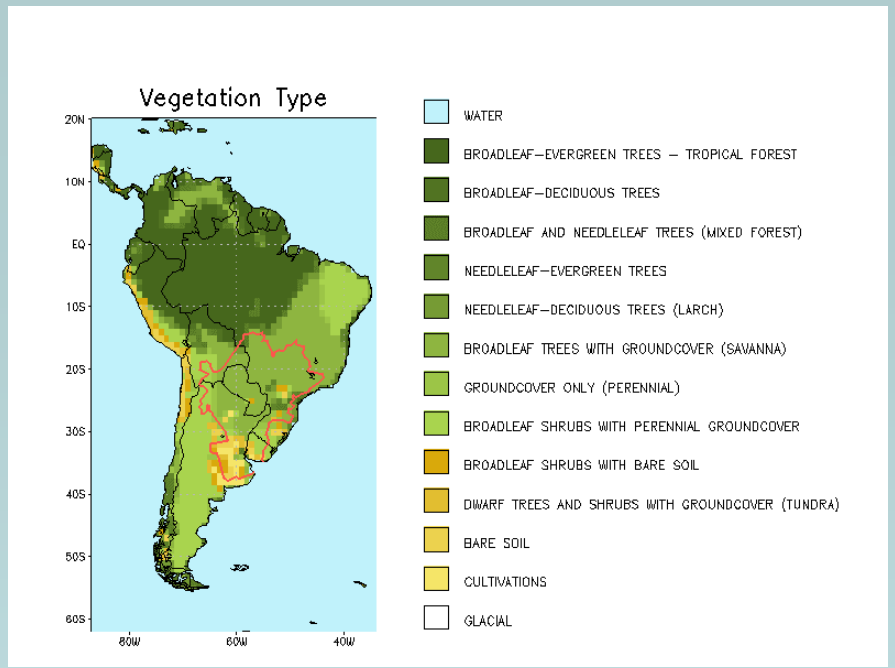




Mean Monthly Streamflow (1979-1999)



Source: Su and Lettenmaier

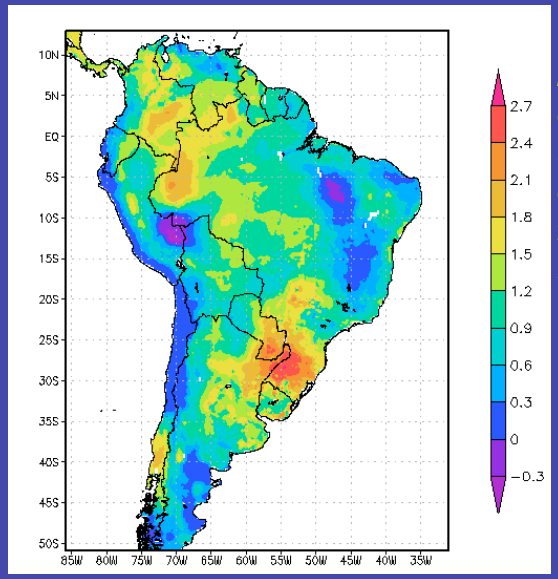

Vegetation Type
20N
10N
EQ
10S
20S
30S
40S
50S
60S
80W
60W
40W
WATER
BROADLEAF—EVERGREEN TREES — TROPICAL FOREST
BROADLEAF—DECIDUOUS TREES
BROADLEAF AND NEEDLELEAF TREES (MIXED FOREST)
NEEDLELEAF—EVERGREEN TREES
NEEDLELEAF—DECIDUOUS TREES (LARCH)
BROADLEAF TREES WITH GROUNDCOVER (SAVANNA)
GROUNDCOVER ONLY (PERENNIAL)
BROADLEAF SHRUBS WITH PERENNIAL GROUNDCOVER
BROADLEAF SHRUBS WITH BARE SOIL
DWARF TREES AND SHRUBS WITH GROUNDCOVER (TUNDRA)
BARE SOIL
CULTIVATIONS
GLACIAL


Peru
Bolivia
Paraguay
Brazil
Chile
Argentina
Uruguay

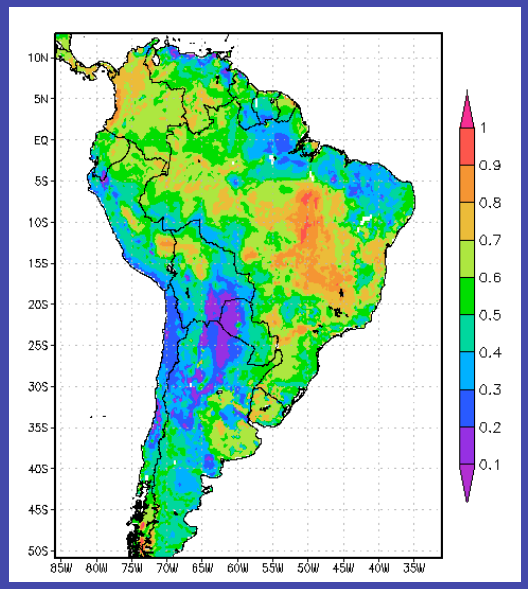

La Plata basin
Rivers
Lakes
Tree Cover, broadleaved, evergreen
Tree Cover, broadleaved, deciduous, closed
Tree Cover, broadleaved, deciduous, open
Tree Cover, needle-leaved, evergreen
Tree Cover, needle-leaved, deciduous
Tree Cover, mixed leaf type
Tree Cover, regularly flooded, fresh
Tree Cover, regularly flooded, saline, (daily variation)
Mosaic: Tree cover/Other natural vegetation
Tree Cover, burnt
Shrub Cover, closed-open, evergreen
Shrub Cover, closed-open, deciduous
Herbaceous Cover, closed-open
Sparse Herbaceous or sparse shrub cover
Regularly flooded shrub and/or herbaceous cover
Cultivated and managed areas
Mosaic: Cropland/Tree Cover/Other Natural Vegetation
Mosaic: Cropland/Shrub and/or Herbaceous cover
Bare Areas
Water Bodies (natural & artificial)
Snow and Ice (natural & artificial)
Artificial surfaces and associated areas
No data

South American Land Data Assimilation System

Courtesy of Gustavo de Goncalves (NASA-CPTEC)

