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AIACC
It's raining, it's pouring, ...
It's time to be adapting
Report of the second AIACC Regional Workshop
for Latin America and the Caribbean
Buenos Aires, Argentina
24-27 August 2004

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AIACC
Building Scientific Capacity

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Preface

The 10th session of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC) will convene in Buenos Aires in December 2004. The issues of climate change impacts and adaptation are expected to figure prominently in the discussions at the COP. These same issues are a focus of the global project Assessments of Impacts and Adaptations to Climate Change (AIACC), which held its second regional workshop for Latin America and the Caribbean in Buenos Aires, just three months prior to the COP. The workshop brought together investigators from AIACC assessments in the region, participants of other regional assessments, public and private sector stakeholders, and members of the policy and scientific communities of Latin America, the Caribbean and beyond.

The workshop presentations and discussions were both scientific and policy focused. The presentations revealed that a great deal of progress has been made in our understanding of the changing climate of the region, its impacts, and the vulnerability of people living in the region to climate change. Investigations of policies and measures for adapting to climate change are underway and useful insights are accumulating. But much work remains to be done in this area. The messages to emerge from the workshop suggest that, as it enters its second decade, the Convention should give greater emphasis to adaptation and to building the capacity, partnerships and knowledge that are needed to support adaptation.

The AIACC project, an enabling project of the Global Environment Facility (GEF), was launched in 2001 by the Global Change SysTem for Analysis, Research and Training (START), the Third World Academy of Sciences (TWAS), the United Nations Environment Programme (UNEP), and the Intergovernmental Panel on Climate Change (IPCC). Funding for the project has been donated by the GEF, participating developing countries, the US Agency for International Development, the US Environmental Protection Agency, the Canadian International Development Agency, and the Rockefeller Foundation. AIACC seeks to:

- Advance scientific understanding of climate change impacts, vulnerabilities and adaptation options in the developing world,
- Build scientific and technical capacity to support National Communications to the UNFCCC and enhance participation of developing country experts in IPCC and other international science activities, and
- Develop networks that link science and policy communities to support adaptation planning and action.

AIACC is achieving these objectives by providing funding, technical support, training, mentoring and networking for twenty-four regional assessments in Africa, Asia, Central and South America, and island states of the Caribbean, Indian and Pacific Oceans. More than 300 scientists, students and stakeholders from 50 countries of the developing world lead and participate in the regional assessments of AIACC. Another 40 scientists from a dozen developed countries also are engaged in the project.

The AIACC regional assessments were begun in early 2002 and are nearing their completion, scheduled for early 2005. The workshop in Buenos Aires is one of three regional workshops held this year to share, evaluate and communicate preliminary results of the twenty-four regional assessments. Similar workshops were held in Dakar, for regional assessments in Africa and the Indian Ocean, and in Manila, for regional assessments in Asia and the Pacific. A report from the Dakar workshop, *Messages from Dakar*, is available on the web at www.aiaccproject.org. The report from the Manila workshop will be available in early 2005.

As the 24 regional assessments of the AIACC project wind up their activities, each will produce technical reports, scientific papers and other outputs. Many will also hold workshops with stakeholders and policymakers in their study areas. Fifteen peer-reviewed journal papers have already appeared in print, an early indication that AIACC is delivering on its scientific and capacity building objectives. Another indication of success is that 33 investigators from the regional assessments of AIACC have been selected to be authors of the IPCC's 4th Assessment Report. In addition to the outputs of the individual assessments, plans are being made for a synthesis of lessons from across the regional assessments that will result in two synthesis volumes being published in 2005.

There is a strong interest among the many partners in the AIACC project to build upon our accomplishments. Discussions are underway to plan and seek funding for follow-up activities that would continue to build the knowledge, capacity and networks that are required to support adaptations to climate change in the developing world.

Neil Leary
AIACC Science Director
International START Secretariat

Acknowledgements

We thank the College of Exact and Natural Sciences of the University of Buenos Aires for hosting the Second AIACC Regional Workshop for Latin America and the Caribbean and Professor Vicente Barros for co-chairing and helping to organize the workshop. Graciela Micopole, Alfredo Rolla, Sergio Martin, Paula Ritcher, Elvira Gentile, Carlos Zotello, Cecilia Boudin, and Anna Murguida are thanked for assisting with the preparations for the workshop and seeing to the needs of the participants during the workshop. Their hard work contributed greatly to the efficiency and success of the event.

We were most honored to have our workshop opened by the Honorable Tulio Del Bono, Secretary of Science and Technology, the Honorable Atilio Savino, Secretary of Environment and Sustainable Development, Ambassador Raul Estrada Oyuela, Ministry of External Affairs, Commerce and Culture, and Professor Pablo Jocovkis, Dean of the College of Exact and Natural Sciences of the University of Buenos Aires. The participation of these senior members of the government of Argentina and of the University are evidence of the importance accorded in Argentina to the challenges of climate change and the need to bring policy and science communities together to shape solutions.

We thank the Global Environment Facility, the US Agency for International Development, the US Environmental Protection Agency, the Canadian International Development Agency, and the Rockefeller Foundation for their generous support of the AIACC project.

Laisha Said-Moshiro of START and Patricia Presiren of TWAS are thanked for their help in coordinating logistical details for the workshop, providing on-site support and arranging travel for the participants. Laisha, Cynthia Tooley and Anne Marie Hall of START are thanked for editing, designing and producing the workshop report.

Finally, thanks are also offered to all the participants in the Buenos Aires workshop for contributing their ideas and energy to the dynamic interactions. The messages that emerged from the workshop are the product of their joint efforts.

