Instrument: **SP1 Cooperation**

Thematic Priority: **Priority Area 1.1.6.3 "Global Change and Ecosystems"**

FP7 Collaborative Project – Grant Agreement 212492

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

DELIVERABLES

D04.01: WP3 and WP4 workshop: Discussion on the collaborative approach and planning for the next 6 months

Due date of deliverable: Month 3

Start date of project: **01/10/2008** Duration: 4 **years**

Organisation name of lead contractor for this deliverable: P10-USP

Deliverable No	Deliverable title	WP	Lead beneficiary	Estimated indicative person-months (permanent staff)	Nature	Dissemination level	Delivery date
D4.1	WP3 and WP4 workshop: Discussion on the collaborative approach and planning for the next 6 months	4	P10-USP	3,75	R	PU	3

WP4 - Hydro climate low-frequency variability trends and shifts in the LPB: Characteristics and Large-scale mechanisms

WP Leaders: Myriam Khodri (IRD), Marcelo Barreiro (UR), Leila de Carvalho (USP)

WP3 and WP4 workshop: Discussion on the collaborative approach and planning for the next 6 months (Kick-off Meeting Report)

The WP4 has three mains objectives:

I. To characterize the regional interdecadal variability over South America and to advance our understanding on the key processes that govern the climate natural low-frequency variability and trends over the past 150 years in the La Plata Basin using observations (input from WP3) and global models.

II. Evaluate the uncertainties involved with the IPCC AR4 (A1B SRES scenario) projected hydroclimate changes on two time horizons: 2010-2040 and 2070-2100.

III. Produce a set of scenarios to assess the uncertainties of future projections due to decadal variability for WP5, WP8 and WP9.

During the **first 6 months** we will start addressing the **Objective I.** and explore the following scientific questions:

- What are the characteristics of the **observed low-frequency** hydroclimate variability and trends in the LPB region and their **teleconnections** to global modes of variability?
- What are the characteristics of the **observed hydroclimate "shifts"** during the 20th century, i.e. rapid and persistent transition between two stable climatic "equilibriums" or simply a change of phase within a decadal signal?
- What are the roles of large-scale variability in determining the **observed precipitation and temperature** variability and trends in the LPB?

During the **following next 6 months,** we will start addressing the **Objective II.** to answer the following scientific questions:

- How well do IPCC AR4 20th century transient model simulations capture the observed large-scale and LPB interannual-to-interdecadal climate variability and trends in the LPB?
- How can IPCC AR4 simulation for the 20th century and observations help in quantifying models uncertainties in future climate predictions?
- Are the models capable to reproduce the interdecadal variability over LPB (regional) and the proper interactions between the global modes of variability?

Working plan and collaborative approach for the first 6 months
Objective I.

Before identifying hydroclimate change of anthropogenic origin in South America, a **comprehensive diagnostic** of the interdecadal variability in observed and proxy longer-term time-series needs to be carried out, as "shifts" and tendencies observed within relatively short data series may result from phase reversal in this variability. The WP4 will have strong links with WP3, whose database it seeks to exploit to characterize the regional interdecadal variability over South America and its relationship with global modes of low-frequency variations in sea surface temperature (SST) and atmospheric circulation. As interdecadal variations also affect the skills of climate models (Grimm et al. 2006), it is therefore **a prerequisite to characterize first such variability in the longer-term observational datasets.** The tasks related to this objective will be started within the next 6 months and deployed during the next year and a half. We've planned to complete most these tasks at the end of 2009.

Task 4.1*: Statistical characterization of the variability, trends and "shift" during the 20th century, at the record's local-scale using a set of observations and proxy over the SESA, Andean, Patagonian and Amazonian regions.*
Responsible: Myriam Khodri

Item 4.1.1*. Work on long instrumental records for a few specific stations that cover at least 60 years. Collaborations within WP4*

- UFPR (A. Grimm) will use gauge based data to characterize the precipitation inter decadal variability with a focus on Brazilian stations.

