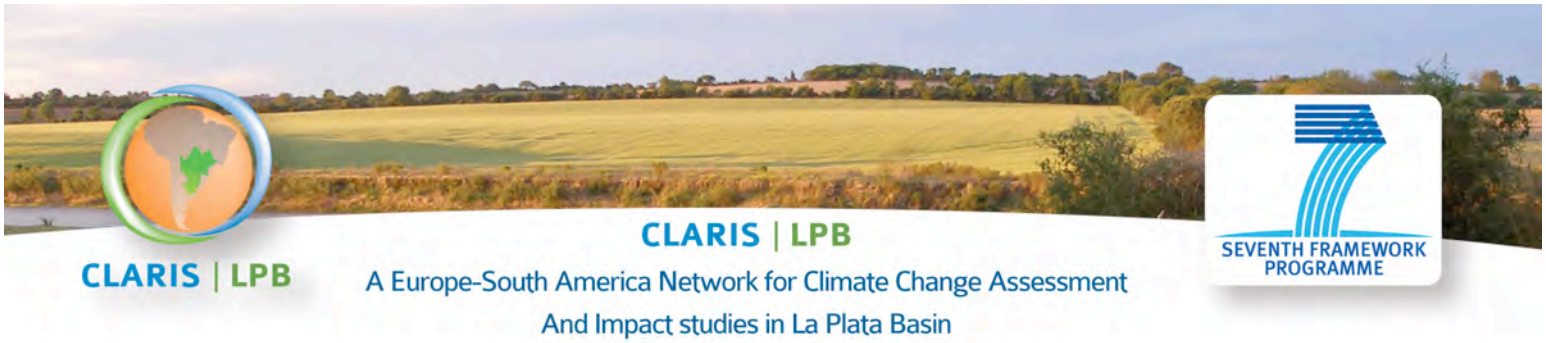

Deliverables

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

D4.3. WP3 and WP4 workshop: Report on the preliminary quantified assessments of the models capabilities in capturing the past low-frequency variations in the Parana-Plata basin and at the continental-scale of South America

Due date of deliverable: Month 12

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

Organisation name of lead contractor for this deliverable: P1-IRD

Deliverable No	Deliverable title	WP	Lead beneficiary	Estimated indicative p-mo (permanent staff)	Nature	Dissemination level	Delivery date
D4.3	WP3 and WP4 workshop Report on the preliminary quantified assessments of the models capabilities in capturing the past low-frequency variations in the Parana-Plata basin and at the continental-scale of South America.	4	P10-USP	10	R	PU	12

Main summary

Several modeling groups (UR, CMCC, IRD) performed ensembles of experiments for the last decades using Atmospheric General Circulation Models (AGCM) that will help the analysis and evaluation of the CMIP-3 (IPCC) model's skills (for the 20th century simulations) in reproducing the main modes of low frequency variability over South America and associated interactions with global modes of variability and existing trends has been initiated. In the first part reported here we mainly focused on the ability of models in reproducing the main climate and started addresing their variability on longer time scales. Preliminary results show that in general most of the IPCC models are able to reproduce key elements of the atmospheric circulation such as the Bolivian High at upper levels and the continental-scale gyre to the east of the Andes that promotes the moisture penetration from the tropical Atlantic into the continent. On the other hand, models tend to represent weaker moisture convergence and less precipitation than observed over LPB. This may be related to the found bias that the IPCC models are not able to represent correctly the weather types that show a deflection of the low-level winds by the Andes Cordillera.

Summary of work

Institutions: Universidade Federal do Paraná (UFP) (Drs. Tércio Ambrizzi, Dr. Gyrlene A. M. Silva and Anita Drumond)