Executive Summary

The global project Assessments of Impacts and Adaptations to Climate Change (AIACC) convened its Second AIACC Regional Workshop for Latin America and the Caribbean in Buenos Aires on 24 – 27 August 2004, just three months prior to the 10th session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). The workshop brought together investigators from six AIACC assessments in Central and South America, Mexico and the Caribbean, participants of other regional assessments, public and private sector stakeholders, and members of the policy and scientific communities of the region and beyond.

Presentations and discussions at the workshop included findings from recent and ongoing assessments in Latin America and the Caribbean about observed climate trends and projected changes, socioeconomic changes, present climate risks, potential future impacts, vulnerability, and options and capacity for adapting to climate change. Also discussed were means of linking scientific assessments with decision-making, integration of adaptation into development policies, capacity building needs, national communications to the UNFCCC, and priorities for activities to follow the current AIACC project.

The messages to emerge from the AIACC workshop in Buenos Aires suggest that, as it enters its second decade, the Convention should give greater emphasis to adaptation and to building the capacity, partnerships and knowledge that are needed to support adaptation. The messages are:

The climate is changing. Observational records show that daily minimum temperatures have been increasing in Latin America and the Caribbean, consistent with decreasing frequency of observed frosts. Annual precipitation has increased in subtropical South America east of the Andes since the 1960s, with increases as high as 40% in some areas. During this period, heavy rainfall and severe flood events have increased in frequency, with notable impacts on water management and agriculture. West of the Andes, precipitation has trended downward over the past century. The causes of the observed precipitation trends are not yet determined and are being investigated, but they may be related in part to human-induced climate change.

Further warming and precipitation changes are projected for coming decades. Climate model projections of annual mean temperature changes for South America range from 0.5 to 1.5°C by the 2020s and 0.5 to 3.0°C by the 2050s. Projections of precipitation trends are varied, but models that best reproduce large scale circulation features over South America project continuation of observed trends: increasing precipitation in eastern South America and decreasing precipitation west of the Andes in central and southern Chile. Intensification of the hydrologic cycle and changes in the frequency of climate extremes can also be expected.

Climate risks are widespread in Latin America and the Caribbean. Climate variability and climate change pose risks now and in the future. Resources and activities at risk include human health, food production, water resources, forests, biodiversity, rural livelihoods, and coastal populations, infrastructure, fisheries and estuaries. Possible impacts of climate change being studied in the AIACC projects include increased flooding and changes in fishery productivity in the Rio de la Plata, changes in the productivity of mixed crop and livestock farms in the Pampas due to climate changes and climate related changes in crop diseases, risks to small-holder farmers in Mexico and Argentina, extreme event impacts in Central America, and greater prevalence of dengue fever in the Caribbean.

Adaptation is needed now. Societies are less well adapted to present climate variability and climate extremes than they might be, resulting in substantial climate related losses. Closing this adaptation deficit is an important first step for increasing resilience and reducing vulnerability to climate change. Experience with past and present means of coping with climatic stresses is being catalogued and can provide a basis for effective action. There is also sufficient understanding now of climate change to begin formulating forward-looking strategies to adapt to future climate change. Many of the AIACC projects have identified adaptation options that can be taken to the next step of pilot demonstrations.

Adaptation to climate change should be integrated with development policies. By integrating adaptation into national development policies, resilience to climate stresses can be built into institutions, infrastructure and resource management practices. Integration will require greater public awareness of climate risks and risk management strategies, assessment of national policies to evaluate where and how climate change considerations can and should be injected, a participatory and "bottom-up" process to engage a variety of stakeholders, and intermediary institutions that can act as an interface between planners and climate change experts. International funding agencies

can lead this transformation of development planning by requiring that consideration of climate risks be integrated into their project investment decisions.

Advances in knowledge about climate change vulnerability and adaptation continue to be needed. Research and assessments undertaken to date have generated considerable understanding of climate change vulnerabilities and adaptation options. This knowledge base can be used to formulate initial responses for adapting to climate change. However, climate change is an ongoing process and there is still much to learn about the threats it poses to valued resources and human wellbeing and the effectiveness, benefits and costs of possible responses. Consequently, there continues to be a need for further research and assessment to better inform our actions, most particularly at local and regional scales in the developing world.

Important scientific and technical capacities exist in Latin America and the Caribbean, but further investments in capacity and regional cooperation are required. There are a number of centers of excellence for climate change research in universities and national government agencies of the region. These centers are valuable assets that generate knowledge and expertise, particularly in the areas of meteorology and climate modeling, that can be used for managing climate risks. However, available capacities are neither sufficiently deep, distributed nor mobilized to adequately address the risk management task.

Investments should be made to deepen the expertise at existing centers of excellence, to extend capacities to additional institutions and countries of the region, and to mobilize capacities for application to climate risk management in partnership with stakeholders. Greater regional cooperation can help to transfer capacities and increase the efficiency with which existing capacities are utilized. Needed capacities include expertise and tools for regional climate modeling and downscaling, modeling of system responses to climate changes, analysis of social vulnerability and adaptive capacity, evaluation of adaptation strategies, risk assessment and decision analysis, participatory assessment, and integrated assessment.

Partnerships among policy, practitioner, stakeholder and science communities are needed for effective adaptation; mobilizing and sustaining these partnerships are important for building adaptation capacity. Partnerships among policy, practitioner, stakeholder and science communities can promote shared understanding of decision-making challenges and of the knowledge needed to make better decisions. Collaborations among these communities can generate and communicate knowledge that is relevant, state-of-the-art, and credible to all parties, and can facilitate applications of the shared knowledge in more effective adaptation decisions. More demonstrations of effective partnerships, such as agricultural extension services that link university researchers, extension agents, farmers and government agencies, are needed.