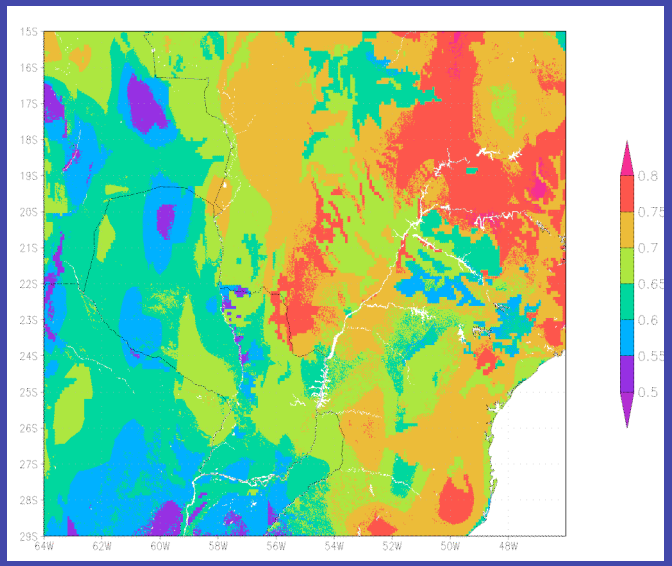


Evaporation in Kg/m2 on December 1989 using ECMWF bias corrected atmospheric forcing *(Berg et al., 2005, Int. J. Clim., 25 (13), 1697-1714)*



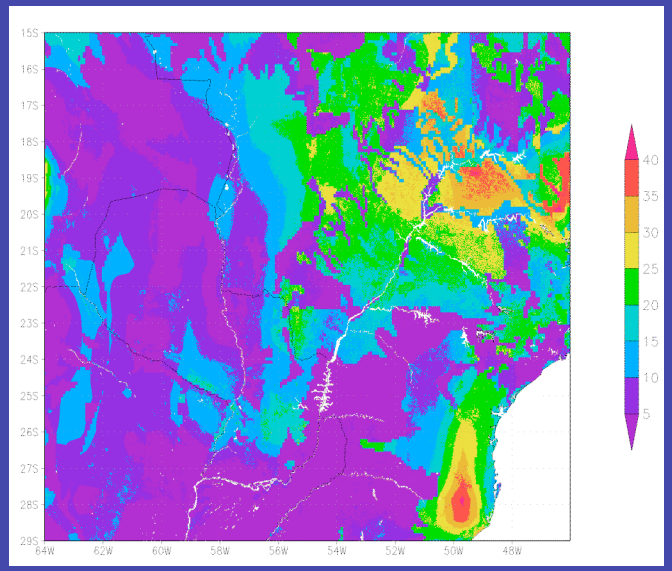
Volumetric soil moisture on December 1989 using ECMWF bias corrected atmospheric forcing *(Berg et al., 2005, Int. J. Clim., 25 (13), 1697-1714)*

Volumetric soil moisture

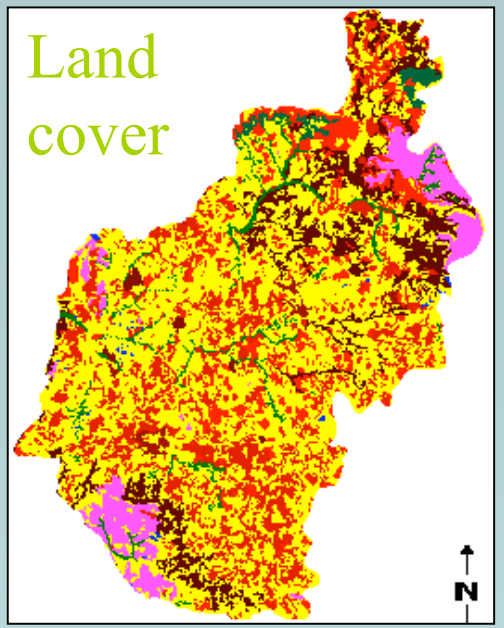


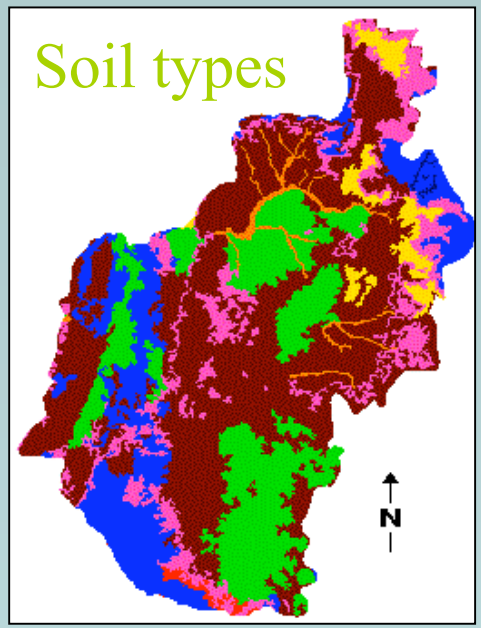
1Km resolution - January 2000

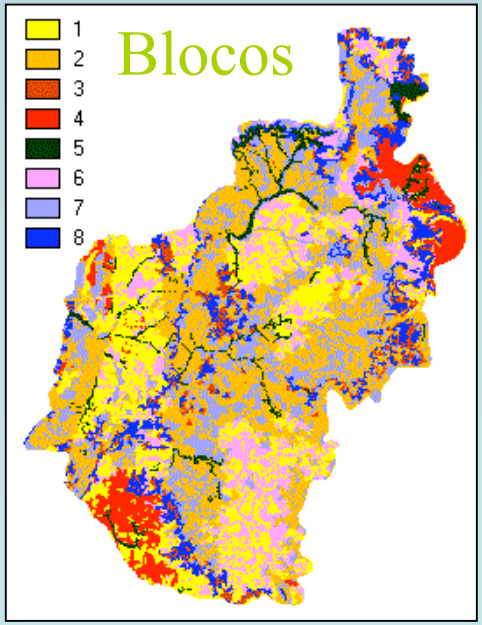
Total runoff (Kg/m²)

