

CLIVAR VAMOS Panel

Report of the 2nd Session

Faculty of Exact and Natural Sciences,
University of Buenos Aires, Buenos Aires Argentina,
March 15-18, 1999

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Report

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Executive Summary

The second meeting of the CLIVAR VAMOS Panel (VPM2) was held at the Faculty of Exact and

Natural Sciences, University of Buenos Aires, Buenos Aires, Argentina, during March 15-18, 1999. About 40 participants attended the meeting, which was chaired by Professor C. R. Mechoso.

The major goals of VPM2 were to develop implementation strategies and plans for VAMOS, including field programmes on the South American monsoon systems (SAMS) and marine stratus/stratocumulus, as well as the design concepts for a database to be used in support of VAMOS research. An important additional goal was to discuss possible ways to fund and manage an international research programme involving many countries in the Americas.

After the opening ceremony, the meeting started with a series of status reports on programmes and projects that contribute and/or co-operate with VAMOS, such as LBA, PIRATA, IRI, IAI, and various French efforts. A report on PACS included an update on EPIC and an overview on the U.S. CLIVAR programme beyond the year 2000. VAMOS endorses EPIC studies on the annual cycle and interannual variability of the cold-tongue/ITCZ complex (CTIC) and the subtropical stratiform cloud deck region in the southeastern Pacific. EPIC contemplates a five-year period (2000-2004) of enhanced monitoring with intensive observations in July-September 2001 and in 2003. There was also a report on the current status of the PACS data, as well as the data collection and archival activities on-going at UCAR Joint Office for Science Support and NOAA National Severe Storms Laboratory. It was felt that VAMOS could greatly benefit from the lessons learned in those on-going activities.

A presentation on GEWEX and GCIP current and planned activities emphasised their strong relevance to VAMOS. For example, the proposed GEWEX American Prediction Project (GAPP) extending from 2001 to 2007 would comprise all of the United States and northern Mexico. This is of great interest to VAMOS since the North American monsoon system is a major component of the climate in the region. Large intersects, therefore, can be expected between GAPP and VAMOS. There was general agreement on the need to co-ordinate field programmes of VAMOS and GEWEX. Of particular relevance to VAMOS is the Co-ordinated Enhanced Observing Period (CEOP) which the Science Steering Group of GEWEX is planning for in 2001-2002.

One of the central themes of VAMOS is the evolution of the South American Monsoon system (SAMS). A presentation on the activities of the VAMOS Working Group on SAMS demonstrated the significant progress made by the group in assessing the current state of knowledge on the subject, identifying gaps in this knowledge, and planning field experiments to close these gaps. The Working Group identified inadequate observations (both in quality and coverage) as well as the limited availability of historical data over South America as the current most limiting factors to adequately address the impact of climate variations (particularly in precipitation) on water resource management, energy production, agriculture and health. The recovery of precipitation and surface temperature data, which in some countries go back to the beginning of the 20th century, must be a first priority for research on SAMS. The Working Group proposed an expanded observational network to enhance monitoring of climate variability in the SAMS region, and a field experiment on the South American low-level jet, a major but largely unknown component of the flow over the continent east of the Andes. This experiment would include a preparatory phase in 2000 and an intense observing period towards the end of 2001.

Another central theme of VAMOS is the study of marine stratus/stratocumulus in the eastern Pacific. VAMOS had appointed a Working Group to develop and promote scientific activities leading to an improved understanding and model simulation of the effects of eastern Pacific stratus/stratocumulus decks on the variability of American Monsoon systems. A presentation on the activities of this group emphasised that international collaboration would greatly contribute to

the success of field programmes in the eastern Pacific since there are various related national efforts that can complement each other in this region. For example, Chile is developing a South American Coastal Stratus Experiment and has an active programme with tidal stations. The Permanent Commission for the South Atlantic, involving Chile, Colombia, Peru, and Ecuador has also a proposed a moored array and a Southeast Pacific Ocean Meteorological Array.

Consistently with CLIVAR policies, the Working Group on the VAMOS database re-emphasised that VAMOS data management will be based, as far as possible, on the principle of free and open access to data. Some participants from South American countries expressed their concerns that an open data policy would be hard to meet, especially by national meteorological services for which providing data is a source of income. It was agreed that the data management might be based on distributed data centres.

Thereafter the meeting split into three break-out groups to start working on implementation strategies. The groups focused on the American low-level jets, marine stratus/stratocumulus, and VAMOS database. The group on low-level jets suggested an additional monitoring programme to determine the climatology and interannual variability of the phenomenon. The original plan to have the intense observational period in 2001 was postponed to 2003, which was regarded as more realistic (funding, logistics, etc.). Further discussions are needed in view of the potential mismatch with the proposed CEOP period. The group was asked to sharpen the focus and the justification for the program based on the climate aspects of the phenomenon.

The group on marine stratus/stratocumulus formulated hypotheses on a connection between heating and rising motion over the Amazon basin and the Altiplano and subsidence along the Pacific coast of South America, which contributes to the existence of low level clouds in that region. Plans were presented for a coastal stratus experiment with an oceanographic focus in January-February 2001 and another two months period in August- September 2001. The second part of the stratus experiment would include studies on the atmospheric divergent motions with an upper air array and combined aircraft/ship observations, and would take place in the same timeframe as the second phase of EPIC in January/February 2003. The group was recommended to broaden their view to match better with the EPIC plan, which means to include the east Pacific cold tongue and warm pool of Mexico in its scope.

The group on a VAMOS database recommended the establishment of a WWW-based Central Information Source for Data under ownership and control by an existing institution with experience on data management and mirror sites in both hemispheres. The database would not be a data archive. Rather, it would include information about VAMOS data and links to data sources. It was indicated that such an activity would require financial support, and that VAMOS should begin to establish agreements with participating countries to allow access and distribution of operational data sets prior to its first field campaign. The group encouraged the VAMOS Panel Chair to work through the WMO Secretary General and the Region II and IV Permanent Representatives to inform national centres on VAMOS activities as well as to promote full co-operation on data access.