AIACC is filling important needs for advancing knowledge, capacity and networks that complement other efforts in Latin America and the Caribbean. AIACC projects, which are undertaken by leading scientific institutions in the region, are advancing knowledge about climate change vulnerabilities and adaptation options, adding to scientific and technical capacity, building partnerships between scientific and other communities, contributing to National Communications, and linking institutions and experts across national boundaries to collaborate on regional issues.

The AIACC-based network that has been established complements others, such as the Inter-American Institute for Global Change Research, by engaging the scientific community with policy, practitioner, and stakeholder communities to better manage environmental risks. Participants in the workshop were in agreement that there is an ongoing need in Latin America and the Caribbean for the assessment, capacity building, partnership mobilization and regional cooperation efforts of AIACC. Future activities that build upon the AIACC work should pursue these same general objectives but with an increasing emphasis on supporting adaptation planning and actions to manage climate risks.

1. Introduction

The global project Assessments of Impacts and Adaptations to Climate Change (AIACC), convened its second regional workshop for Latin America and the Caribbean in Buenos Aires on 24 – 27 August 2004. The workshop brought together investigators from six AIACC assessments in Central and South America, Mexico and the Caribbean, participants of other regional assessments, public and private sector stakeholders, and members of the policy and scientific communities of Latin America, the Caribbean and beyond. The purposes of the workshop were to share information from recent and ongoing assessments in the region and to discuss applications of the information in adaptation measures and policy, capacity building needs, national communications, and priorities for activities to follow the current AIACC project.

Presentations on the first day of the workshop gave a broad overview of climate change assessment activities, capacity building efforts, and national communication preparations in Latin America and the Caribbean. Plenary sessions on the following days covered the topics of climate variability, changes and scenarios; socioeconomic scenarios; climate change impacts and vulnerability; adaptation opportunities and capacity; and adaptation, stakeholders and linking to decision-making.

Small breakout groups met several times during the workshop to discuss a variety of topics. These included: climate science capacity in the region; methods for climate change scenario construction; observed climate trends and projected changes; present day climate risks; methods and tools for vulnerability and adaptation assessment; capacity needs for vulnerability and adaptation assessment; supporting decision-making and national communications with assessments; integrating adaptation into development policies; and building upon the AIACC project.

The messages that emerged from the workshop suggest that greater emphasis should be given in coming years within the climate change Convention to adaptation and to building the capacity, partnerships and knowledge that are needed to support adaptation. The main messages are

- The climate of Latin America and the Caribbean is changing and will continue to change, in part due to human causes;
- Climate risks are widespread in the region and include threats to human health, food production, water resources, forests, biodiversity, rural livelihoods, and coastal populations, infrastructure, fisheries and estuaries;
- Adaptation is needed now and there is sufficient knowledge to act;
- Adaptation should be integrated into development policies;
- Advances in knowledge about climate change vulnerability and adaptation continue to be needed, particularly at local and regional scales in the developing world;
- Further investments in scientific and technical capacity, and in regional cooperation, are required to support adaptation;
- Mobilizing and sustaining partnerships among policy, practitioner, stakeholder and science communities are important for building adaptation capacity; and
- AIACC is filling important needs for advancing knowledge, capacity and networks that complement other efforts in Latin America and the Caribbean.

Remarks made in the opening session of the workshop are presented in section 2 of the report. Reports from the breakout sessions appear in section 3. Abstracts of the presentations made in the plenary sessions can be found in section 4 of this report. The full presentations can be downloaded from the web at www.aiaccproject.org. The workshop agenda and list of participants can be found in appendices 1 and 2.

2.
Opening of the Workshop

The Second AIACC Regional Workshop for Latin America and the Caribbean was opened by the Honorable Tulio Del Bono, Secretary of Science, Technology and Productive Innovation, the Honorable Atilio Savino, Secretary of Environment and Sustainable Development, Ambassador Raul Estrada Oyuela of the Ministry of External Affairs, Commerce and Culture, and Professor Pablo M. Jacovkis, Dean of the College of Exact and Natural Sciences, University of Buenos Aires. Following are their opening remarks.

Honorable Tulio Del Bono
Secretary of Science, Technology and Productive Innovation, Government of Argentina

It is a great pleasure for me to open this important meeting for the AIACC Project. I am very glad that this event takes place in our country, as we find the objectives of this project aiming to develop scientific information on the vulnerability and adaptation to climate change in the developing countries of great interest. Let me then, greet the AIACC initiative and wish the greatest success to this meeting.

Argentina, like just a few countries in the world, has been blessed with an abundant biological and climatic diversity together with exceptional natural resources. Because of that, the State has the responsibility to generate a culture aiming at the preservation of its natural goods. Accordingly, climate change, its causes and effects, are very important issues for our Government as they could affect the future of our people, since the development of our country is closely bound to the management of its natural resources.

In the context of the global heating foreseen by science, we wonder what will be the destiny of the mountain glaciers of our homeland in the next decades, most of them already receding to a large extent. How will the services that these glaciers offered to us in terms of hydrologic resources, in aesthetic values and in tourism be affected? We should also wonder how the provinces where water is today a scarce resource, but on which almost all life and economy of these regions depend, will be affected.

Given the speed with which the climate change is taking place, these queries also require quick answers. However, to be effective, they can only come from the systematic activity of science. We need to assess our vulnerabilities to climate change and find solutions to adapt to it, because adaptation that comes only after a change in climate will imply considerably greater costs, as it was learned from the experiences of the recent past. Whatever the future climate scenarios may be, the strategic planning of the State policies should be an essential component of the process of adaptation, necessarily based on the science of climate change. For the adaptation to be efficient, international cooperation is required. This cooperation is an essential tool in

all scientific activity, but it is strategic and more necessary in this case, as the problem of concern is global phenomenon. Argentina has a long tradition in scientific international cooperation. In the case of climate change, it promotes the participation of Argentine scientists in different international programs. In particular, Argentine scientists are engaged in 3 out of the 6 Latin American projects selected and funded by AIACC Project.

