

DROUGHT RESEARCH DURING LPB

E. HUGO BERBERY
ESSIC/CICS-MD, University of Maryland





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



CLARIS – LPB:
ACC

IAI – LPB:
Ecosystems, Biodiversity, LCLUC

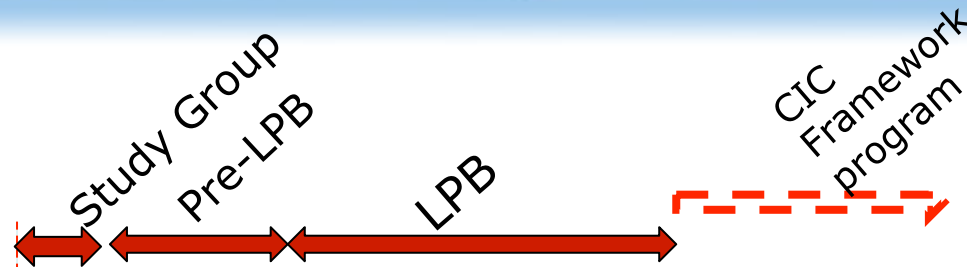
CIC-GEF
Framework Program for the sustainable management of the La Plata Basin water resources, in relation to climate variability and change

Multiple Regional Projects

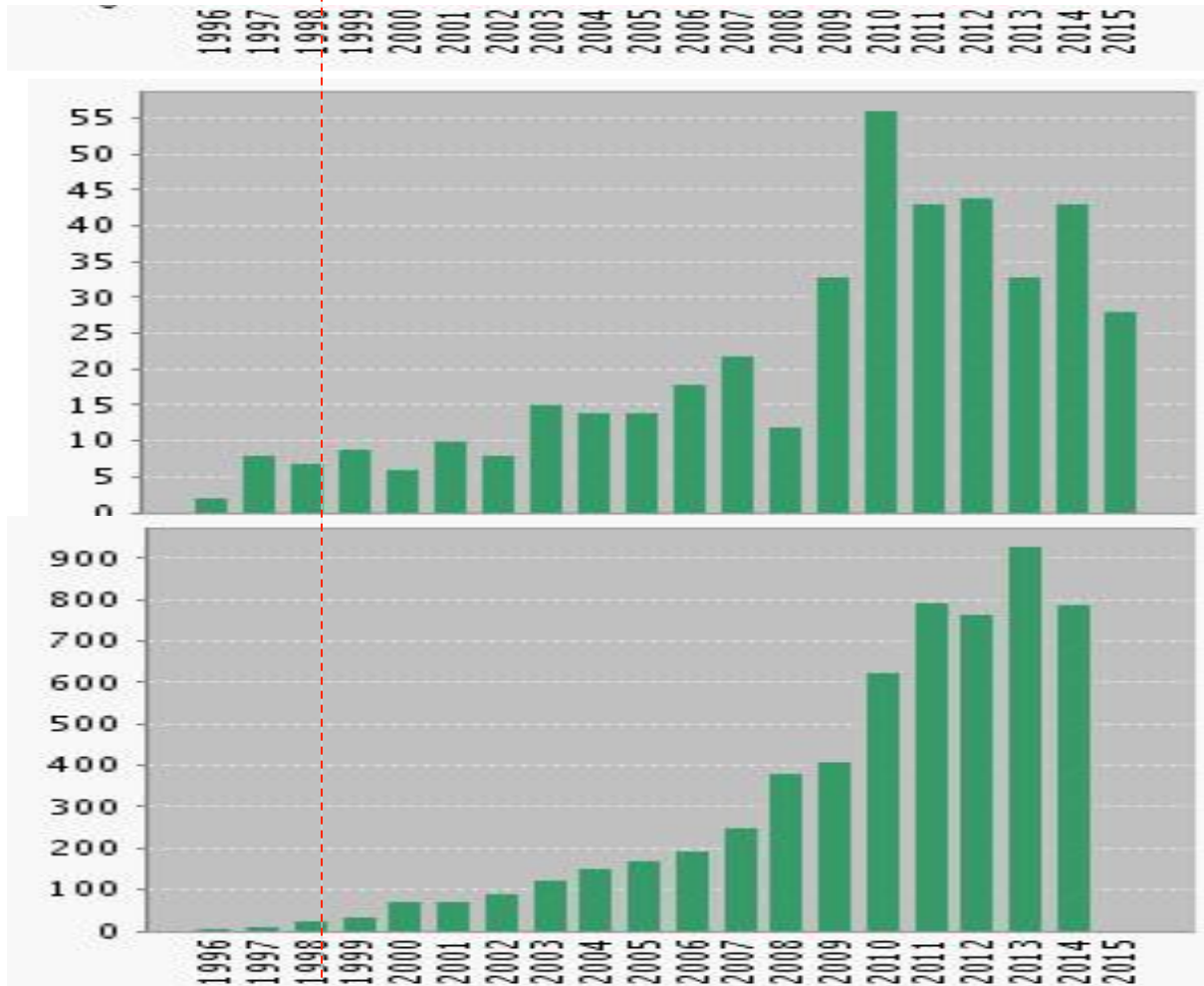