The break-out sessions were followed by a plenary discussion on the funding and organisation of a program as complex and multinational as VAMOS. A short presentation on the Global Environmental Facility (GEF) highlighted that this can be a source of support for VAMOS programmes. GEF is an interim funding mechanism to help developing nations address adverse climate change impact issues. In the context of VAMOS, GEF funds could be used to develop components of a climate change monitoring system for the region, which is a long-term goal of the

programme. One component is a network of buoys capable of monitoring the physical, chemical and biological structure of the ocean off the west coast of South America from Colombia to the southern tip of Chile. Another component is a series of monitoring sites located within continental South America, initially forming part of the VAMOS network designed to investigate low-level jets, but additionally equipped to make carbon budget related measurements and to measure other parameters most relevant to climate change. It was agreed to start activities leading to the development of a proposal to be submitted through the World Bank, UNEP or UNDP. Drs. C. R. Mechoso and D. Rogers were appointed as preliminary points of contact for the overall effort.

There was a consensus on the current lack of a practical way to funnel funds from several sources to VAMOS programmes via a neutral (international) institution. The possibility was mentioned that IAI, a programme participating in VAMOS, might provide an interim solution to the problem. A possible scenario would be that VAMOS and IAI together define activities that VAMOS wishes to encourage and are also within the scientific goals of IAI. Currently IAI already funds projects relevant to VAMOS, such as climate variability in the Americas, ENSO and interannual climate variability, ocean-land-atmosphere interaction and hydrology (water resources). Other areas of common interest are comparative studies of ecosystems, biodiversity, land and water resource in the Americas, changes in the composition of the atmosphere, and integrated assessments, human dimension and applications. This role of IAO would be effective for funds provided by agencies which have traditionally funded the institute.

The need for help to coordinate several international activities was stated in the strongest possible terms. The role of a VAMOS Project Office discussed. It was generally felt that a co-ordination office would be of great help for the implementations of specific VAMOS projects. There was some discussion about possible locations and tasks of such an office. It was decided that the location might vary as the science focus adjusts to different field programmes. In terms of financial matters, several participants expressed concern that the ICPO and the JCRF of WCRP have not been able to provide resources for meetings without contributions from other national funds.

Thereafter the meeting participants attended a highly interesting series of lectures by climate researchers from the Department of Atmospheric Sciences of the University of Buenos Aires. A particularly relevant lecture addressed the South Atlantic Climate Change Experiment (SACC), which is planned by scientists from Argentina, Brazil, United States and Uruguay. The primary goal of SACC is to better understand the interactive relationship of the southwestern South Atlantic sea surface temperature (SST) and the larger scale climate behaviour. The VAMOS panel is considering an endorsement of SACC, and a number of clarifications on the scientific questions to be addressed by the programme were formulated. In general, the presentations demonstrated the very high level and relevance to VAMOS of climate research performed in Argentina.

The meeting participants strongly agreed that CLIVAR/VAMOS is uniquely placed to make major contributions towards the understanding of the processes that contribute to climate variability in the Americas, and to provide guidance and co-ordination in the development of observational systems that can be used to help mitigate deleterious effects of climate change on nations of South America. There was a consensus on the interest and readiness of the countries in the region to embark and support collaborative research on the American monsoon systems. Such readiness is partly due to the enhanced regional awareness on the potential benefits that will come from a better prediction of climate variability.

The next panel meeting was tentatively fixed for April 2000 in Santiago, Chile, together with the 6th Conference on Southern Hemisphere Meteorology and Oceanography of the American

Meteorological Society.

Prof. Dr. Carlos R. Mechoso

1. Introduction

The second session of the CLIVAR VAMOS meeting was opened by the vice-chair of the panel Dr. Victor Magaña. He greeted about 40 participants and conveyed the apologies of Dr. C. Roberto Mechoso, chair of the VAMOS panel, who was unable to attend the morning session because of unexpected travel delays. Dr. Magaña's introduction was followed by a warm welcome by Dr. Pablo Jacovkis, the Dean of the Faculty of Exact and Natural Sciences (University of Buenos Aires), Dr. Mario Nuñez, Director of CIMA (Centro de Investigaciones del Mar y la Atmosfera), Dr. Jesus Gardiol, Chair of the Department of Atmospheric Sciences, University of Buenos Aires, and Lic. Carlos Ereño, President of the IAI Executive Council.

The opening ceremony was followed by a progress report on CLIVAR given by Dr. A. Villwock, staff scientist in the International CLIVAR Project Office. Dr. Villwock highlighted three main CLIVAR activities in the past year:

1. Publication of the CLIVAR Initial Implementation Plan,
2. CLIVAR Conference, and
3. Relocation and staff changes in the International CLIVAR Project Office.

More details on each one of these activities can be found in [Appendix 3](#). Dr. Villwock outlined the principal objectives for the meeting. These were to develop implementation strategies and plans for VAMOS, with particular focus on:

- A VAMOS Field Programme on South American Low Level,
- A VAMOS Stratus/Stratocumulus Field Programme,
- A VAMOS Database

Another important objective was to discuss how to implement and fund a project like VAMOS in the framework of an international research programme involving many diverse countries in the Americas.

2. Status reports

The morning and part of the afternoon session in the first day of the meeting focused on status reports on the programmes and projects contributing and/or co-operating with VAMOS.

2.1 LBA

Dr. P. da Silva Dias presented a report on the progress made in the Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) experiment, with particular emphasis on the "Wet

Season Atmospheric Mesoscale Campaign" field campaign in Rondonia (WETAMC). LBA is an international research enterprise led by Brazil.