Regarding climate change mitigation and the adaptation process, the most powerful countries should assume the greater responsibilities, but all of us should contribute, because we are all somehow responsible. Let us hope that some day soon, mankind will understand that it does not own the world, and cannot do with it whatever it pleases. Let us hope that some day we will see ourselves as managers of the earth and that our main task as managers of these resources is to care for them and preserve them for our children and our grandchildren.

Once this day comes, perhaps it won't be necessary to invest so many resources, as now, to correct the problems that we ourselves generate. That is why on behalf of the Government of Argentina and of the Ministry of Education, Science and Technology, I

welcome this meeting. I would like to thank the AIACC leaders for their contribution and efforts to fund and support this research. We hereby commit our support to strengthen the AIACC studies, so that they can be successfully implemented and carried out. Finally, I would like to wish you success in your deliberations and in the work to come in the future. Thank you very much.

Honorable Atilio Savino
Secretary of Environment and Sustainable Development, Government of Argentina

Good afternoon, and welcome to our country. It is such a great pleasure to be with all of you at the beginning of this regional workshop that, no doubt, will be fruitful.

Somebody said that the future would not be the way we thought was going to be. In the past, we used to have an idea of the future as something more or less certain or at least foreseeable. Now the lack of predictability in the future seems to be the rule and the issue of climate change is one of the important sources of this lack of predictability. Therefore, we should consider climate change not only as a threat, but also as a reality of our time, especially now that we already see frequent and clear signals of its existence and effects.

The universal acknowledgement that climate change exists is the first important signal of rationality, because once recognized, we will follow the obligation and the commitment of fighting against it and looking for solutions. Meetings like this one will definitely contribute to develop the necessary brainpower, knowledge and research to find the required solutions.

In the Argentine Government, we have a joint vision, with no place for isolated actions. Different sectors are working together in the design of the policies and the promotion of research. Better knowledge is not only needed for domestic decisions, but it is also required to actively participate in the international negotiations. Regarding this aspect, we want the ratification of the Kyoto Protocol very soon.

I believe that the environmental problems should be addressed using not only a multi-disciplinary, but also a trans-disciplinary approach, convening political decision-makers, universities, researchers and non-governmental organizations. In this way, appropriate approaches for dealing with the environmental issues can be created with the participation of all sectors, whether public or private. This is necessary but not enough; in addition, the solutions should guarantee equity among all the interests and especially for the humblest sectors.

It is very important that once having recognized the problem, we apply all our research capabilities to face it. This will not guarantee the complete and final solution, but in a modern world, at least it will permit us to understand the causes and alternatives and from this understanding to propose better solutions. Therefore, the work of researchers and the work done by the University is essential for this process.

We all know that climate change is a global problem but it has to be solved through the contribution and commitments of the different countries in order to arrive to the best solutions. In the case of Argentina, not only are we complying with our commitments, producing and reporting our national communication, but, we are hosting the next Conference of the Parties in December 2004. This is another clear sign of the Argentine commitment to the solution of the climate change issue.

This Conference of the Parties is also an opportunity to look for the necessary consensus among the different countries of the world, particularly within Latin America, as we all have common problems. These common problems are characterized especially by the vulnerability of our countries to the effects of climate change. However, we should not only look at the issues of the vulnerability and adaptation to climate change, but also we should decisively promote more research to reach solutions for generating either renewable energy or become more and more efficient in terms of energy.

These are but a few of the vital issues that we face at this time, without forgetting something that worsens vulnerability, that unfortunately is a feature of our country, which is poverty, a problem now being frontally combated. Climate change generates and worsens poverty conditions and therefore, it not only urges a global commitment against climate change, but in addition, it is another reason to fight poverty.

As I said, it is a pleasure for us to know that you are meeting here to contribute your knowledge in the search for new solutions, to generate contributions so that we might all understand better what future climate is going to be like and be better prepared to protect our activities and infrastructure. It is also to understand how we can generate a synergy with the other conventions because no doubt, when we speak about climate change we also have to think and speak about biodiversity, desertification, flooding, and other environmental issues. So again, welcome to our beloved country. I

wish you success in your deliberations and I hope the conclusions that you will reach in these four days will be used not only within your Project, but also in any discussion that might occur at the next Conference of the Parties here in Argentina. I expect this be another result of this meeting. Thank you, and best wishes.

Ambassador Raul Estrada Oyuela,
Ministry of External Affairs, Commerce and Culture, Government of Argentina
(excerpted comments from his opening remarks)

Adapatation and vulnerabilty were the forgotten pillars of the United Nations Framework Convention on Climate Change. The Kyoto Protocol is about mitigation, having only two brief references to adaptation. It is wrong to perceive adaptation as a local issue. Both mitigation and adaptation have a global nature. Mitigation and adaptation are part of the same equation for responding to climate change.

The Intergovernmental Panel on Climate Change (IPCC) recently endorsed the importance of adaptation as part of the climate change strategy. Adaptation is necessary now and it will be necessary all along the process in the future. The global interest in adaptation is also related to global security. Those who are reluctant to assume mitigation commitments have wider obligations to contribute to adaptation.

There is no such thing as natural adaptation. Traditional knowledge doesn't solve all adaptation problems either. This knowledge is only adaptation to traditional changes in climate, not to what is happening now. So adaptation must be proactive.