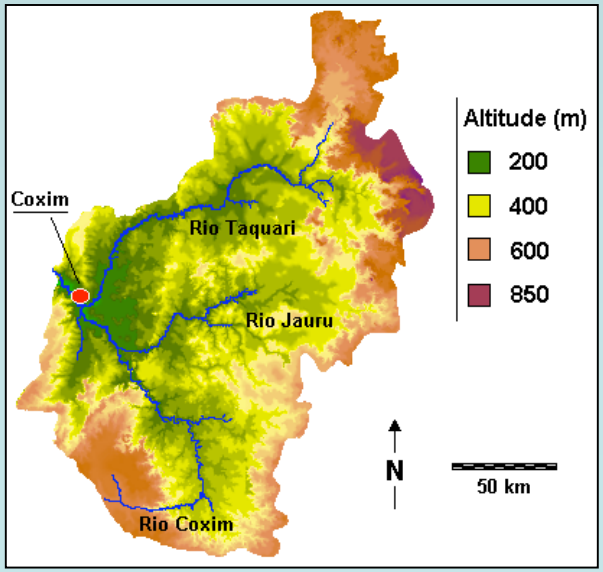


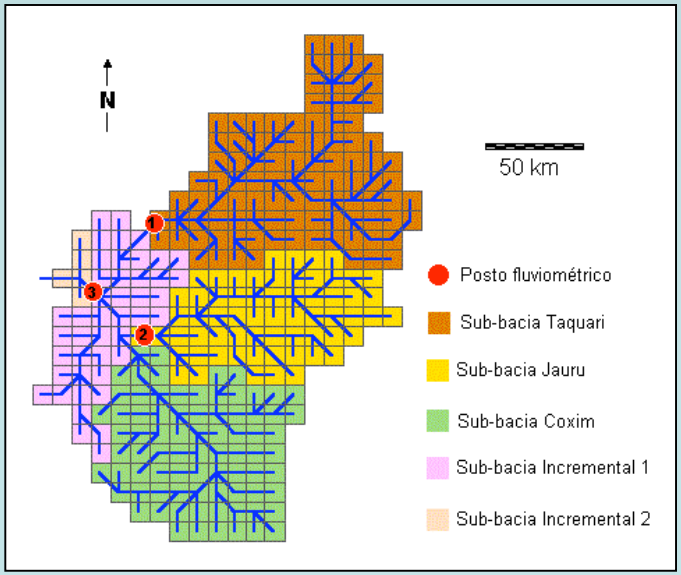

BRASIL
40° W
00° S
Rio Paraguai
Rio Taquari
Bacia do rio
Taquari, MS
30° S
70° W
30° S
40° W


Land
cover
N


Soil types
N


1
2
3
4
5
6
7
8
Blocos


Coxim
Rio Taquari
Rio Jauru
Rio Coxim
Altitude (m)
200
400
600
850
N
50 km

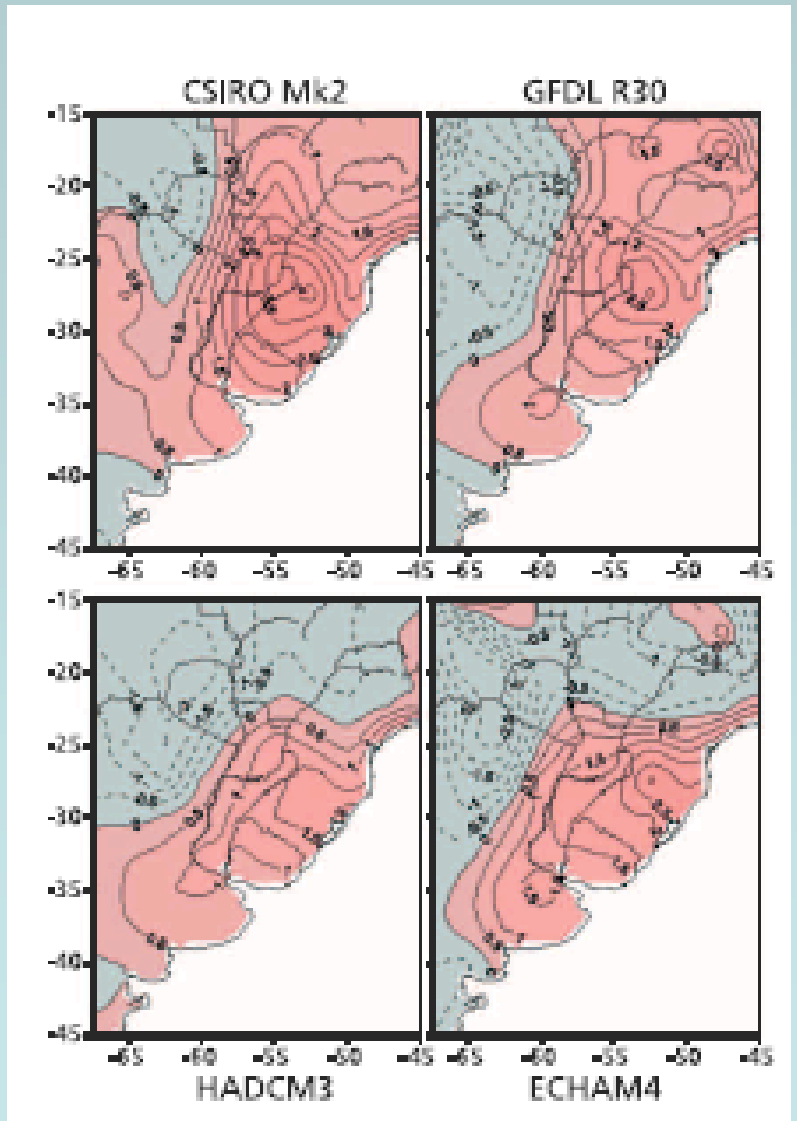

N
50 km
1
2
3
Posto fluviométrico
Sub-bacia Taquari
Sub-bacia Jauru
Sub-bacia Coxim
Sub-bacia Incremental 1
Sub-bacia Incremental 2