This work investigates the evolution and impact of the El Niño (EN) events in the moisture transport from the tropics to the Southeastern South America (SESA) during the austral summer according to different Pacific Decadal Oscillation (PDO) phases (warm, PDO(+), and cold, PDO(-)) observed along the period between 1950 and 1999. The variability of the South American Low Level Jet east of the Andes (SALLJ) and some properties of extratropical cyclones over the southern cone of the continent in response to the changes in the atmospheric circulation due to above mentioned events are analyzed. It is shown that the EN events during PDO(+) exhibits some differences in anomalous wave pattern at high levels due to the variability of Sea Surface Temperature (SST) anomalies on the Equatorial Pacific and Atlantic oceans compared with the events for PDO(-). This implies positive precipitation anomalies over the SESA which are associated with the enhancement of convergent moisture flux in this region.
On the other hand, the EN events during PDO(-) showed positive precipitation anomalies only over the southern SESA and negative to the north which is associated with downward motion and anomalous divergence over the central eastern Brazil. This pattern may have contributed with the weakening of the moisture flux transported by the trade winds towards the subtropics. The extratropical cyclones tracked through a numerical scheme showed higher frequency and lower central pressures on the extreme of Southern Brazil, Uruguay, Northeastern Argentina and around the Southwest Atlantic during the EN events of PDO(+) compared to negative PDO phase. This is in agreement with the largest flux convergence of warm and humid air from the tropics to these areas.
Numerical experiments with the Community Atmosphere Model version 3.0 also helped on the interpretation of the observational analysis providing a strong indication that the EN events depend on the PDO phases to force the climate anomalies in the summer season over the continent. It seems that the local influence of the Southwestern Atlantic Ocean has an impact on the precipitation over the northern continent, eastern part of the Northeast and Southeast Brazil showing a dipolar structure. These results are in agreement with previous observational studies suggesting that the PDO and ENSO may have combined effects in the precipitation anomalous distributions in some regions of the South American continent.

Institutions: Consejo Nacional de Investigaciones Cientificas y Técnicas (CONICET) (Carolina Vera, Paula Gonzalez and Gabriel Silvestri)

The manuscripts of the following papers (which have been presented at the 9th International Conference on Southern Hemisphere Meteorology and Oceanography, Melbourne, Australia, February 9-13, 2009) are being prepared to be submitted soon for publication.

Vera, C. S., P. Gonzalez, G. Silvestri, 2009: About uncertainties in WCRP/CMIP3 climate simulations over South America.

Gonzalez, P. L. M., C. S. Vera, 2009: Intraseasonal variability over South America in WCRP/CMIP3 simulations.

In addition, as part of the PhD thesis of Clementine Junquas (advisors: H. LeTreut (LMD), C. Vera (CONICET)), the ability in representing the key elements of the South American Monsoon such as atmospheric circulation at upper and lower levels, precipitation, moisture transport and convergence (by mean fields as well as by perturbations) was assessed for a subset of the IPCC AR4 models. Preliminary results show that in general most of the models are able to reproduce key elements such as the Bolivian High at upper levels and the continental-scale gyre extended over the tropical and subtropical regions to the east of the Andes that promotes the moisture penetration from the tropical Atlantic into the continent. On the other hand, models have dissimilar skills in representing the location and intensity of the precipitation maximum over central Brazil, the SACZ. In addition, most of the models tend to represent weaker moisture convergence and less precipitation than observed over LPB. Models that have higher resolution tend to represent better the features associated with SAM.

Institutions: University of Sao Paulo (USP) and University of California Santa Barbara (Leila Carvalho)

The South American Monsoon System (SAMS) is characterized by intense convective activity and precipitation during austral summer. SAMS play a fundamental role in variations of precipitation and river flow over the LPB region. We investigated relationships between sea surface temperature (SST) and the variability of the characteristics of South America Monsoon System (SAMS), such as the onset dates and total precipitation over central-southeastern Brazil in the WCRP-CMIP3 multi-model simulations. We examined the relationships between SAMS and SST in the present climate with NCEP/NCAR reanalysis from 1979-2007. SST patterns were obtained from Empirical Orthogonal Function analysis. We showed that variations in SST on interannual timescales over the South Atlantic Ocean play an important role in modulating the total summer monsoon precipitation. On the other hand, El Niño - Southern Oscillation (ENSO) plays a significant role in the variability of the onset dates over the central-eastern Brazil. El Niño (La Niña) events are associated with late (early) onsets in that region. Nevertheless, negative (positive) SST anomalies over Tropical South Atlantic and positive (negative) SST anomalies over Extratropical South Atlantic are associated with early (late) onset and wet (dry) summers over southeastern Brazil and late (early) onset and dry (wet) summers over northeastern Brazil. Simulations from Phase 3 of the World Climate Research Programme Coupled Model Intercomparison Project (CMIP-3) were assessed for the 20th century climate scenario (1971-2000). Most CMIP3 coupled models reproduce the main modes of variability of the Tropical Pacific and South Atlantic Oceans. ECHAM5 is the model that best represents ENSO and its influence on SAMS. CNRM and FGOALS have the worst performance in reproducing ENSO. GFDL2.0 and MIROC-M are the models that best represent the SST variability over South Atlantic, whereas FGOALS cannot properly simulate the South Atlantic SST variability. These results are 'in press' in the Climate Dynamics journal and are part of the PhD thesis of Rodrigo J. Bombardi, currently at the University of California Santa Barbara.