The importance of science and technology is therefore essential. Scientific inputs and communication are of the utmost importance. Scientists mush not hide in "ivory towers" on the issue of climate change. All scientific families must interact among each other and with society at large. Refinement and improvement of regional models are essential for adequate formulation of national adaptation plans. The international community already has a good number of tools and mechanisms being utilized by scientific groups and in research activities dealing with modeling and adaptation. In Argentina, the scientific community is fully cooperating with the government on adaptation and vulnerabilty, and in particular for the elaboration of the second national communication.

But a notorious lack of adequate capacity for scientific research on modeling and adaptation exists in the developing countries. Establishing and strengthening scientific, technological and institutional resources in these countries is therefore essential to achieve our objectives.

Our government is deeply committed to include adaptation and vulnerability as a central issue for the 10th session of the Conference of the Parties to the UNFCCC, which we will host here in Buenos Aires in December of this year.

Professor Pablo M. Jacovkis
Dean of the College of Exact and Natural Sciences, University of Buenos Aires.

Secretaries of State, Ambassador, Distinguished Visitors, Ladies and Gentlemen: The College of Exact and Natural Sciences is very proud to participate through many of its scientists, together with researchers from other colleges of the University of Buenos Aires, in this important meeting. The College of Exact Sciences does not consider itself, and I agree, as an ivory tower, something isolated and not related to national and international problems. Thus, as it has been doing for a long time, it will continue supporting projects committed to solve specific problems of our society.

In the case of climate change, our College has a special responsibility because it is the only institution in Argentina that offers university programs in Oceanography and in Atmospheric Sciences and also because it produces research in these fields at a very high level. So, with these considerations in mind, I am very glad that Dr. Barros invited me to participate in this opening session and I wish you the greatest success in this meeting. Thank you. During the workshop we held small breakout sessions to discuss assessment methods, capacity needs, policy applications of assessment results, and future assessment activities. Following are the reports from the breakout sessions.

3.
Reports from Breakout Sessions

3.1 Climate Science Capacity in the Latin America and the Caribbean Region

(Session 1A)
Chair: Carlos Fuller
Reporter: Gustavo Nagy

Countries of Latin America and the Caribbean developed substantial capacity for general climate science over the past one to two decades in their universities, meteorological services and other research and applied science institutions. Earlier priority focused on understanding climate variability and applying that knowledge to climate prediction at short time scales (seasonal to inter-annual). Gradually, the focus moved towards longer time scales and climate change. Many universities and climate research institutions have well established PhD programs providing state-of-the art advanced training in climate analysis and modeling. In addition, the infrastructure required to advance climate science is rapidly increasing. Several groups have capacity to use numerical models as the main tool for projections of climate change for the future. However, this capability is not yet widespread in the region. A number of assessment projects such as AIACC, CATHALAC, and MACC, as well as training workshops offered by a number of organizations, are helping to transfer capabilities for regional climate modeling, statistical downscaling, and the use and interpretation of climate scenarios from regional centers of expertise to new users.

Following is a description of some of the climate science capacities and capacity building activities in the region. The list primarily reflects the capacities and activities of the organizations of persons who participated in the breakout session and is not a comprehensive list for the entire Latin American and Caribbean region.

CPTEC in Brazil is a leading research center for climate system analysis, climate modeling and climate prediction. CPTEC has extensive data, expertise and research activities, as well as a modern supercomputing facility. CPTEC has provided technical assistance on climate change scenarios for the AIACC assessment and, in collaboration with the Inter-American Institute for Global Change Research, is planning to offer training courses in regional climate modeling. The courses would be offered twice per year, would accommodate approximately 10 persons each session, and would focus on early career scientists.

Universities in Brazil, Argentina, Chile, Costa Rica and other countries in the region offer high quality programs in meteorology and are centers of expertise and research that can contribute to improved understanding of climate risks.

The CATHALAC Project coordinates two climate science related activities. One is a data warehouse function that is part of the Earth Observing System and is funded by NASA. The data warehouse stores and provides access to 8 to 10 terabytes of climate, hydrologic and atmospheric data. A second activity is an assessment of adaptive capacity in Central America, Mexico and Cuba. As part of this activity, regional climate modeling capabilities are being applied by the project team to develop regional scale scenarios of climate change. Regional numerical climate models MM5 and PRECIS are the tools that are being used in the project. Climate modeling workshops, conducted with support from USAID and NASA are providing training in climate modeling. Each country is being set up with an access node that will include a workstation and GIS software.

The Climate Studies Group at the University of the West Indies, Mona, conducts statistical analyses of climate, analyses of climate dynamics and regional climate modeling using the MM5 and PRECIS models. They participate in the AIACC project and are assisting with scenarios of climate change in the Caribbean for the Mainstreaming Adaptation to Climate Change (MACC) project. The Caribbean Institute for Meteorology and Hydrology, a training and research organization located in Barbados, also participates in the MACC project. The institute provides training in meteorology and hydrology, conducts research, provides advice to governments, and collects, analyzes and publishes meteorological and hydrological data.

In Central America, the Comite Regional de Recursos Hidraulicos (CRRH) is an intergovernmental center with expertise in meteorology, climate and water resources and provides training in these areas. CRRH provides capability to perform climate simulations for Central America using the MM5 model. CRRH is a participant in AIACC and has played a leading role in previous climate change assessments.

The discussion highlighted a number of needs for further capacity building in the region. Visiting scientist exchanges among institutions in the region, both short- and long-term, are effective means of building capacity and also building links between institutions. Opportunities for scientist exchanges should be increased.

