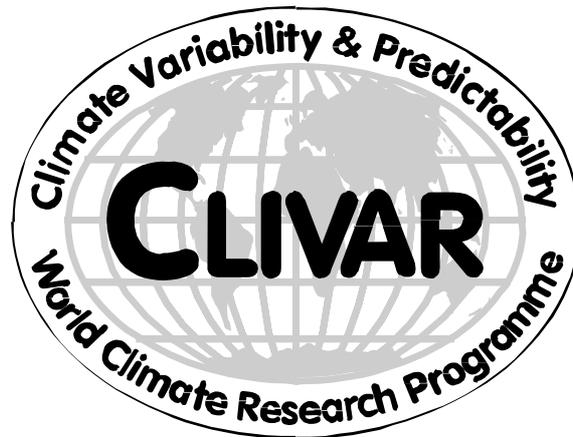


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Appendix 1: List of Participants

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1. Introduction

Prof. Dr. Carlos Roberto Mechoso, chairman of the CLIVAR VAMOS panel, Dr. Andreas Villwock, and Prof. Dr. Carlos Ereño representatives of the International CLIVAR Project Office welcomed more than 50 participants (see Appendix 1). In his welcoming address, Dr. Villwock highlighted the role of the VAMOS project within the WCRP CLIVAR programme and its strong interaction with GEWEX. He pointed out that within CLIVAR, VAMOS is the programme that is closest to implementation (e.g. through the Low Level Jet field programme). Dr. Villwock expressed his hope that this meeting will contribute significantly to the development of the PLATIN programme to one of the key elements of VAMOS. Welcoming addresses were given by Prof. Dr. Rafael Guarga (Rector of the Universidad de la República, Montevideo) and Ing. Alvaro Cutinella (President of the Academia Nacional de Ingeniería del Uruguay).

In his report Prof. Mechoso reviewed the progress of the VAMOS programme and gave an introduction to the La Plata Basin study (PLATIN) which is one of the key issues of this 4th panel meeting. A comprehensive overview to the current status of VAMOS can be found in Appendix 3.

The international research programme VAMOS, under the auspices of the WCRP/CLIVAR programme) with its components NAME (North American Monsoon Experiment), MESA (Monsoon Experiment in South America) and VEPIC (VAMOS Eastern Pacific Investigation of Climate) is targeting important aspects of climate research within the Americas and the adjacent oceans. Nevertheless there are still topics, such as issues related to tropical cyclones or the Bolivian antiplano that are currently not covered by CLIVAR/VAMOS.

The 4th panel meeting is organized around three main topics:

1. The development of a La Plata Basin Programme (PLATIN)
2. Development of a Science Plan for a field program on marine stratocumulus along the coasts of Peru and Chile (VEPIC)
3. Finalise the implementation plan for the South American Low Level Jet Experiment (SALLJ).

In addition, updates on programmes that contribute to VAMOS, particularly NAME have to be provided.

The first three days of the meeting are organized as a workshop on the Climatology and Hydrology of the La Plata Basin, including applications to power generation and agriculture. After a series of scientific presentations, working groups for SALLJ/PLATIN, VEPIC and applications/human dimensions meet.

Prof. Mechoso pointed out the VAMOS projects have to provide conclusive evidence that their research goals are key not only for a better understanding of climate phenomena but also to improve predictability on various time scales.

2. Scientific presentations

2.1 VAMOS Data Management Activities.

Drs. José Meitín (Co-Chair, VAMOS Data Working Group) and Steve Williams (NOAA National Severe Storms Lab and UCAR Joint Office for Science Support) gave an overview of the VAMOS Database and of data management activities within CLIVAR Data Task Team and GEWEX Hydrometeorology Panel Data Management Working. This included a description of the data collection and archival activities over the past year on-going at UCAR Joint Office for Science Support and NOAA National Severe Storms Laboratory in support of the Pan American Climate Studies. A brief overview of the data services available through UCAR / JOSS was included as well as a description of the JOSS interactive data. Updated datasets in support of PACS, and its upcoming field campaign, named EPIC-2001 were discussed. These ongoing activities comprise: (1) Gridded daily precipitation (1948-present) for North America. (2) Digitized, high resolution, rawinsonde archive from San Cristobal station, Galapagos, Ecuador from 1991 to present. (3) Daily precipitation archive for Central America in support of PACS. (4) A new regional Eta model run for South America domain. (5) High resolution visible satellite sectors over Bolivia and Paraguay.

A VAMOS data information server on the World Wide Web (WWW) is maintained (<http://www.joss.ucar.edu/vamos/>) which contains distributed links to existing data centers and sources, as well as, climatological and oceanographic information. A mirror server for the Southern Hemisphere has been added at <http://vamos.iai.int/>.

During the panel session the Dr. Meitín made a proposal to the VAMOS Science Panel to begin archiving full resolution, multi-spectral, digital satellite imagery over the regions of interest to VAMOS (VEPIC, PLATIN, Low-Level Jet region/ MESA) to build a short-term climatology over the area. This proposal was approved by the panel (see section 6.2).

2.2 Real Time Monitoring of the American Monsoons and the North American Monsoon Experiment (NAME)

In the first part of his presentation Dr. Wayne Higgins (NOAA, National Center for Environmental Prediction, NCEP) gave examples for real-time monitoring of the American monsoons at the Climate Prediction Center using a gauge based precipitation data base and analyses. In the second part he provided a brief introduction on NAME. A science and implementation plan has been drafted and subsequently a NAME Science working group is in process of building.

2.3 The Monsoon Experiment South America (MESA)

Dr. Hugo Berbery (U. Maryland) reported on the different components of the South American Monsoon System, and contrasted the summer climate of North and South America. Particular interest was put on a comparison between the La Plata and Mississippi basins which, while having similar size and mean annual streamflow, differ in basic aspects like the annual cycle of streamflow, circulation, as well as in the precipitation origins. (see further details in Berbery and Mechoso, in Exchanges 2/2000). The discussion also focused in the SA Low-level jet, which unlike the North American counterpart is present throughout the year, with important implications for the hydrologic cycle of the La Plata basin.

Dr. Pedro da Silva-Dias reported on the recent developments within the LBA programme. He gave some examples of results obtained through the wet season field campaign (Jan./Feb. 1999) in Rondonia (western Brazil). The objectives of the experiment were:

- to understand the coupling between biosphere and atmosphere processes in the wet season in the Amazon region including budgets of heat, water vapor, trace gases and VOC;
- to determine the cloud dynamics and microphysics interactions over rain forest and over adjacent deforested areas including the role of aerosol and biogenic compounds as CCN;
- to understand the local response of clouds and rainfall to large scale forcing;
- to improve modeling of biosphere-atmosphere processes in different scales.

Two distinct atmospheric patterns (phases) were observed, a westerly and an easterly phase. The westerly phase can be characterized by clear air (low cloud condensation nuclei load), low, marine type clouds, whereas during the easterly phase (pre-monsoon) these characteristics are reversed. The large-scale convection pattern is the primary forcing for the precipitation.

LBA is now planning the complement 'dry season' field campaign which will take place in late austral winter and spring 2002, just before the planned field phase for the LLJ experiment.

2.4 The South American Low Level Jet Program (SALLJ)

Dr. Michael Douglas reviewed the status of the plans for the Low Level Jet field experiment. The meeting heard encouraging news from the Paraguayan and Peruvian invitees to the workshop. Paraguay is planning to establish later this year a radiosonde station in Estigarribia (western Paraguay) to replace a pilot balloon stations now operating there. And in Peru there are three new radiosonde stations undergoing demonstration trials, with full data transmission scheduled for mid-2001. Collectively, these radiosonde stations will strengthen the background monitoring for the SALLJ experiment. In addition, new networks of automated surface stations being established in both countries.

The possible use of a research aircraft remains uncertain, with the precise formulation of a research plan still pending. The possible use of the aerosonde and other remotely piloted vehicles was raised, and an evaluation of the merits of this approach versus an aircraft was suggested

The success of this field project does not critically depend on the aircraft, thus it would not lead to a complete failure if unavailable. The LLJ working group will work on justification, details of the field operations plan and the budget during this meeting.

The suggestion of one of the Bolivian representatives at the workshop to hold a meeting in Bolivia prior to the SALLJ programme was welcomed. It was suggested that a workshop related to the design of conducting of the field programme be held in Santa Cruz, possibly in early 2002.

A comprehensive report about the issues related to the SALLJ field programme can be found in section 5.1.2.

2.5 US CLIVAR and the Eastern Pacific Investigation of Climate Program (EPIC)

Prof. Dr. Chris Bretherton (U. Washington) reviewed the developments within the US programmes PACS and EPIC (Eastern Pacific Investigation of Climate) (1999-2003). EPIC is a joint program of the Pan American and Pacific panels of US CLIVAR funded through NSF and NOAA, and a contribution to VAMOS and international Pacific CLIVAR. The overall goal of EPIC is to observe and understand the feedbacks between the atmosphere and upper ocean in:

- the Eastern Pacific cold tongue/ITCZ region.
- the SE Pacific stratocumulus cloud regime.

The scientific motivations for EPIC are:

- Strong ENSO and seasonal variability
- Strong horizontal gradients - contrast to W Pacific
- Deep convection, stratocumulus, strong shallow ocean currents/mixing are major coupled O-A modelling problems.

EPIC has the following components

1. US CLIVAR-sponsored enhanced monitoring and empirical studies

- 1.1 PACS SONET - Routine pilot balloon observations at many central and S American sites.
- 1.2 IMET buoy (B. Weller, WHIO) at 20 S, 85 W - operational since Oct. 2000 with real-time satellite data transmission.
- 1.3 Satellite retrievals of E Pacific cloud properties (Minnis/Albrecht) and analysis of scatterometer winds, TMI SST (Chelton/Esbensen)
- 1.4 TAO buoy enhancements on 95W, 110 W (surface pressure and SW radiation)

2. Pilot studies

- 2.1 Equatorial transects on TAO maintenance cruises
- 2.2 Ron Brown 1997 TEPPS cruise (Yuter et al 2000a,b) -found

3. EPIC 2001

The intensive observational period (IOP) of EPIC will take place from Sept. 15 – Oct. 15.

- Sept.-Oct. 2001, based along 95°W TAO buoy line
- Combines ship-based and aircraft measurements.