- UBA (Federico Robledo, Olga Penalba, Natalia Zazulie, Matilde Rusticucci), **UR (**Madeleine Renom) and **CONICET** (Carolina Vera, Gabriel Silvestri) will work on a few individual instrumental times-series for precipitation (gauge based) and temperature:

(1) **UBA and UR** will characterize the variability on interannual and interdecadal timescales of extreme precipitation (using daily precipitation data from gauges) and temperature fields in La Plata Basin and in high latitudes (Antarctica);
(2) **CONICET** will focus on the low frequency modulation of the interannual variation of precipitation over the La Plata basin (example on Figure 1)**.**

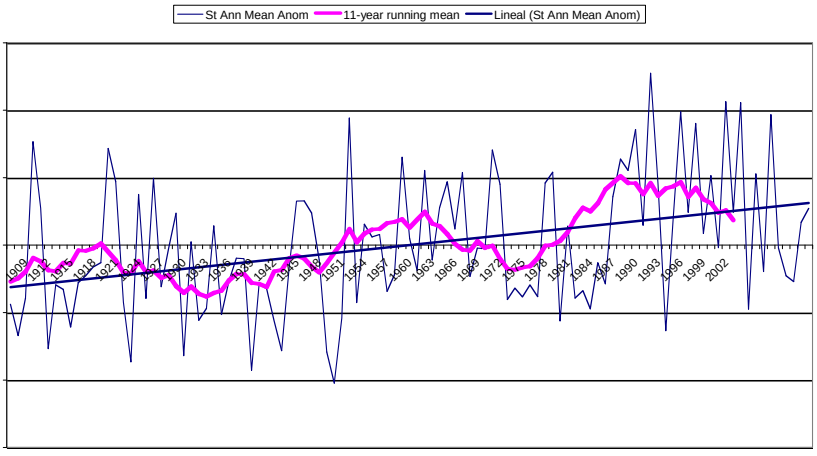

Figure 1. Standardized annual precipitation anomalies in Corrientes (Vera and Silvestri 2008)

Item 4.1.2. **Integrating longer-term proxy with instrumental records to help in characterizing the low frequency variability of the 20th century. Collaborations between WP4 and the Paleo-group of WP3**

- IRD (M. Khodri, F. Vimeux, F. Sylvestre), **CIGES-CONICET** (E. Piovano), University of Geneva (Daniel Ariztegui) in collaboration with **USP** (L. Carvalho) and **CONICET** (C. Vera) will focus on characterising the low frequency variability of the isotopic proxy data (for the last 150 years) from Andean and Patagonian ice cores and SESA lakes cores and compare to instrumental records to see if this is consistent (one example of proxy record on figure 2).

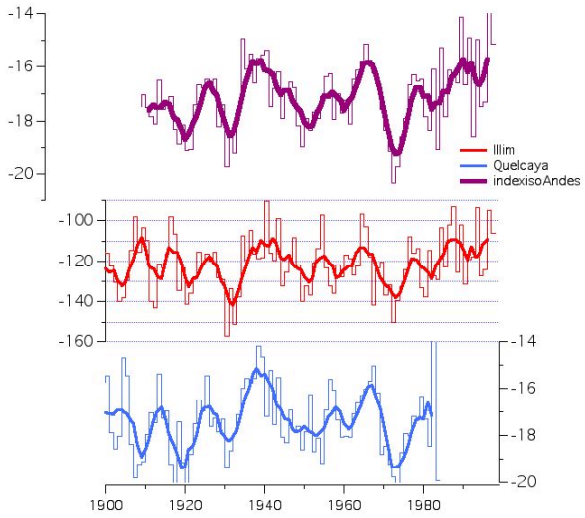

Figure 2. Decadal fluctuations over the last 100 years inferred from Andean ice core isotopic records

-USP (L. Carvalho, Ana Elizabethe da Silva) in collaboration with **CONICET** (C. Vera) will address the long-term variations in the South America Monsoon system. They plan to use a monsoon index based on NCEP/NCAR reanalysis. The advantage of this index is that it can separate SAMS from the SACZ and can be extend through the period from 1948-present. USP and CONICET will compare the amplitude of the monsoon (indicated by the amplitude in the index), and the length of the monsoon, with observed precipitation and try to use a proxy for precipitation to extend this study to longer periods. They will investigate the occurrence of extreme events (dry and warm spells) in Argentina during phases of intensification of the monsoon and the SACZ and compare distinct indexes to know which one has stronger signal over Argentina. Once the importance of the amplitude of the indexes and their anomalies on seasonal temperature are understood, the same analyses will be applied on paleoclimate records of temperature over eastern Argentina to understand how these features have evolved in the past century.

Task 4.2: *Statistical characterization of the patterns of interdecadal variability of precipitation over South America and its relationship with global modes of low-frequency variations during the 20th century, with emphasis on regions with strong components of interdecadal variability*

Responsible: Alice Grimm

UFPR will characterize the interdecadal variability patterns of precipitation over South America and in collaboration with **USP, IRD, UBA** and **CONICET** will evaluate such relationship by analyzing larger-scale observational sets of sea surface temperature (SST) and atmospheric circulation from available Reanalyses and proxy (e.g. ERA40, HadISST, Antarctic ice cores, etc).