There is a need for short training courses on sta-

tistical and dynamical downscaling, climate trend analysis, vulnerability assessment methods, impact modeling for selected sectors, and costing of adaptation options. There is also a growing need for more narrowly focused short courses to provide in-depth, hands on training with a single method or tool (e.g. PRECIS, GAMS, etc.). Ideally, students should be provided with application software for the model or tool that can be used at their home institution.

Climate change related training courses are offered with fair frequency in the region. But there is little coordination among the groups offering the courses and there is no centralized source of information about training opportunities. Groups offering training should coordinate their efforts so as to provide better coverage of topics and greater opportunities for participation throughout the region.

3.2 Methods for Climate Change Scenario Construction (Session 1B)

Chair: Mario Nunez
Reporter: Moira Doyle

The global general circulation models (GCMs) used to simulate the Earth's climate yield outputs at spatial resolutions that are much coarser than is required for evaluating climate change impacts, vulnerability and adaptation responses. Researchers interested in the latter need to translate or downscale the coarse scale outputs of the GCMs to the finer resolutions at which they work. They also need to be cognizant of the skill with which different GCMs perform in order to make informed choices about the GCMs they will use to construct scenarios of future climate change.

Control run simulations from GCMs generally reproduce a significant amount of the basic characteristics of the observed climate of Latin America and the Caribbean. However, errors between model projections and observations can be relatively large for some variables, precipitation for example, and such errors pose problems for generating credible scenarios of future climate change.

It is often recommended that global models that validate better against observations be selected for use in constructing scenarios of future climate change. But one model may perform well for some variables and regions relative to other models and less well for other variables and regions. Researchers should validate control run simulations against observations for their specific region of study and for the specific variables that will be used in impact studies. Those that do not validate well relative to other models might be excluded, or given less weight than others. However, there is not a universal consensus on this.

A number of approaches are available to translate the coarse resolution outputs of the GCMs to the finer resolutions needed for impacts research. Very simple approaches include directly applying projected changes from a GCM for a grid-box, or interpolating changes from multiple grid-boxes, to scale observational data. More complex approaches that use greater information include statistical and dynamical downscaling. Each approach has advantages and limitations, and each is likely to be applied in future assessments in the region.

Statistical downscaling uses statistical relationships between observed climate variables and larger scale features of the climate to produce downscaled scenarios. Dynamical downscaling uses the same basic physics as represented in GCMs but in regional climate models with finer resolution and more realistic topography and other features. Large scale outputs of the GCMs are used as inputs to the regional model for dynamical downscaling. If seasonal cycles are represented reasonably well by GCM simulations, then dynamical downscaling may provide a better representation of the observed climate variables than does a GCM.

Recent research has focused on probabilistic scenarios as probabilistic information has greater potential value for risk management and adaptation decisions. Probabilistic scenarios that are based on multi-model ensembles is a promising approach that should be explored for use in climate change assessments in the region.

Incremental scenarios that are guided by climate model outputs and other information are a useful approach for exploring the sensitivity of different systems to variations in climate. For example, in semi-arid and arid regions in which temperature changes drive evaporation, it is highly likely that the region will become drier if temperature increases despite possible increases in rainfall. Incremental scenarios of different degrees of soil drying can be used to explore effects on, and possible thresholds in, dry-land farming or grazing systems.

Recommendations from the breakout session are to (i) promote more regional collaboration for climate modeling and generation and sharing of climate change scenarios, (ii) increase sharing of analytic results and knowledge across the region through regional workshops (these

might be co-organized by START/AIACC, WCRP/VAMOS, and IAI), and (iii) establish a virtual center for Regional Climate Model (RCM) output dissemination.

3.3 Observed Climate Trends and Projected Changes

(Session 1C)
Chair: Vincente Barros
Reporter: Ines Camilloni

The AIACC and other assessment projects represented at the workshop are from two large regions: Central America-México and the Caribbean region (CAM-CAR), and subtropical South America. Some common patterns can be observed in both regions: increases in daily minimum temperatures, but no defined trend in maximum temperatures. The trend in the daily minimum temperature is consistent with other indicators, such as frequency of frost. As a consequence, there has been a considerable reduction in the diurnal range of temperature. This result is consistent with what should be expected from the increasing greenhouse effect.

In subtropical South America, east of the Andes, there is a long-term positive trend in precipitation that began about 1970 (later in the north of this region and earlier in the south). In some areas that were already humid before the trend, the increment in annual precipitation reached 30 % and more. This trend was accompanied by a positive trend in the heavy short-term precipitation events. Of course, the trends present large variability within the region. These trends were reflected and amplified in the river flows and had notable impact, both in water management and agriculture. In contrast to the southeastern region, there is a strong declining precipitation trend west of the Andes in Central Chile that started at least a hundred years ago.

There are some indications that these changes are related at least in part to the human caused climate change. However, it is also possible that some low-frequency variability process has contributed to the observed precipitation trends in subtropical South America. From the point of view of their impacts and possible lessons for adaptation, it does not matter if their cause is human-driven climate change or natural variability. But growing evidence of the global warming connection may help to reduce uncertainties when projecting the forecast of the future climate.

The projections of future climate change show trends for the future of the same sign as those observed in the CAM-CAR and subtropical South America during recent decades. However, the models project greater warming for more northern areas of South America than in southern areas. This is opposite to the observed gradient of greater warming for points farther south in South America.

Models that best reproduce the circulation field over South America show a positive trend for precipitation in eastern South America and a negative trend in central and southern Chile. Since this is consistent with the trends observed in the last decades, there is some grounds to anticipate that annual precipitation fields will at least maintain their present conditions during the next two or three decades, and not return to their pre-1979 values. With less confidence, it may be conjectured that both the positive and the negative trends at both sides of the Andes will continue in coming decades.