Institutions: Universidade Federal do Paraná (UFP) (Alice Marlene Grimm and João Paulo Jankowski Saboia) and Institut de Recherche pour le Developpement (IRD/LOCEAN) (Myriam Khodri)

Alice Marlene Grimm and João Paulo Jankowski Saboia worked jointly with Dr. Myriam Khodri (IRD, LOCEAN) during a 15-day visit to LOCEAN-Paris, in order to answer the following questions:
i) How does a climate model forced by observed SST reproduce the observed precipitation climatology over South America?
ii) How are the observed continental-scale interdecadal variability modes of precipitation in South America related with the variations in the Laguna Mar Chiquita?
iii) How does a climate model forced by observed SST reproduce the observed precipitation interdecadal variability in South America?
iv) How are the variability modes in nature and in the model related with SST and atmospheric circulation?
The analyzed model is the LMDz atmospheric model, with resolution 2.5° X 3.75°, and 19 vertical levels, forced by HadISST sea surface temperatures. The analysis was carried out with the ensemble mean of 10 members (1951-2005). The climatology was also analyzed with a higher resolution run.
The model output was submitted to the same analysis applied to the observed precipitation data, described above. Some preliminary analysis was also performed on the observed (Reanalysis) and simulated circulation fields associated with the modes of interdecadal precipitation variability. Our conclusions are:
i) The model reproduces well the precipitation climatology for all seasons. The simulation is even better with higher resolution (zoom on South America), especially over the La Plata Basin in austral autumn, winter and spring.
ii) The first and fourth rotated modes of spring precipitation, and the first, second and third modes of summer precipitation contribute to the variations in the Laguna Mar Chiquita level, and hence to the interdecadal variability of precipitation in the corresponding basin.
iii) The model shows modes of variability that account for the interdecadal variability in Laguna Mar Chiquita, although not all the features in the model modes correspond to the features in the corresponding observed modes. The mid 70's change in the lake level corresponds to a change of phase in the interdecadal variability both observed and simulated.
iv) As not all the features in the model and observed modes are the same, it is not expected that the circulation anomalies are the same.
v) The best correspondence between the model and the observed variability happens in the first spring mode. In summer, the model does not reproduce the tendency to opposite anomalies in central-east South America, produced by local surface atmosphere interactions.
vi) There is good correspondence between the SST anomalies associated with the observed and the model modes of variability.
vii) The future work should analyze modes of higher resolution runs and of a coupled model, because the higher resolution really improves the rainfall climatology in the La Plata basin and the coupled model would take into account the important influence of the atmosphere on the ocean in the Atlantic.

Institutions: Université Paris 7, Universidad de Buenos Aires (UBA) and Institut de Recherche pour le Developpement (IRD/LOCEAN) (Espinoza JC, Boulanger JP, Lengaigne M, Rust H, Ronchail J)

In this work we assess and compare observed atmospheric circulation patterns from ECMWF ERA-40 reanalysis and those simulated by 14 coupled ocean-atmosphere circulation models (GCMs) from IPCC-AR4/CMIP3. Circulation patterns and their clustering in weather types (WTs) are described using observed and simulated 850hPa winds over tropical South America (10°S-40°S and 50°-80°W), a neural clustering (Self-Organizing Maps) and classification algorithm (hierarchic agglomerative classification). In order to identify the models that best reproduce the observed atmospheric circulation, several statistic tests are applied. Systematic biases are noticed in most models. The principal one is associated to inaccurate trajectories of the low-level winds that cross the Andes Cordillera instead of being deflected by this obstacle. Moreover, observed and simulated WTs/rainfall relationships are analysed with a special focus on the La Plata and Amazon Basins. Significant biases in these relationships are identified, especially in the north-western part of the Amazon Basin. Finally, models that reasonably reproduce atmospheric circulation, WTs and WTs/rainfall relationships in tropical South America are the following: INGV ECHAM4, CNRM CM3.0 and MIROC 3.2 high resolution. The results of this work facilitate choosing suitable models for rainfall prevision and for determining the hydrological impacts of the Climate Change in the La Plata and Amazon Basins.
Initial criteria to describe the capability of the GCMs to define circulation patterns