3.1 Atmospheric science goals:

- Initiation of deep convection in the E Pacific warm pool, and its association with easterly waves.
- Boundary layer evolution in cross-equatorial flow across cold tongue.
- Exploratory SE Pacific stratus cruise.

3.2 Oceanographic goals:

- Near-surface variability associated with atmospheric mesoscale convective systems.
- Ocean microstructure and turbulent mixing processes below the base of the mixed layer.

3.3 US Platforms

- Research vessel 'Ron Brown' (soundings, ocean profiling and microstructure, 5 cm scanning radar, 8 mm radar, lidar, PBL profiler, radiation, turbulence, surface met). (3 weeks at 10°N, 95°W, 3 weeks to S)
- Research vessel 'New Horizon' (ocean measurements, 3 weeks at 10°N)
- Aircraft 'NCAR C-130' (incl. AXBTs, no Doppler, Huatulco-based)
- Aerosondes (radiosonde-like measurements, pre-programmed track using GPS and radar altimeter; first major deployment in a field experiment, based at Galapagos)
- TAO buoys, IMET stratus buoy.

With respect to VEPIC Bretherton showed that although the most prominent region with stratus cloud decks is the SE Pacific off the coast of South America, most observational studies have been carried out in other regions (e.g. off the coast of California). Because of the uniqueness of the stratus off South America (shape of the coastline, extending up to the equator) and possible impact on the large-scale monsoonal circulation over South America, there is a good justification for a VEPIC project. The strong relationship to South America, the participants felt that this project should remain under the auspices of VAMOS instead of being covered by the upcoming Pacific activity of international CLIVAR.

2.6 A VAMOS Investigation of the Eastern Pacific Climate (VEPIC)

Drs. José Rutllant and René Garreaud (U. of Chile) provided some more detailed information about the current status of the VEPIC project. Rutllant elaborated on the modelling aspects of VEPIC project. An improved knowledge about the stratus decks could improve the regional models through better boundary conditions and also contribute to the improvements of GCM for ENSO forecasting. Garraud highlighted the high frequency aspects of the stratus decks (diurnal cycle) and the effect of the altiplano convection on the stratus up to 300km off the coast.

Dr. R. Nuñez reported on the Ocean South East Pacific Array (OSEPA). The funding from Chile is still pending. The sea level network has been completed by March 11. 2 Ocean Met Buoys will be deployed throughout the year. WHOI installed on October 2000 an ocean-met buoy at Latitude 20° S; Longitude 085° W (~1000 nm offshore from Iquique).

Perú – NAYLAMP: a new monitoring system funded by World Bank and Perú is in place. Four ocean-met buoys installed plus sea level and hydrometeorological stations along the coastline and inland. Website <http://www.naylamp.dhn.mil.pe/>

CPPS had a meeting in Lima, Perú in 2000 to work on initial proposal (PDF) to be presented to GEF-World Bank by Chile-Perú-Colombia-Ecuador. Draft report is under review.

2.7 Climate Forcing of Major Floods of the Paraná River

Dr. Vicente Barros (U. Buenos Aires) demonstrated in his presentation the relationships between ENSO and river discharge. The highest floods occur in those cases when Niño-3 SST anomalies last longer than average. Major issues in this context are:

- the climate forcing
- features of major floods
- flood forecasting
- social impacts

2.8 The IAI PROSUR Project

Dr. Mario Nuñez (U. Buenos Aires) gave an introduction to the PROSUR programme (Programme for the Study of Regional Climate Variability and Changes, their Prediction and Impact in the MERCOSUR Area (IAI CRN-055)). PROSUR is part of the Collaborative Research Network (CRN) of the Inter American Institute (IAI) and has been developed to promote research into the causes of climate variability in the Mercosur region of South America. Scientists from the Mercosur countries (Argentina, Brazil, Paraguay, and Uruguay) are leading the effort, with scientists from the United States also participating. The purpose of the CRN is to support an environment conducive to collaborative research.

This is being accomplished by sponsoring scientific visits to each of the participating institutions, holding regular meetings where results are disseminated and discussed, and by encouraging the free exchange of data.

Problems involving climate variability and the human response to that variability are quite complex and it is clearly impossible for one group to address even a single one of them effectively. At present, however, there are many barriers to effective collaboration, including the physical separation between groups, a lack of communication between disciplines, an historical resistance to the open exchange of data, and language barriers. It is believed that by providing an environment conducive to collaboration, the barriers will be reduced and the pace of research will accelerate more rapidly. These will result in developing a predictive capability and an understanding of how to make best use of those predictions, ultimately resulting in a benefit to the population within the region.

PROSUR was designed through a series of meetings and workshops involving the participating institutions. Three themes have been identified as the priorities to be addressed:

- Physical and dynamical processes related to climate variability in southeast South America.
- Tropical - extratropical interactions related to circulation and precipitation variability over southeast South America.
- Impacts of climate variability on sectors of social and economic importance in the Mercosur region.

More information can be found under: <http://www-cima.at.fcen.uba.ar/prosur/default.htm>

The VAMOS panel welcomed this initiative as an important contribution to VAMOS especially with regard to the planned PLATIN project.

3. Special Session on Human Dimensions and Applications for PLATIN

3.1 Introduction, charge to presenters, and an example of river basin IA in the U.S. Pacific Northwest

To motivate the session Sean Willard (NOAA/OGP) showed in his introduction an example from a river basin in the US Pacific Northwest. He outlined some principles and lessons from previous integrated assessment studies.

3.2 Some aspects of climate variability over La Plata River basin and opportunities for applications

Dr. Guillermo Berri (U. Buenos Aires) highlighted the applications of current climate forecasts. He started with a preliminary evaluation of Southeast South America Climate Outlook Fora. A series of these outlook fora for Southeast South America begun in Montevideo, Uruguay in December 1997, in the middle of the last strong El Niño 1997/98. Participation included specialists of the four countries of the Mercosur region, i.e. Argentina, Brazil, Paraguay and Uruguay and various disciplines, such as meteorology, agronomy, hydrology, oceanography, related environmental sciences, public health and social sciences. The motivation was the concern about the ongoing El Niño in mid 1997, the availability of experimental climate forecast, and the knowledge about the impact of past El Niño in the region. The Fora produced seasonal forecasts of the averaged precipitation and temperature anomaly expected for the upcoming 3-month period.

For the 1997/98 El Niño and the following La Niña period good grounds for predictive skill were obtained. Nevertheless, in some areas which do not have a strong relationships to ENSO, the forecasts failed. Moreover, these areas are affected by local factors such as the vicinity to the Atlantic Ocean, for example in the case of eastern Uruguay where 9 out of 9 categorical disagreements are found.

In the following Berri gave an example of practical application of climate prediction to decision-making in water resources management in Argentina. For a river basin in western Argentina the usage of statistically based climate forecasts for the purpose of hydroelectricity management was applied. The power utility company uses the prediction of accumulated water volume to produce future electricity generation estimates.

The results are discussed in Appendix 3 in greater detail.

3.3 Hydrological Review of La Plata Basin

Alvaro Brandino and Julio Patrone from the Uruguayan Energy Company (UTE) gave an overview about the use of hydropower production in the La Plata Basin and their requirements in terms of climate forecasts. They emphasised the great importance of hydropower plants for the total energy production of Argentina (40%), Brazil (91%), Paraguay (99%) and Uruguay (73%). A substantial part of this hydro power energy production comes from the river in the La Plata Basin. The goal is to operate the hydro power plants at the minimum total cost, that takes into account the operation and quality conditions. UTE uses for planning the production of the power plants and the purchases and sales to adjacent countries. The models can calculate for a given period the production and purchases, that minimizes the total system cost, fulfilling the set of operating constraints.

UTE uses a short-term model (optimization period: 1 week), a middle term model (optimization period: 3 months) and a long term model (optimization period includes several

years). For these models different kind of hydrological, climatic or synoptic input data is required. For example, the short term model needs:

- Forecast inflows for each dam
 - the daily mean, in m³/sec,
 - for each of the next 7 days ahead.
- The forecast minimum rains in each basin (mm).

For the mid-term model Temperature (minimum, maximum) and mean forecast for the next 2 weeks are required to forecast the energy demand. In addition, Scenario Trees of Inflows for each dam and information about the ‘Year type’, i.e., whether the current year is or not an extreme event “El Niño” or “La Niña”.

Thus, accurate climate information from synoptic to interannual time scales is required to optimise the energy production by power plants in the La Plata Basin.

3.4 Application of ENSO forecasts to water resource management: a case study in the Parana Basin

Dr. Heidi Cullen (IRI) presented an application of seasonal to interannual (ENSO) forecasts to the water resources sector in South America. The typical ENSO impacts to the Paraná watershed are wetter than average conditions, i.e. high runoff and thus an impact on flood risk and also on hydropower production. As an example the ITAIPU hydropower station was selected. ITAPU at the Paraná river produces 89% of power consumed in Paraguay and 25% of power consumed in Brazil. The goal for the hydropower management is the optimization of flood protection vs. energy generation. The risk for the power generations is that the demand for energy exceeds the supply. Some objectives and methods for improved operational reservoir management are:

- Quantify watershed connection to patterns of large-scale climate variability (ENSO, PDO, NAO, Tropical Dipole)
- Generate probabilistic hydrologic forecasts using multivariate, nonparametric time series simulations preconditioned on large-scale climate
- Modify rule curves given a seasonal forecast and incorporate into a Decision Support System (DSS)
- Negotiate allocation of supply among users

Cullen concluded that sustainable management of water resources requires understanding large-scale climate variability, anthropogenic forcing, and human demands. Given that some large-scale variations (ENSO) have limited predictability, physical and statistical forecasting methods can be applied to current management techniques. Substantial gain in resilience to climate variability results can be obtained when the reservoir is operated by a control scheme using reliable forecasts. The presentation has shown a clear need of an “end to end” understanding of hydropower systems.

3.5 Climate Variability in the Agricultural Sector: Impacts & Challenges

In his presentation Dr. Walter Baetghen (IFDC) described the usage of climate forecast information for the agricultural sector. Climate variability measured in seasonal and interannual scales is a key factor affecting agricultural production. Farmers have developed successful production systems by learning to adapt to the variable climatic conditions of their environments. Still most members of the agricultural community (private and public sectors) are usually unable to improve their planning and decision-making by anticipating and adapting to expected climatic conditions.