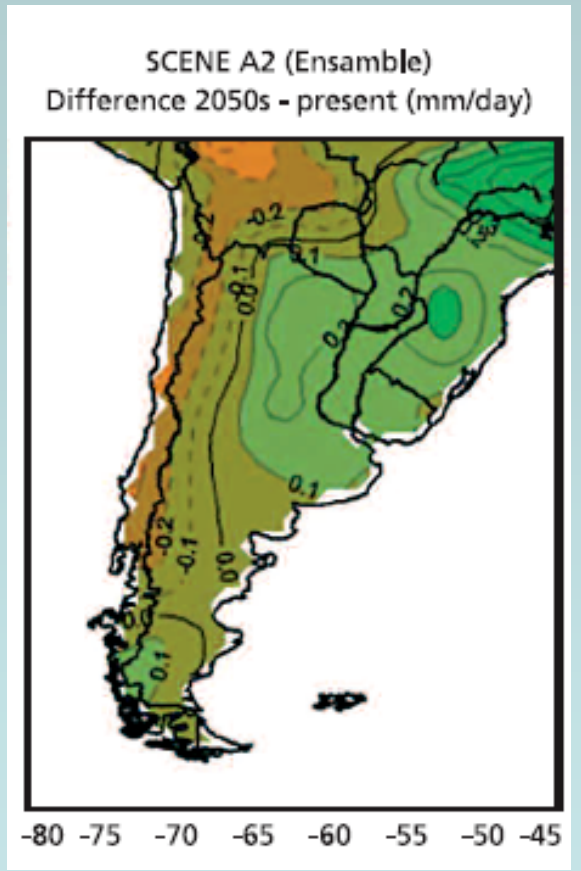
Scientific Motivations

Climate Change

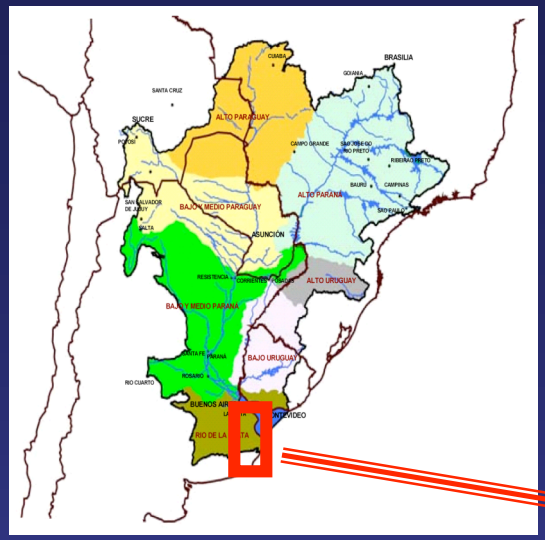
- Greenhouse gases
- Aerosols
- Land cover/land use changes

Difference (mm/day) between observed annual precipitation and estimates by four GCMs.