Item 4.2.1. **Relating Amazonian and LPB precipitation anomalies to weather regimes**

-IRD (Jhan Carlo Espinoza, Matthieu Lengaigne, Josyane Ronchail) will define weather regimes at a synoptic scale and will associate them to precipitations anomalies over the LPB. This will allow identifying the main atmospheric patterns and variables initiating the observed precipitations anomalies over LPB during the last 50 years. This type of work has already been done over the Amazonian basin (Espinoza et al., in prep) using neuronal methods and ERA-40 fields. The confrontation of these results to the ones obtained for LPB will allow a better characterisation of precipitation anomalies evolutions between the Amazonian basin and LPB.

Item 4.2.2. **Relating low frequency LPB precipitation anomalies to global modes of variability**

-Collaboration between CONICET (Paula Gonzalez, Carolina Vera, Gabriel Silvestri**), UBA** (Federico Robledo**,** Olga Penalba, Natalia Zazulie, Matilde Rusticucci) and **UR (**Madeleine Renom)**:**

(1) Carolina Vera, Gabriel Silvestri will explore the interdecadal variations of **ENSO** and **SAM** influences of on the LPB precipitation decadal variability. Similar work has already been carried out on interannual timescale (Vera and Silvestri 2008), which revealed that the strong influence of ENSO and SAM over LPB precipitation anomalies were not stable with time. The statistical characterisation of such influences on lower frequency timescales will help in designing the modelling strategies of task 4.3 concerning the teleconnection processes.

(2) Paula Gonzalez, Carolina Vera will explore the low frequency variability of the intra seasonal oscillations in LPB precipitation and temperatures and their links to the global modes of variability. Their results will link to the results of WP6 on extremes.

(3) Federico Robledo, **Olga Penalba, Natalia Zazulie, Matilde Rusticucci, Madeleine Renom** will rely on the results of task 1 in conjunction with atmosphere and ocean data from Reanalysis to examine the relationship between the large-scale Southern Hemisphere extratropical dynamical fields (e.g. sea level pressure) and the extreme in precipitation and temperature fields over LPB. They will focus on tropical and extra-tropical Sea Surface Temperatures (SST) of the **South Atlantic Ocean** to explore possible relations with the variability and changes in the extreme precipitation and temperature over the South of South America.

-Collaboration between UFPR (Alice Grimm, João Paulo Jankowski Saboia), **IRD** (Myriam Khodri):

(1) **Alice Grimm and João Paulo Jankowski Saboia** will be working on a continental way using precipitation time-series from 10 000 stations (ANA database) located all over the continents in order to characterize the patterns of interdecadal variability. The objective will be to get a broad picture of this variability and locate which regions display

the strongest signal in term of interdecadal variability at the continental scale. So far, this work has been done for spring and summer (cf. figure 3) and a first tentative to relate these signals to global SST variability (HadISST) has been carried out. Plan to do that for all seasons and even at a monthly scale.