LBA aims to generate new knowledge, essential to the understanding of the processes within the ecology, hydrology, biogeochemistry and climatology of Amazonia, the impacts of the different land uses on these processes and the interactions between the Amazonia and the global biogeophysical system of the planet. The programme is organized around two fundamental questions that will be addressed with a strategy based on a multidisciplinary approach:

- How does the Amazonia operate as a regional entity, at the present?
- How will the changes in soil usage affect the biological, chemical and physical modus operandum of Amazonia, including its own sustainability and its influence on the global climate?

WETAMC focuses on the local effects of deforestation, and its various impacts, as well as on the regional response to the larger scale forcing, within the lines of the LBA. A major ground validation programme within the NASA TRMM, known as TRMM/LBA, was collocated with the WETAMC. The field phase of this campaign took place in the Rondonia state of Brazil (Southwest side of Amazonia) during January and February 1999. TRMM/LBA had a focus on the dynamical, microphysical, electrical and diabatic heating characteristics of tropical convection in the Amazon region.

Together, the WETAMC and TRMM/LBA campaigns represent a once in a lifetime opportunity for an in-depth study tropical convection in Amazonia and its relationships to the underlying forested and deforested regions. The full abstract with selected illustrations can be found in [Appendix 3](#).

2.2. PIRATA

Dr. T. Busalacchi provided the participants with the most recent status of the PIRATA. As described by Servain et al. in the October 1998 issue of the Bulletin of the American Meteorological Society, the tropical Atlantic Ocean is characterized by a large seasonal cycle around which there are climatically significant interannual and decadal time scale variations. The most pronounced of these interannual variations are equatorial warm events, somewhat similar to the El Niño events for the Pacific, and the so-called Atlantic sea surface temperature (SST) dipole. Both of these phenomena in turn may be related to El Niño/Southern Oscillation (ENSO) variability in the tropical Pacific and other modes of regional climatic variability in ways that are not yet fully understood. PIRATA (Pilot Research Moored Array in the Tropical Atlantic) will address the lack of oceanic and atmospheric data in the tropical Atlantic which limits our ability to make progress on these important climate issues. The PIRATA array consists of 12 moored ATLAS buoy sites to be occupied during the years 1997 to 2000 for monitoring the surface variables and upper ocean thermal structure at key locations in the tropical Atlantic. Meteorological and oceanographical measurements are transmitted via satellite in real-time, and are available to all interested users in the research or operational communities. The total number of moorings is a compromise between the need to put out a large enough array for a long enough period of time to gain fundamentally new insights into coupled ocean-atmosphere interactions in the region, while at the same time recognizing the practical constraints of resource limitations in terms of funding, ship-time, and personnel. Seen as a pilot GOOS/GCOS experiment, PIRATA

contributes to monitor in real-time the tropical Atlantic and anticipates a comprehensive observing system which could be operational in the region for the 2000's.

2.3 IRI

Dr. A. Moura, Director of the IRI, reviewed the current activities of the IRI with special emphasis on lessons learned during the 1997/98 ENSO. In his talk ([summary see in Appendix](#)) he argued that recent ENSO event has taught several important lessons:

- a) Additional observations, both in situ and satellite derived oceanic observations are key issues to improve model forecasts. Enhanced satellite derived precipitation and gauge data are crucial for validation.
- b) Downscaling using regional models bounded by GCM runs look promising in several regions, but is an intensive effort requiring collaboration between larger and local organisations. Since downscaling is one of the unifying approaches of CLIVAR this is not only relevant to VAMOS but also for other regional studies.
- c) Since the people want information, there is a need for improved representation of the products delivered by the scientist/meteorological services.
- d) Collaborative efforts are necessary for local capacity building, increased understanding and an improved feedback to the scientific community. In addition, the scientific community should increase their co-operation, e.g. by a shared modular approach to model development to facilitate testing of specific modules and comparative studies.

2.4 French efforts related to VAMOS

Dr. J. Picaut gave an overview on the different activities of French scientists related to VAMOS.

On seasonal to decadal time scales, two research programmes presently focus on the Atlantic Ocean (ECLAT for Etudes Climatiques de l'Atlantique Tropical, and MERCATOR) and another one the tropical Pacific (ECOP for Etudes Climatiques de l'Ocean Pacifique tropical).

The objective of the ECLAT programme is to study the climatic variability on seasonal to the decadal time scale in the tropical Atlantic and the adjacent tropical continents, Africa and South America, and to determine its predictable components.

MERCATOR is a project initiated by the oceanographic community in France. The objective is to develop an eddy resolving data assimilation system for the ocean. It is a contribution to the Global Ocean Data Assimilation Experiment (GODAE) planned for the years 2003-2005.

ECOP is a continuation of the French effort in the tropical Pacific during the 1985-94 TOGA (Tropical Ocean and Global Atmosphere) programme and its 1992-93 COARE (Coupled Ocean-Atmosphere Response Experiment) sub-programme.

Several French research groups (some of them based in South America) are studying the hydrology of South America. The NGT (Neige et Glaciers Tropicaux, for tropical snow and glaciers) programme, through an observational network and modelling, focus on:

- mass and energy balance of the glaciers of South America,
- high altitude water resource,
- climate versus water resource during the last 500 years.

In particular, the influence of the Pacific and Atlantic oceans on the rainfall, and the relation between glacier runoff and ENSO are studied.

Another programme is concerned with the reconstruction of paleo-climatological records up to the Holocene (10,000 years) by various means. This programme has already provided interesting results on the long-term variations of the ITCZ over the Amazon basin.

More information on these projects can be found in [Appendix 3](#).