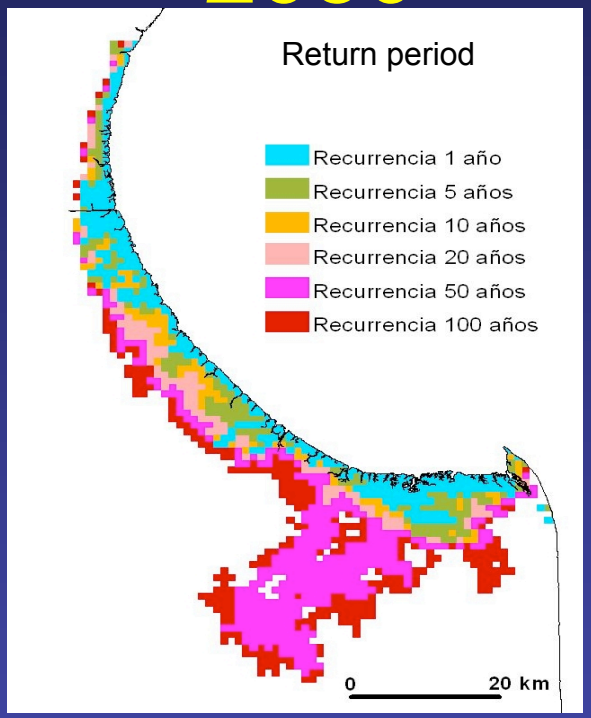




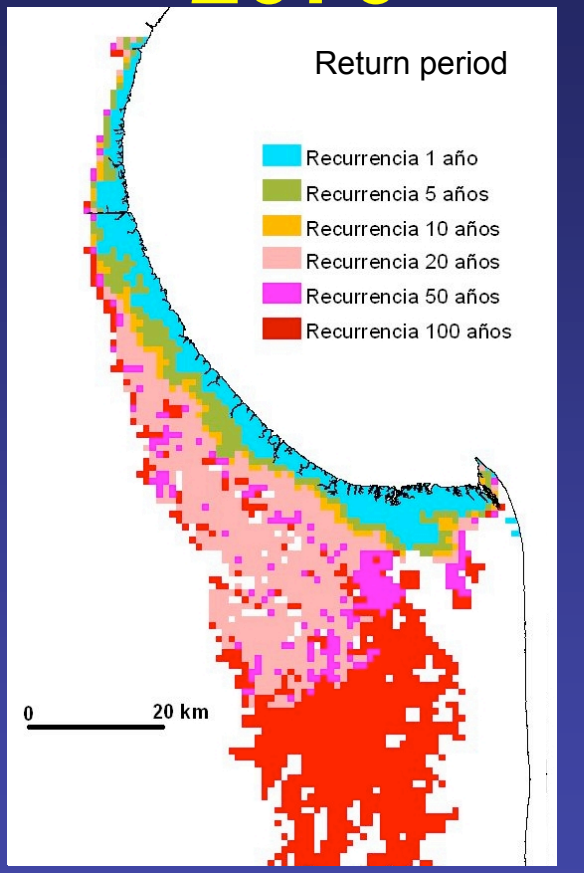
RISK MAPS



2030



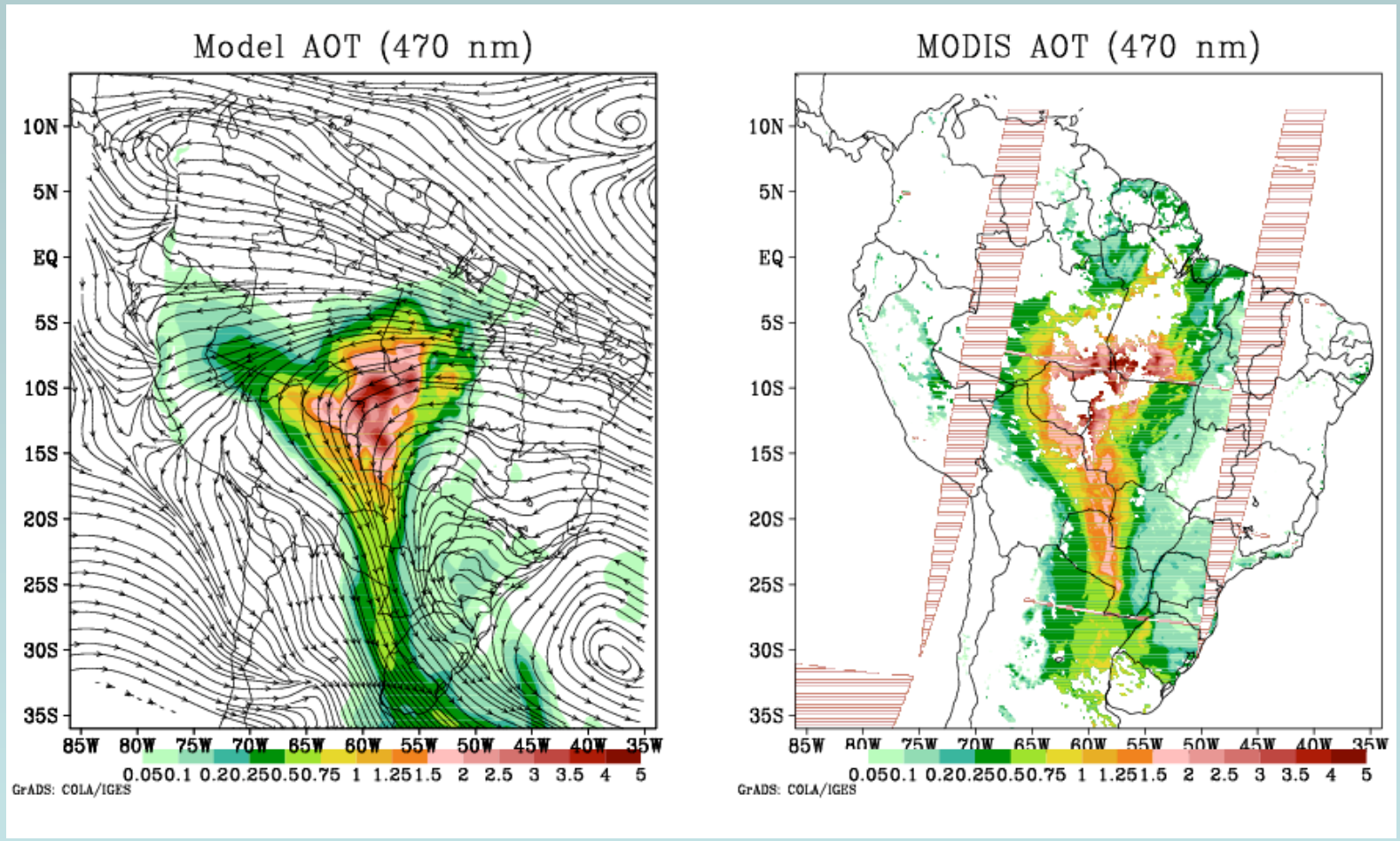
2070



"Floods will be more frequent over larger (populated) areas near the mouth of the La Plata River"

Re, Luduena & Menendez

Aerosol effects



Numerical simulation and validation with MODIS of aerosol optical thickness. Freitas et al (2005)

Planned activities

LPB's observational component

Datasets

Field experiment & Enhanced monitoring

Monitoring/Field experiment issues discussed during the First SISG Meeting

1. Survey for the field experiment
Collect existing met/hydro information through the region in preparation for the field experiment.

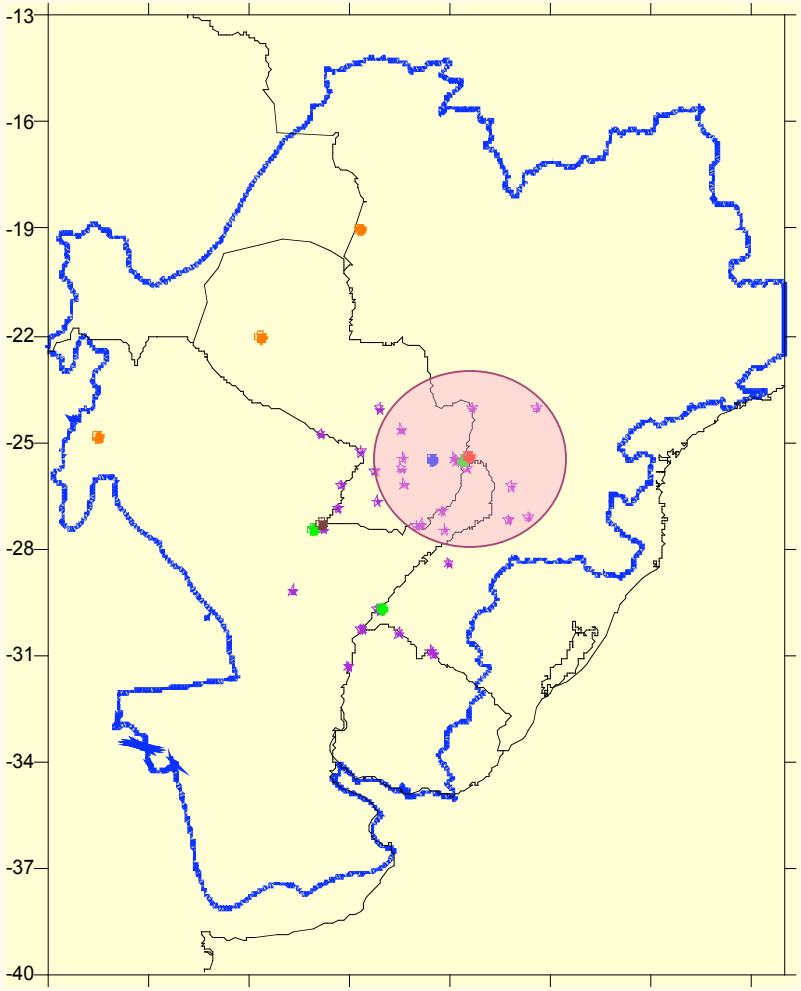
2. Establishing of a supersite representative of LPB
To determine an appropriate site to centralize hydro/met observations for a broader community.