Finally, social and economic impacts of climate change cannot be studied isolated from changes in other driving forces of the aspects studied.

3.4 Present Day Climate Risks

(Session 2A)
Chair: Sam Rawlins
Reporter: D. Amarakoon

Present day climate variability and extremes pose widespread risks in Latin America and the Caribbean. Vector borne diseases, water borne diseases, and respiratory diseases have demonstrated associations with variations in climate. Hurricanes and heavy rainfall events cause flooding and mudslides that pose risks to human lives as well as infrastructure and economic activities. The availability and quality of water are directly impacted by drought and other climate variations, which in turn impact food production, agricultural livelihoods and wildfire risks. Land degradation can be exacerbated by climate extremes, which can adversely affect biodiversity. Coastal populations, infrastructure and deltas face risks from storm surges, flooding and coastal erosion.

Vulnerability to climate risks varies for different socio-economic classes. For example, poorer people are more susceptible to the destruction caused by hurricanes and flooding for a variety of reasons. The poor typically live in substandard housing that is more susceptible to damage from winds, heavy rain and floodwaters. Substandard or non-existent sewage facilities and lack of potable water in poor neighborhoods can result in greater exposure to water borne diseases after flooding. Areas that are historically prone to flooding or mudslides are often inhabited by the poor.

Consequently, reducing poverty can lessen vulnerability to climate risks. With higher living standards, better housing located out of hazardous zones, higher education, better water and sanitation facilities, and improved nutrition and health, communities have greater resilience to withstand and recover from shocks and have greater capacity to adapt to a changing environment.

Communities have evolved a variety of means of coping with climate risks. Appropriate and sustainable means of coping are organized within a community, use community resources, and share responsibility among community members. Inappropriate and less sustainable means of coping occurs when a community is reliant on actions and resources that are primarily external (from the national government, for example) and when little or no responsibility for managing risks is taken by members of the community. Some examples of coping strategies related to extreme weather events include: establishment and enforcement of building codes; adherence to disaster preparedness plans; implementation of emergency management warning systems; coordination of response measures under extreme event scenarios; availability and use of hazard mapping; education and disaster awareness promotion programs; and insurance. In the agricultural sector, introduction of farmers to new crops/strains and advice on crop diversification exist in some regions can aid farmers to cope with climate variability.

Measures that can add to a community's capacity to cope with climate variability and manage climate risks include:

- Better housing for poor that is located out of hazardous zones
- Improved sanitation and greater access to clean water in poor neighborhoods
- Early warning systems combined with public education about the hazard, preventive actions prior to a warning, and appropriate responses when a warning is issued
- Better building codes and strict enforcement
- Better management of resources during emergencies
- Public education programs on preparedness for slow onset hazards (e.g. drought)
- Improve weather and climate forecasting from short to seasonal time horizons
- Develop partnerships among forecasters, intermediary organizations and users to facilitate delivery, interpretation and application of forecasts to manage climate risks

3.5 Methods and Tools for V&A Assessment

(Session 2B)
Chair: Alex de Sherbinin
Reporter: Alvaro Ponce

The discussion group identified the vulnerability and adaptation assessment methods and tools being used by the AIACC projects in Latin America and the Caribbean and discussed their potential for broader application. Martha Perdomo of the UNFCCC Secretariat encouraged each of the research teams to contribute write ups of their methods to a compendium of assessment methods and tools that is being compiled by the UNFCCC. Contributions from the AIACC research teams are especially important because the majority of the methods and tools currently identified in the compendium have been designed and implemented in developed countries. The AIACC project is collecting information about the methods and tools being used by each team, with assistance from CIESIN. This information is being posted on the AIACC website for Data, Methods and Synthesis (http://sedac.ciesin.columbia.edu/aiacc) and will be made available to the UNFCCC Secretariat.

The methods and tools currently being used by AIACC projects in the region include the following:

- Risk Spaces (LA29)
- Social Vulnerability (LA26)
- Multi-criteria models (LA29)
- GIS in Hazards Risk Analysis (LA26 & 32)
- Organigram Analysis (LA26)
- Disaster Analysis (LA06)
- Socioeconomic Assessment (SIS06)
- Decision Support Systems (LA27)
- Vulnerability Matrix using Proxy Variables (LA32)

The discussion group made the following recommendations:

- Present results of V&A assessments language that decision makers understand and emphasize results with policy relevance. For example, report estimates of benefits and costs in monetary terms when possible.
- Adapt tools for application to local contexts and document how the tool was tailored to the application so as to provide to other potential users. In a similar vein, international manuals for disaster management and coping with climate risks need to be adapted to local realities.
- Review general vulnerability research that is not

specifically climate change related, for methods that could be adapted for application to climate change V&A assessment.
• There is a need to evolve from impact assessment to more integrative methodologies.
• Methods are needed to evaluate long-term infrastructure investments for climate risks and to incorporate consideration of climate risks into investment decisions. Otherwise poorer countries may get stuck in a cycle of disasters and accumulated debts resulting from loans to address those disasters.
• It is important to educate children about climate change and adaptation strategies so that the next generation will be better prepared to address the challenges arising from climate change.

3.6 Capacity Needs for Vulnerability and Adaptation Assessments

(Session 2C)
Chair: Cecilia Conde
Reporter: Marta Vinocur

Capacity for vulnerability and adaptation assessment has developed in the region from research within the region on natural hazards, health risks, environmental risks, food security, and poverty and development needs. Capacity to apply the methods of vulnerability and adaptation assessment to climate change has been enhanced and extended to many countries in the region through a number of international and bilateral assessment projects such as AIACC, MACC and others. The capacity exists within universities and government research agencies, also to some degree in organizations that work on problems in areas such as hazards management, food security, and public health.