2.5 IAI

Dr. V. Magaña summarised the present status of the Inter American Institute (IAI), and presented his views on possible

co-operations and funding mechanisms useful to implement and fund VAMOS. Prior to the meeting, Panel members had met with A. Rabuffetti (President of IAI), C Ereño (Chair of IAI's Executive Council), and B. Wilcox (IAI's Chief Scientific Officer). The discussions with the IAI representatives resulted in a possible scenario for a collaboration between VAMOS and IAI:

1. VAMOS, acting as the advisory group for IAI in VAMOS related science, will define short to medium term scientific priorities.
2. VAMOS and IAI will together define a sub-group of activities (within those that are necessary to address the scientific priorities) that can most effectively be accomplished by acting through IAI.
3. IAI will examine which of the activities specified in (2) are already being adequately addressed by existing IAI projects.
4. VAMOS and IAI will seek new funds from the agencies that contribute to IAI (e.g. NSF, NOAA) to support projects defined in (3) as being gaps in IAI's programme.

Currently IAI already funds projects relevant to VAMOS in several areas (most relevant in *italics*):

1. *Understanding climate variability in the Americas*

- ENSO and interannual climate variability
- Ocean-Land-Atmosphere Interaction
- Hydrology (water resources)

2. *Comparative studies of ecosystems, biodiversity, land and water resource in the Americas*

3. *Changes in the composition of the atmosphere*

4. Integrated assessments, human dimension and applications

- Crosscutting all three preceding categories

Most of the Science Agenda for IAI is now being implemented by the Collaborative Research Networks (CRN's), a new programme of the IAI. This programme is designed to encourage the development of research networks composed of scientific teams from across the Americas that focus on global change problems of regional importance. More information about the CRN's relevant to VAMOS can be found in the [Appendix](#) and under: <http://www.iai.int>

2.6 PACS-EPIC

Dr. Steve Esbensen reported about the progress with the ongoing US projects EPIC and PACS.

2.6.1 PACS

The implementation of PACS research activities beyond the year 2000 is being affected by a major reorganisation of the U.S. CLIVAR Program. U.S. CLIVAR will focus initially on phenomena in three overlapping geographic regions -- the Pacific, Pan American and Atlantic regions (see Fig. 1). The U.S. CLIVAR SSC will establish three interacting implementation panels -- Pacific, Pan American and Atlantic.



Fig. 1: US-CLIVAR Principal Research Areas

It is expected that PACS will become an interagency component of the U.S. CLIVAR programme. The PACS Science Working Group, which has been providing advice directly to the NOAA PACS grants programme, would evolve into the Pan American implementation panel for U.S. CLIVAR.

The scientific objectives of the new CLIVAR PACS initiative will be unchanged from the current PACS program, and will continue to map closely onto VAMOS scientific objectives. The Pan American panel will focus on ocean-atmosphere-land interactions in the Pan American sector, with a strong emphasis on the role of land surface processes in climate variability.

It is expected that a major focus of the Pan American panel will be the development of a joint CLIVAR-GEWEX activity to address understanding the essential mechanisms and improving simulations of North American warm season rainfall.

2.6.2 EPIC Implementation Plans

An ad hoc U.S. EPIC Science Working Group was formed to add the proposed U.S. implementation plans to the EPIC Science Plan, resulting in a entitled: A Science and Implementation Plan for EPIC: 'An Eastern Pacific Investigation of Climate Processes in the Coupled Ocean-Atmosphere System' (available under: <http://tao.atmos.washington.edu/pacs>).

Figure 2 shows the proposed timeline for U.S. observational activities in support of EPIC. The foundation of U.S. EPIC field activities is a five year period (2000-2004) of enhanced monitoring of the annual cycle and interannual variability of the cold-tongue/ITCZ complex (CTIC) and the subtropical stratiform cloud deck region in the southeastern Pacific. More intensive observations are proposed for a 6-8 week Intensive Observation Period during the July-September 2001 time period. An intensive observing period in the stratus decks off Chile and Peru (Stratus II) is proposed for 2003.

U.S. EPIC PIs wish to collaborate with other VAMOS scientists in Latin American to better understand the connections between the CTIC and stratus regime and the coastal and land surface processes in the Mexican, Central American and South American regions.



Figure 2: Timeline of the EPIC project

2.7 GCIP and GEWEX

Dr. J. Leese reported on the current status of the GCIP programme. GCIP will have its final observational period in the Missouri River Basin in 1999/2000. More details about this project can be found in the appendix. The second part of his presentation highlighted the GCIP data collection and management principles. (A summary can be found in [Appendix 3](#)).

For the future GCIP is interested to work with VAMOS on the North American Low-Level Jet which affects the SW of the U.S.

Dr. J. Shuttleworth provided the participants with an update on GEWEX activities relevant to VAMOS. Especially, he highlighted the new hydrological initiated by GEWEX. This new initiative would complement and give added value to the research that will take place in global change research programmes during the first decade of the next millennium. Another important project presented to the participants was an overview of the GEWEX American Prediction Project (GAPP) which is an extension of the GEWEX Continental-scale International Project (GCIP) planned to occur in the 2001 to 2007 time frame. This project will build on GCIP but extend its focus all of the United States and northern Mexico and will therefore have large intersects with VAMOS. More details about GAPP can be found in the [Appendix 3](#).

Dr. J. Leese reported to the panel that the GEWEX Science Steering Group proposes to the JSC a Co-ordinated Enhanced Observing Period (CEOP). This effort should be a co-ordinated study with CLIVAR and ACSYS and take place in 2001-2002 to characterise the climate system with a particular focus on the (heat) source and sink regions driving and modifying circulations that affect the climate system and many of its anomalies. VAMOS should consider to organise their field work in co-operation with GEWEX. This item was also discussed through the executive session of the panel (see [section 7.3](#)).