A typical reason mentioned by decision makers for the lack of such anticipatory planning, has been the lack of means to predict climate conditions (e.g., precipitation, temperature) with sufficient skill and lead time.

W. Baetghen described the current status of climate forecast applications in the agricultural sector of Uruguay, although the situation is similar throughout SE South America.

He concluded that most of the required elements to ensure effective applications of climate outlooks in agriculture seem to be available and functioning in the region. However, the general perception is that stakeholders are not taking full advantage of the available information and tools. Possible reasons for this lack of extensive use of the climate forecasts have to be investigated in more detail. (see the full abstract in Appendix 3).

3.6 Risk, disasters and uncertainty. Floods at the estuary of the La Plata River and its littoral

Dr. Claudia Natenzon from the Facultad de Filosofía y Letras, UBA presented results from the PIRNA project (Programa de Investigaciones en Recursos Naturales y Ambiente). The project has the goal to investigate the risk, disasters and uncertainty of floods at the estuary of the La Plata River and its littoral. The objectives of this programme are:

- To identify, to assess and to design management proposals about environmental risk at the estuary of the La Plata River and its littoral.
- The project focuses on technological and flood's hazards in several administrative units of the study area.

The analysis carried out was based on Risk Theory, using a multidisciplinary and territorial planning approach, including instruments and techniques like statistical data bases for GIS, satellite images (with visual and digital analysis), field surveys and interviews.

More information can be obtained under

<http://www.filo.uba.ar/institutos/geografía/home.htm>

3.7 OAS experience in the Plata Basin and a vision for the future

Dr. Jorge Rucks from the Unit for Sustainable Development and Environment of OAS (Organization of American States) gave an overview about the experience of OAS in the area of the La Plata Basin and a vision for the future.

The Unit for Sustainable Development and Environment (USDE) is the principal technical arm of the OAS General Secretariat for responding to the needs of member states on issues relating to sustainable development within an economic development context. Technical issues addressed by the USDE include transboundary management of water resources, reduction of vulnerability to natural hazards, public participation in decision-making, climate change/sea-level rise, coastal-zone management, renewable energy planning, and biodiversity.

Areas of action of USDE comprise:

- Biodiversity
- Climate Change and Coastal Zone Management
- Environmental Law
- Natural Hazards
- Public Participation
- Renewable Energy
- Summit of the Americas Process

- Water Resources

An example for a project with relevance to PLATIN is a project under Water Resources, named 'Integrated Watershed Management Practices for the Pantanal and Upper Paraguay River Basin'. This project has been approved by the Global Environment Facility (GEF) as part of the Operational Program No. 9 'International Waters' with relevance to the cross-cutting area of land degradation. The Unit for Sustainable Development and Environment of the OAS is the executing agency in accordance with UNEP. The execution of the program and its implementation started in October 1999 and will last approximately 30 months. More information can be obtained under <http://www.oas.org/>

3.8 Discussion

In the discussion the question was raised whether VAMOS, as a part of a 'physical' climate research programme, would be significantly enhanced by a 'human dimension' component as part of the programme. It was felt that VAMOS should encourage the dialogue between the different communities, and that the PLATIN project could be a good testbed to incorporate an application component. Hydropower management and agriculture seem to be two candidates that are interested to benefit from reliable climate forecasts. In general, the participants felt in general more comfortable to call it an application component than human dimensions.

4. Review of Climate Research in Uruguay

The participants welcomed four presentations about climate research activities in Uruguay. The institutional framework for climate research in Uruguay can be outlined as follows. At the University of the Republic in Montevideo, Uruguay, two departments, namely the Dept. of Fluid Mechanics and the Dept. of Physics (Unit of Meteorology) contribute to climate research in Uruguay. In addition, collaborative national efforts, such as CONICYT (National Council for Scientific and Technological Research) and CSIC (Council of Scientific Research of the University of Republic), but also with applied sciences are carried out.

Uruguayan researchers also participate in international efforts, such as IAI (Inter-American Institute for Global Change) Projects, AUGM (Association of "Montevideo" Group of Universities), or in the Regional SESA (South Eastern South America) Climate For a.

A broad list of research topics comprises:

- Climatology and spatial – temporal variability of the precipitation field in Uruguay and in the South Eastern South American (SESA) region.
- Climate anomalies affecting Uruguay (and SESA).

In his introduction, Gabriel Pisciotano reviewed the spatial-temporal variability in precipitation and its relationships to ENSO. In addition, diagnostic studies have been carried out to investigate the ENSO mechanisms influencing SESA using an ensemble seasonal simulation of the UCLA GCM.

Mario Bidegain continued with results from analysis of precipitation, temperature and surface moisture anomalies associated with the ENSO. The analysis exhibits increased precipitation, moisture, and negative anomalies of temperature during El Niño years and vice-versa for La Niña cases. In addition, long-time series of precipitation show decadal variations in a 10-15 years period and a slight positive trend.

Gabriel Cazes showed results from EOF analysis of different atmospheric fields and their relationship to ENSO. He pointed out that the influence of ENSO shows a strong seasonal dependence (e.g. strong during austral spring).

Alvaro Díaz presented results from his work on the relationship between SST anomalies and rainfall in SESA. Using multivariate and univariate techniques for tropical/subtropical Pacific and Atlantic SST positive correlations of DJF SST's (in the Atlantic) and rainfall were found.

.Selected scientific questions for future research

- Teleconnections in the regional (SESA) climate (e.g. from El Niño-region) are seasonally dependent Mechanisms???? Global scale and regional scale circulation anomalies and their relations).
- Break El Niño and “inversion” La Niña, relationship between ENSO and precipitation in Uruguay, during summer (February, El Niño; January and February, La Niña). (Hyp.: During La Niña summer, weak zonal circulation in SESA and, then, convective/monsoon-like? increased phenomena in the region).
- Temperature and moisture ENSO-related anomalies are directly related to precipitation anomalies or must be explained by other mechanisms?
- There are extreme events (in SESA) not related to ENSO
E.g.: 1984; 1979
- Description and mechanisms for influences of the Atlantic (tropical and subtropical) SSTs; and their predictability
- Difficulties for climate prediction because of seasonal dependence.

- To what extent a GCM is able to reproduce the physical mechanisms found in the “observationally-based datasets”?
Qualitative evaluation of the GCM capabilities to be used in prognostic mode (global scale and regional scale).
- Summer circulation patterns (like EOF), to what extent are they internal modes or externally “forced” by “Boundary Conditions” (BC); SST, Atl.-Pac?? and/or soil condition, LLJ/moisture-flux related conditions??
- Difficulties in the use and application of regional climate prediction because an explicit decision-make procedure is needed.
- The skill of the climate prediction techniques is due to some few (for e.g. strong El Niño or LN) events or really there are some climate prediction skill in other circumstances?
- The most “significant” scientifically based issue may not coincide with the most important applied issue (e.g. River streamflow)
- Interdecadal trends and causes ?
- Intraseasonal wet & dry events ?

5. Working Group Reports

Thereafter, the three, resp. four working groups (PLATIN and ALLJS spend part time together) were formed to discuss in greater detail issues related to their projects.

1. PLATIN/ALLJS
2. VEPIC
3. Human Dimension / Application

5.1 Report from the ALLJS/PLATIN Working Group

5.1.1 Report from the PLATIN Working Group

Working Group Participants:

C. Vera, M. Nuñez, R. Clarke, V. Barros, D. Lettenmaier, H. Berbery

Motivation:

Uniqueness of the Plata Basin:

- Connection between tropics and extratropics
- Major storage in the Pantanal

Driving questions for this study are:

- How are droughts and floods in the La Plata Basin characterized from a climatological and hydrological point of view?
- What is the role of global climate change and land use change on regional weather, climate, hydrology and agriculture?
- How predictable is the regional weather and climate variability and its impact on hydrological, agricultural and social systems of the basin?

Suggestions for the Plata Document

Based on the document that emerged from the La Plata workshop in December 1999 (Montevideo, Uruguay) the group will start developing a scientific plan for PLATIN. The document can be accessed under: <http://www.meto.umd.edu/~berbery/lpb/laplata.html>. The following suggestions for modifications and additions to that document were made:

- Section on operational numerical forecasting systems in the area;
- Further discussion on cyclogenesis in the area (discussion on mountain role, valley circulation and nocturnal development of cyclones and role of SST);
- Historical perspective of LLJ;
- Further discuss the operational data collection system: tables of upper air radiosonde data availability, systems (VAISSALA etc.), surface data (number of automatic stations, communications, airport data, climatological network, mesoscale observational systems, radars etc. Also discuss the satellite data availability and a section of perspectives for the immediate future;
- Add a discussion on moisture source (recycling, isotopic studies and contribution of the Atlantic source);
- Section on especial field activities held in the past (data sources and scientific design);
- Hydrological modeling of the region;
- Much more work on intraseasonal variability in the area and degree of predictability;

- Include Clarke/Tucci analysis of interdecadal variability of the Pantanal and its role in the storage;
- Geochemistry of the area (river + ground water?);
- Role of biomass burning aerosols and gases in the regional energy balance and implications;
- More discussion on the land use change and possible impacts in the coupled atmosphere/water/vegetation systems;
- Enhance the human dimension component of the document with specific examples.

Specific questions

- A large number of scientific questions on the climatology and hydrology of La Plata basin were raised at the meeting. This section includes a selection of these questions.
- How can the basin climatology and hydrology be remotely influenced by SST anomalies from different ocean basins and low-frequency variations (MJO, NAO, etc.)?
- To what degree is the basin climatology and hydrology affected by SST anomalies? Conversely, how do the larger scale precipitation and surface winds affect the nearby oceanic circulation? Does the SACZ play an active role, or is it merely responding passively to large-scale changes?
- How is decadal variability in the tropical Atlantic SSTs linked to precipitation anomalies in the basin, particularly in the northern part (Upper Paraguay and Paraná)?
- What are the seasonal variations of links between anomalies in SST and in climate over the basin?
- What is the relative importance of local and remote sources of moisture for precipitation in the basin?
- Do soil processes play an important role in the basin? In particular, do the large variations in the flooded area of the Pantanal impact and are themselves influenced by the variations in region climatology?
- Is there a climatologic impact on the Pantanal area due to the fragile environment and the great variability and persistence of the flooded areas?
- What determines the recurrent modes of variability in the major rivers of the La Plata River basin (Paraná, Paraguay, Uruguay, Negro)?
- Can the links between both SST and streamflow variations be used to obtain useful probabilistic prediction of river behaviour?
- What are the climatological and hydrological characterization of droughts and floods in the La Plata Basin both in time and space?
- What developments and improvements in hydrologic models are required to better represent the relationships among model parameters and changes in soil use?
- How predictable is hydroclimatology variability in the La Plata Basin?
- What are the most limiting factors to adequately address these questions?
- How do climate soil, and vegetation interact to produce conditions of floods and droughts in the La Plata Basin?
- What is the role of biomass burning aerosols in the regional energy balance and its possible impact on cloud microphysical processes?
- What is the role of land use change in the observed long term precipitation changes?
- Are vegetation/atmosphere processes relevant to weather/climate variability in the area?