A Brief History of (LPB) Time



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



CIC: Intergovernmental Committee for La Plata Basin
<http://www.cicplata.org/>

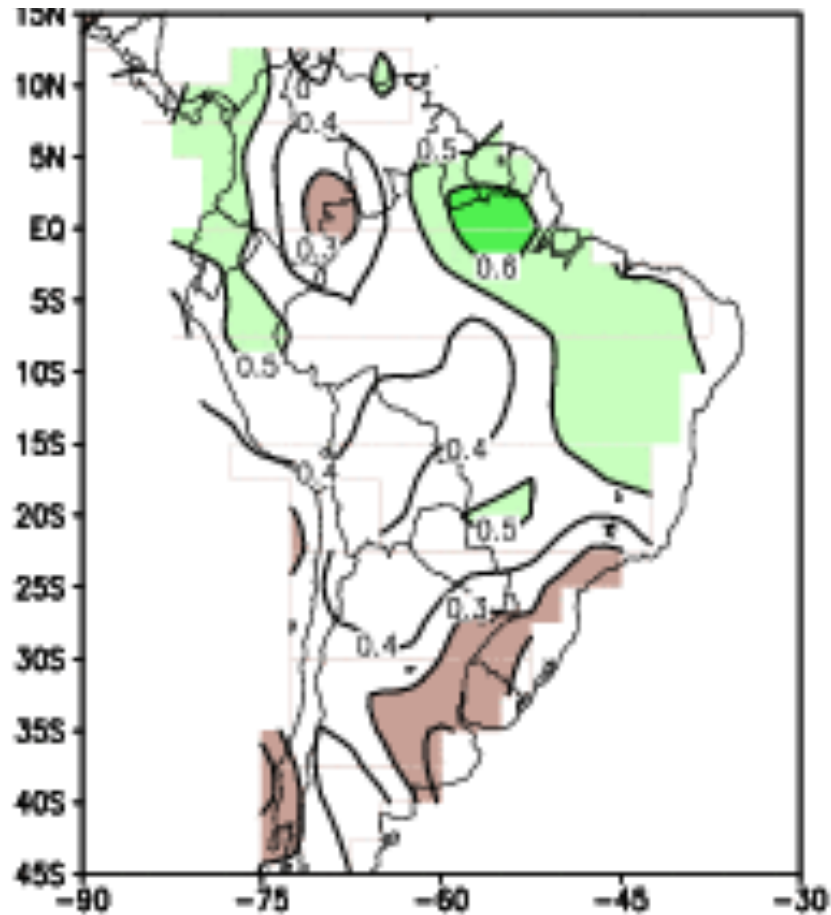


**Topic: La Plata Basin
Published Items in Each Year**

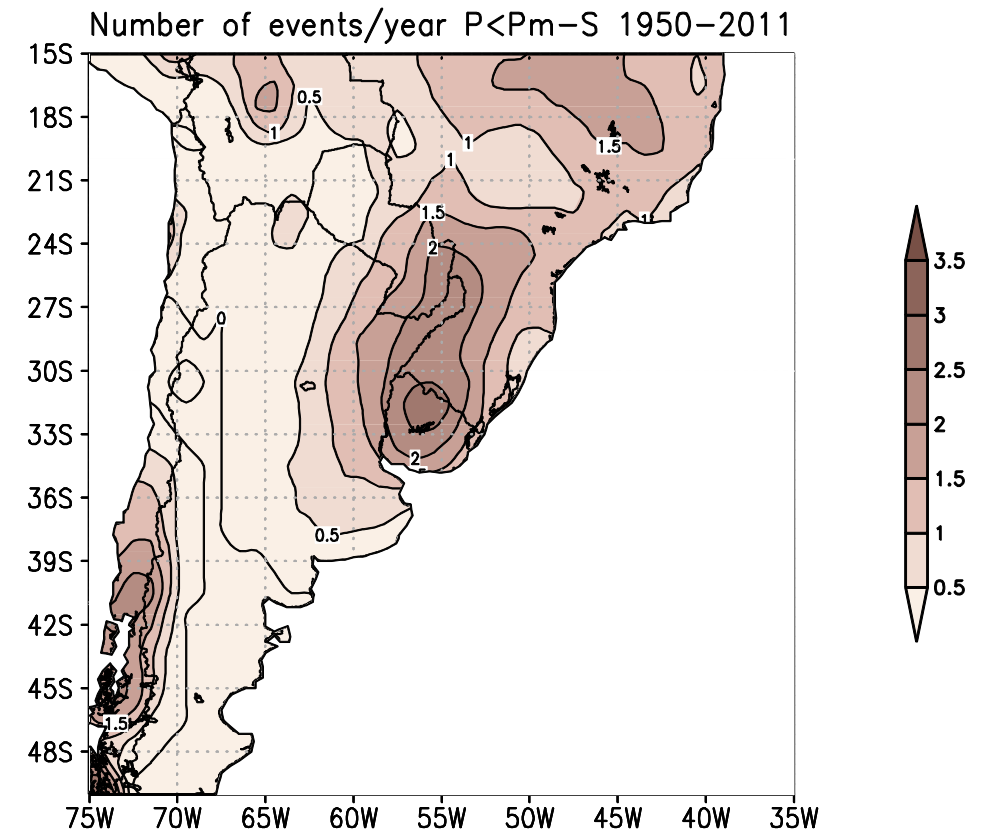
**Topic: La Plata Basin
Citations in Each Year**

Drought statistics

Percentage of the total number of extreme events that persist more than one year.