3. Radar integration
A network of radar systems is being integrated in South-eastern Brazil. Integration of radars from Paraguay and Argentina using the same protocols is an objective.

4. Flux Towers
To select 1 to 3 flux towers to be used as reference sites representative of LPB for international initiatives (e.g., CEOP).

5. Soil moisture measurements
To obtain soil moisture observations for model calibration and other agricultural purposes.

Working on establishing a supersite

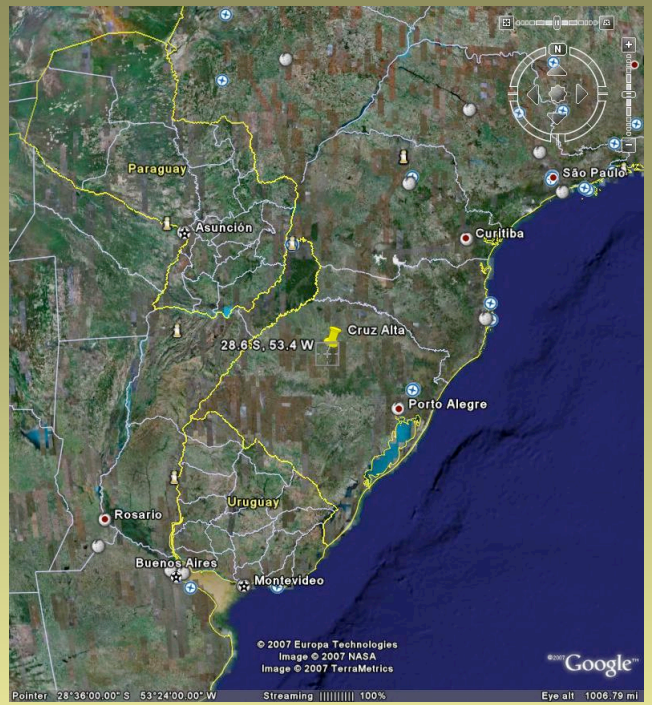


Raingauge Meso-network
Soil moisture measurements
Radar
Flux Tower
Aerosols
Rawindsonde
Wind profiler

Cruz Alta (approx 28.6S, 53.4W)

(Courtesy of Osvaldo Moraes)

Soy bean field



sensible heat,
latent heat,
CO2,
momentum fluxes,
soil moisture,
soil temperature

Micrometeorological observations in the Pantanal Area-Central Brazil

Fazenda São Bento– MS
(19º 33' S; 57º 54' W)

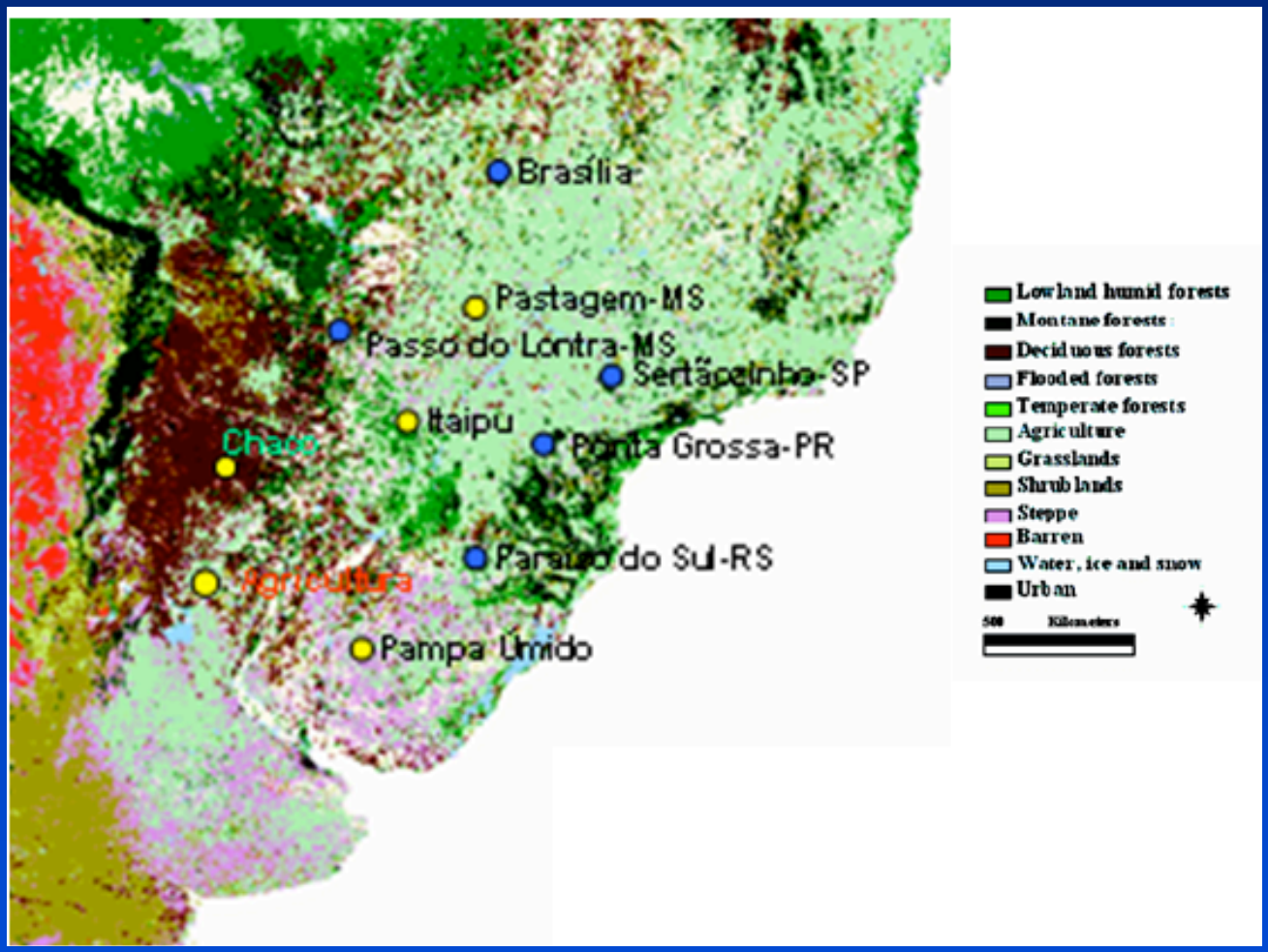
Sensors at instrument tower (21 meters high)