What institutions should be involved ?

- improve available list
- special emphasis to the participation of operational services (met./hydr./agric. and emergency/civil defense)

What are the major obstacles ?

- geo-stationary satellite data availability
- difficult to get the various communities to work together.

Why PLATIN can become a major motivator for efforts by different countries and scientific disciplines?

In response to the recommendation of the GEWEX SSG, the VAMOS panel formed a Science Study Team for the PLATIN study (see also section 6.2).

5.1.2 Report from the ALLS Working Group

Working Group Participants:

M. Douglas, J. Marengo, M. Nicolini (Co-chairs), J. N. Paegle, J. Paegle, G. Miranda, R. Vaillarpando, J. Baez

This document is a draft prepared from the presentations and discussions of the 4th VAMOS panel meeting held in Montevideo, Uruguay, March 26-30 2001. It contains input from various individuals, as well as some discussions and updates from the science questions, hypotheses and objectives of the SALLJ field experiment, and is based on the documents: ALLS (American Low-level Jet Study prepared by J.N. Paegle and others, and the ALLS East Andean Low-Level Jet Field Experiment, implemented by M. Douglas. It is assumed that the reader is familiar with these two documents. The current draft of the ALLS document can be accessed under:http://www.clivar.org/publications/wg_reports/vamos/pdf_files/all.pdf.

The timing for the field experiment is on the November 15 2002-February 15 2003 window.

Background

The study region is sufficiently large to encompass the major portion of the low-level jet east of the Andes Mountains, as depicted on monthly mean analyses at 850mb (the level near which the wind speeds associated with the jet reach their maximum values), and by recent studies using the PACS-SONET pilot balloon observations in eastern Bolivia. On a daily basis the jet axis may vary considerably in strength and position, and may not be present at all during post cold frontal conditions over eastern Bolivia and Paraguay. From the limited observations made during special field campaigns since 1998, and with the NCEP reanalyses, some preliminary ideas on the diurnal and day-to-day variability of the SALLJ have been identified, indicating that the position of the strongest winds associated with the jet lie close to the positions indicated from monthly mean maps generated from large scale reanalyses.

Science Questions and Hypotheses:

The involvement of scientists and institutions from 7 countries from the region, related to the SALLJ area, plus the United States will provide an starting point in a series of detailed and high resolution surface, upper-air and remote sensing observations, and together with modeling studies and others will allow to get some answers to these science questions:

- 1) What is the role of the LLJ east of the Andes on the moisture transport from the Amazon to the La Plata basins?
- 2) What is the synoptic structure of the LLJ and its association with intraseasonal variations linked to the SACZ, convection in Amazonia, the MJO and circulation anomalies at large-scale?
- 3) What is the diurnal cycle of the LLJ, moisture transport and related rain? What is the impact of diurnally modulated precipitation on the averaged circulation (through differences in precipitation amounts and difference in cloud radiative processes during day and night).
- 4) What is the relationship between the Chaco Low and the intensity of the LLJ?
- 5) Currently, how well can available models represent the circulation and rainfall structure and time/space variability of LLJ? Will this representation improve after knowledge gained from special field experiment data is incorporated to models for weather and seasonal climate forecast?
- 6) Will skill of climate models and model predictability improve with better representations of features such as the LLJ?

The main hypotheses of the SALLJ field experiment are:

- 1) Water vapor transport by a "moisture corridor" east of the Andes (SALLJ) is a key component of the water balance and moisture exchanges between the Amazon and La Plata basins.
- 2) SALLJ has potential variability on diurnal, synoptic, intraseasonal and interannual time scales. This variability is influenced by ENSO as well as climate anomalies in the tropical and subtropical Atlantic, and by land surface conditions.
- 3) Improved observational data sets on SALLJ will contribute to more successful weather and climate forecasts. This will improve forecast skill in a region which is known to have a relatively low predictability, such as the South American monsoon area (central-southeast South America)

The answer to these scientific questions and the discussion of the hypotheses can be summarized in the following set of general and specific objectives:

Objective 1: *To improve the knowledge on the LLJ east of the Andes and its role in the moisture transport and balance, precipitation, and interactions between the Amazon and La Plata basins.*

- a) To investigate fluxes of momentum, moisture and moisture divergence in the PBL (surface- 3 km) with emphasis on the LLJ and region east of the Andes.
- b) To describe the diurnal cycle on the area of the LLJ, and its relation to moisture fluxes and precipitation
- c) To describe the seasonal cycle of low level winds and moisture flux in central South America.
- d) To investigate and characterize precipitation type, intensity and distribution.

- e) To obtain information on temperature and moisture profiles to estimate the atmospheric component of moisture balance, along the core and on the entrance and exit region of the jet.
- f) To obtain information on meteorological conditions on the large-scale that favor the formation of the LLJ.

Objective 2: *To develop conceptual models and to analyze/simulate processes described in Objective 1*

- a) To compare the analyses produced by model from operational centers "with" the special observations from the field experiment assimilated at grid point scale.
- b) To compare the analyses produced by model from operational centers "without" the special observations from the field experiment assimilated at grid point scale.
- c) To assess the skill of eta and sigma coordinate models to investigate processes a) and b).
- d) To assess capacity of current regional models (e.g. Eta 20, and 40 km and RAMS 40 km) and global models with fixed grids and variable resolution in simulation and prediction modes.
- e) To identify which of the components of the model, on simulation and prediction modes are sensitive to insertion of special data sets.

Objective 3: *To develop, validate and calibrate models for short and medium range weather forecast and seasonal climate.*

- a) To determine if semi-regular signals of the SACZ/SALLJ complexes can be predicted.
- b) To determine if predictability in the central-southeast South America (region of the South American monsoon) would depend on the phases of SACZ/SALLJ being well represented in models after assimilation of data from the special observations of the field experiment.
- c) To assess if improvements in the forecasts of rainfall and temperature near the Andes from Eta model compared to models in sigma coordinates, could be related to the type of coordinate near the Andes or to the parameterization of rainfall.
- d) To assess the relative merits of global model with variable resolution and regional model nesting on climate simulation over South America.
- e) To investigate the effect of large-scale circulation anomalies and orographic influences (Andes cordillera) in the diurnal cycle of LLJ and related rainfall, circulation and convection.
- f) To evaluate and calibrate models (global and regional) as well as the NCEP/NCAR reanalyses with the special field observations.
- g) To investigate whether a regional analysis system could be developed that will reproduce observed features revealed by the field experiment when only long-term data is used. If this is the case, retrospective analysis with such system might be carried out for climate studies.

Objective 4: *To establish connections between the intensity and transport of moisture of the SALLJ in the development of CCMs at the exit region of the jet over Bolivia-Paraguay-south/southeast Brazil-northern Argentina, and their modulation by the diurnal cycle*

- a) To analyze the characteristics of convection at the exit region of the SALLJ can support the formation of CCMs during the wet season, and to determine their spatial characteristics and life cycle as well as the associated rainfall intensity, lightning, and dynamic and thermodynamics aspects.

b) To describe the impact of convection, rainfall and circulation anomalies in the Amazon basin in the development of CCM and rainfall in the exit region of the jet (lower La Plata river basin).

For this ambitious undertaking the following countries and institutions have shown interest to participate on the design and implementation of the field campaign and the scientific issues associated with it:

Participating Countries and Institutions

- Argentina (Servicio Meteorologico Nacional, CIMA-Universidad de Buenos Aires, INA, CIFEA...)
- Bolivia (AASANA, Universidad Mayor de San Andres, SENAMHI*....)
- Brazil (CPTEC/INPE, USP-IAG, SIMEPAR, Univ. Federal Rio de Janeiro*, CTA, Univ. Federal de Rio Grande*)
- Chile (DMN*, Univ of Chile*..)
- Peru (SENAMHI*)
- Paraguay (DINAC)
- United States (Univ of Utah, Iowa State Univ.,NOAA/NSSL, NASA,....)
- Uruguay (UTE*, Univ. de la Republica, DMH,...)

(*) Potential participants

Contributing and related projects

The regional efforts to fund SALLJ activities, and other related operational and research activities relevant or linked to SALLJ are shown in the following related projects (Funded/ in operation/submitted or in process of looking for funding or in implementation)

Project	Status	Focus	Region
PACS-SONET	1997-2003	Synoptic scale monthly time scales	L. America
SALLJ-Argentina (ANPCyT)	2001-2003	Synoptic, mesoscale, convection	Argentina
PROSUR (IAI)	2000-2004	Climate variability in MERCOSUR	MERCOSUR
SIVAM	2002-	Radiosonde, Surface stations, met radars	Brazil
INPE-PCDs	1999-	Meteorological Hydrological	Brazil
Paegle (NSF)	2001-2004	LLJ	USA
Peru RS (Pto. Maldonado, Iquitos) Lima, Piura	2002?	Operational	Peru

Project	Status	Focus	Region
Paraguay RS(Mrscal. Estigarribia, Asuncion?) Radar?	July 2001?	Operational	Paraguay
SALLJ-Brazil (FAPESP)	Oct2002-Feb. 2003	Mesoscale, synoptic	Brazil
DRY-TO-WET LBA-Brazil (FAPESP)	Jun2002-Oct 2002	Mesoscale, synoptic, at. chemistry	Brazil
Uruguay RS	Operational updates	Upper-air, rain	Uruguay and

Timeline of the LLJ fields project preparation and field campaign

Two special SOP have been defined: November 15-December 15 2002 and January 15-February 15 2003 within an enhanced observation period from Nov 15 2002 - Feb 15 2003

The following is a description of the time line of activities pre and during the SALLJ field campaign, with tentative levels of funding that will be sought from US sources for field work. The experiments in Brazil and Argentina are not constrained by this proposed budget, and can go ahead without it, even though more reduced in objectives and regional collaboration.