2.8 Report of the SAMS Working group

Dr. Julia Paegle reviewed the first meeting of the SAMS working group held in October 22-24, 1999 at AOML (Atlantic Oceanographic and Meteorological Laboratory) in Miami. The meeting goals were to promote interaction and co-ordinate efforts of scientists interested on advancing the understanding and predictability of summer precipitation over South America. The participants were asked to:

1. assess the current state of knowledge on the South American Monsoon,
2. identify gaps in this knowledge and field experiments (existing or already planned) designed to close these gaps,
3. prioritise problems and
4. define special observing needs and numerical experiments as required for specific topics.

A special session on the SAMS has been proposed to take place during the 6th International Conference on Southern Hemisphere Meteorology and Oceanography (6ISHMO), to be held April 3-7, 2000 in Santiago, Chile. This will allow for an exposure of VAMOS science plans to a broad audience of interested scientists, further develop implementation planning, and entrain greater participation in the programme.

The participants demonstrated a keen interest in advancing knowledge on the SAMS through a

programme of complementary activities on empirical studies, enhanced observational systems and development of numerical models that address the unique challenges presented by the South American steep orography and variable surface conditions.

The meeting discussed components, evolution and variability of SAMS, the relative importance of the Altiplano and Amazon heat sources, atmospheric teleconnections between the Americas during austral summer, numerical modelling applications for the region and ocean-atmospheric interactions.

Current plans for a two-months field-experiment of the low-level jet east of the Andes were extensively discussed as well as a proposal for an expanded observational network for five years to improve monitoring of climate variability over the region. The discussion was lively and indicative of the support and interest that this research topic currently generates in several South-American countries and the USA. The role of international initiatives such as those of CLIVAR through VAMOS, the IAI and national funding institutions was also addressed. There was a general consensus in the readiness of the region to embark and support collaborative research on SAMS.

Such readiness is partly due to the enhanced regional awareness on the impact that summer precipitation and its variations have on water resource management, energy production, agriculture and health. In addition, links between summer precipitation over South America and inter-annual to intraseasonal processes such as El Niño-Southern Oscillation (ENSO), Atlantic sea surface temperatures and the Madden-Julian Oscillation are indicative of the inherent predictability of this precipitation regime. Improving the knowledge on these physical processes is a pre-requisite to substantial gains in the prediction of summer rains.

To better understand the dynamics of these links it is necessary to more completely quantify these relationships in the historical record. This quantification should be multidisciplinary and involve assessments of related variability in water resources, agricultural yields, tropical diseases and availability of energy. The impact of rainfall and temperature variability on human activities needs to be determined to assess vulnerability and to develop prediction techniques for better resource management.

The discussion isolated the following questions that limit our understanding of the SAMS:

- dynamical processes responsible for the onset, demise and character of the monsoon over different regions of South America.
- cause-effect relationships for monsoon modulations in scales from intraseasonal to interdecadal, including teleconnection patterns that span the Pan-American region.
- variability of the atmospheric and terrestrial components of the water and energy cycles at various time scales, including the role of -level flow in the vicinity of the Andes
- physical processes that cause the organisation of nocturnal meso-scale convective systems in the La Plata river basin, and whether these are linked to low-level jets similar to those found over the North American plains.
- effect of the ITCZ and Atlantic SST's in the modulation of the SAMS
- land-surface effects in various time scales.

The discussions held at the meeting identified inadequate observations (both in quality and coverage) as well as limited availability of historical data over South America as the current most limiting factors to adequately address these questions. This situation will be partly alleviated in the future with the LBA experiment over Amazonia, availability of TRMM measurements and other products obtained by remote platforms. The discussion also identified as main priorities the recovery of precipitation and surface temperature data which in some countries go back to the beginning of the 20th century and endorsement of currently planned activities to enhance climate monitoring and deploy a field experiment on the low-level jet east of the Andes. A report of this meeting is available from Dr. Julia Paegle or under:

http://www.met.utah.edu/jnpaegle/research/miami_report.html

2.9 PACS Data Systems

Dr. José Meitín presented the current status of the data system designed for PACS. This includes a description of the data collection and archival activities on-going at UCAR Joint Office for Science Support and NOAA National Severe Storms Laboratory. He presented a strategy which has been applied for PACS, but might also be useful for data management under VAMOS:

1. Development of a Data Strategy:

Helpful tools to develop a data strategy for PACS were:

- a) Meetings/Workshops
- b) Questionnaires
- c) Distributed Data Archives

2. Data Support and Services

The elements of PACS Data Support and Services are:

- a) Web Pages
- b) Data collection and quality control
- c) Interactive data systems (e.g. CODIAC)
- d) Long term elements
- e) Links to other data sources

3. Data Collection and Quality Control

Data sets currently being collected, processed and archived include:

- a) Geostationary satellite data from GOES-East and West;
- b) Polar orbiting DMSP data (liquid water, retrieved rainfall, integrated water vapour)

processed by NOAA Climate Diagnostic Center;

- c) Special upper-air soundings (including pilot balloons) in the PACS region;
- d) GTS-transmitted surface and upper-air reports, and
- e) higher resolution data from the PACS-1997 pilot studies (and ship cruise).

A PACS data management World Wide Web (WWW) access page has been developed and maintained which contains distributed links to existing data centres and sources, as well as, meteorological and oceanographic information. Investigation of historical datasets and new data sources for the PACS region continues. Some contacts have been established to Latin American data centres and their climatological datasets of interest to PACS investigators.

3. Charges to Working Groups

When the meeting reconvened in the morning of the second day, Dr. Mechoso outlined the principles to be considered by each VAMOS component in the preparation of their contribution to the implementation plan.

1. Science questions to be addressed
2. Relevant theory, modeling, and field programmes
3. Implementation document (including requirements for infrastructure, personnel, etc.)
4. Appointment of a Scientific Working Group
5. Consideration of a societal impact component
6. Starting date, funding review process
7. Requirements of a Project Office

A template for the implementation plan in a particular area was developed by Dr. K. Sawyer and can be found in [Appendix 3](#).

