Extremes in CLIVAR's
Variability of the American Monsoons System Panel (VAMOS)

Examples in La Plata Basin

World Climate Research Programme

Report from the VAMOS Extremes Task Force

VAMOS is in a unique position to utilize its continental perspective in linking extremes in warm season climate behavior to the circulation structures defined as the monsoon systems.

Such a perspective would constitute a multi-scale approach to understanding the subtle interplay of processes occurring at different space and time scales within monsoon systems, such as terrain heating, vegetation-atmosphere coupling, land-sea breezes, regional moisture flux patterns, synoptic disturbances and teleconnections.

General Considerations

… considered **(1)** issues that were coherent across VAMOS program areas, **(2)** aspects of extremes that could be somewhat unique to VAMOS, and **(3)** how to capitalize on existing and on-going efforts within the climate community (e.g., CEOP; USCLIVAR).

Based on this we believe that **our definitions of extremes should be cast in terms of seasonal to intra-seasonal departures from climate normals**, even if the dynamical understanding of specific types of extreme events requires examination at shorter timescales, such as analyzing the underlying synoptic meteorology.

A suggested list of major extreme events for VAMOS is given by the following:

Droughts: Drought is broadly defined by persistent precipitation deficits. Monthly mean data should be sufficient to analyze drought. For **meteorological drought**, we propose use of standardized precipitation indices. In other contexts, drought may be defined using different variables, such as soil moisture deficit for **agricultural drought** or streamflow deficits for **hydrological droughts**.

Fluvial or inundation periods: Wet extremes are envisioned to encompass a wider range of timescales.
(One example, taken from the GEWEX/CEOP definition, could be "substantial precipitation for 24h to several days that affects basins or regions on scales of at least 10^5 km^2".)

Heat waves: Temperature-based extremes would also require daily data. The *specific definition will be regionally dependent*. Since heat waves would be of greatest interest in the context of drought, the temperature extremes should probably be considered mainly in terms of their covariance with precipitation extremes.

Social impact of extremes: seeking to quantify the cost of specific extreme events (human lives, infrastructure damages, animal and vegetation damages, biodiversity, …).

- The NCDC routinely documents the Risk and cost for the United States. They call billion Dollar events: http://www.ncdc.noaa.gov/oa/reports/billionz.html. They list events for each year and give the dollar amounts for the damage.

- Similarly, severe disasters at the national level are catalogued and quantified in various ways by the Emergency Events Database (EM-DAT, http://www.emdat.be/).

Some efforts examining observed and projected extremes have already begun (within the VAMOS Panel)

a) To provide context to projected climate change impact on extreme event frequency and intensity, Tereza Cavazos has been examining extreme events of NW Mexico precipitation using historical records.

b) Anji Seth is involved in the Sustainable Agriculture and Natural Resource Management Collaborative Research Project (SANREM CRSP), which is a program working with SENAHMI Bolivia to perform analysis of observed and projected extremes for the Altiplano region.

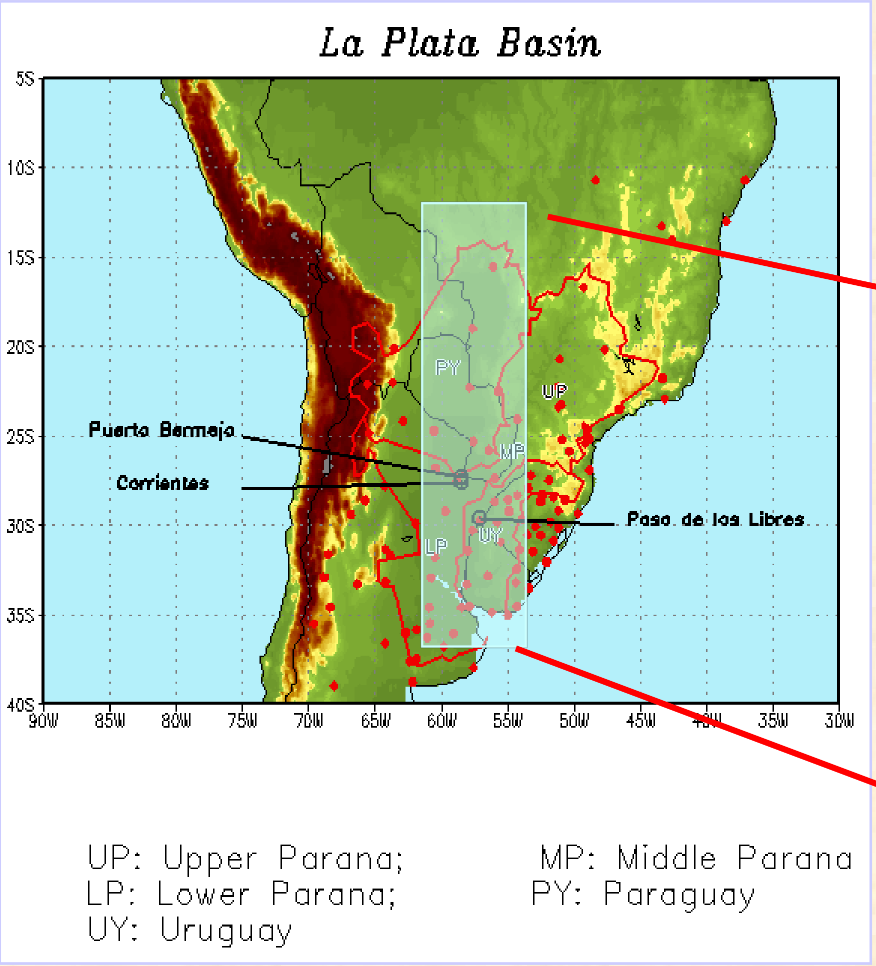
c) Jose Marengo and Carlos Nobre are involved in studies of trends in extremes in Southeastern South America, Amazonia and Northeast Brazil, with the objective of assessing impacts and vulnerability and also to proposed adaptation measurements. Emphasis is on water resources, human health, agriculture, and energy generation.