Figure 1a displays the Kohonen Map (Kc) computed using observed and simulated 850hPa winds in the whole region for September – October – November (SON) season and the number of days projected on each neuron. With the aim to describe the main atmospherics situations obtains in the Kc, we can go one step further by computing Hierarchical Agglomerative Clustering (HAC) to group neurons describing similar situations and extract more synthetic information. The HAC computes a hierarchical clustering of the 289 reference vectors of the Kc. The neurons have been classified in 15 classes. Figure 1b shows the location of 15 classes on the Kc and Figure 1c displays the mean low-level winds associated to 15 classes grouping similar observed and simulated days.

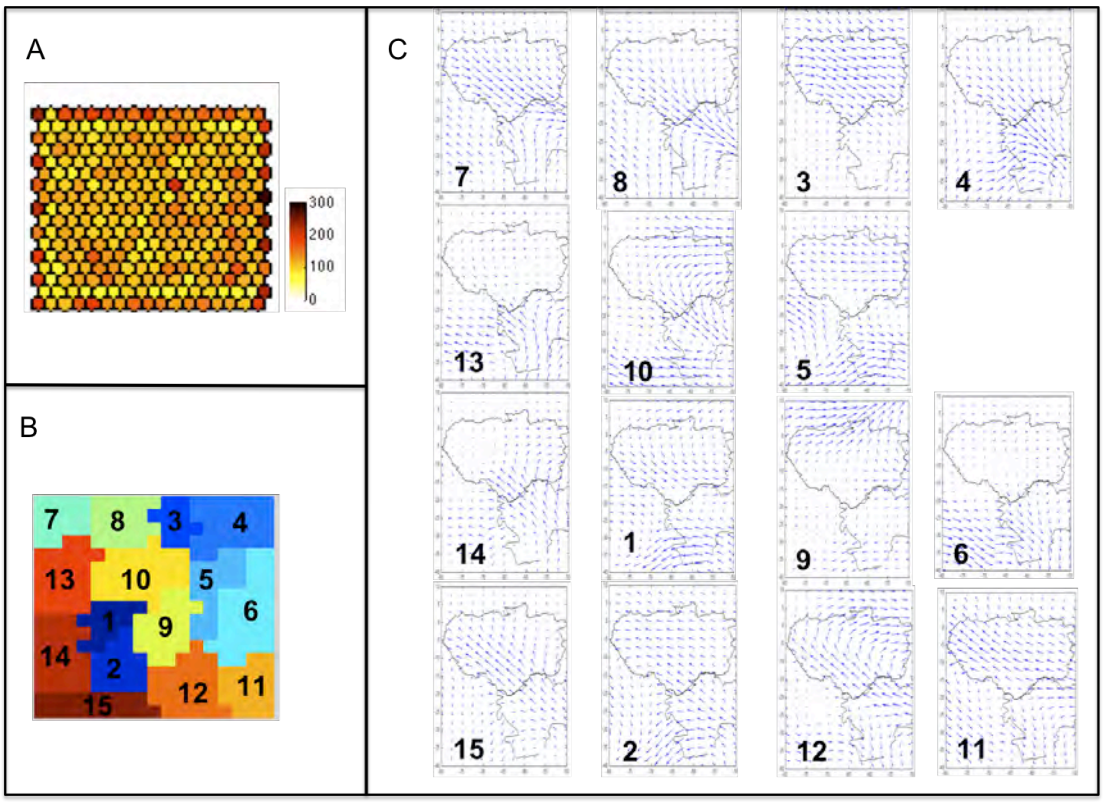

Figure 1. A) Kohonen Map computing using observed and simulated 850hPa winds in SON season and the number of days projected on each neuron. B) Location of 15 classes on the Kc. C) mean low-level winds associated to 15 classes, limit of the Amazon and La Plata Basins are indicated. Western limit of the basins represent the top of the Andes Cordillera.