3.1 Proposal for a CLIVAR/VAMOS Field programme on the South American Low Level Jet

Dr. Matilde Nicolini reported on the progress towards a proposal for a field experiment on the South American Low Level Jet. The main goal of the experiment is to better understand the role of the low-level circulation east of the Andes on the moisture and energy exchange between tropics and extratropics, and on the regional climate and climate variability. A central motivation of the experiment is to provide validation data sets to determine the uncertainty of circulation features, including moisture flux in model simulations and analyses. The current schedule for the experiment starts with a build-up phase in 2000 and culminates with the fieldwork itself toward the end of 2001. The latter is divided into a special observing period of about 3-4 months and an imbedded intensive observation period for one month. (For more details see [Appendix 3](#)).

Dr. Mechoso recommended sharpening the focus and the justification for the field experiment with special emphasis to the 'climate' component. There were some concerns whether the current

timetable is realistic although it would match with the proposed CEOPS observational period.

3.2 Proposal for a CLIVAR/VAMOS Field programme on Marine Stratus/Stratocumulus

Dr. Bruce Albrecht reported on the planning status for a field experiment on marine stratus/stratocumulus off the coast of Peru. The overall goal of the VAMOS Stratus Studies Program is to develop and promote scientific activities leading to an improved understanding and model simulation of the effects of eastern Pacific stratus decks on the Variability of American Monsoon Systems.

The justification for this project evolves out of three items:

- There are very few observations in the eastern Pacific, particularly along the west of South America
- Stratus/Stratocumulus clouds have a large impact on the energy budget
- The parameterisation especially in climate models is still very poor, mainly due to inadequate knowledge of the processes.

Dr. Albrecht indicated that the group intends to be aware of other projects being active in this area during the next years, as EPIC, the South American Coastal Stratus Experiment and Chilean programme with tidal stations and a proposed moored array and a proposed South East Pacific Ocean Met. Array (Proposed by CPPS).

The VAMOS panel recommended the group to broaden their view to match better with the EPIC plan. This larger scope means to include the east Pacific cold tongue and warm pool of Mexico as well. As already stated for the LLJ working group the justification for this problem should be put in the large scale climatic context and a connection to the LLJ should be emphasised, e.g. interaction between the altiplano convergence and the coastal stratus.

Dr. José Ruttlant provided the participants with a first draft of a proposal for a field programme on marine stratus (see [Appendix 3](#)).

3.3 Proposal for a VAMOS Data Base

Dr. V. Magaña reviewed basic concepts of a data management structure under VAMOS. The VAMOS data management will be based, as far as possible, on the principle of free and open access to data. Some meeting participants from South American countries expressed their concerns that an open data policy will be hard to met, since data distribution is a source of income for several Meteorological Services in the region.

Although CLIVAR might consider the establishment of major data centres, it is assumed that the data management will have to rely on distributed data centres. Dr. Magaña provided the panel with a list of existing data sources. In addition it was pointed out that the table in the CLIVAR Implementation Plan already serves as a list of data set relevant to VAMOS (available under: http://www.dkrz.de/clivar/vol2/pg3_new.html)

Dr. A. Villwock as a member of the recently formed CLIVAR Data Task Team will report on the

next meeting of the joint WOCE/CLIVAR Data Products Committee in April about the activities of the VAMOS data base group.

(More details can be found in [Appendix 3](#)).

4. General Discussion on Organisation of International VAMOS Programmes

4.1 Global Environmental Facility (GEF)

The discussion about possible international funding sources was started in the afternoon by a short presentation on the Global Environmental Facility (GEF) provided by Dr. David Rogers. Dr. Rogers had recently met with Dr. Patricio Bernal, IOC Executive Secretary and Assistant Director General of UNESCO. GEF is an interim funding mechanism to help developing nations address adverse climate change impact issues. The facility provides grants and concessional funding to recipient countries for projects and programs that protect the global environment and promote sustainable economic growth. (More information about GEF can be found in the [Appendix 3](#) and under <http://www.gefweb.org/>)

Dr. Rogers suggested that GEF funds might be applicable to VAMOS projects whose activities would contribute to various South American countries ability to adapt to the adverse effects of climate change. That CLIVAR/VAMOS has long term goals and support from Annex I and Annex II Parties to the Framework Convention lends itself to developing components of a climate change monitoring system for the region. A group of meeting participants discussed two components that are important to VAMOS and that may be of interest to GEF.

One component consists of a network of buoys capable of monitoring the physical, chemical and biological structure of the ocean off the west coast of South America from Colombia to the southern tip of Chile. A proposal has been submitted to the Chilean government to fund a network of buoys with Chilean waters to measure currents, surface fluxes, sea surface temperature and salinity. These buoys are intended to prepare Chile for the adverse affects of the inter-annual variability of the climate, which contributes to ENSO events. Additional sensors could extend the capability of these buoys to provide long term climate change information. Similar networks are envisaged off the coasts of Columbia, Ecuador and Peru, applicable to both short-term climate variability problems as well as long term climate change monitoring.

The other component consists of a series of monitoring sites located within continental south America, initially forming part of the VAMOS network designed to investigate low level jets, but additionally equipped to make carbon budget related measurements and to measure other parameters most relevant to climate change.

As a research programme, CLIVAR/VAMOS is uniquely placed to provide both understanding of the processes that contribute to climate variability and to guide the development of a system of observations that can be used to help mitigate the effects of adverse climate change for the nations of South America.

There was agreement on the interest to prepare proposals to be submitted through the World Bank, UNEP or UNDP. Prior to this, however, VAMOS should prepare a short consultative document to discuss with GEP and others to ensure that the work proceeds along the appropriate track and to determine the scale of the effort.

Drs. Mechoso and Rogers are the preliminary points of contact for the overall effort. They will develop the initial points of contact with GEF in consultation with the other members of the VAMOS group interested in using this funding mechanism.