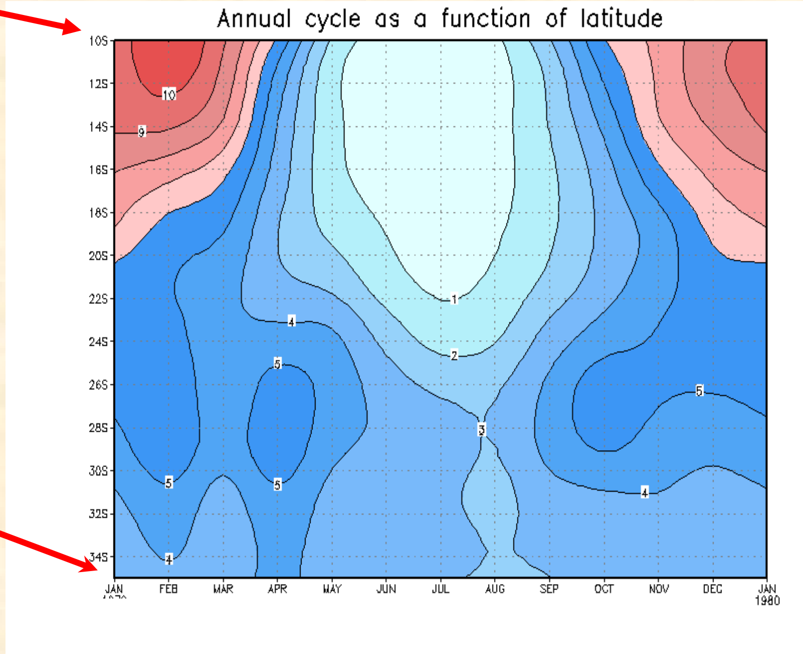
d) The **CLARIS LPB** European project includes a specific WorkPackage dedicated to **changes in extremes events under climate change in the La Plata Basin.**

Extreme events in the La Plata Basin

- Hydrological impacts
- Agricultural impacts
- Social and economic consequences

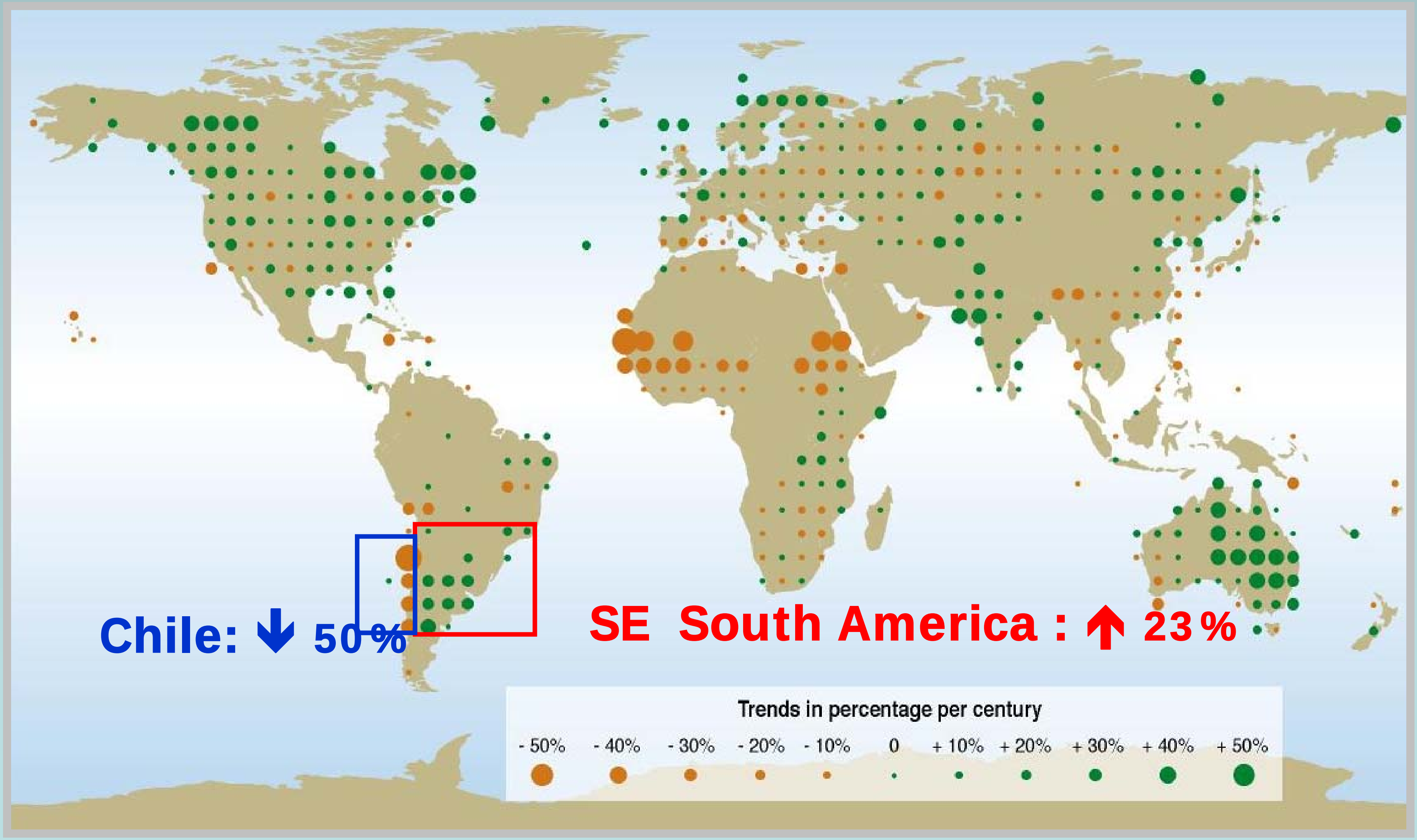
Annual cycle of precipitation (mm/day) as a function of the latitude.