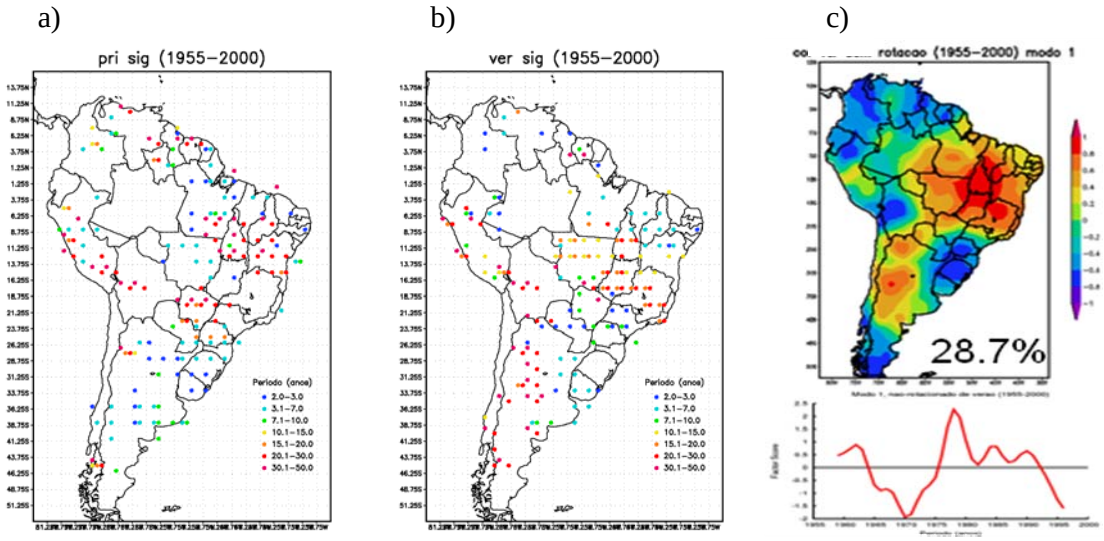

Figure 3. a) Cycles in spring total rainfall. b) Cycles in summer total rainfall. c) First interdecadal mode of summer precipitation (J. P. Saboia and A. Grimm)

(2) After determining the most important modes and the regions in which their components are strongest, **Alice Grimm, João Paulo Jankowski Saboia and Myriam Khodri** will carry out comparisons with regional long-term records and proxy in Argentina, Brazil or any other regions that has a strong signal in order extend the same analyses (including links to dynamical fields from reanalyses) back in time. We plan collaborations with people who analyses the proxy data in the WP3 and an iterative approach between task 1 & 2 to give a perspective on the long-term low frequency variability.

Prospective working plan and collaborative approach for the following next 6 months Objective II.

The strategy to be developed during the following next 6 months will strongly depends on the results obtained during the first phase on the characterization of the observed low frequency variability. For this reason we only present here a prospective working plan, which might be subject to updates and changes during the working process.

Task 4.3: *Statistical assessment of the existing IPCC AR4 OAGCMs skills in reproducing the 20th century LPB mean climate, trends, low frequency variability and teleconnections against the diagnostics of Tasks 4.1 and 4.2.*

Responsible: Leila Carvalho

Item 4.3.1 *Statistical analyses of the IPCC AR4 models skills in reproducing global and regional modes of variability for the 20th century. Collaboration between CONICET, UFPR, UBA, IRD, CNRS and USP*

-CONICET (Mariano Alavrez, Carolina Vera, Gabriel Silvestri, Paula Gonzalez), **UFPR** (Alice Grimm), **UBA** (Federico Robledo), **IRD/CNRS** (Jhan Carlo Espinoza,Jean Philippe, Matthieu Langaigne) and **USP** (Rodrigo Bombardi, Leila Carvalho) will collaborate on the evaluation of global and regional modes of variability in the existing IPCC 20th century climate simulations including both natural and anthropogenic forcing. Results of the various model-ensembles dispersions (from the mean) will be compared and their skill evaluated against datasets analyses of task 4.1 and 4.2. As climate variability in the La Plata Basin is significantly connected with the tropical (e. g. SAMS: South American Monsoon), the Andean region and the extra-tropics, a continental and global scale analysis is advisable before focusing on LPB region:

(1) UFPR and **UBA** and **CONICET** will each work on a subset of models within the IPCC database (still has to be defined) on which the assessment of low frequency variability over LPB and the links to global modes will be carried out against task 1 and 2.

(2) USP has already started to examine all IPCC AR4 OAGCMs with daily data available (365 days) with respect to the skill in representing the present variations of SAMS (onset, demise, duration, total precipitation, daily precipitation). Comparisons were performed with precipitation from satellite (GPCP). They will investigate the influence of SST and the annular mode variations on the monsoon from observations and in IPCC models.

(3) IRD/CNRS will use neural networks (Selg-Organizing maps or Kohonen maps) to evaluate IPCC model skills and biases in representing 20th century climate variability. The same statistical technique will allow to comparing their projections. IRD/CNRS will aim at identifying potential physical relationships between model biases and their 21st century projections. The collaboration will mainly be between IRD and CONICET, with the implications of UBA external collaborators (Neural network experts). We aim at presenting results in late 2009.

