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)

Maximum height of 40 dBZ > 14.2 km

Flash rate > 126.7 (#/min)

Velasco and Fritsch 1987

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

black: 1950-1969
red 1980-1999
Amplification of the precipitation signal in the streamflow

<table>
<thead>
<tr>
<th></th>
<th>Rainfall rate over La Plata Basin (m³ s⁻¹)</th>
<th>Streamflow (m³ s⁻¹)</th>
<th>Evaporation + Infiltration (m³ s⁻¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>107,000</td>
<td>36,600</td>
<td>70,400</td>
</tr>
<tr>
<td>1999</td>
<td>81,600</td>
<td>20,440</td>
<td>61,600</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>El Niño</td>
<td>76,000</td>
<td>25,250</td>
<td>50,750</td>
</tr>
<tr>
<td>La Niña</td>
<td>71,000</td>
<td>21,640</td>
<td>49,360</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td></td>
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<tr>
<td>1951-1970</td>
<td>72,000</td>
<td>19,300</td>
<td>52,700</td>
</tr>
<tr>
<td>1980-1999</td>
<td>83,500</td>
<td>26,000</td>
<td>56,500</td>
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<tr>
<td>Difference</td>
<td></td>
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</tr>
</tbody>
</table>

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
Predictability and the role of surface effects
Slowly evolving lower boundaries: Sea surface Temperatures
Slowly evolving lower boundaries: Soil moisture

Power spectrum of Soil moisture

Power spectrum of Precipitation

Land processes

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)

- Parana at Posadas
  Area: 975,000 km²

- Uruguay at Paso de los
  Area: 189,300 km²

- Paraguay at Bermejo
  Area: 1,100,000 km²

- Parana at Jupia
  Area: 478,000 km²

- Iguazu at Estreito
  Area: 63,236 km²

Observed

Simulated

Source: Su and Lettenmaier
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

Total runoff (Kg/m²)

1Km resolution - January 2000
Climate Change

- Greenhouse gases
- Aerosols
- Land cover/land use changes
Difference (mm/day) between observed annual precipitation and estimates by four GCMs.
"Floods will be more frequent over larger (populated) areas near the mouth of the La Plata River" 

Re, Luduena & Menendez
Aerosol effects

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
Soy bean field

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

Cruz Alta (approx 28.6S, 53.4W)
(Courtesy of Osvaldo Moraes)
Micrometeorological observations in the Pantanal Area-Central Brazil

Fazenda São Bento—MS (19° 33’ S; 57° 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 CO2 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
La Plata Basin Program

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 for these reasons, the 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/WRCP 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.
LPB Timeline (2005-2015)

- **2005**: Build-up Phase
- **2006**: Monitoring, Field Experiment
- **2007**: Model calibrations, parameterizations
- **2008**: Predictability and Climate Change studies
- **2009**: Development of an integrated system
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
La Plata Basin/CE at NCAR/EOL

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

La Plata Basin
Continental Scale Experiment

Program Overview

- CLIVAR/VAMOS and GEWEX/CORP identified the Rio La Plata Basin as a climate-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 climate 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 Plate Basin in agreement with producers and users of climate information.

Latest News

- Presentations from the 1st Meeting of the LPB Implementation Team
  18-19 Sept 2005, Brazil
- 1st Meeting of the LPB Implementation Team
  18-19 Sept 2005, Brazil
- Presentations

LPB Workshops and Meetings

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
CLIMATE CHANGE IN THE LA PLATA BASIN

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

Thanks...