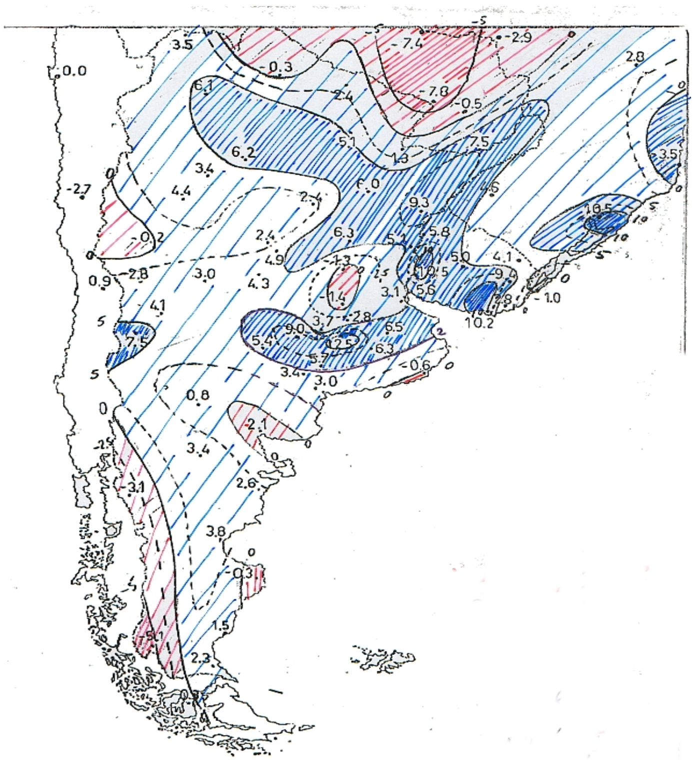


From Berbery and Barros 2002, JHM.

Trends in annual precipitation 1900-2000



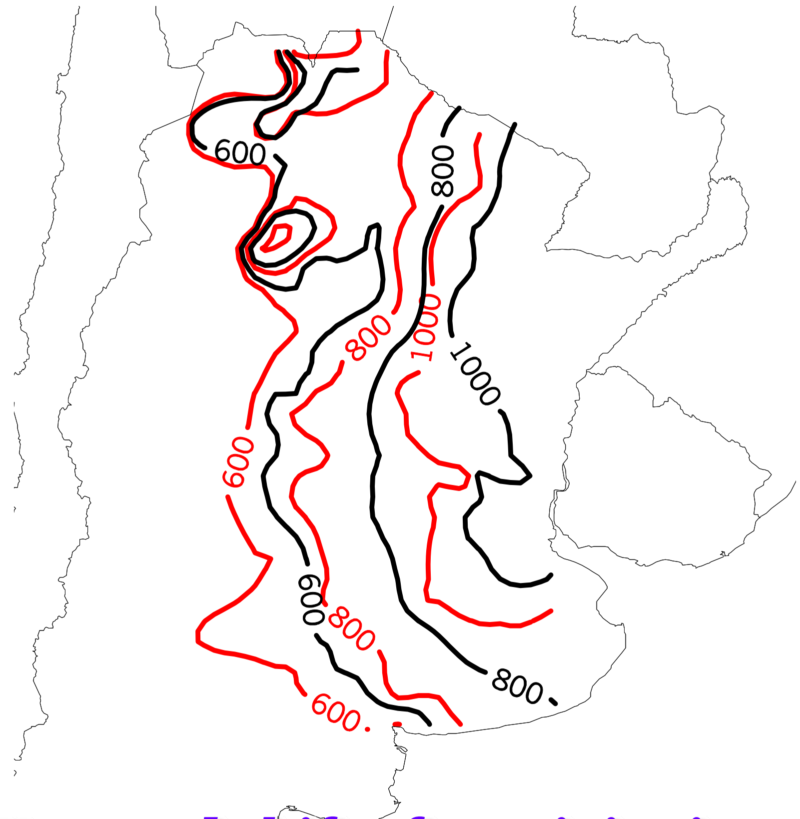
IPCC (2001)