Drs. Nuñez and da Silva Dias are the preliminary points of contact for the buoy programme and the land-based observing network, respectively.

4.2 General Discussion

In the following there was a general discussion about the organisation of international VAMOS projects, and the possibilities for their funding and implementing.

A number of issues were identified by panel members, and invited participants. Some of these issues had been discussed with the SSG co-chairs and the ICPO.

The lack of enough funding for VAMOS meetings was mentioned first. CLIVAR through the ICPO and the JCRF of WCRP will not be able to provide more resources for meetings. These resources have to come through other national funds. IAI expressed willingness to provide limited support for the attendance of panel members to meetings of relevant CRN's.

Next the participants commented on a possible role of the IAI or an International CLIVAR or VAMOS Board in administering international funds for implementation of VAMOS research programmes. There was a general agreement on the absence of a practical way to either use the IAI or to create an Intergovernmental VAMOS Board to funnel all funds via neutral (international) medium. Although IAI might help in the future or second stage of VAMOS to serve as an international pool for funding VAMOS related research, e.g. by having joint proposals with NOAA or NSF, currently no realistic way for administering international funds could be seen. Since it is highly likely that the funding for any VAMOS project will at least partly be provided by US resources, there is still the danger that VAMOS be perceived as an extension of US efforts.

The role of a VAMOS Project Office was regarded as a different issue. The participants felt that for the implementations of specific VAMOS projects some sort of co-ordination office would be of great help. There was a lengthy discussion about the tasks of such an office and its possible locations. It was decided that a location in Argentina or Brazil would bring in the most advantages for hosting a Co-ordination Office since the location at IAI was not favoured in the first place because the participants felt that the office should be closer to the center of gravity of science projects in progress at any one time.

5. Scientific Presentation of members of the hosting institute

On the morning of the third day, scientists involved in climate research at the Department of Atmospheric Sciences, University of Buenos Aires presented a series of seven lectures. Abstracts of these lectures can be found in [Appendix 3](#).

5.1 South Atlantic Climate Change Experiment

Dr. A. Piola gave an overview of the South Atlantic Climate Change Experiment (SACC) and its relevance to VAMOS (the full abstract can be found in [Appendix 3](#)).

The South Atlantic Climate Change (SACC) initiative derives from a series of meetings sponsored

by the US National Science Foundation and the Inter-American Institute for Global Change Research, and attended by scientists from Argentina, Brazil, United States and Uruguay. The goals of these meetings were to define priorities on regional and basin-scale climate variability and global change issues, and to promote the communication and collaboration among scientists and scientific institutions of the Americas. The complete document prepared for CLIVAR can be found at: <http://www.oce.orst.edu/po/research/matano2/index.html>.

The primary goal of SACC is to better understand the interactive relationships between the southwestern South Atlantic sea surface temperature (SST) and the larger scale climate behaviour. The variability of the ocean in the Malvinas confluence zone seems to have significant impact on the variability of precipitation in northern Argentina and southern Brazil. It is not clear what the driving force for this strong interannual variability is. A possible relationship with the LLJ circulation might also be considered.

In response to the SACC initiative a series of research proposals have been submitted to international and national funding organizations. These include the International Consortium for the Study of Global and Climate Change in the Western South Atlantic - Argentina (SHN), Brazil (IOSUP and INPE), USA (OSU, RSMAS/UM), Uruguay (UR) - which was funded by IAI for the period 1999-2003. Southwest Atlantic Circulation Experiment - OSU, LDEO, SIO, RSMAS/UM, NOAA - which was submitted to NSF. Finally, the Bifurcation of the South Equatorial Current - IOUSP, INPE, FAPESP, NOAA/AOML, URI - which was submitted to NSF.

6. Final reports from the Break-out Groups

6.1 VAMOS Data Base Break-out Group

The break-out group recommended to reaffirm the principles outlined in the Report of the VAMOS Workshop on Field Programmes of free and open access; and the strategy of distributed data centres to the fullest extent possible, rather than through establishment of one centralised data centre.

The break-out group also had a series of specific recommendations for VAMOS:

1. To establish a WWW-based Central Information Source for Data.

- Ownership and control by an existing institution.
- Designate a mirror site (N Hemisphere-S Hemisphere)
- WWW site will have information about VAMOS data and links to data sources.
- Not a data archive.

2. The Panel Chair to work through the WMO Secretary General to the Region II and IV Permanent Representatives to inform about VAMOS activities, to suggest and encourage full co-operation on data access.

3. The establishment of a strong co-ordination with GEWEX and, in particular, the reliance on GEWEX for Land Surface Data sets (e.g. LBA, GCIP, PACS).

4. To develop infrastructure requirements for data access based on needs as outlined in the VAMOS Science Plan.

The working group assumed that work on data will comply with several guidelines:

1. VAMOS data sets will begin with the establishment of VAMOS Projects
2. VAMOS Information Centre (WWW) will require some type of support, thus VAMOS will have to identify resources for this activity.
3. In-situ and retrospective data are archived at existing National Data Centers, therefore VAMOS should begin to establish agreements with participating countries to allow access and distribution of operational data sets prior to its first field campaign.

6.2 Marine Stratus and Stratocumulus Break-out Group

The break-out group formulated hypotheses about a connection of the heating over the Amazon basin and the Altiplano which indirectly affects the subsidence and the coastal jet that, and the low level cloud systems off the coast of Peru.

The time line of this project, which should also include oceanographic studies in the southeastern Pacific and in the cold tongue (upwelling) region, is to map it with the EPIC Phase I (2000-2003 (oceanographic)). A coastal stratus experiment could be initiated for Jan.-Feb. 2001 and another two months period in Aug.- Sept. 2001.