Number of months per year that have P below a certain threshold



The drought of 2008



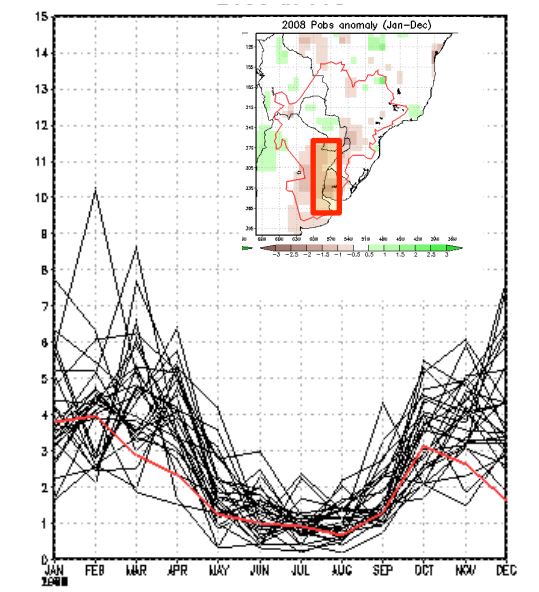
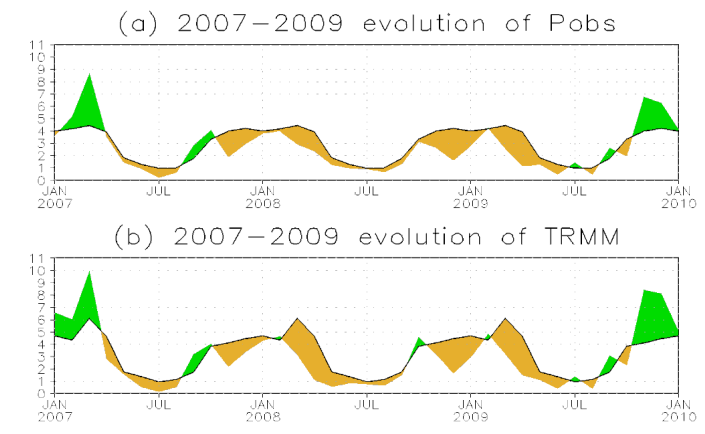
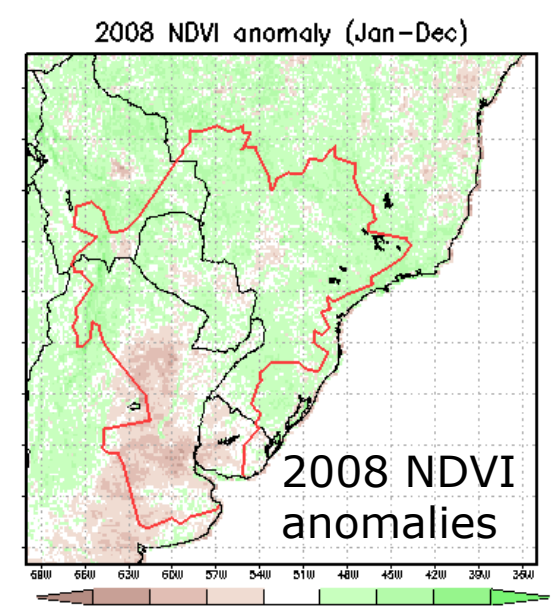
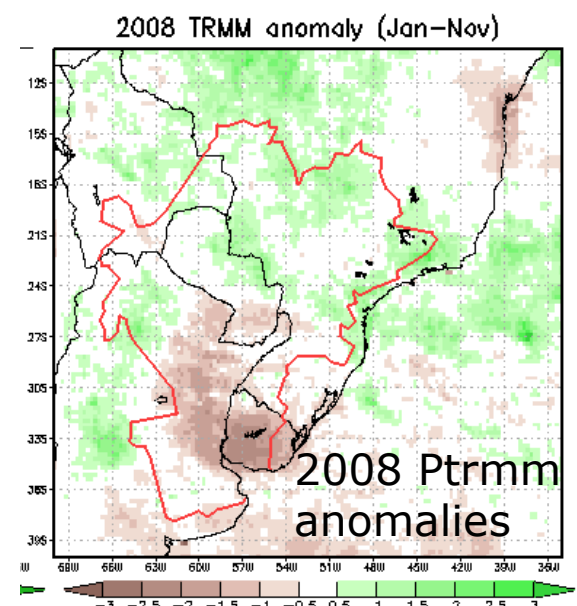
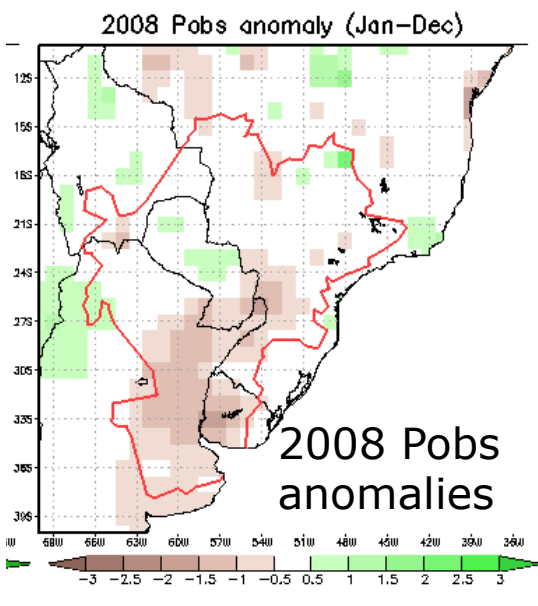
- Identified as the most intense of the last 50 to 100 years
- Some locations registered the lowest SPI values in their historical record
- There was a 37% drop in agricultural production
- Beef production was 500,000 tons less than the 2003-2007 average



The 2008 drought affecting the southern portion of the la Plata Basin

Coverage, duration and intensity

Drought evolution

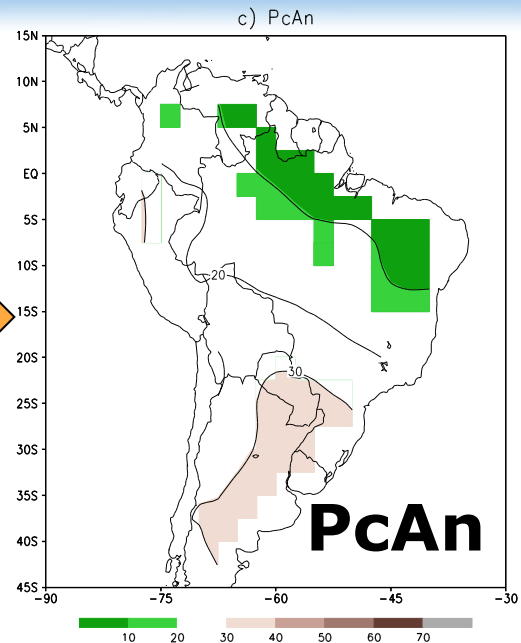
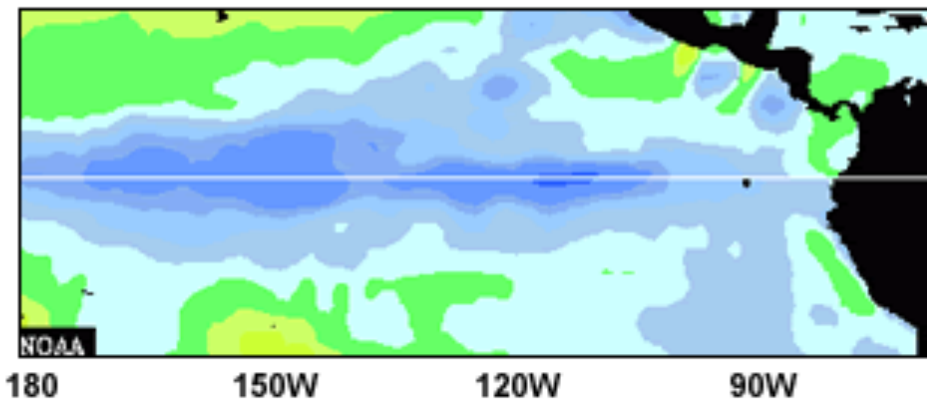