LINEAR TRENDS

1956 – 1991

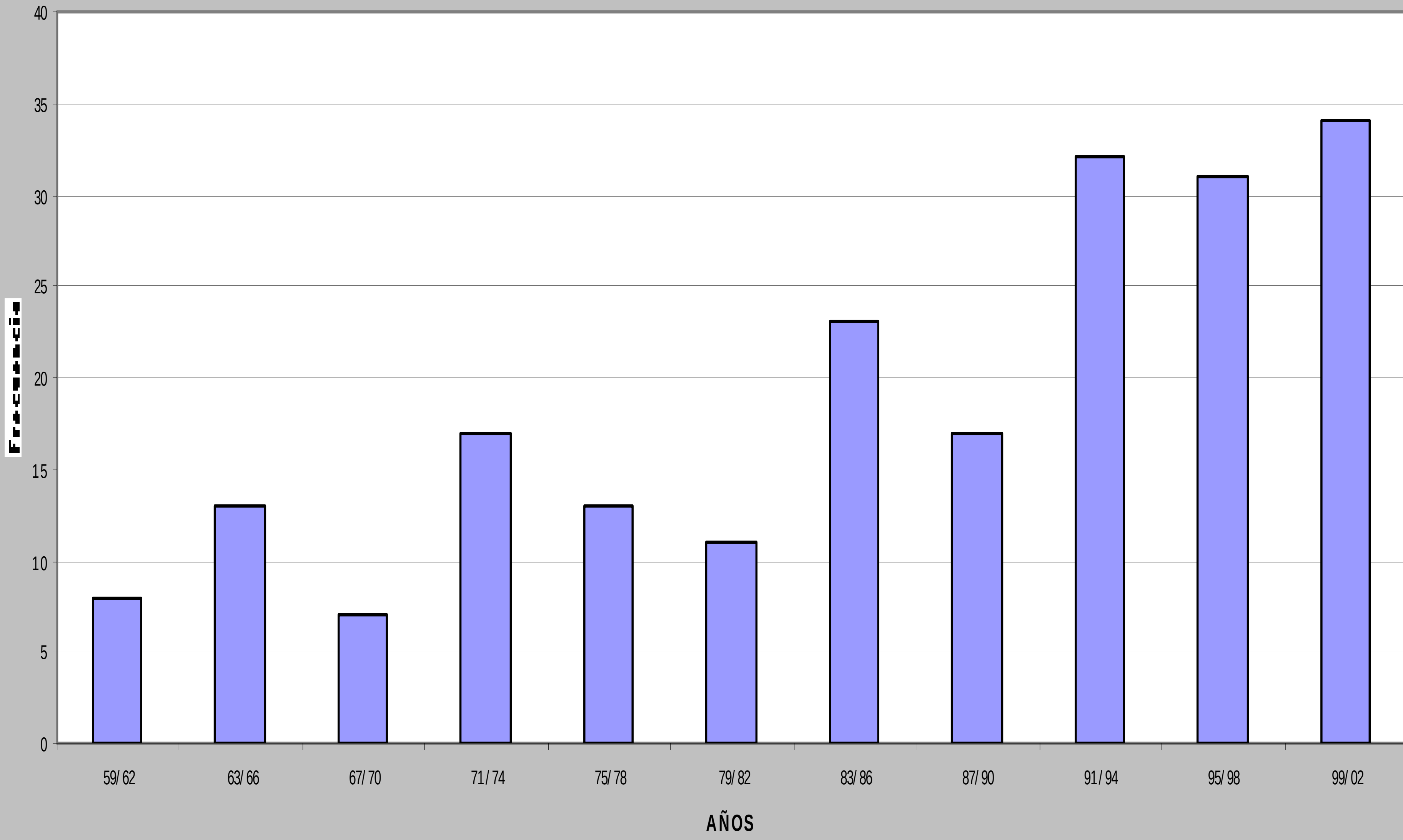
mm/year



Westward shift of precipitation intensity

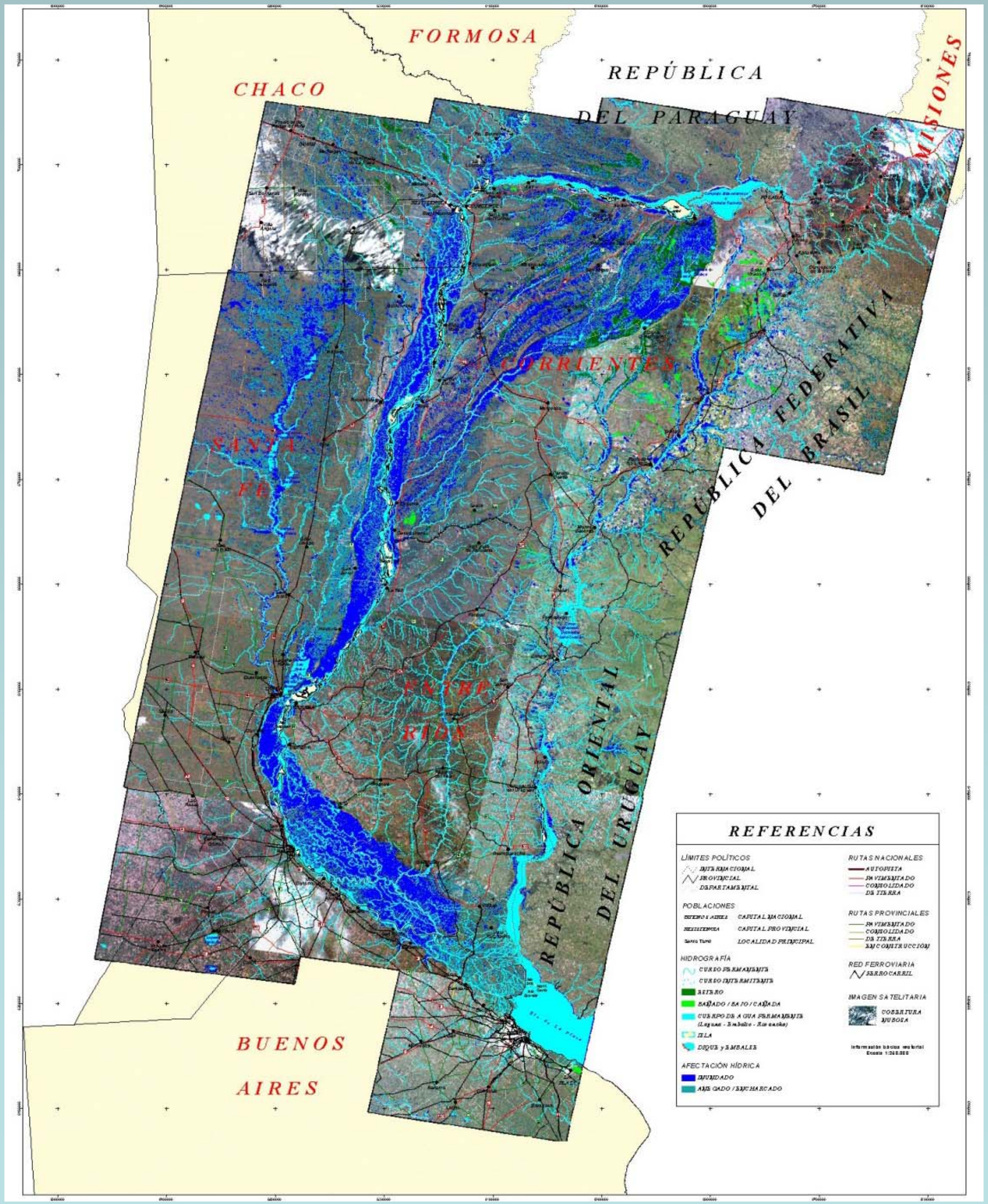
black: 1950-1969
red: 1980-1999

Number of cases where precip exceeded 100 mm



Normal conditions

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