The second phase of the stratus experiment (coastal phase) could take place during the second phase of EPIC (focus on the divergence with an upper air array and combined aircraft / ship observations in Jan./Feb. 2003).

The group recognized that a series of actions have to be taken in short order:

1. Include modelling issues in its plans.
2. Expand membership of the VAMOS Stratus/Stratocumulus Working Group by recruiting a 'Blue ocean' oceanographer, and a large-scale modeller
3. Develop a new acronym

A summary of the current status of the Stratus project can be found in [Appendix 3](#).

6.3 South American Low Level Jet Break-out Group

The break-out group suggested an additional monitoring programme to determine the interannual variability of the LLJ. The original plan to have the intense observational period in 2001 was postponed to 2003 which was regarded as more realistic (funding, logistics, etc.). It was noticed that such a schedule does not agree with that of CEOPS.

6.4 Discussion on break-out group reports

The three break-out groups were asked to improve their proposals in two important ways:

- To establish more clearly the way in which each project addresses CLIVARs scientific goals.

This implies to place more emphasis on the relevance of the project to better understand climate and climate variability. It was recognized that VAMOS topics will likely have a GEWEX component. Nevertheless, CLIVAR concerns must be first priority and GEWEX aspects primarily addressed by establishing appropriate collaborations.

- The problems of Ocean-Atmosphere, and Land-Atmosphere interaction should be given similar attention.

In addition, the Stratus Working group was asked to broaden its scope to map better on the EPIC plan. This group will be chaired by Drs. B. Albrecht and J. Rutllant. For the data base working group Drs. C. Ropelewski and J. Meitín will take the lead and the Working Group on the South American Low Level Jet will be co-chaired by Drs. M. Nicolini, J. Marengo and M. Douglas. Dr. Jan Paegle will act as the lead author for the LLJ implementation document.

7. Executive Session

The executive panel session was held Tuesday, March 16, 4-6:30 pm.

7.1 Membership

Dr. M. Wallace's efforts in the creation stages of the VAMOS project was very much acknowledged. It was noted, however, that neither he nor Dr. H. Fuenzalida were able to attend the panel meetings held so far. In addition, they have not been very active in panel matters in recent times. The panel felt that replacements had to be appointed without delay in view of the quick pace of the programme.

The panel nominated Dr. J. Rutllant, a Chilean scientist who already co-chairs the Stratus Working Group to replace Dr. Fuenzalida. Dr. P. Aceituno was mentioned as an alternative candidate, but it was thought that he might be very busy with the organisation of the 6th Conference on Southern Hemisphere Meteorology and Oceanography of the American Meteorological Society.

Dr. Julia Paegle was nominated to replace Dr. M. Wallace. She is one of the co-chairs of the LLJ projects and would also be a member of the US-CLIVAR PACS project. As a back-up Dr. J. Hurrell was suggested.

7.2 EPIC and VAMOS

Dr. S. Esbensen emphasized that EPIC's focus is not restricted to the subtropical stratocumulus. The programme also addresses the cold tongue and the eastern Pacific warm pool. A VAMOS project narrowly focused on stratocumulus, therefore, would not provide appropriate international framework to the US EPIC. In view of these comments, the panel members strongly agreed that the VAMOS program on stratus/stratocumulus should extend its view towards the eastern Pacific to include the warm pool and cold tongue-ITCZ complex. This requires ocean-atmosphere coupling and oceanographic aspects be further strengthened. In general it was felt that the scientific justification of VAMOS projects should emphasize the climate aspect/background addressed by CLIVAR, although it was recognized that a GEWEX component would likely be included through appropriate collaborations. It appears that within the organization of US/CLIVAR, EPIC would be placed under the PBECS effort. There was agreement on the suitability that US EPIC be placed under both US-PACS and PBECS in the new US-CLIVAR organization.

7.3 GEWEX CEOP

Dr. J. Shuttleworth recalled that the GEWEX Science Steering Group proposes to the JSC a Co-ordinated Enhanced Observing Period (CEOP). This effort would be a co-ordinated study with CLIVAR and ACSYS and take place in the 2001-2002 large-ocean atmosphere interaction as well as in oceanography to characterize the climate system with a particular focus on the (heat) source and sink regions driving and modifying circulations that affect the climate system and many of its anomalies.

CEOP would focus on the major monsoonal circulations:

- Asian/Australian region through GAME and the Joint Air-Sea Monsoon Interaction Experiment (JASMINE)
- American monsoon systems through GCIP, LBA and the Variability of the American Monsoon Systems (VAMOS)
- African monsoons through CATCH

The VAMOS panel endorsed the idea to participate in the proposed GEWEX/CLIVAR CEOP project if this is considered by the JSC and CLIVAR SSG. This implies that the VAMOS field experiments should have their intense observation periods in the CEOP timeframe.

7.4 Other Business

The next panel meeting will be scheduled in conjunction with the 6th Conference on Southern Hemisphere Meteorology and Oceanography of the American Meteorological Society in Santiago de Chile, April 3-7, 2000. More information on the AMS meeting is available under: <http://www.SHMO.Chile2000.cl>. The exact dates for the panel meeting will be determined at a later date.

8. Closing

Prof. R. Mechoso reminded the participants that early fall 1999 is the deadline for the preparation of strategy/implementation documents for the Low Level Jet, the Stratus Project and the VAMOS data base. The PACS and EPIC documents could be regarded as "a standard". For all documents, the template prepared by Dr. K. Sawyer should be used.

Prof. R. Mechoso warmly thanked all participants in the meeting. He conveyed the general feeling that Dr. C. Vera and her co-workers performed an outstanding job with the local organisation. Additionally, he expressed his acknowledgements for the support from the representative of the CLIVAR Project Office, Dr. A. Villwock, and thanked NOAA/OGP and CLIVAR for their co-sponsoring of this meeting.

Last update: 29.11.2002 by [Andreas Villwock](#)