In order to identify if there are classes more associated to simulations or observations the indice dPij is computed using Formula 1.

$$dPij = P(ERA\text{-}40)i - P(GCMj)i \qquad (1)$$

Where P(ERA-40)i is the probability (in percentage) of finding observed days in the class i and P(GCMj)i is the probability of finding days from GCM j in the class i. dPij values are show in Figure 2. Negative dPij values (blue colours) represent the classes where simulated days are particularly abundant in relation to observed days, them some classes are less related to observations i.e. class 4, 7, 11 and 1 (predominant negatives dPij, Figure 2). These classes, display inaccurate trajectories of the low-level winds that cross the Andes Cordillera (Figure 1c). In the lower right part of the Kc, class 11 display anomalies of the Southeast low-level winds crossing the equatorial Andes instead of deflected toward northeast (as her neighbour class 12). Topologically opposed, class 7 shows northwest low-level winds crossing the equatorial Andes, from Pacific Ocean to Amazon Basin (AB). Class 4 on the top left part of the Kc displays inaccurate trajectories of the low-level winds that cross the Andes from Pacific Ocean to the North of the La Plata Basin (LPB). Similar inaccurate trajectories of the low-level winds is observed in class 1 but in opposite direction instead of deflected toward northwest (as her neighbour class 14).

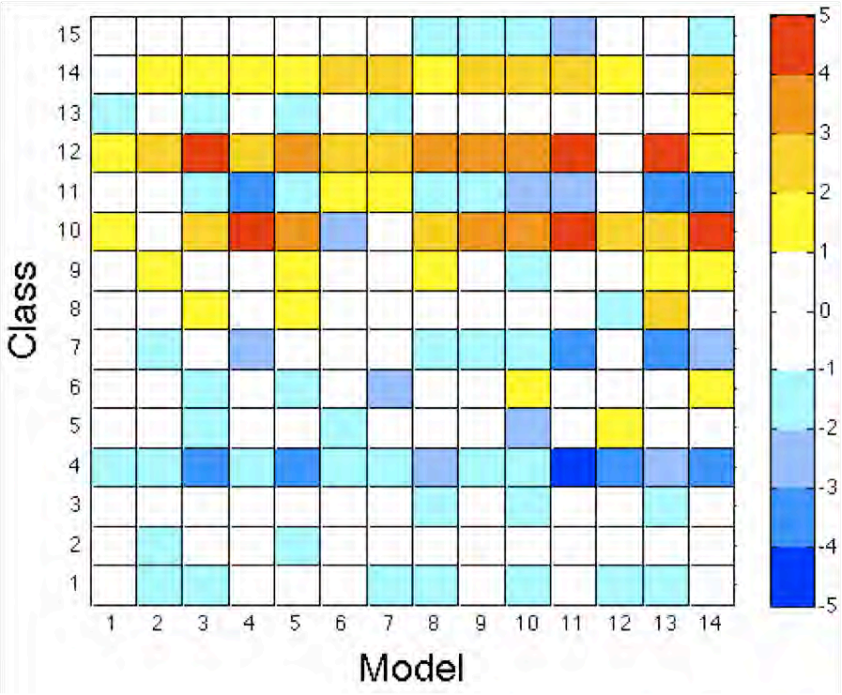

Figure 2. dPij values for 15 class and 14 models. Models are designed as follow: 1=CNRM CM3.0; 2=MIROC 3.2 high resolution; 3=MIROC 3.2 medium resolution; 4=MPI ECHAM5; 5=CCCMA CGM 3.1; 6=CSIRO MK3.0; 7=CSIRO MK 3.5; 8=GFDL CM 2.0; 9=GFDL CM 2.1; 10=INM CM3.0; 11=MRI CGCM 2.3.2a; 12=INGV ECHAM4; 13=IPSL CM 4; 14=MIUB ECHO.G.

The positives dPij values (red colors in Figure 2) are associated with classes where observations are predominant, that is to say in classes less reproduced by GCMs. Three classes are clearly less reproduced by GCMs, i.e. class 10, 12 and 14. Class 10 is characterized by reinforced trade winds over AB, which are deflected southward approaching the Andes Cordillera. Consequently north-western winds at the East of the Andes (that include low-level jet) are well developed. Class 12 shows similar low-level circulation to class 11 (described above) with the differences that, in class 12 southeastern wind anomalies are deflected toward the northeast as they approach the equatorial Andes. Class 14 displays similar low-level circulation to class 1 (described above), but in class 14 southeastern winds over LPB are deflected northward guided by the eastern side of the Andes, and consequently southern wind anomalies are observed over the South of the AB. In conclusion, inappropriate definition of the Andes Cordillera by GCMs seems to be the most important source of biases in the models. Additionally, fewer colors in the columns of Figure 2 can be associated to more adequate models for reproducing the low-level circulation in tropical and sub-tropical South America during SON season, i.e models 1 (CNRM CM3.0), 2 (MIROC 3.2 high resolution) and 12 (INGV ECHAM4). Several statistical test have confirmed than these 3 models are the most appropriate to reproduce weather types in this region.