Time series of river discharge

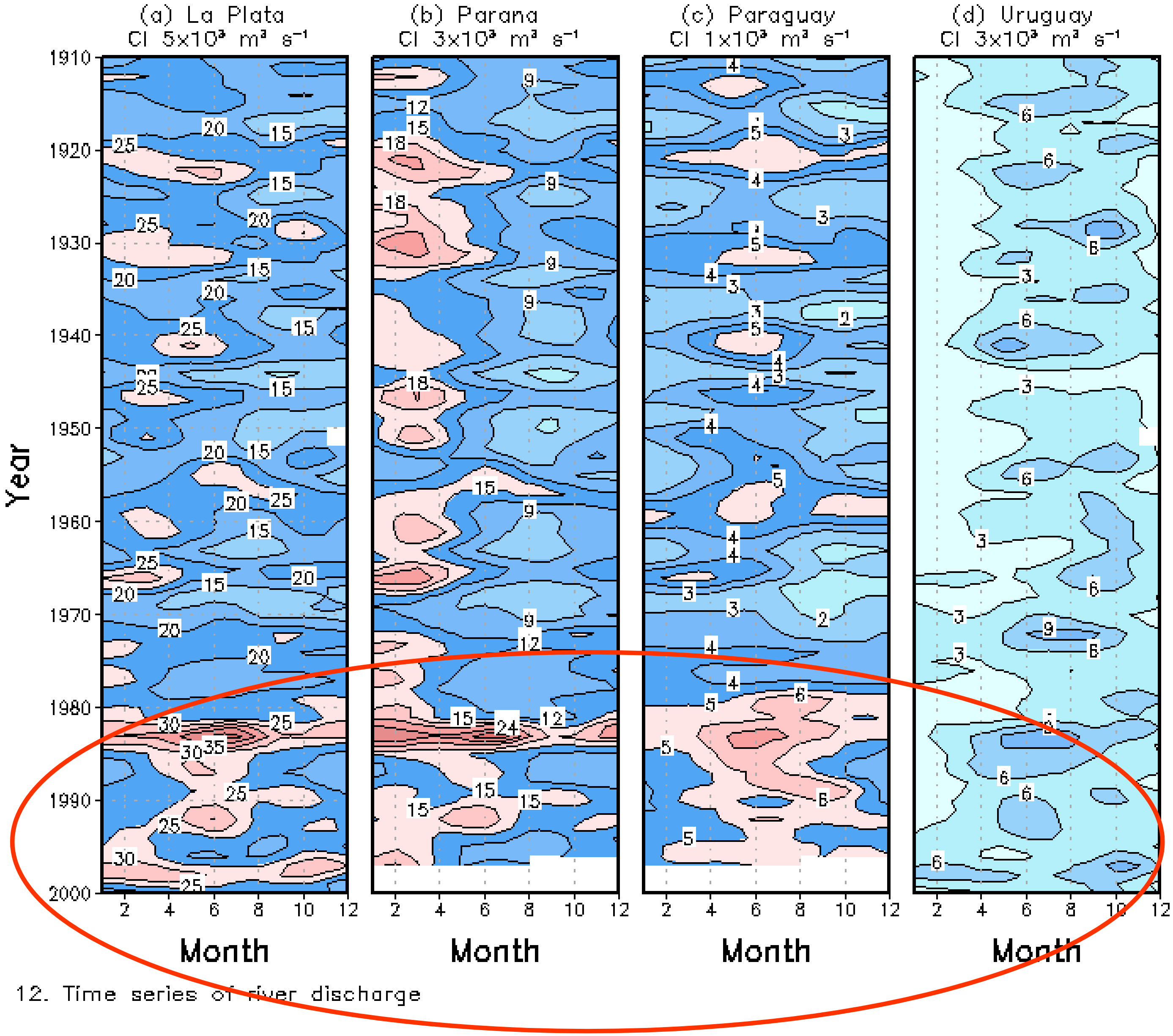


Figure 12. Time series of river discharge

Amplification of the precipitation signal in the streamflow

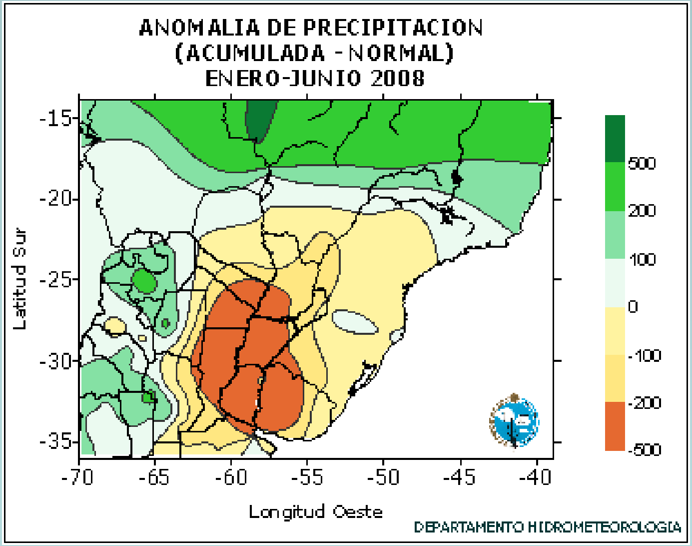
	Rainfall rate over La Plata Basin ($m^3 s^{-1}$)	Streamflow ($m^3 s^{-1}$)	Evaporation + Infiltration ($m^3 s^{-1}$)