Air temperature profile (5 levels)
H2O concentration profile (5 levels)
op canopy temperature (Infra-red sensor)
Wind velocity profile 5 levels)
Wind direction
Air pressure
Precipitation
Incoming and outgoing solar radiation (short wave radiation)
Incoming and outgoing terrestrial radiation (long wave radiation)
Incoming photosynthetically active radiation (PAR)
Turbulence measurements above forest canopy
High frequency (10.4 Hz) three wind components, air temperature, H2O and C
Concentration (Sensible and latent heat flux and CO2 flux)
Soil measurements
Soil heat flux (2 plates at depth of 1 cm and 10 cm, respectively)
2 five-level profiles of soil humidity, electric conductivity and temperature
(sensors at depths of 1, 5, 10, 20, and 40 cm)
Methane concentration

Additional instrumentation:

Radiosonde station
Tethered balloon

Flux towers


Brasília
Pastagem-MS
Passo do Lontra-MS
Sertãozinho-SP
Itaipu
Chaco
Ponta Grossa-PR
Agricultura
Pampa Úmido
Lowland humid forests
Montane forests
Deciduous forests
Flooded forests
Temperate forests
Agriculture
Grasslands
Shrublands
Steppe
Barren
Water, ice and snow
Urban
500 Kilometers

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

LPB

La Plata Basin Program

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- Experiments
- Satellite´s Images
- Climate monitoring
- Vegetation Fires monitoring
- Pollution monitoring
- Hidrometeoroly monitoring
- Numerical Forecast
- Databank
- Publications
- Links

La Plata Basin Program


Localization of the la Plata Basin

In recent years there has been a major effort toward a closer integration between countries in South America. Of particular relevance, Argentina, Brazil and Uruguay, together with Paraguay, currently operate as a common economic market in southern South America (MERCOSUR). Regional governments are using the framework of the MERCOSUR to develop common socioeconomic policies, and in fact the scientific community is also starting to use MERCOSUR's structure to establish regional collaborative research activities. For these reasons, this time is especially auspicious for establishing collaborative projects in southern South America.

The La Plata basin in southeastern South America has always been a subject of interest for all of these countries because of its importance in the regional economies. But it is also important from the scientific standpoint due to the uniqueness of many of its climatological features. La Plata basin is located in an area where significant tropical-extratropical interactions take place; it holds the largest wetland in the world, known as "Pantanal", that naturally regulates floods, is a local source of moisture for precipitation processes, and has a wide variety of unique flora and fauna species.

The WMO/WCRP CLIVAR panel on the Variability of American Monsoon Systems (VAMOS) has found general consensus on the region's readiness to embark on and support collaborative research on the La Plata Basin's climate/hydrology. This readiness is primarily due to an enhanced awareness of the impact that climate variations can have on water resource management, energy production, agriculture and health. Improved prediction can potentially result in large economic and social benefits to the region.

Forecast

- Meteograms: Escolha uma opção
- ETA Model
- Fire Risk (Forecast)
- Models comparison

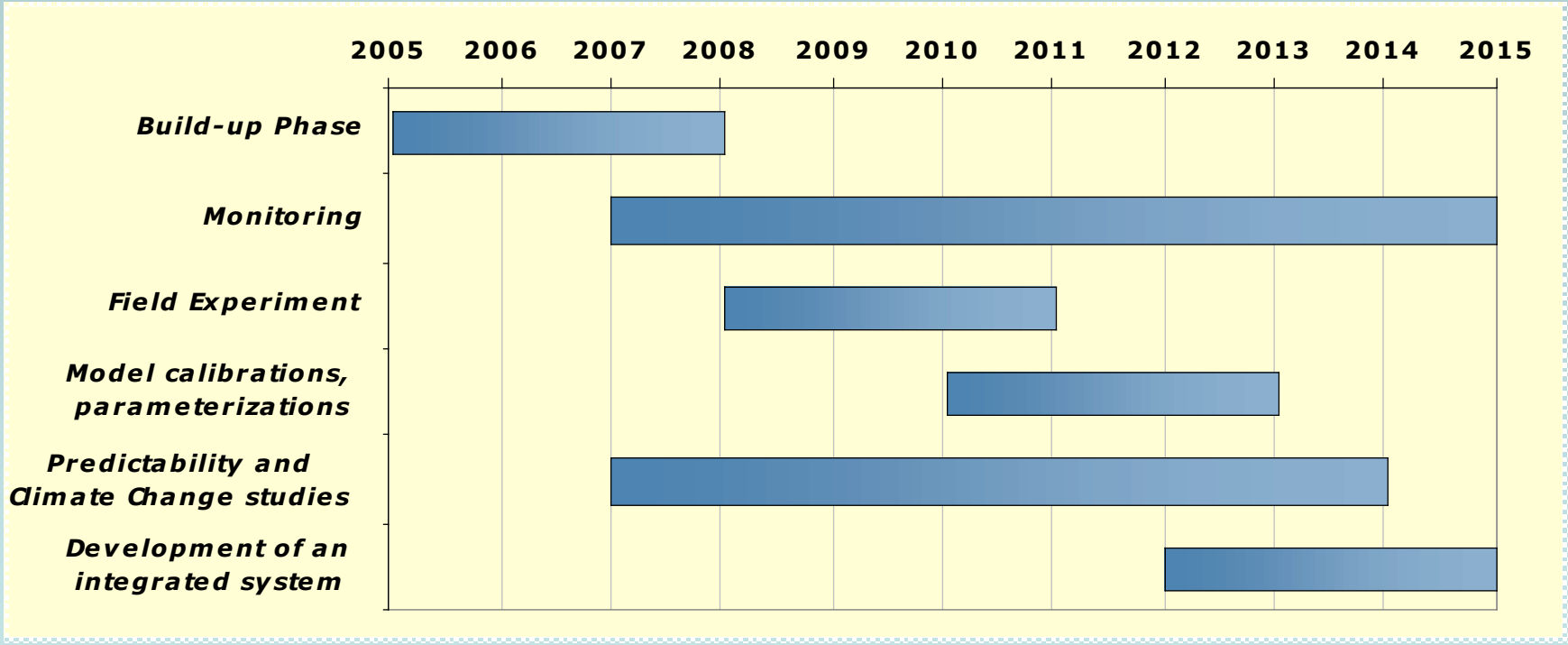
Monitoring

- 10 days - Acc.Precipitation
- Climatology: Month

Satellite´s Images

- Visible images
- Visible Animation
- Infrared images
- Infrared Animation
- Precipitation
- Cloud Classification
- Convective Coude Tracking