Institutions: Universidad de la Republica
Marcelo Barreiro

We performed a systematic study of the predictability of surface air temperature and precipitation in Southeastern South America (SESA) using ensembles of AGCM simulations, focusing on the role of the South Atlantic and its interaction with the El Niño-Southern Oscillation (ENSO). We used SPEEDY, a full AGCM with simplified physics that allows the construction of large ensembles of experiments. It is found that the interannual predictability of climate over SESA is strongly tied to ENSO showing high predictability during the seasons and periods when there is ENSO influence (Figure 3). The most robust ENSO signal during the whole period of study (1949-2006) is during spring when warm events tend to increase the precipitation over Southeastern South America. Moreover, the predictability shows large inter-decadal changes: for the period 1949-1977, the surface temperature shows high predictability during late fall and early winter. On the other hand, for the period 1978-2006, the temperature shows (low) predictability only during winter, while the precipitation shows not only high predictability in spring but also in fall.

Furthermore, it is found that the Atlantic does not directly affect the climate over SESA. However, the experiments where air-sea coupling is allowed in the south Atlantic suggest that this ocean can act as a moderator of the ENSO influence. During warm ENSO events the ocean off Brazil and Uruguay tends to warm up through changes in the atmospheric heat fluxes, altering the atmospheric anomalies and the predictability of climate over SESA. The main effect of the air-sea coupling is to strengthen the surface temperature anomalies over SESA; changes in precipitation are more subtle. We further found that the thermodynamic coupling can increase or decrease the predictability. For example, the air-sea coupling significantly increases the skill of the model in simulating the surface air temperature anomalies for most seasons during period 1949-1977, but tends to decrease the skill in late fall during period 1978-2006. This decrease in skill during late fall in 1978-2006 is found to be due to a wrong simulation of the remote ENSO signal that is further intensified by the local air-sea coupling in the south Atlantic. Thus, our results suggest that climate models used for seasonal prediction should simulate correctly not only the remote ENSO signal, but also the local air-sea thermodynamic coupling.

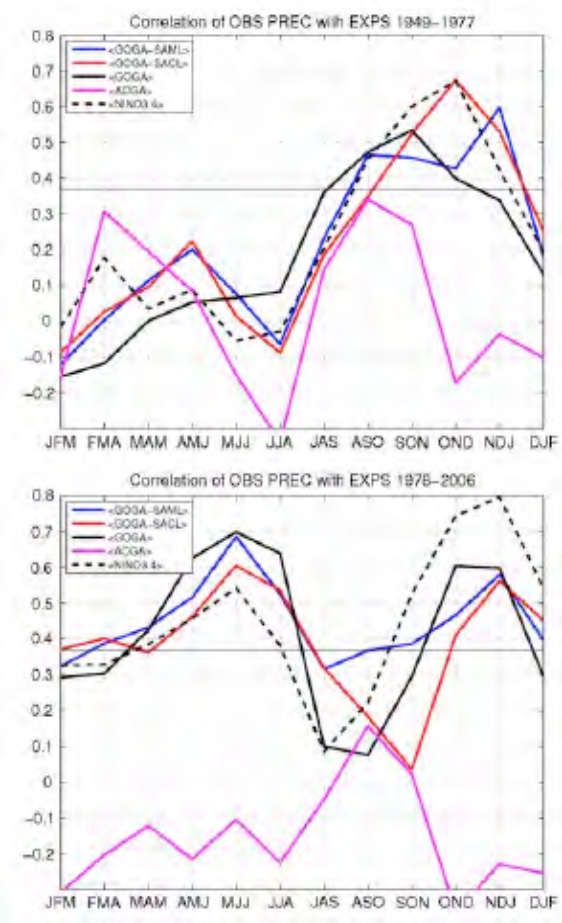

Figure 3. Predictability of precipitation during period 1949-1977 (above) and 1978-2006 (below).