1998	107,000	36,600	70,400
1999	81,600	20,440	61,600
Difference	*23 %*	*44 %*	*13 %*
El Niño	76,000	25,250	50,750
La Niña	71,000	21,640	49,360
Difference	*7 %*	*17 %*	*3 %*
1951-1970	72,000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

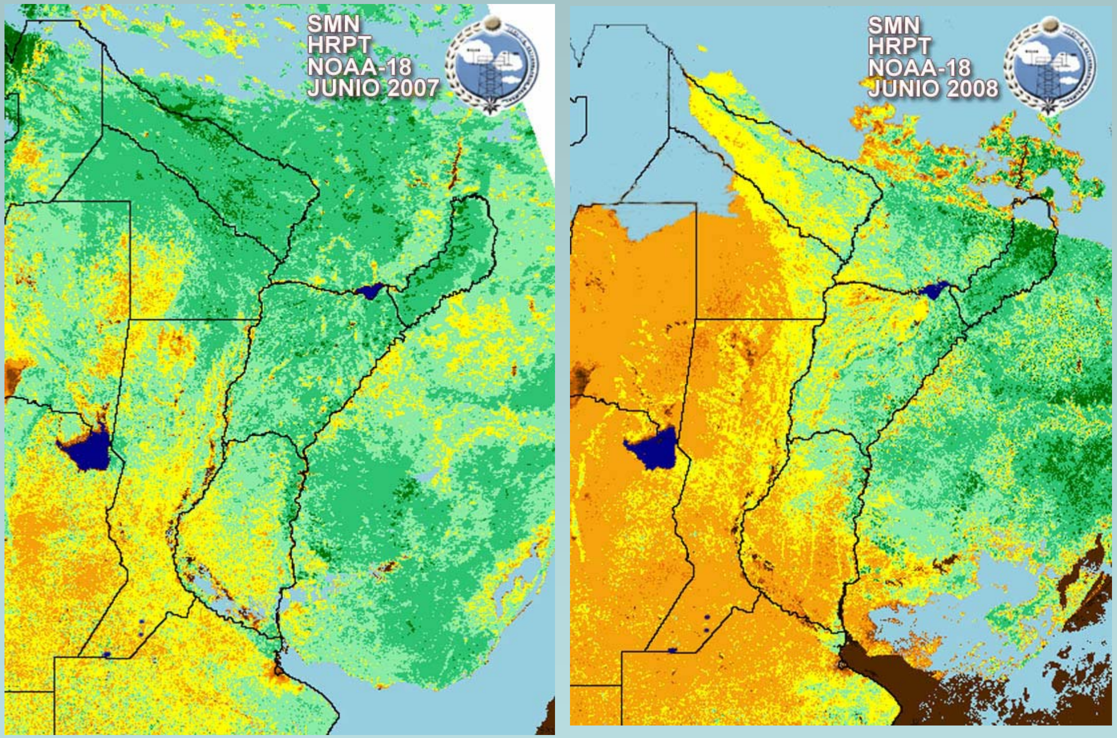
Berbery and Barros (2002)