Droughts in southern South America: Large scale context

La Niña + Tropical Atlantic effects

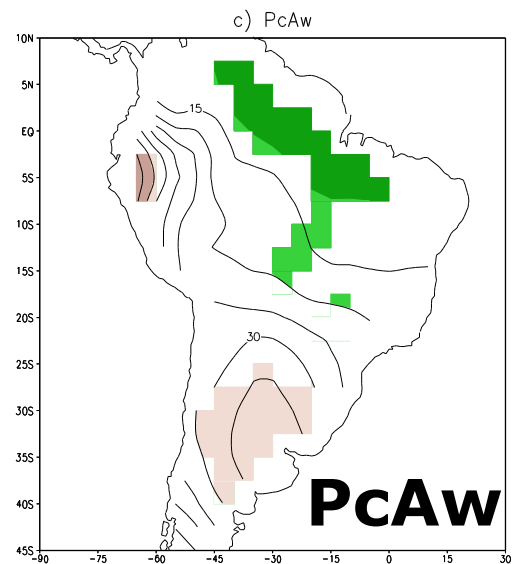
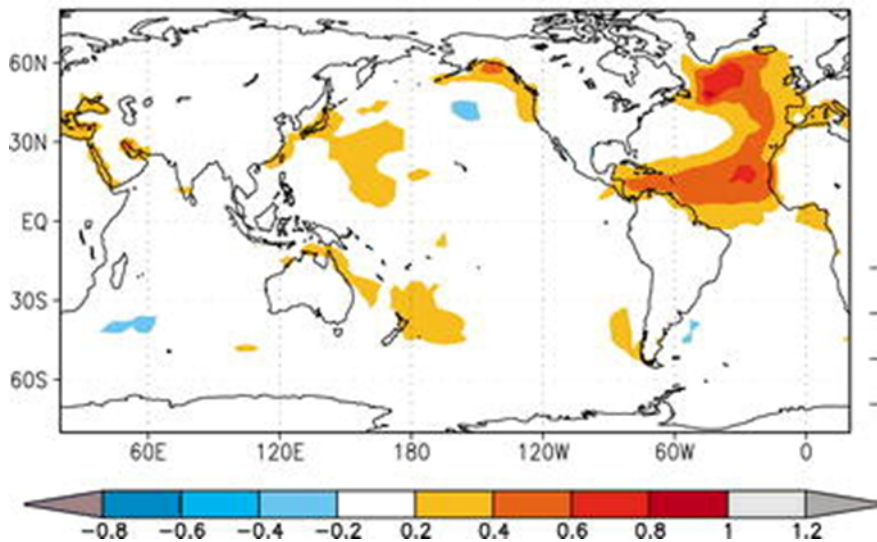


Pacific SST



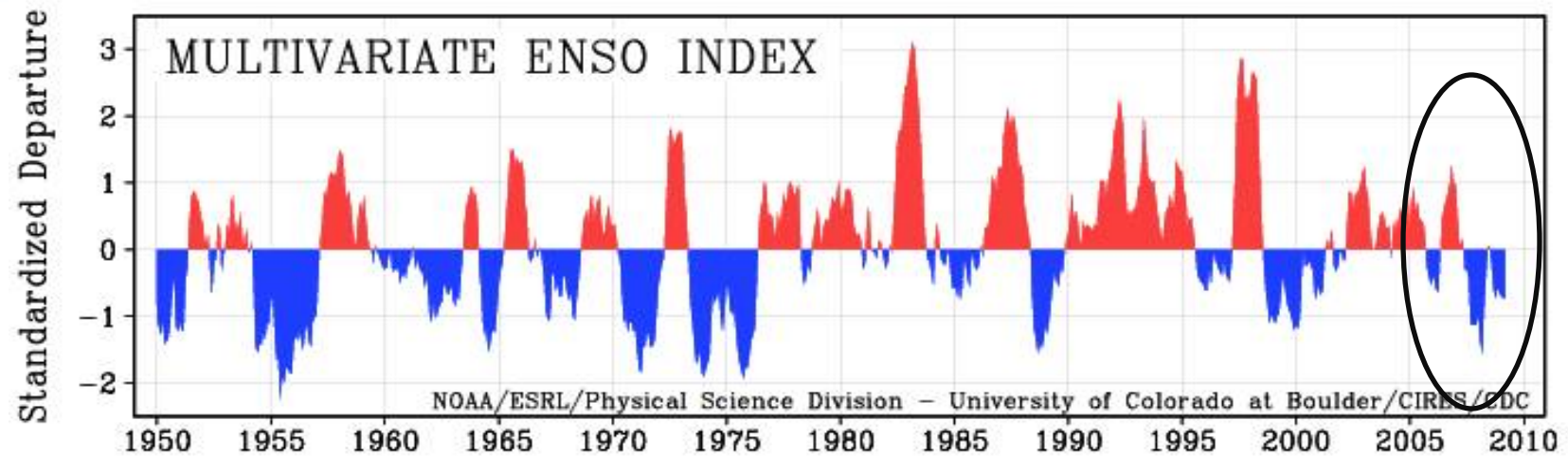
Atlantic SST

REOF3 5.8%



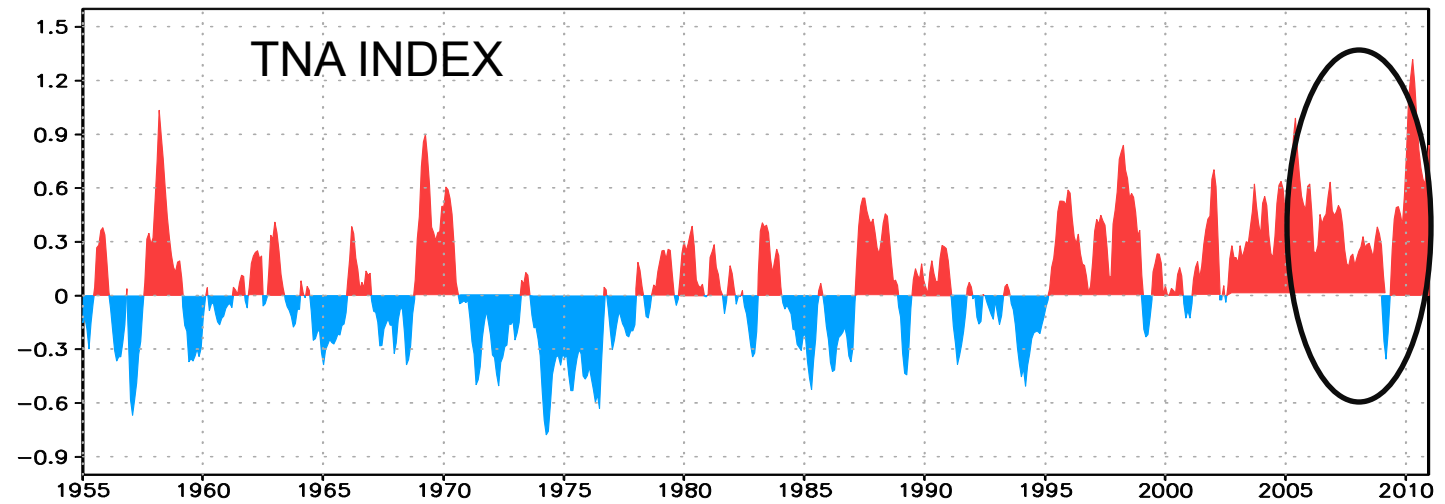
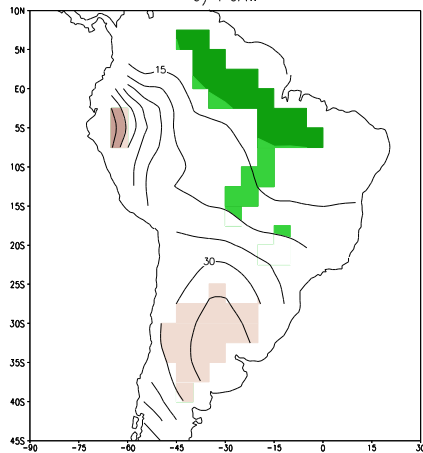
Mo and Berbery 2011