The predictability is calculated as the correlation between the observed precipitation and the simulated in the ensemble mean of the experiment. There are four experiments: GOGA where observed SST is imposed globally, AOGA where observed SST is imposed in the Atlantic only, GOGA-SACL where observed SST is imposed everywhere except in the south Atlantic where climatology is imposed, and GOGA-SAML where observed SST is imposed everywhere expect in the south Atlantic where the AGCM is coupled to a slab ocean. The dashed line is the correlation between the observed precipitation and the Nino3.4 index.

Gabriel Cazes Boezio, Lic. Stefanie Talento and Marcelo Barreiro

Several studies shown that ENSO can affect the surface climate of important sub regions of La Plata Basin during austral Spring that coincides with an El Niño or La Niña event, and also, to a smaller degree, in the following austral fall. The effect of ENSO in this region during austral Summer is less clear, particularly for La Niña events. We would like to point out that most of these studies consider data sets that end by the eighties or early ninties. Recents studies by Kayano and Silva et al. show that La Niña in the last three decades actually show a tendency to affect parts of La Plata Basin during Austral Summer, in the same way that it does in Spring, inducing tendencies for precipitation to be below normal in South Eastern South America (although the impact during Spring is stronger).

The activities included:

- simulation with the UCLA AGCM of the austral summers during the last 6 decades. Simulations of the whole year for the last 6 decades are actually proceeding.
- A study, by using cluster analysis technique, of the global anomalies of SST fields during December-January-February of the last 6 decades. It was found that La Niña episodes before and after the late seventies tend to be in different and quite stable clusters.
- Anomalous atmospheric circulations during DJF of earlier and later La Niña episodes are being studied and compared through NCAR reanalysis data, and data from simulations performed with UCLA and SPEEDY AGCMs

It is found that “later” La Niña episodes induce changes in the upper level circulation over La Plata basin which are consistent with the impact of these La Niña episodes. “Earlier” la Niña episodes may differ from “later” in the effects of the Tropical Indian Ocean on the upper level circulation in the Tropical and Sub-tropial Pacific, and also eastward of these regions, in a way consistent with the lesser impact of La Niña on La Plata basin. The influence of the Tropical Atlantic Ocean on lower level circulation in South America can also contribute in the same direction.

Institutions: Centro Euro-Mediterraneo per i Cambiamenti Climatici (CMCC) (Stefano Materia and Annalisa Cherchi)

The exchanges of water between the land, the atmosphere and the ocean are fundamental components of the climate system, and it is now recognized the importance of including them in General Circulation Models (GCMs). In particular, in recent years the relationship between hydrology and climate in La Plata Basin has become a debatable topic. The area is influenced by both seasonal (Monsoon system) and interannual (ENSO) variability. Also, according to some recent works (Antico, 2009), low frequency processes such as PDO would influence the watershed regime.
GCMs include river routing schemes (RRSs) to convert surface and subsurface runoff generated by precipitation into lateral flow of water over land. At present, the major limitation of the current approaches is the use of time-independent flow-velocities (Arora and Boer, 1999) determined by topography. In reality, topography is not the sole factor establishing the velocity of water at a given cross section; in fact such velocity depends on the amount of water flowing through the cross section itself. From a modeling point of view, the retention times in a grid box should be a function of the amount of runoff generated by the GCM. Neglecting this aspect could result in a misleading representation of the timing and quantity of freshwater discharged into the oceans, which is expected to affect the simulation of global climate. For instance, the discharge from Rio de la Plata is suggested to be the linkage between ENSO and the interannual variability of marine currents along the South American Atlantic coast (Campos et al., 1999). Furthermore, the described issue is potentially a crucial element in determining the river discharge response to a hypothetical climatic change of precipitation patterns and amounts.
These reasons motivated us to implement a new concept of RRSs, based on the hydrologic model "Hydrology Discharge" (HD, Hagemann and Dümenil, 1998). The main innovation of this approach concerns flow velocity. In the new RRS called HYDROS (HYdro-Dynamic ROuting Scheme), this variable is not prescribed, but it is calculated at each time step of the routing scheme, according to the amount of runoff generated by a GCM grid cell. HYDROS is intended to be coupled to CGCM in order to assess the impact of freshwater flow on the ocean circulation.
Among 30 watersheds tested, HYDROS is found to improve the simulation of the phase of mean annual discharge in the La Plata drainage basin. The area is largely affected by the inundation of Pantanal, which, acting as a buffer that delays and spreads the discharge over the year, is responsible for the lack of a direct correspondence between the mean annual cycle of discharge and precipitation. The Paraná River discharge simulation at Timbues performed with the new RRSs reproduces better the flat discharge pattern than the simulation with HD, which on the contrary shows a pronounced peak. The improvements obtained with HYDROS depend on the scheme implemented by CMCC for flow velocity, which is most likely capable in representing the buffering effect of wetlands. These results are highlighted in a manuscript in preparation (Materia et al., 2009)
Modeling a realistic response of river discharge to various climate conditions would be fundamental for the assessment of new strategies for land use and water management. Moreover, a reliable representation of the timing of freshwater discharge into the Atlantic Ocean may improve our knowledge on marine processes at regional and global scale.