April 2001: Place holders for P-3, and wind profilers, and radiosonde ground stations.

By May 1 2001: the ALLS document needs to be finalized (now is in draft form), to be considered by the US/CLIVAR PAN AM committee meeting to be held during May 2001. Jose Marengo will take the leading role to include missing references, strengthen the numerical modeling part, add sections on the use of satellite data, ground support, impact on local weather services and data management. The WG will send input at his request.

June 2001: NOAA-OGP Announcement of Opportunity for PACS proposals related to LLJ (SALLJ)

January 2002: Purchase of raingauges and shipping to countries (50 k)

February 2002: Training field phase preparation session (10 days, in Santa Cruz, 2-5 representatives for each of the 8 countries involved, strong participation of the IOG). Some travel support required (30 k). Funding commitments by December 2001.

April 15 2002: Order radiosondes (390 k), pilot balloons (65 k)

June 1 2002: Process custom permits

July 1 2002: Shipping radiosondes and pibals to sites

September 2002: Shipping radiosonde ground stations and moving them to the field

November 15 2002: First SOP starts

November 2002: Expected arrival of aircraft and wind profilers

January 15 2003: Second SOP starts

February 20 2003: Retrieve temporary equipment (portable radiosonde wind profilers)

February-June 2003: Data processing and check raingauge network

Budget:

The following is an estimate of the budget for activities related to LLF field experiment that will need funding by US institutions (NOAA-PACS, etc). The largest funding component is necessary to increment the number of upper-air soundings.

Enhancement during SALLJ:

2 RS/day in 5 stations (Trinidad, Santa Cruz, Las Lomitas, M. Estigarribia, 1 station in Uruguay)	150 k
Bring to 4 RS/day for 60 days (Trinidad, Santa Cruz, Las Lomitas, M. Estigarribia, Resistencia, Cruzeiro do Sul, Rio Branco, 1 station in Uruguay)	240 k
PIBAL enhancements	65 k
3 wind profilers (915 Mhz, 3 months, 25 k each)	75 k (NSF)
Raingauge network	50 k
Training session in Santa Cruz	30 k
P-3 aircraft, horizontal and vertical structure, Altiplano, thermal low, Chaco cases, weather radar, cloud and rainfall characterization (we need ideas and contributions for using aircraft data to support request to NOAA) NC. But 1 student and un-anticipated costs	50 k
Other costs: travel (US-South American countries joint proposals, Travel grants for scientists/students) 10 persons, 80 dollars/day for 100 Days	80 k
Sub Total:	665 k

TBD JOSS support**TBD Mike Douglas Research****TBD Other research**

The raingauge network enhancement in the different countries involved in the field experiment can be summarized in the following, either from current networks in operation as well as from proposed networks (mission specific).

Argentina:

~100 automatic stations within the lower Plata basin (acquisition stage- INA)

Volunteer network, municipalities, possible extra locations at different provinces (National Weather Service).

Brazil:

2 rain gauge networks of digital recording pluviometers (40-50 pluviometers, 5 minute resolution) in Acre and Rondonia, networks of EMBRAPA, ANEEL, INMET, Secretary of Agriculture (states), ELETROBRAS, INPE-PCDs in Amazonia.

Bolivia:

Identification of possible locations with coffee growers, military posts, (8 stations in Yunga's area). AASANA, Universidad de San Andres?

Paraguay:

36 automatic stations (3 Chaco region) and 4 ground stations (installed) but need satellite link (DINAC)

Organizational aspects

The SALLJ-WG proposes the formation of an special committee, referred as Implementation and Operations Group (IOG), that will deal with logistic aspects such as customs, visas for visitors, international permits for traveling across countries's orders, etc. We suggest the following names, which will be formally invited with letters from VAMOS:

C. B. Emmanuel (UCAR), Carlos Ereño (VAMOS)-Coordinators

Argentina: Miguel Angel Rabiolo (SMN)/ Mario García (SMN)

Bolivia: Guillermina Miranda (UNIV)/Ramiro Villarpando (AASANA)

Brazil: LBA-Project Office (Name TBD)

Paraguay: Julian Baez (DINAC)/Benjamin Grassi

Uruguay: Mario Bidegain (Uruguay Met Service, Univ La Republica)/Mario Caffera (Uruguay Met Service).

Action Items

- Based on the comments from the VAMOS Panel members, the following issues relevant to the field experiment were discussed by the VAMOS panel.
- Plan for an International Workshop/Scientific Conference on the SALLJ to be held in Santa Cruz, Bolivia, on the first half of 2002. Chairs will be Carolina Vera and someone from N. America (may be V. Kousky), to bring together an interested community on SALLJ issues residing within and outside South America.
- The SALLJ-Brazil and SALLJ-Argentina are not constrained by US requested funding, which is dedicated to implemented observational networks in Bolivia and Paraguay and to upgrade observations in the countries involved.
- There will be an operational center (either in Santa Cruz and/or Rondonia) for weather forecasts and similar products to plan for operation of NCAR's P3 airplane and to design the special IOP during the campaigns.
- Co-ordinations among countries for timing of soundings and homogeneous radiosonde networks (Vaissala) are needed. Quality of sondes and data currently entering the operational centers data stream needs to be checked with sufficient lead time to avoid rejections in assimilation systems and obtain good quality analysis and forecasts during the experiment.
- Use of P-3 is at no cost (maximize the use of the aircraft), letter of intent to NOAA should be sent ASAP to get an answer by December 2001.
- Send letters of invitation to IRD (France) since it has strong links with researchers in Bolivia and Brazil and its scientists could be interested in participants.

- Use of aircraft (if properly justified) from the NCAR deployment pool. Submit letters of intent by October 2001 by an NSF supported University faculty.
- Discussions among the "core group", time for the operation implementation, it is suggested an exchange of ideas and the WG on SALLJ can post the text of the proposal for suggestions of the science community.
- Draft letter (from the SALLJ-WG) to possible members of the IOG asking them for their help in the logistic, formalities, etc of the activities related to the implementation of SALLJ activities.

The issue of Data Management needs further discussion. The Brazilian component (SALLJ-Brasil) will use the LBA-DIS data managements and protocols. Issues that have not been addressed include how such policies and protocols blend with those from other countries and whether an authorship policy needs to be established before the experiment takes place.

5.2 Report from the VEPIC Working Group

Working Group Participants:

Chris Bretherton¹, Ben Felzer*, Rene Garreaud, Pablo Lagos, José Meitin*, Rodrigo Núñez, José Rutllant¹, Steve Esbensen, Bjorn Stevens², Roberto Mechoso*, Pedro Silva Dias*

¹Co-Chairs, ² Rapporteur, * Participated in part of the meeting.

VEPIC can be characterized as a project of enhanced monitoring and pilot studies designed to capitalize on unique physical and infrastructural features of southeast Pacific stratus region on diurnal and longer timescales

1. The following scientific goals for VEPIC have been formulated:
 - Drizzle – Entrainment and Cloud Liquid Water Path.
 - Upper ocean coupling and feedbacks and their relation to ENSO.
 - Relation to continental convection – Including slope flows.
 - Higher order statistics – Particularly synoptic and diurnal rectification.
 - Comparative climatology.
 - Aerosol effects and characterization in Marine Boundary Layer (MBL).
2. The following physical features relevant to VEPIC have been identified:
 - Connection to monsoon.
 - Extent of stratus.
 - Coupling to monsoon.
 - Extreme coastal features.
 - Susceptability to aerosol modification.
3. Observational infrastructure for VEPIC
 - Extensive buoy array.
 - Coastal meteorological network.
 - San Felix Island.
 - Regional interest.
4. The modelling component of VEPIC should comprise:
 - Simple model interpretative studies.
 - Evaluation of ECMWF and NCEP column data.
 - Satellite product evaluation and synthesis.
 - Climate model evaluation.
5. Initial timeline for the observational components for VEPIC
 - Installation of instrumentation on San Felix Island (July 2002).
 - Deployment of Chilean Buoys (at latitudes 33° S and 20° S), second semester 2001.
 - 1st. VEPIC SOP Sep-2002 to Jan-2003.
 - 2nd. VEPIC SOP Sep-2003 to Jan-2004.
 - Possible intensive field phase Oct-2005 (or 2006).
 - VEPIC science panel will meet at VPM5.

5.3 Report from the Human Dimensions / Applications Working Group

Working Group Participants:

H. Cullen, W. Baethgen, F. Wald, G. Berri, C. Natenzon

Two approaches to include a human dimensions / application component were discussed.

- What kind of information does VAMOS need to improve work in human dimensions? - A wish list.
- To develop an agenda for PLATIN leading to the establishment of an end-to-end program for the benefit of society?

The group felt that a wish list type of approach is certainly not sufficient. Thus second approach of developing an agenda for end-to-end programme for PLATIN is likely to be the favourable option.

Points of intersection with human dimensions / applications that could lead to comprehensive studies are:

- Water balance of the La Plata Basin agriculture, hydropower, health (water quality), risk management
- Investigation land use change (satellite remote sensing, surface observations)
- Predictability: improve products, incorporate user needs

Other aspects of a human dimensions component are a sort of sector oriented research:

- Improve 'Decision Support Systems' by understanding the decision-making process
- Education and outreach
- Vulnerability studies

Especially for this last point there is still need for additional discussion whether and in which form CLIVAR/VAMOS wants to address these issues in a PLATIN project.

6. VAMOS panel session

6.1 Scientific Projects

The VAMOS panel reviewed the progress of the different components being made through the 4th meeting of the panel.

6.1.1 Monsoon Experiment in South American (MESA)

This major VAMOS initiative comprises in the first stage the field project on the South American Low level Jet (LLJ) and in the second stage late the La Plata basin Experiment (PLATIN).

Low Level Jet Experiment (LLJ)

The low level jet experiment planning is now well under way. The working group sharpened the focus / context for the experiment and presented a draft for a budget (see section 5.1.1). The working group will continue their efforts and complete the document until early summer (e.g. data management section, budgeting, etc.)