The 2008 drought in southern La Plata Basin: remote forcings



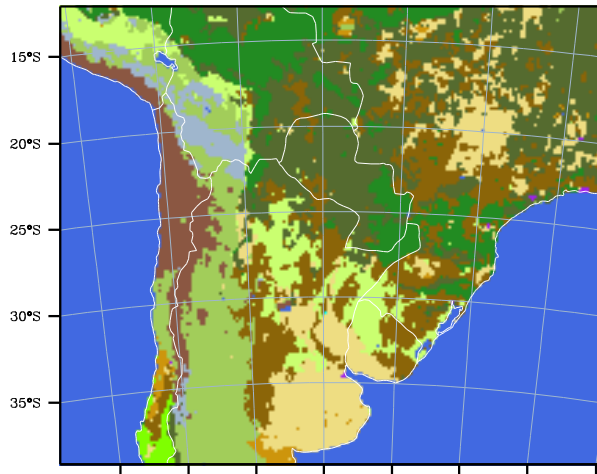
PcAw

c) PcAw

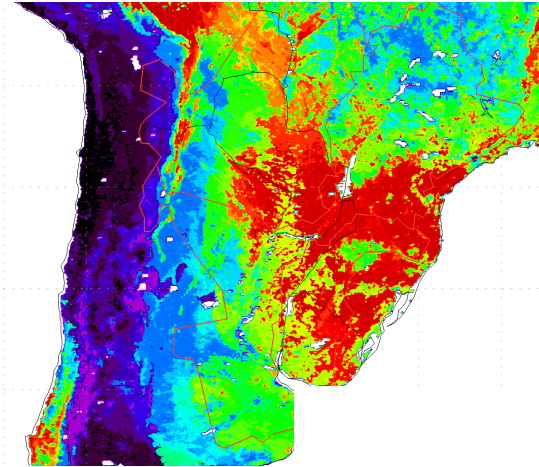


Land-surface effects during the 2008 drought

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



Land cover – constant in time



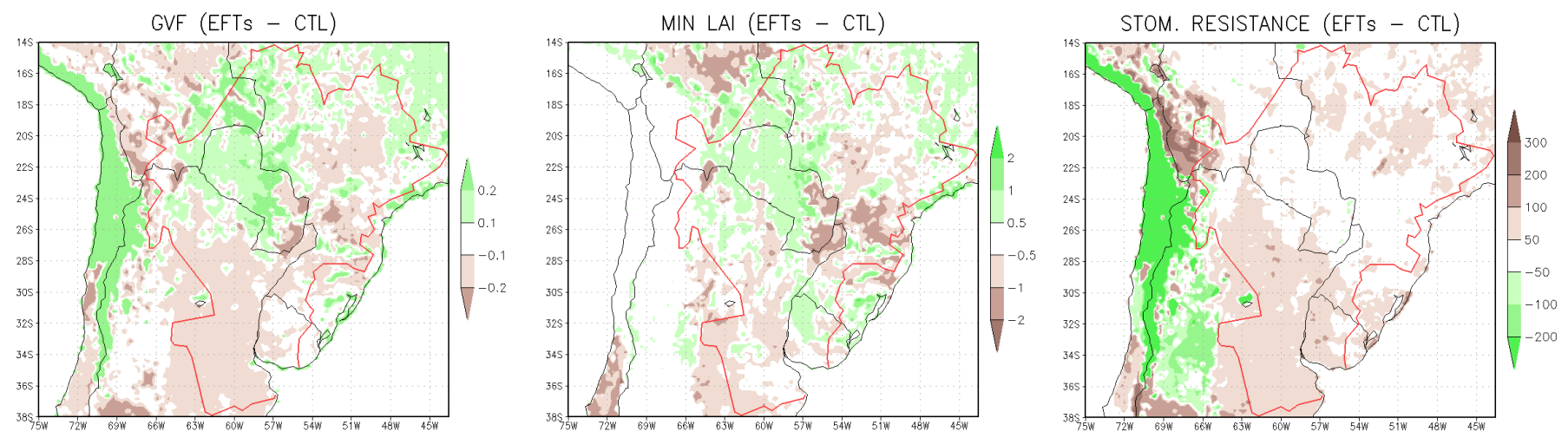
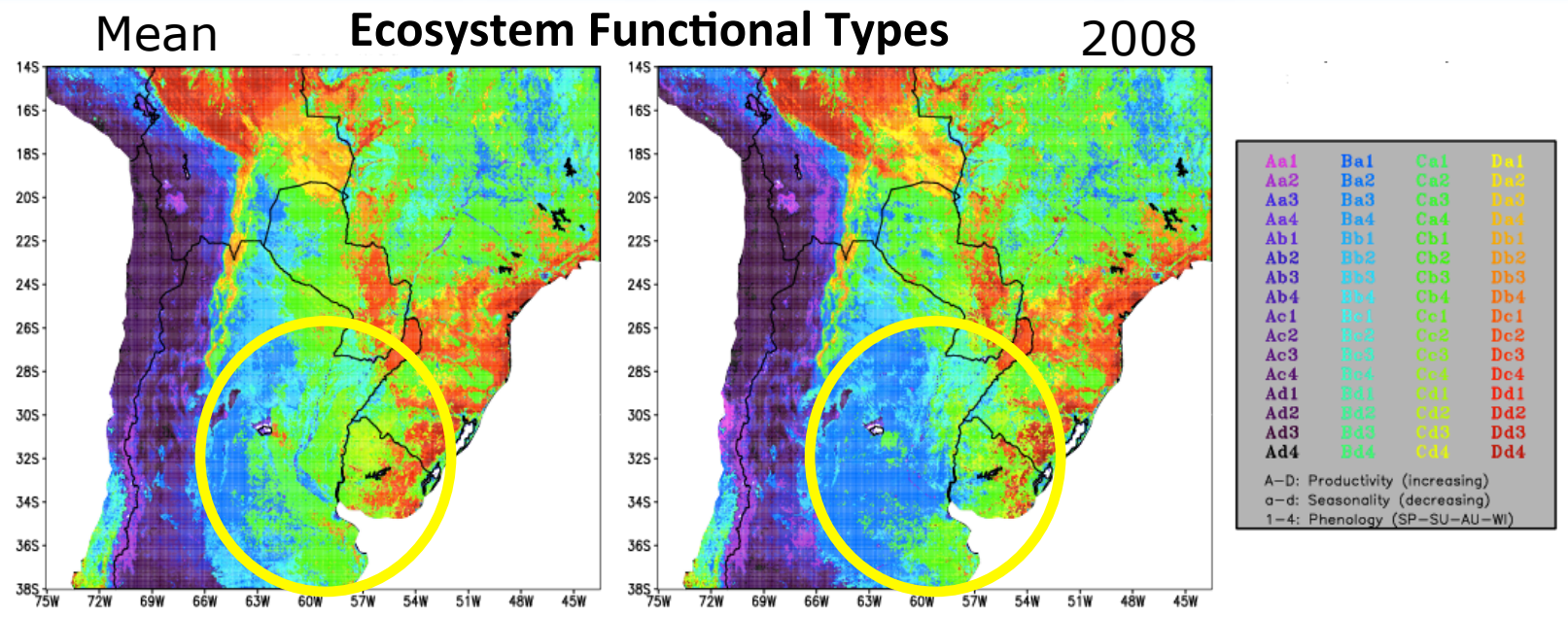
EFTs –time varying