Item 4.3.2 *Sensitivity experiments to increase the statistical significance of the global modes remote influences on the LPB low frequency variability. Collaboration between UFPR, IRD, CMCC and UR*

UFPR (Alice Grimm), **IRD** (Myriam Khodri), **CMCC** (Annalisa Cherchi) and **UR** (Marcelo Barreiro, Gabriel Cazes) will collaborate on this task. Since different data platforms have been used in the construction of the Reanalysis and large-scale dynamical fields used in task 2, long-term trends and low frequency variability calculated from it may be non-physical. In order to clarify whether the diagnostics of task 2 from the reanalysis data are a physical signal of true climate change or just a hiatus, we also plan to integrate ensembles of 100-years AGCM experiments (10 members) using LMDZ (**IRD**) and ECHAM (**CMCC**) (which are part of two IPCC AR4 OAGCMs) forced by observed SSTs of the last 100 years. By analyzing this numerical datasets (previously validated against task 1 and 2) we intend to enhance the statistical significance of the climate characterization by sub-periods. The reproduction of these links will be verified in the two IPCC 20th century climate ensembles simulations including the corresponding atmospheric model. Possible discrepancies from the observed links will also be analyzed through comparison of the Influence Functions computed with observed basic states with those computed with simulated basic states (LMDZ and ECHAM-AGCM ensembles and corresponding IPCC models). The basic states will be diagnosed from observed and simulated atmospheric circulation characteristics of opposite phases within inter decadal cycles (mainly from composites of extremes phases of precipitations anomalies). This step will also help isolate and define the possible dynamical links between diabatic heating anomalies generating circulation anomalies that affect the La Plata Basin. The

results will help us define AGCM sensitivity experiments for the following tasks beginning at the end of the first year.

Beginning of month 12, we indeed plan (UR, IRD, CMCC) in addition to the above experiments, to conduct additional experiments using AGCMs (UCLA, ECHAM, LMDZ) in order to further understand the mechanisms involved in the teleconnections. Planned experiments include forcing the AGCMs with historical SST in each basin separately, as defined within **Item 4.3.2**, to study the influence of each ocean on La Plata basin hydroclimate. The model results will be compared and validated with observational data sets in the common period. Once the important oceanic regions are identified, additional targeted experiments will be conducted to further clarify the physical mechanisms responsible for the connections. In particular, **UR** will use the Speedy model, which is a simplified AGCM that allows to create large ensembles of experiments that span a long period of time (from 1880 to the present), allowing to better understand the remote influences of the oceans on the climate of La Plata basin on decadal and longer times scales.

Methodology to isolate the inter decadal variability in the LPB and their links to global modes of variability

-Type of analyses of analyses on individual time-series:

We will first try to identify what is the best method to isolate the band of oscillations/variations. Examples: Singular spectral analyses, Fourier analyses, Wavelets analyses, etc. Plan to use the statistical tool kit from UCLA.

-Type of analyses at a regional scale and links to the variability at a global scale:

Use different filtering techniques to isolates the regions showing the strongest low frequency variability over South America

Co-variability of the time-series in the LPB (precipitation, temperature) and SSTs, Sea Level Pressure…

Define indices based on the areas (boxes in the tropics or extra tropics of South America) showing a consistent low frequency variability and relate these to global modes of SST variability and dynamical fields.

These indices will help to define the strongest relationship of LPB variability with global modes (NAO, PDO, etc).

-Tool/support to foster interactions:

We will use WP7 support to create a forum for discussions on each subject (keeping the chronology of the discussion for the follow-up) and with upload/download of images to support the discussion on the scientific level and on the methods to carry out for the statistical analyses (need something similar to “Google Group”).

We will also plan videoconferences during the working/analysing process.

Need support from WP7 to set up a data portal where to put simulations outputs and related papers.

-Discussions with WP3

We plan exchanges via email or skype to see what individual instrumental time series we could work on.

We plan a videoconference and use the web forum to exchange with the paleo-group to get a better understanding on the climatic quantities inferred from available proxy data.

-Discussion with WP9

We plan to exchanges via email or skype on the stream flow data analyses performed within WP9 to compare to our results and discuss/share on the statistical methodology used within each WP.

Time-table

- Month 4: First Videoconferences scheduled on January 15 2009 to have an update on the analyses progresses, share on scientific results, statistical tools, methods used so far.

- Month 6 **D4.2:** (items 4.1.1&4.1.2) Report on the statistical characterization of the variability patterns, trends and shifts detections in time-series of precipitation (instrumental and proxy), temperature observations at the record-scale.

- Month 6 Videoconferences to discuss and better define the strategy to develop for task 3

- One-day meeting before the next general meeting

- Month 12 **D4.2:** (items 4.2.1 & 4.2.2) Report on the links between low frequency LPB precipitation and temperature anomalies to global modes of variability

- Month 12 **D4.2:** (item 4.3.1&4.3.2) Report on the first results on multi-model (IPCC) skills in simulating important characteristics of past decadal variability of the LPB hydroclimate (such as for example the 1940 or 1970 climate shifts) and teleconnections to main modes of variability