In addition, the working group and NOAA/OGP have agreed on a timeline for funding opportunities / call for proposals, etc. There is still some uncertainty about the availability of an aircraft, but this would not lead to a complete failure if unavailable.

If funding process is successful, there will be a scientific workshop and a training meeting in early 2002 in Santa Cruz, Bolivia. It was pointed out that the cooperation with Bolivian scientists has to be strengthened in preparation to the field phase.

In case of a delay of the experiment, Argentina would not be able to contribute because their proposals have already been funded for the planned timeline. In addition, it has to be emphasised that the LBA field experiment in eastern Amazonia, preceding the LLJ field phase provides a major advantage in logistic and scientific matters.

Concerning the data of the field experiment and the management of the field project UCAR JOSS will be involved. The expertise of this group will be extremely helpful for the field study. A budget for their contribution will be made up during the next months.

In this context, the panel endorsed the satellite archiving activity at UCAR. The data base for South America will become available to the community and provide a useful resource of information.

PLATIN

The La Plata Experiment was the main focus of VPM4. VAMOS will try to design this experiment as an end-to-end study (i.e. with an application component). The presentations of application components for a PLATIN study at the meeting have shown the strong interest of the Hydropower and agriculture community to interact with the physical climate science community in this project. The application link should be revisited at VPM5.

The PLATIN project has been presented to the GEWEX SSG, since this would likely to be a joint CLIVAR/GEWEX enterprise. The GEWEX SSG asked to form a Science Study Group for this project to prepare a more comprehensive scientific prospectus for this project. The panel hopes that the CLIVAR SSG will also endorse this action and formed a group with the following terms of reference and membership:

Terms of Reference:

- To prepare a Science Plan documenting scientific issues on the climate and hydrology of the La Plata Basin that are key to a better understanding and modelling of their interactions as well as for a better prediction of their variability and impact on human activities
- In the preparation of the Science Plan, to work closely with national, regional and international research programmes already established or becoming involved in the subject, such as those in CLIVAR/VAMOS, GEWEX/GHP, and IAI/CRN, as well as with users of climate variability and prediction information.
- To discuss methodologies for implementation of the Science Plan, while encouraging the development of regional expertise to assume leadership during the implementation phase of the Plan.
- To report to the CLIVAR and GEWEX SSGs through their VAMOS and GHP panels.

Membership:

Roberto Mechoso (UCLA, USA) (chair)
Walter Baethgen (IFDC, Uruguay)
Vicente Barros (UBA, Argentina)
Hugo Berbery (U. Maryland, USA)
Robin Clarke (IPH, Brazil)
Heidi Cullen (IRI, USA)
Benjamin Grassi (UNA, Paraguay)
Dennis Lettenmaier (U. Washington, USA)
Pedro da Silva Dias (USP, Brazil)

The group will start to work based on a workshop that was held end of 1999 in Montevideo (<http://www.meto.umd.edu/~berbery/lpb/laplata.html>).

Carlos Ereño will explore the possibilities of funding from the GEF resource for such a project. There is an interest of GEF to support studies on hydrology and water management which are also a key issues for PLATIN. Basically, there are 3 levels of funding. With a concept paper which would be a first level approach to GEF, about \$25k could be allocated, a pre-proposal, if funded would encompass about \$750k and a full proposal in the order of \$10m-30m. For the second and third stage a strong political components is required but it might be relatively easy to initiate the first step.

PROSUR

The panel recognized that this IAI project is already very much contributing to further the goals of VAMOS. PROSUR will be invited to nominate a representative to the VAMOS panel meetings.

6.1.2 VEPIC

Due to the activities of Chile and Peru in the planning an implementation of a buoy network in the eastern subtropical Pacific and the upcoming EPIC field phase, some 'critical mass' for initial studies in the stratus regime off the coast of South America will become available within the next 2 years. In addition, the VEPIC working group made very good progress during the meeting (see section 5.2 for a summary).

A Science Workshop related to VEPIC should be planned for 2003. Peru has offered to host such a meeting. An international field experiment would be planned after 2005 but there will be some activity through the next years mainly by Peru and Chile that might also provide some important information between the large-scale link of the subsidence area in the Pacific and the LLJ / convection over South America at the time of the LLJ field study.

In view of the upcoming planning activities for an international CLIVAR Pacific programme, the panel recommended to keep the VEPIC project under the auspices of VAMOS, because a) of its important scientific linkages to the South American Monsoon Experiment and b) because of the opportunity of the countries at the South American coast to participate in VAMOS.

6.1.3 NAME

The joint CLIVAR GEWEX NAME Science working group is in the process of building. W. Higgins presented a list for designated members of this working group to the panel. There was some concern about the representation of the National Weather Service in this group. The proposed Terms of Reference are:

TBD

At VPM4 there was only a minor focus on the NAME project. A very comprehensive draft of a science and implementation plan has been written and is available to the community. The VAMOS panel decided to revisit this project in more detail at VPM5. Therefore, a venue on the Northern Hemisphere was preferred in support of this. First choice is Costa Rica, second, Mexico.

6.2. VAMOS Legacy

The following proposal was put forward by J. Shuttleworth and was endorsed by the panel:

The VAMOS panel requires that its subsidiary projects actively seek to create a legacy from VAMOS, in the form of:

- a) A project data base (that might become ongoing after the project) with established data exchange policies consistent with CLIVAR.
- b) Education and Training for regional scientists involved in the project.
- c) Any observational systems that may have been proven by the project to be of value for improved climate and hydrological prediction.
- d) Any implemented upgrades to the operational systems used by interested stakeholders that may have been developed during the project.
- e) Published records of progress that reflect the international framework of the project.

In the context of the last point, the panel recommended the preparation of an article emphasizing the VAMOS contribution to the understanding of the South American Monsoon System. The article will be authored by the VAMOS panel and preferably submitted to an international journal.

6.3. Panel Membership:

The following changes were proposed:

P. Silva-Dias, who has recently been appointed to the CLIVAR SSG will step down. As a replacement Maria de Silva Dias (same institution) has been proposed.

The panel will invite a scientist from Central America to become a new member of the panel. This individual will replace Victor Magaña (UNAM, Mexico).

The panel expressed their thanks for the efforts and contributions of Drs. Silva Dias and Magaña in the initial phase of VAMOS.

In this context, the panel welcomes PROSUR as a programme affiliated to VAMOS and invites the programme to nominate a representative for the VAMOS panel.

R. Mechoso invited the panel to submit suggestions for the future leadership of the panel by e-mail. A leadership with co-chairs from North and South America should be considered.

6.4. Future Meetings:

As a venue for the next meeting that should target mainly issues related to the NAME project, locations in Central America have been proposed. Possible options would be Costa Rica or Mexico City. The timeframe will be late March 2002.

In addition, the panel suggested to hold a scientific workshop in preparation of the field phase of the LLJ experiment in early 2002 in Santa Cruz, Bolivia. Carolina Vera was appointed to take the lead for the organization of this workshop.

A Science Workshop related to VEPIC will be planned for 2003. Peru has offered to host such a meeting.

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Appendix 2: Agenda

WCRP/CLIVAR
Fourth Annual Meeting of the VAMOS Panel
Montevideo, Uruguay, 26-30 March 2001

Monday, March 26

- 8:50am **Opening** – Andreas Villwock, Carlos Ereño (World Climate Research Programme (WCRP)/ CLImate VARIability (CLIVAR) Project Office)
- 9:00am **Welcome**
Rafael Guarga (Rector, Universidad de la República, Uruguay)
Jorge Brovetto (Presidente, Grupo Montevideo de Universidades),
Alvaro Cutinella (Presidente, Academia Nacional de Ingeniería del Uruguay)
- 9:30am **Report on VAMOS and Introduction to the La Plata Basin (PLATIN) Workshop** – C. Roberto Mechoso (UCLA, VAMOS Chair)
- 10:00am **The VAMOS Database** – José Meitin, Steve Williams (University Corporation for Atmospheric Research, UCAR)
- 10:30am Break**
- 11:00am **Real Time Monitoring of the American Monsoons and the North American Monsoon Experiment (NAME)** – Wayne Higgins (NOAA, National Center for Environmental Prediction, NCEP)
- 11:30am **The Monsoon Experiment South America (MESA)** – Hugo Berbery (U. Maryland), P. Silva Diaz (U. Sao Paulo)
- 12:00pm **The South American Low Level Jet Program (SALLJ)** – Co-Chairs of SALLJ Working Group: Mike Douglas (NOAA), Matilde Nicolini (U. Buenos Aires), José Marengo (INPE, CPTEC)
- 12:30pm Break**
- 2:00pm **US CLIVAR and the Eastern Pacific Investigation of Climate Program (EPIC)** – Chris Bretherton (U. Washington) and V. Magaña (U. Nacional Autónoma, Mexico)
- 2:30pm **A VAMOS Investigation of the Eastern Pacific Climate (VEPIC)** – José Rutllant, René Garreaud (U. of Chile)
- 3:00pm **Climate Forcing of Major Floods of the Paraná River** – Vicente Barros (U. Buenos Aires)
- 3:30pm **The IAI PROSUR Project** – Mario Nuñez (U. Buenos Aires)
- 4:10pm Break**
- 4:30pm **Working Group Meeting**
- | | |
|---------------------|---|
| 1. SALLJ/PLATIN | J. Paegle, J. Marengo, Co-Chairs
M. Niccolini, M. Douglas, Rapporteurs |
| 2. VEPIC | C. Bretherton, J. Rutllant, Co-Chairs
B. Stevens, Rapporteur |
| 3. Human Dimensions | S. Willard, G. Berri, Co-Chairs
H. Cullen, Rapporteur |
- 5:30pm **Adjourn**

Tuesday, March 27

- 9:00am **Introduction, charge to presenters, and an example of river basin IA in the U.S. Pacific Northwest** – Sean Willard (NOAA/OGP)
- 9:20am **Some aspects of climate variability over La Plata River basin and opportunities for applications** – Guillermo Berri (U. Buenos Aires)
- 9:50am **Hydrological Review of La Plata Basin** – Alvaro Brandino Julio Patrone (UTE)
- 10:10am **Application of ENSO Forecasts to Water Resource Management: a case study in the Paraná Basin** – Heidi Cullen (IRI)
- 10:30am **Climate Variability in the Agricultural Sector: Impacts & Challenges** – Walter Baetghen (IFDC)
- 10:50am **Risk, disasters and uncertainty. Floods at the estuary of the La Plata River and its littoral** – Claudia Natenzon (U. Buenos Aires)
- 11:10am** *Break*
- 11:50am **OAS experience in the Plata Basin and a vision for the future** – Jorge Rucks (OAS)
- 12:10pm **PROSUR HD initiative** – Mario Nuñez (IAI)
- 12:50pm** *Break*
- 2:30pm **Working Group meeting**
- 6:00pm** *Adjourn for the day*