Why not LC(t)? And what are Ecosystem Functional Types?

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

Interannual variability of the land surface biophysical properties

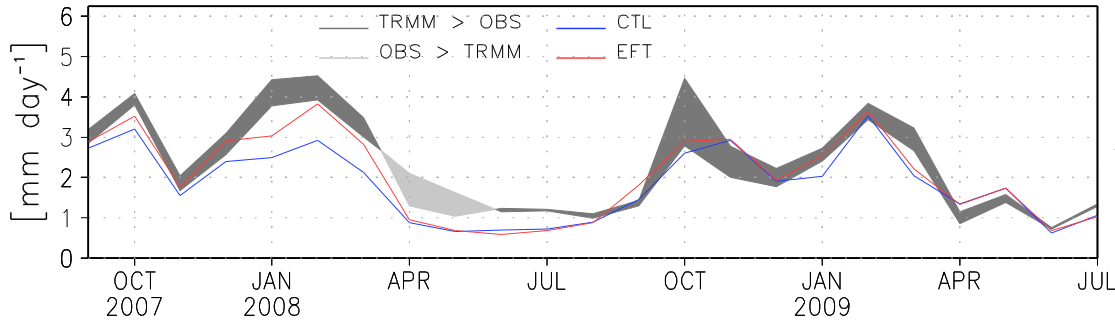
Müller et al 2014



Precipitation Biases



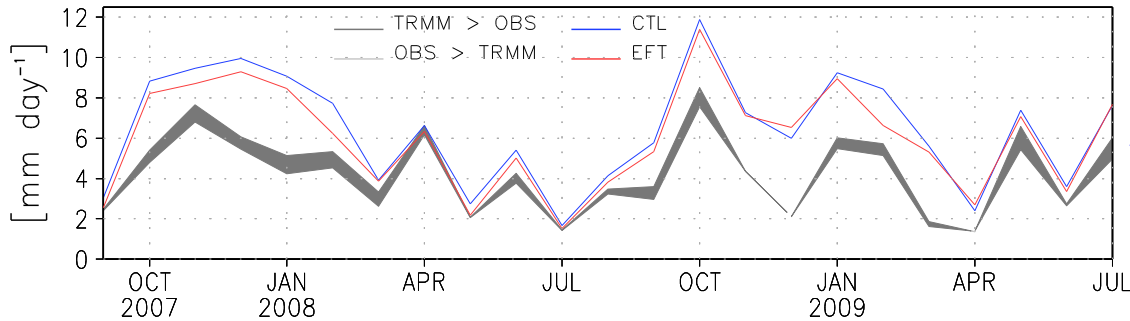
(a) P Region A



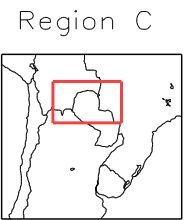
**Bias reduction,
summer: 8.5%**



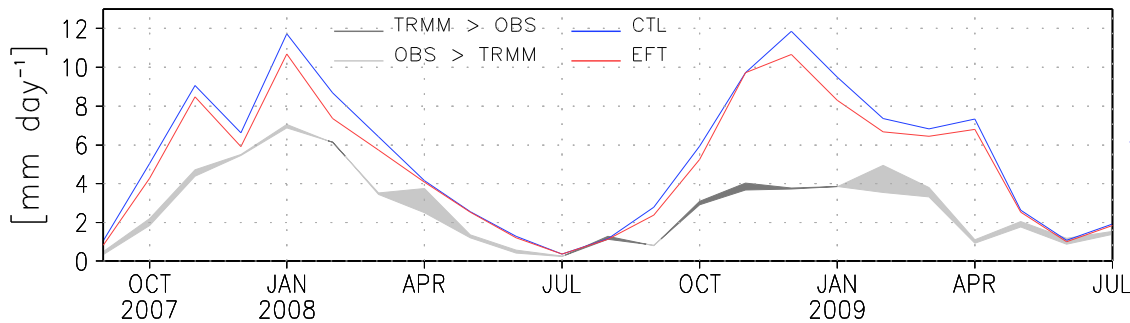
(b) P Region B



**Bias reduction,
summer: 12%**



(c) P Region C



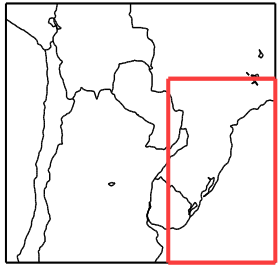
**Bias reduction,
summer: 21.5%**

Blue:	P_m (ctl)
Red:	P_m (w/EFTs)
Dark gray:	$P_{trmm} > P_{obs}$
Gray:	$P_{trmm} < P_{obs}$