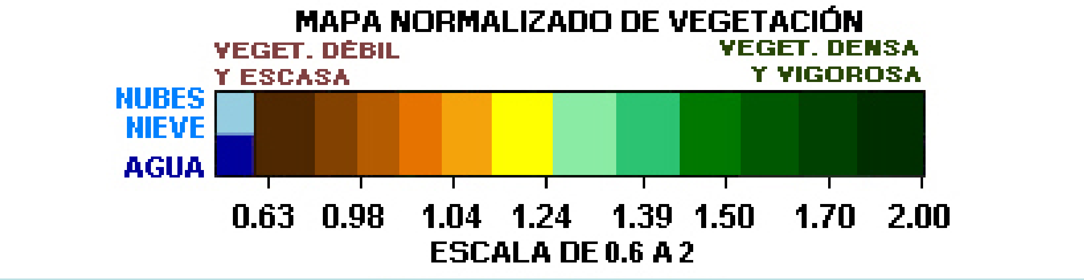
Monitoring of seasonal droughts and floods

Ministerio de Defensa
Secretaría de Planeamiento
Servicio Meteorológico Nacional

Products at SMN(AR)

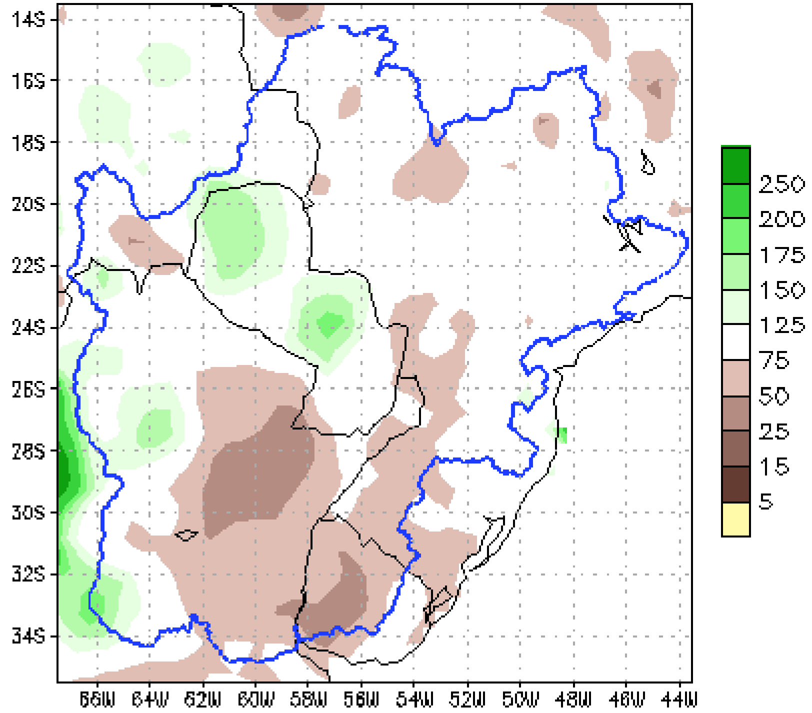






Climate Prediction Center

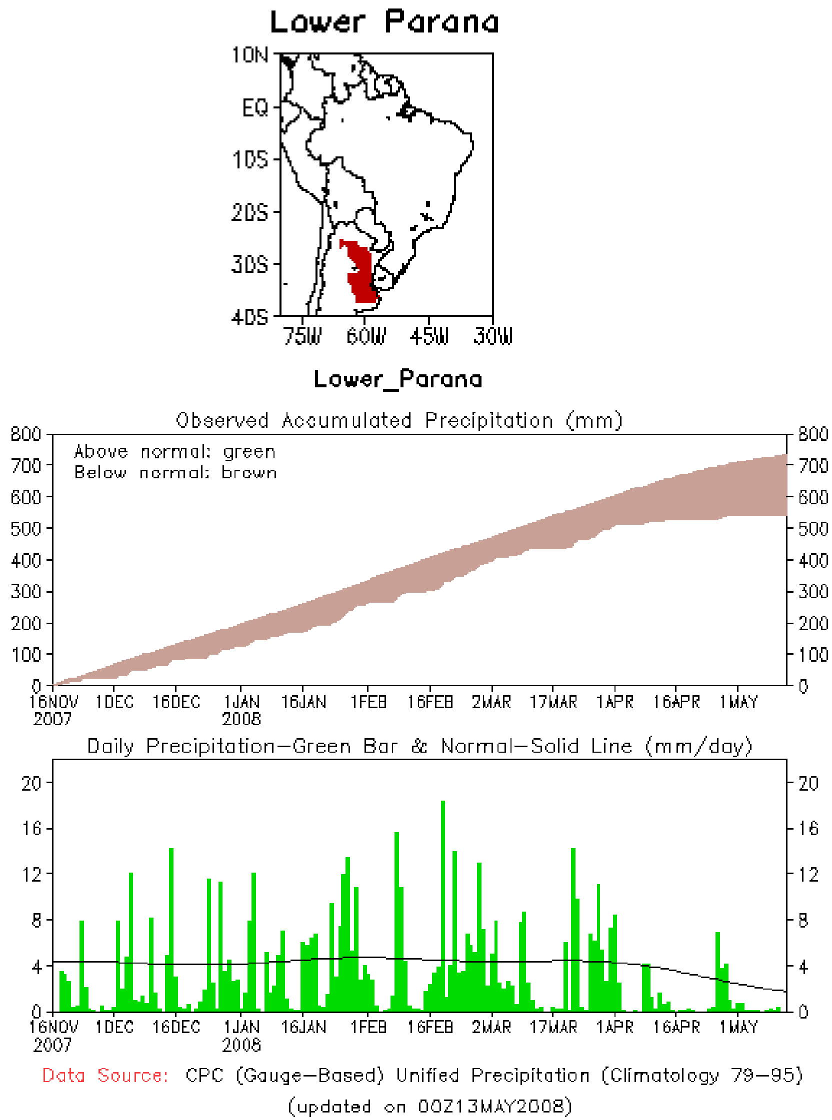