Institutions: Centro Euro-Mediterraneo per i Cambiamenti Climatici (CMCC) (Laura Zamboni and Annalisa Cherchi), and Universidad de la Republica (UR) (Marcelo Barreiro)

CMCC has started to integrate an ensemble, currently consisting of 6 members, of AGCM experiments forcing ECHAM with observed SSTs of the last century. The atmospheric model version is the same (in terms of the physics and horizontal resolution) used in the coupled model to produce the IPCC AR4 experiments archived in the PCMDI repository. A preliminary analysis of the ensemble mean that was started to characterize the capability of the model in reproducing the South America and La Plata basin climatology shows that the model captures the main features of variability and in particular precipitation patterns and the South American Low Level Jet (SALLJ). To extend the analysis, CMCC and Marcelo Barreiro (UR), in collaboration with Fred Kucharski (ICTP, International Centre for Theoretical Physics) are developing a dynamical investigation on the impact ENSO flavors' have on rainfall over La Plata Basin.

The rationale for the study roots in the recent identification of a pattern named "dateline El Niño" which differs from canonical El Niño Southern Oscillation (ENSO) in the fact that larger SSTa are localized over the central Tropical Pacific closer to the dateline instead of over the eastern side (see for example Trenberth and Stepaniak 2001, Wang 1995). The two patterns together have been referred to as different "flavors" of ENSO. The analysis is relevant in the context of decadal variability since the dateline ENSO have been more frequent in recent decades (Trenberth and Stepaniak 2001).

The aim of our study consists in characterizing each flavor, the associated teleconnections to SESA and the mechanisms impacting on rainfall there. To stratify ENSO events we have defined three indices: "nino east" (nE), "nino west" (nW) and "trans-nino east-west" (TNEW). They are similar to the indices used by Trenberth and Stepaniak (2001), but they suit our purposes better since they depend on two areas of equal extension, which together cover the entire eastern Pacific from the South American coast up to the dateline. Within the classification, we identified a third category we named "spread ENSO" characterized by positive SSTa of almost equal intensity over the entire eastern-central Pacific. Similar patterns but with negative SSTa will be referred to "eastern", "dateline" and "spread" La Niña.

We have started investigating the October-November bi-month, for the period 1950-present, since spring is the season in which the ENSO related forced variability is expected to be easier to detect (Grimm 2003, Cazes-Boezio et. al 2003, Zamboni et. al 2009). As second step, we plan to extend the analysis to the summer and fall seasons. The analysis is conducted by using both observational data (NCEP-NCAR reanalysis, CRU and CMAP precipitation datasets) and experiments with prescribed SST using three general circulation models: ECHAM, the ICTP AGCM (formerly known as SPEEDY) and CAM. Idealized experiments, in which Gaussian-shape SSTa that mimic the 3 flavors are superimposed on climatological SSTs, have been started as well using the ICTP AGCM.

Reanalysis and observed data suggest a larger impact for the "eastern ENSO", which is characterized by larger extratropical connection and a more intense and extended SALLJ. It is found that a strengthened SALLJ increases the availability of moisture in SESA therefore inducing positive rainfall anomalies over the region, while reduced precipitation is observed over the South Atlantic Convergence Zone (SACZ). The central role of the SALLJ is found also in GCM experiments in which the SALLJ is enhanced by a Gill-type response, which is particularly evident in the idealized ICTP AGCM runs. Comparable results are found for the "dateline ENSO", while the "spread" events have the smallest influence on SESA rainfall, do not present either reduced precipitation over SACZ or a well-defined extratropical connection.