LPB Timeline (2005-2015)



LPB Funding – (in planning)

Many Regional Projects
PROSUR
Other projects being developed with local support (e.g., collaborations CIMA-CPTEC…)

CLARIS - LPB
A Europe-South America Network for Climate Change Assessment and Impact Studies

IAI
Ecosystems, Biodiversity, Land Use and Cover, and Water Resources

CIC-GEF
Framework Program for the sustainable management of the La Plata Basin water resources, in relation to climate variability and change

NCAR (NSF)
Collaborations during Field Experiment

http://www.eol.ucar.edu/projects/lpb

Program Overview

- CLIVAR/VAMOS and GEWEX/GHP identified the *Rio La Plata* Basin as a dimate-hydrology system with components that are potentially predictable with useful skill from seasons in advance, and whose variability has important impacts on human activities.
- LPB provides a framework for integration of regional projects leading to improved predictions of the dimate and hydrology system, and the coordination of those projects at the highest international level (WMO/WCRP)
- LPB can act as an advocacy group to agencies that provide funding for science projects and the strengthening of the scientific infrastructure.
- LPB aims to enhance the scientific infrastructure in the Plata Basin in agreement with producers and users of dimate information.

Latest News

- Presentations from the 1st Meeting of the LPB Implementation Team 18-19 Sept 2006, Brazil
- Calendar
- LPB Implementation Plan
- LPB Status Update to the 9th VAMOS Panel

LPB Workshops and Meetings

- 1st Meeting of the LPB Implementation Team 18-19 Sept 2006, Brazil
- Presentations

Science Planning

- Documents
- GIS Demonstration Map Server

Data Management

- LPB Data Management page at NCAR/EOL
- Master List of All LPB International Data Sets
- LPB (DRAFT) Data Policy
- LPB web site at CPTEC, Brazil

Other Links

- Related Projects
- Institutions, Offices and Organizations

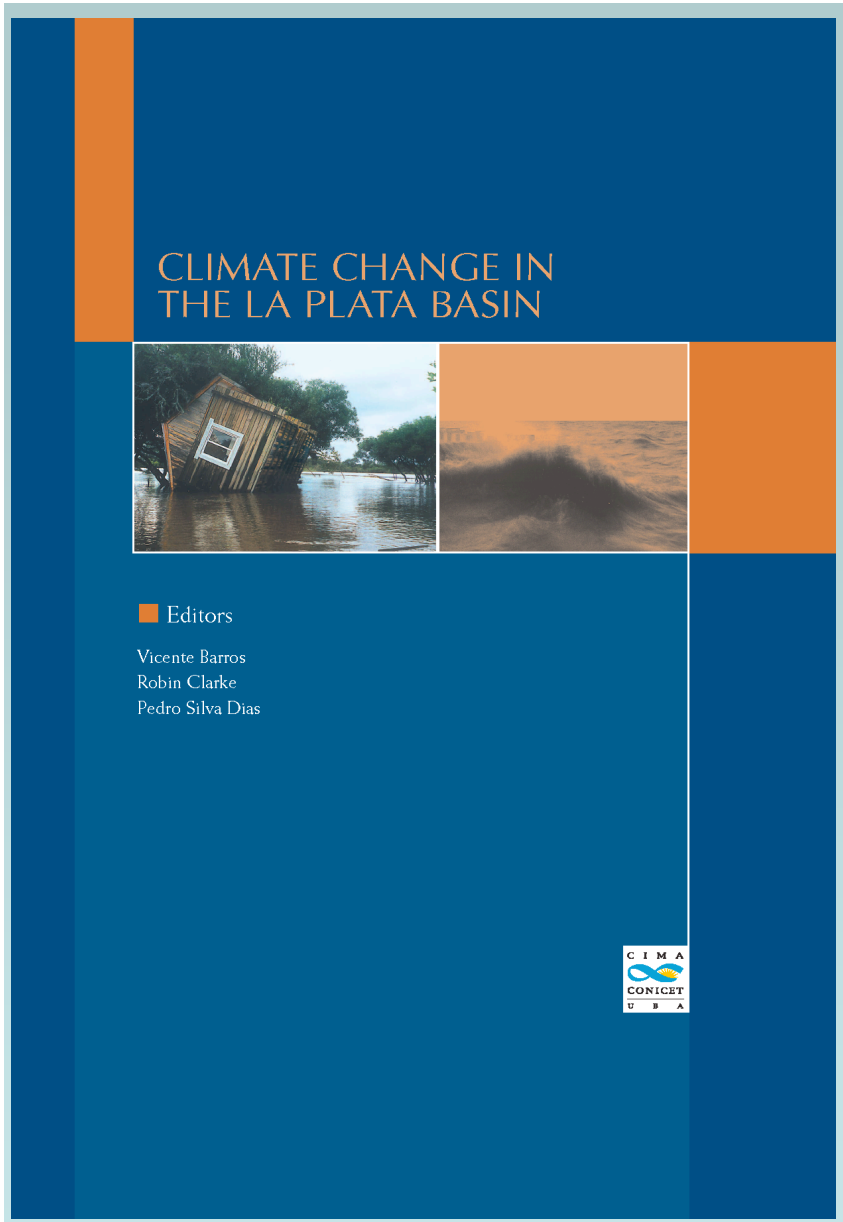
Program Structure

- LPB Implementation Team
- VAMOS Support Center
- Monsoon Experiment South America (MESA)

Program Focus

Program efforts during this first year will be divided largely into three main foci:

- **Focus 1**
- **Focus 2**
- **Focus 3**



Thanks...

Useful URLs

-http://www.eol.ucar.edu/projects/lpb

-http://www.cicplata.org

-http://www.cptec.inpe.br/lpb

-http://www.atmos.umd.edu/~berbery/lpb