Wednesday, March 28

- 9:00am **Review of Climate Research in Uruguay** – J. L. Genta, Coordinator (U. de la República)
- 10:30am **Working Group Meeting**
- 12:30pm** *Break*
- 2:00pm **Working Groups Meeting**
- 8:00pm** *Workshop Dinner*

Thursday, March 29

- 9:00am Report of SALLJ/PLATIN Working Groups
- 9:45am Report of VEPIC Working Group
- 10:30am** *Break*
- 11:00am Report of HD Working Group
- 11:45am **General Discussion**
- 12:30pm** *Break*
- 1:30pm VAMOS Panel – Executive Session
- 3:30pm VAMOS Panel meets with Working Groups Co-Chairs and Rapporteurs
- 6:00pm** *Adjourn*

Friday, March 30

- 9:00am VAMOS Panel meets with Working Groups Co-Chairs, Rapporteurs and Agency Representatives
- 12:30pm** *End of Meeting*

Appendix 3: Extended Abstracts

Status of VAMOS

The following report by C. Roberto Mechoso was prepared for the annual meeting of the Joint Scientific Committee (JSC) of WCRP in March 2001.

VAMOS Report to JSC – February 2001

C. Roberto Mechoso - Chair

The primary goals of VAMOS in the Americas are to improve the 1) understanding of the monsoon systems in the context of the global climate system, 2) capacity for seasonal to interannual climate predictions, and 3) assessment of anthropogenic climate change impacts. The Panel's strategy to achieve these goals is based on the identification of scientifically important climate phenomena with demonstrated potential for predictable components. Once this is achieved, the Panel encourages the establishment of partnerships between scientists in interested countries for development of research programs, and contributes to the search for funding sources. The Panel promotes a broad participation in field campaigns, both to bring local expertise to an international setting and to enhance scientific exchange and capacity building.

The current VAMOS plans are centred on two internationally coordinated efforts: The Monsoon Experiment South America (MESA) and the North American Monsoon Experiment (NAME). MESA and NAME aim to improve the description and understanding of the key components of the American monsoon systems, their variability, and roles in the global water cycle. They also aim to improve observational data sets, as well as the simulation and monthly-to-seasonal prediction of the monsoon and regional water resources. The American monsoon experiments will provide an important linkage between two major WCRP components: 1) CLIVAR, which has an emphasis on ocean-atmosphere interactions and 2) GEWEX, which has an emphasis on land-atmosphere interactions. Such collaboration will investigate the relative importance for the modulations of the monsoon systems of coupled interactions between the ocean, land and atmosphere. In implementing the infrastructure required to address the relevant science questions, the programs will contribute decisively to establish a long-term climate and hydrology monitoring capability throughout the Americas by the end of the decade.

MESA is organized as a sequence of three stages to be developed sequentially. The first stage focuses on the moisture corridor east of the Andes and the participation in the US-led Eastern Pacific Investigation of Climate (EPIC). The South American Low-Level Jet Program (SALLJ) addresses the former subject. SALLJ is a component of a broader program on American LLJs, which aims to 1) identify LLJ events and characterize their diurnal, synoptic, intra-seasonal and interannual variability, 2) estimate LLJ contributions to the hydrological cycle, 3) determine relationships with circulation and rainfall over adjacent mountain complexes, and 4) develop and validate theories on LLJ generation and variability. A two-month field campaign is planned for the southern summer of 2003 following another campaign towards the end of 2002 under LBA leadership. Research proposals have been funded in Argentina, and are being written/submitted in Brazil and the US. Concerning EPIC, VAMOS scientists are participating in several ways. Aerosondes will be operated from the Galapagos Island, Ecuador, and aircraft will operate from locations in Mexico and Ecuador. Scientists from Mexico, Brazil, Colombia Costa Rica, Jamaica and the US have started a field program on the warm pool in the eastern tropical Pacific.

The second stage of MESA will have two major components. One will address the climatology and hydrology of La Plata Basin, where significant atmosphere-ocean interactions develop and whose variability has important impacts on human activities. A first meeting was held in Montevideo, Uruguay, December 1999. This resulted in a report and a proposal leading to the establishment of a research program under joint sponsorship by CLIVAR and GEWEX, as further described later in this report. The other major component of MESA Stage 2 will be VEPIC, which has been provisionally defined as "a program of data analysis, monitoring, and modeling activities together with pilot observational studies on the climate variability in the Eastern Pacific from the US down to the Chilean coast." Some preparatory activities are already taking place. Chilean and US scientists have been analyzing synoptic data on low cloud cover from islands near the coast, as well as on-board surface meteorological data and rawinsoundings obtained in cruises from the Chilean coast. A preliminary analysis of the relationships between the stratocumulus decks along the coast of South America and outgoing longwave radiation (OLR) over the Altiplano has been done on the basis of satellite data. A VEPIC Workshop will be held sometime in 2002 in collaboration with the US CLIVAR Pacific panel. The third stage of MESA will consolidate these research efforts into a climate monitoring capability for the Americas towards the end of CLIVAR.

NAME is organized in three tiers that overlap in time. The two-year period 2003-2004 has been identified as providing an excellent opportunity to carry out both MESA and NAME data collection activities. The principal research phases will continue for several years following the data collection phase. To accomplish these objectives, planning has proceeded with the intent of developing: 1) Empirical and modeling studies plus data set development and enhanced monitoring activities that carry on some elements of the existing PACS program and US CLIVAR-GEWEX Warm Season Precipitation Initiative; (2) Field activities in the core region of the North American monsoon during the summers of 2003 2004, including build up field analysis and modeling phases; In addition to significant improvements in short term climate prediction, NAME will lead to joint international experience with Mexican and Central American scientists in the exploitation of in situ and satellite data, advancements in high-resolution climate models, advancements in the development of the climate observing system, and the production of consistent climate data sets over the Americas. The latest working draft of the NAME Science and Implementation Plan is available at the URL:

<http://www.cpc.ncep.noaa.gov/products/precip/monsoon/NAME.html>.

At the present time NAME has been endorsed by the US CLIVAR Pan American panel as a U.S. national process study, and by the CLIVAR/VAMOS panel as the North American component of VAMOS implementation. In addition, NAME is included as a chapter in the emerging GAPP Science Plan and Implementation Strategy. The NAME Science and Implementation Plan was compiled by the NAME Project Science Team (PST), a grass roots organization made up of atmospheric scientists, oceanographers and hydrologists in the U.S., Mexico and Central America. In the future NAME will be managed by a Scientific Working Group (SWG) that is approved by U.S. CLIVAR and International CLIVAR/VAMOS in consultation with U.S. GEWEX organizations. The NAME implementation plan will be an agenda item at the U.S. CLIVAR SSC meeting in spring 2001. The NAME 2001 SWG nominees will be considered for approval at that time.

At its third annual meeting (VPM3), the panel decided to propose the CLIVAR and GEWEX SSGs the formation of a Science Working Group on the Climatology and Hydrology of the La Plata Basin (PLATIN). The two SSGs decided to endorse the proposal at their annual meetings in May 2000 and January 2001. The SWG will be co-chaired by Dr. C. R. Mechoso and Dr. Pedro L. Silva Dias. The rationale behind the proposal was that collaboration between GEWEX and CLIVAR scientists was deemed essential for the successful realization of a scientific program. GEWEX and CLIVAR are both WCRP programs with significant differences in methodology and organization. A joint SWG can quickly and efficiently avoid artificial roadblocks.

The SWG will prepare a Science Plan documenting scientific issues on the climate and hydrology of the La Plata Basin that are key to a better understanding and modeling of their interactions as well as for a better prediction of their variability and impact on human activities. In the preparation of the Science Plan, the SWG will work closely with national, regional and international research programmes already established or becoming involved in the subject, such as those in CLIVAR/VAMOS, GEWEX/GHP, and IAI/CRN, as well as with users of climate variability and prediction information. To discuss methodologies for implementation of the Science Plan, while encouraging the development of regional expertise to assume leadership during the implementation phase of the Plan. The SWG will report to the CLIVAR and GEWEX SSGs through their VAMOS and GHP panels. PLATIN, therefore, in tends to be a genuine end-to-end-program.

The fourth annual meeting of the VAMOS Panel will be held in Montevideo, Uruguay, March 26-30, 2001, and will include a workshop on La Plata Basin. The meeting will be cosponsored by WCRP/CLIVAR International Project Office, US CLIVAR Project Office, NOAA Office of Global Programs (OGP), Universidad de la República, Uruguay, Grupo Montevideo de Universidades, and National Academy of Engineering of Uruguay.

The panel wishes to acknowledge the outstanding support of Andreas Villwock, ICPO. It also gratefully acknowledges the help of John Gould and Valery Detemmerman in the appointment of a part-time ICPO staffer based in South America: Dr. Carlos Ereño. Dr. Ereño, which is based in Buenos Aires, Argentina, is providing essential coordination between the many CLIVAR related activities that are developing in Central and South America.

Some aspects of climate variability over La Plata River basin and opportunities for applications¹

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Preliminary Evaluation of Southeast South America Climate Outlook Fora

A series of climate outlook Fora for Southeast South America begun in Montevideo, Uruguay in December 1997, in the middle of the last strong El Niño 1997/98. Participation included specialists of the four countries of the Mercosur region, i.e. Argentina, Brazil, Paraguay and Uruguay. The motivation was the concern about the ongoing El Niño in mid 1997, the availability of experimental climate forecast, and the knowledge about the impact of past El Niño in the region. In three years, a total of 12 meetings were conducted in the region. Participation in the Fora included researchers in meteorology, agronomy, hydrology, oceanography, related environmental sciences, public health and social sciences, as well as users of agriculture, water resources management, hydroelectric generation, civil defense and emergencies. Sponsorship was received from different international organizations and research institutes in climate variability and short-term climate prediction, as well as universities, research institutes and research centers in the region, national weather services, water resources centers and hydropower plants, national and regional rural societies and other national and regional organizations. The economic resources for the meetings were provided mostly by local and regional sources. The Fora produce seasonal forecasts of the averaged precipitation and temperature anomaly expected for the upcoming 3-month period.