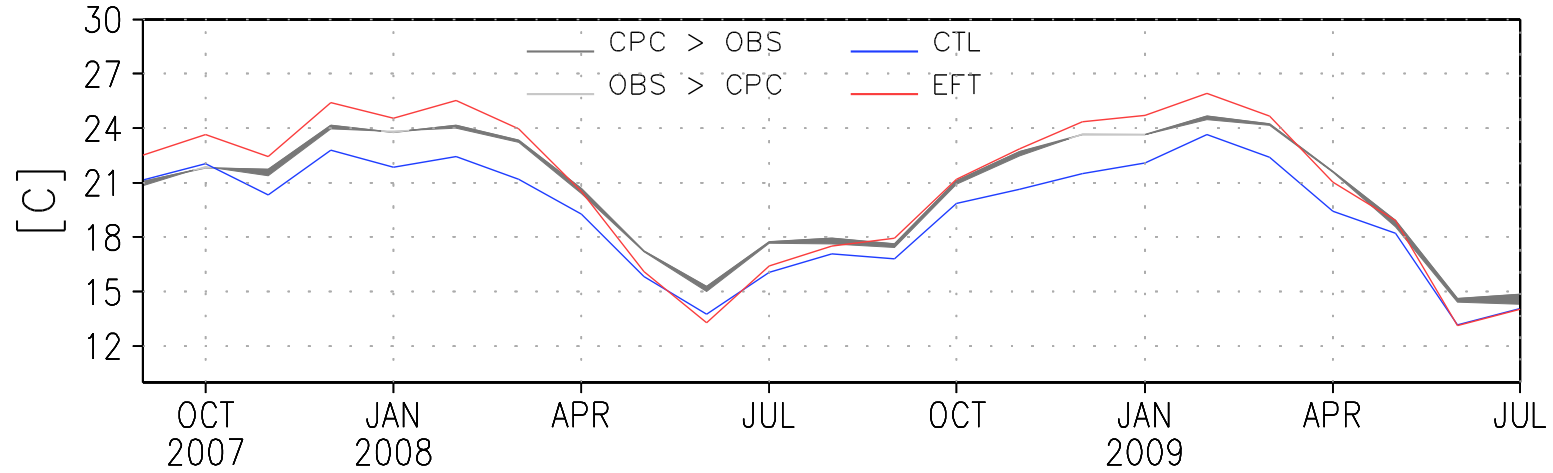
Systematically, P_{EFT}
Is closer to OBS than P_m

Temperature Biases

Eastern Region

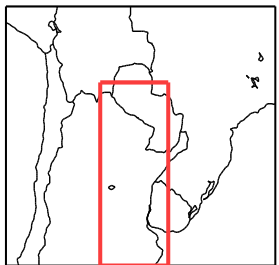


(a) T Eastern Region

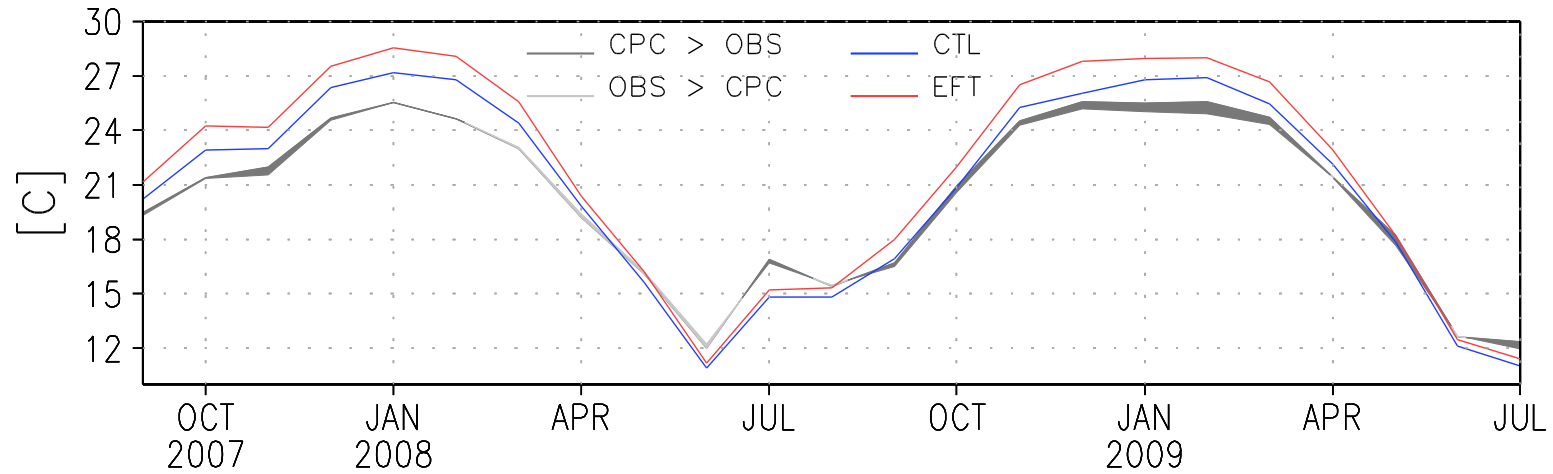


Bias reduction: 1 C

Central Region



(b) T Central Region



Bias increase: 0.9 C



CLARIS | LPB

CLARIS | LPB

A Europe-South America Network for Climate Change Assessment
And Impact studies in La Plata Basin



Work Package 6

Processes and future evolution of extreme climate events in La Plata Basin

WP Leaders:

Iracema Cavalcanti (BR) and Andrea Carril (AR)

<http://www.claris-eu.org/>



CLARIS | LPB

CLARIS | LPB

A Europe-South America Network for Climate Change Assessment
And Impact studies in La Plata Basin



The main objective of WP6 was to *elucidate the climate processes that are associated with extreme hydroclimate conditions over LPB region...*

...and to analyze extreme events over the La Plata basin region based on observational datasets, ensembles of 20th and 21st century large-scale (IPCC), and regional (WP5) model simulations



CLARIS | LPB

CLARIS | LPB

A Europe-South America Network for Climate Change Assessment
And Impact studies in La Plata Basin



Specific objectives are:

- To characterize the frequency and intensity of extreme hydro-climate events and their impact over LPB, **assessing the capability of models to represent those extremes** and the related mechanisms (for past to present time).
- To explore the relationships between the occurrence of extremes, **the large scale anomalous** pattern in which extremes are embedded and the **local atmospheric-land surface feedbacks**, identifying interannual to decadal modulations (for past to present time).
- To assess **changes in extremes** (frequency, persistence & intensity) as derived from **climate change scenarios** in global and regional models (future climate).