180-day accumulated P (% of normal)
16NOV07 – 13MAY08

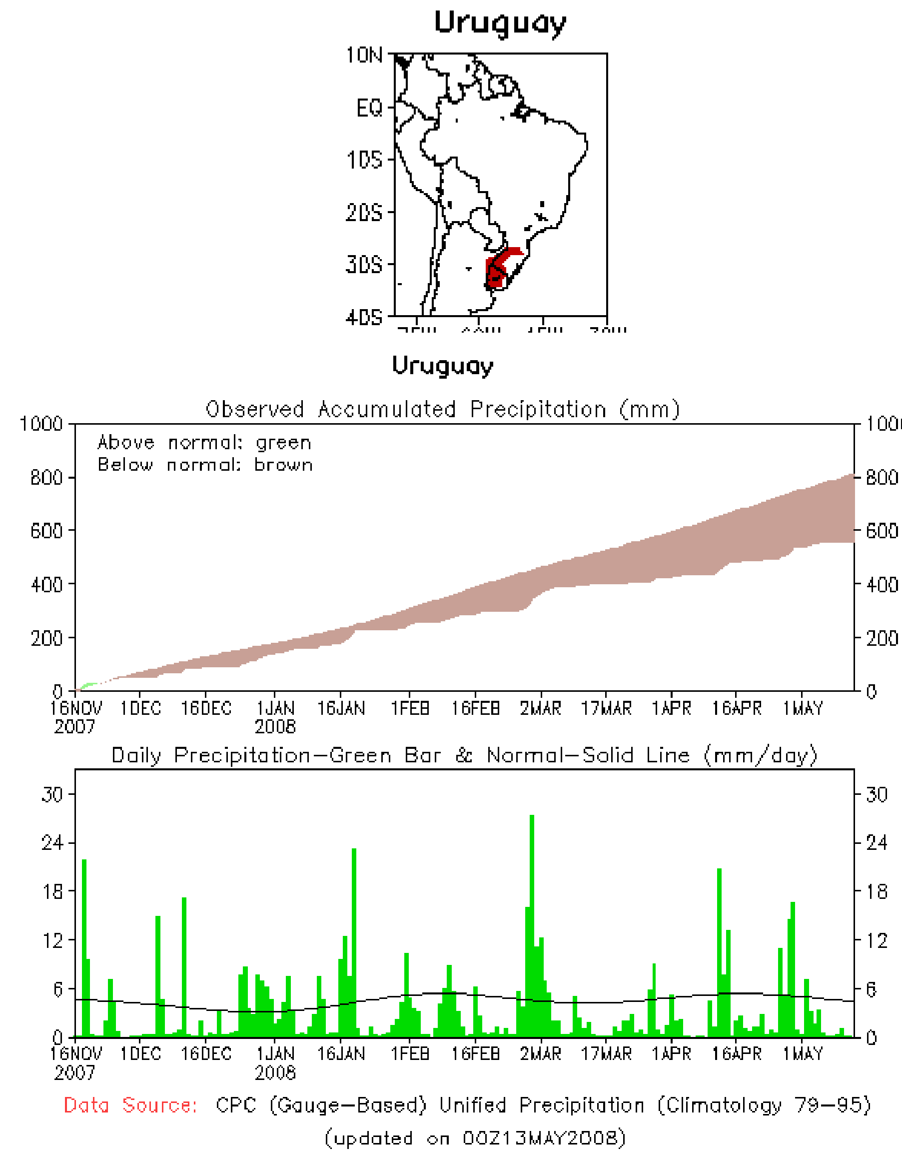


Data Source: CPC Unified (gauge-based) Precipitation Climatology (1979–1995)

Example 3': Basin averages.
180-day accumulated P (% of normal)
16NOV07 – 13MAY08

Climate Prediction Center





Thanks...