The backbone of the regional climate assessment is the consensus agreement between coupled ocean-atmosphere model forecast, physically based statistical models, results of diagnosis analysis and published research on climate variability over the region and expert interpretation of this information in the context of the current situation. The region considered for the forecast includes continental areas bounded between 20°S to 40°S and to the east of the Andes Mountains. Seasonal climate forecasts of precipitation are expressed in probabilistic terms. For this purpose, three categories are identified: *above-normal*, *normal*, and *below-normal*, which are associated to a tercile distribution of precipitation. Homogeneous regions are identified in each case and the seasonal climate forecast is presented as the probability of occurrence of each category during the upcoming 3-month period. The probabilities assigned to each category are determined by consensus agreement among the specialists. A preliminary evaluation of the first 9 forecasts analyzes the categorical agreement between precipitation forecasts and observations (Berri and Hordij, 2000). Due to the limited number of cases to verify, the analysis considers that the forecast corresponds to the most likely category, i.e. the category having the highest probability.

Figure 1 presents a summary of results of the first 9 forecast. Regions with red shading represent 0 out of 9 categorical agreements, while regions with dark blue shading represent 9 out of 9 categorical agreements. Considering that a 3-category forecast has a one third chance to be correct (3 out of 9), only regions with at least 6 or more categorical agreements could be considered with a minimal degree of skill. Figure 1 shows that the central part of the analyzed region would satisfy that condition, which includes a smaller region with 7 out of 9 agreements. These areas are located over Northeastern Argentina, within the region where statistically significant correlation between ENSO and precipitation has been reported by different authors. It should be stressed that during the analyzed period, 1998 until mid 2000, there was a very strong El Niño at the beginning, followed immediately by a strong La Niña event. Both situations provided good grounds for the skill obtained. On the other hand, the areas where there was disagreement do not show such strong association with ENSO. Moreover, these areas are affected by local factors such as the vicinity to the Atlantic Ocean, for example in the case of eastern Uruguay where 9 out of 9 categorical disagreements are found. Orographic effects and different degrees of seasonal feedback between the atmosphere and the underlying surface affect some regions as for example Central-Western Argentina. Also, the rapid change of ENSO phase in early 1998 from El Niño to La Niña contributed to the uncertainty of the climate community as to whether classifying that year as a late El Niño or early La Niña part of the cycle. This situation conspired against a proper utilization of the results obtained in climate diagnostic studies based on ENSO ensembles.

An example of practical application of climate prediction to decision-making in water resources management in Argentina

The Diamante River, located in western Argentina approximately between 34°S-35°S and 69°W-70°W, has its source in the high ranges of the central Andes Mountains. The hydrological regime presents a well-defined spring and summer maximum, when the melting of the snow accumulated during wintertime takes place, and the period October-March accounts for 70% of the annual water volume. The total drainage area upstream the flowgauge station is 2,750 km². Downstream the station are located the Agua del Toro and Los Reyunos hydropower plants, with a combined power of 500 Mw. Important irrigation areas totaling 800 km² are located downstream these water reservoirs, which are dedicated to vegetables crops, grapes and other fruits that represent an important economic activity in the region.

For the purpose of hydroelectricity management, it is convenient to define the accumulated water volume flowing during the period October-March, which it is referred to as the seasonal volume. At the end of the winter, in September, an estimate of the snow volume in the catchment is made and the first seasonal volume prediction is issued. The snowpack thickness model in use by the water resources operator converts the snow volume into an equivalent water volume that will flow during the period October-March. The power utility company uses this prediction to produce future electricity generation estimates.

A multiple linear regression model is developed, employing Niño3 SST anomalies during March-April and November-December and two auto-regressive components, i.e. seasonal volume observed 1 and 2 years before (Berri and Flamenco, 1999). The model produces 3-category forecast (above normal, normal and below normal), of the October-March seasonal volume anomalies. A cross-validation analysis carried on comparing model predictions with observations for the period 1951-1994, achieve statistically significant correlation, and the result is shown in Figure 2. Since November-December Niño3 SST anomalies are input to the model, they are replaced with 9-month Cane and Zebiak model predictions (Chen et al., 1995), performed in May. A cross-validation analysis of the SST model predictions for the period 1980-1994, achieves a categorical skill of 73%, equal to that of the snowpack model during the same period. The following table shows the result of the contingency analysis.

		Predicted		
		Below	Normal	Above
Observed	Below	3	2	0
	Normal	2	3	0
	Above	0	0	5

The advantage of the SST model resides in the ability to produce a forecast in May, before the wintertime snowfalls that feed the system. The availability of the forecast in May can be of utility to the water resources operator for a better planning of the system. For example, irrigation downstream the dam begins in July and it is operated without any knowledge of the water replacement in the system. Advance knowledge of the surpluses or shortages that the system might experience during the following season, could certainly help a better planning of the water resources. Another example is related to the value of the hydroelectricity generated by the power plants in the system. In August, representatives of all sectors involved in generation and distribution of electricity in the interconnected system in Argentina, discuss the price of the kilowatt to be delivered by each plant during the following 12-month period. Normally, the price is agreed considering mean seasonal offer and demand patterns. Thus, advance knowledge of water availability in the dam could help the local operation to discuss a fairer price.

References

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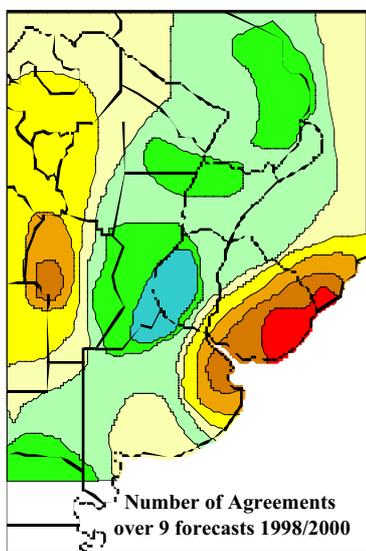


Figure 1

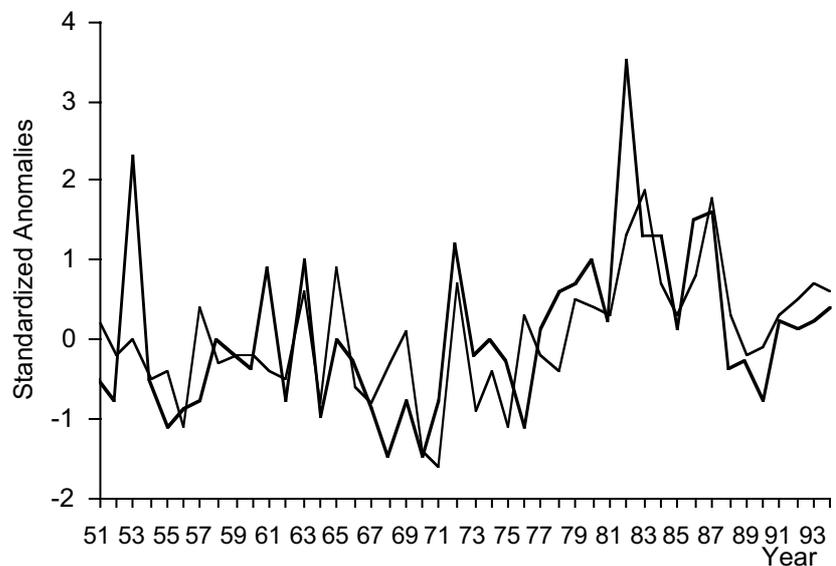


Figure 2

Climate Variability in Agriculture: Impacts and Challenges

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Climate variability measured in seasonal and interannual scales is a key factor affecting agricultural production. Farmers have developed successful production systems by learning to adapt to the variable climatic conditions of their environments. Still most members of the agricultural community (private and public sectors) are usually unable to improve their planning and decision-making by anticipating and adapting to expected climatic conditions.

A typical reason mentioned by decision makers for the lack of such anticipatory planning, has been the lack of means to predict climate conditions (e.g., precipitation, temperature) with sufficient skill and lead time. In selected regions of the world, this situation has changed dramatically due to recent advances in the capacity to predict climate anomalies linked to the onset and intensity of a warm or cold event as part of the El Niño/Southern Oscillation (ENSO) phenomenon. ENSO is the main source of interannual climate variability in many parts of the world.

The current presentation describes the current status of climate forecast applications in the agricultural sector of Uruguay, although the situation is similar throughout SE South America. The paper is organized as a checklist of the information, tools and activities required to ensure effective applications of seasonal climate outlooks for improving agricultural planning and decision-making. Such checklist includes: useful information provided by the climate scientific community, characterization of the sensitivity of different production systems to climate variability and to other factors, and tools for exploring alternative decisions.

Firstly we describe the actual climate outlooks available for the user community, and some of the tools that can be employed to explore alternative agricultural management practices. Climate is merely one of a large number of variables that stakeholders need to consider in the planning and decision making processes. Therefore, examples are presented of the impact of other sources of variability that greatly affect the farmers' income (e.g., prices, costs, etc.).

Additionally, farming includes many different activities which can be linked with one another, can be competing for the same resources, etc. We thus propose that effective applications of climate forecasts must frame the climate information in broader decision support tools that also include data on prices, land use feasibility, evaluation of the economical and environmental impact of different technologies, etc. The article also briefly describes the new Information and Decision Support System that IFDC and INIA are developing for the Uruguayan agricultural sector.

The SE South American experience has shown that effective applications of climate outlooks require: (a) multidisciplinary approach (meteorologists, agricultural researchers, social scientists, etc.), and (b) active involvement of the end users (farmers, government agencies) and intermediaries (agronomists, advisers). We present the outline of an INIA-IFDC on-going project which is attempting to achieve both.

The presentation concludes that most of the required elements to ensure effective applications of climate outlooks in agriculture seem to be available and functioning in the region. However, the general perception is that stakeholders are not taking full advantage of the available information and tools. Consequently the paper leaves as open discussion points some of the possible reasons for this lack of extensive use of the climate forecasts.