CLARIS | LPB

CLARIS | LPB

A Europe-South America Network for Climate Change Assessment
And Impact studies in La Plata Basin



Task 6.1: An investigation of the atmospheric features (large scale, synoptic and mesoscale systems), land surface-atmosphere, and ocean-atmosphere feedbacks, associated with the occurrence of extremes in precipitation and temperature.

Task 6.2: A quantification of observed and simulated trends in extremes

Task 6.3: An assessment of the global warming influence on the statistics of the extremes

Planned special issue of Climate Research with CLARIS-LPB studies

1. Andrea F. Carril, Iracema F. A. Cavalcanti and Contributing Authors. “Extreme events in La Plata basin: A retrospective analysis of what we have learned during CLARIS-LPB project”
2. G. Cazes, S. Talento “La Niña events before and after 1979 and their impact over southeastern South America during austral summer: The role of the Indian Ocean”
3. Renata G. Tedeschi, Iracema F. A. Cavalcanti, Alice M. Grimm, “Influence of Central and East ENSO on precipitation and extreme precipitation events in La Plata Basin: simulation and projection on HadGEM2-ES model”
4. Alice M. Grimm and Rodrigo B. Rodakowski. “Relationships between interdecadal variability and frequency of extreme precipitation events in the La Plata Basin”
5. Alice M. Grimm and Evelin L. Pallú. “Impacts of ENSO events on South America precipitation and its extremes in present and future: observations and two CMIP5 models”
6. Alice M. Grimm, Myriam Khodry, and João Paulo J. Saboia. “Interdecadal Oscillations of the South American monsoon in observations and model, with focus on the La Plata Basin”
7. Renom, Madeleine and De Mello, Santiago. “Frost events in Uruguay. Observed changes and variability 1950-2009”

Planned special issue of Climate Research with CLARIS-LPB studies

10. Barbara Tencer, Matilde Rusticucci. "Joint occurrence of daily temperature and precipitation extreme events over Southeastern South America"
11. Iracema F.A. Cavalcanti, Virginia P. Silveira. "Uncertainties in precipitation extremes over La Plata Basin from simulations and projections of CLARIS-LPB regional models"
13. Noelia López de la Franca Arema, Andrea F. Carril, Claudio G. Menéndez and Enrique Sánchez. "Changes in 21st century scenarios for temperature extreme indices over South America derived from an ensemble of regional climate models"
15. Olga C. Penalba, María L. Bettolli, Juan A. Rivera, Vanesa C. Pántano. "Extreme rainfall and hydric condition in La Plata Basin and the associated circulation"
18. R. P. da Rocha, M. S. Reboita, T. Ambrizzi, S. A. Solman, E. Sanchez, P. Samuelsson, L. Li, J. Marengo, N.L. Pessacg, A.R.C. Remedio, S. C. Chou et al. "Regional projections for A1B scenario of dry and wet spells during the summer over La Plata Basin"



Publications

- Bettolli et al,2010. Regionalization of dry days in Argentina.A methodological approach.Meteorologica
- Carril et al,2011:Assessment of a multi-RCM ensemble for South America.Clim.Dyn.
- Cavalcanti and Shimizu,2012- Amer.J. Climate Change.
- Grimm and Tedeschi,2009:ENSO and extreme rainfall events in South America.J. Clim.
- Grimm,2011:Interannual climate variability in South America:impacts on seasonalprecipitation,extreme events and possible effects of climate change.Statistic Environmental Research and Risk Assessment.
- Llano and Penalba,2012:A climatic analysis of dry sequences in Argentina.Int.J.Climatol.
- Marengo et al,2012:Recent developments on the South American monsoon system.International Journal of Climatology
- Marengo et al, 2010 An intercomparison of observed and simulated extreme rainfall and temperature events during the last half of the twentieth century:part 2: historicaltrends.Climatic Change
- Penalba and Robledo,2009:Spatialand temporalvariability of the frequency of extreme daily rainfall regime in the La Plata Basin during the 20th century.Climatic Change
- Penalba and Bettolli,2011:Climate change impacts on atmospheric circulation and daily precipitation in the Argentine Pampas region.Climate Change / Book 1,ISBN 978-953-307-419-1.
- Pessacg N.and Solman S.,2012:Impacts of land use change in southern South American climate. Climate Research (in press).
- Renom et al,2011: Multidecadal changes in the relationship between extreme temperatura events in Uruguay and the generalatmospheric circulation.Clim.Dyn.
- Rivera et al,2012: Inter-annual and inter-decadal variability of dry days in Argentina.Int.J.Ciimatol.
- Robledo et al.,2012: Teleconnections between tropical-extratropical oceans and the daily intensity of extreme rainfall over Argentina.Int. J.Climatol.
- Robledo and Penalba,2009.Amílisis estacional de la frecuencia diaria y la intensidad de extremes de sobre el sudeste de Sudamerica precipitaci6n.Meteorologica
- Rusticucci and Tencer,2008:Observed changes in return values of annual temperature extremes over Argentina.J.Ciim.
- Rusticucci et al,2010 An intercomparison of model-simulated in extreme rainfall and temperature events during the last half of twentieth century. Part 1 : Mean values and variability.Climatic Change
- Sorensson and Menendez,2011: Summer soil-precipitation coupling in South America.Tellus
- Sorensson et al,2010:Projected precipitation changes in South America:a dynamical downscaling within CLARIS.Meteorol.Z
- Tedeschi et al.,2012:Influences of two types of ENSO on South American precipitation.Int.J.of Climatol.
- Tencer and Rusticucci,2012: Analysis of interdecadal Variability of Temperature Extreme Events in Argentina applying EVT, Atm6sfera,in press.
- Vasconcellos and Cavalcanti,2010: Extreme precipitation over Southeastern Brazil in the austral summer and relations with the SH annular mode. Atmos.Sci.letters.

Thanks