However, because of the multi-disciplinary nature of vulnerability and adaptation assessment, the capacity is often diffused across units of an organization and across organizations. This presents problems for assembling and maintaining teams of experts with the appropriate set of skills to undertake vulnerability and adaptation assessments. Teams are assembled on a project-by-project basis, which lessens the ability to accumulate experience, knowledge and skills and to develop strong cross-disciplinary working relationships. Because of this, an important capacity building need is to sustain and nurture networks such as the AIACC-based network that can help with the accumulation of experience and knowledge, provide training to new members, and sustain working relationships among experts across institutions and across national borders.

There are some centers where significant capacity exists, such as UNAM, CPTEC, and UBA, which could play important roles in such a network and in helping to build capacity that extends beyond existing centers. A "learning-by-doing" approach in which capacity for vulnerability and adaptation assessment is developed through participation in multidisciplinary assessments has been shown to be highly effective. The existing centers of capacity could support learning-by-doing capacity building by providing guidance on the design of new assessments, technical assistance with their implementation, visiting scientist programs, and training activities.

Some of the areas in which technical assistance and training are needed include concepts and tools for profiling and measuring vulnerability, applications of GIS to risk and vulnerability mapping, spatial statistical analysis, multi-criteria analysis of adaptation options,

decision support system modeling tools, risk assessment, socioeconomic scenarios, and climate change scenarios. Coordination of short training courses offered through institutions in the region on these and similar topics is needed. There is also a need for semester long courses and the development of masters programs.

The AIACC regional assessments are building a valuable base of experience for development and application of varied methods for vulnerability and adaptation assessment. These methods and lessons from their application need to be documented and widely communicated. This is being done through the Data, Methods and Synthesis website of the project, and through contributions from AIACC to the UNFCCC's compendium of methods and tools for assessing vulnerability and adaptation. Technical reports and scientific papers from the AIACC regional assessments, and the cross-project

synthesis reports that are planned, will provide additional avenues for dissemination of this information.

The methods and tools being applied in V&A assessments are still highly varied. As yet there is no consensus on best methods and tools for these assessments. There is some interest in trying to standardize V&A assessment methods. But this would be difficult to accomplish satisfactorily given the highly varied purposes, issues, sectors/systems, and local contexts of assessments. A more realistic and useful objective would be to try to standardize a set of questions to be addressed in each assessment, recognizing that the specific methods that would be applied would vary from one assessment to the next.

There is limited experience and capacity in the region for effective communication with stakeholders about climate related vulnerabilities. Effective communication of the results of assessments with different stakeholders is important if adaptive responses are to gain support and be implemented. This requires understanding the communication patterns of each social group and how they have previously dealt with hazards and responded to risk information. A variety of means of communication may be employed, ranging from small workshops with selected stakeholder representatives, to larger public meetings, printed materials, production of videos and use of newspaper, radio and television media. To use these means of communication effectively, assessment projects should involve persons with appropriate expertise in communication and social sciences. There is a need to accumulate and knowledge about communication strategies that have been used and their effectiveness, and to build capacity to design and implement communication strategies for climate risks and risk management.

3.7 Supporting Decision Making and National Communications with Assessments

(Session 3A)
Chair: Max Campos
Reporter: Claudia Natenzon

The first national communications to the UNFCCC contained little information about the vulnerabilities from climate change that countries face or about options or strategies for adapting to climate change. For the second national communications, countries should report their vulnerabilities and national priorities for lessening risks through adaptation. Since completion of their first national communications, more countries have made assessments of their vulnerabilities and, to a lesser extent, some of the possible options for adapting. Many of these assessments have been conducted in the developing countries with support from a variety of bilateral and multilateral programs and projects, including the AIACC project. Through these assessments, knowledge is accumulating about climate change vulnerability and adaptation that can be and is being contributed to preparations of 2nd national communications to the UNFCCC.

However, there are still important gaps in knowledge about climate change vulnerability and adaptation, particularly at local, sub-national and national scales at which most adaptation actions would be implemented. In most countries, the assessments that have been undertaken usually have focused on only a few select sectors or systems. Those that remain unstudied are not necessarily those for which climate risks are less severe or less important. Within the sectors and systems that have been examined, there remain significant uncertainties about some of the potential impacts; interactions of climate change impacts with other changes such as land degradation, air quality changes, growing water demands, and globalization; consequences of the interacting impacts for human welfare; and, most especially, the likely performance, costs and consequences of different adaptations for reducing climate risks.

Because of the gaps, there remains a need for further assessment efforts in all countries of the region, and most particularly among the less developed countries where fewer assessments have been conducted. Future assessments should give greater emphasis to identifying and evaluating adaptation options and strategies. Assessments should engage decision makers, practitioners and other stakeholders with assessment experts to undertake assessments. Partnerships among these groups can improve assessments by focusing them on priority decision problems, incorporating important and relevant knowledge from stakeholder groups, designing assessments so as to generate the knowledge that is needed to make better decisions, and sharing and communicating the knowledge to those who can act on it.

Incorporation of assessment results in national communications can increase awareness of vulnerability and adaptation issues among the audience of the communications and among the decision makers involved in their preparation and review. But more needs to be done if the assessments are to influence policy decisions. Communication of assessment results to politicians, government agency decision makers, program

and resource managers, and the public is needed to raise awareness of climate change, climate change risks, and the need and feasibility of taking action to reduce risks. Real progress on adaptation will require demonstrating links between climate change impacts and adaptation with development objectives. If this is done convincingly, then climate change adaptation can be mainstreamed by, for example, incorporating adaptation in national development plans and including assessment of climate risks in the environmental impact assessment process for project implementation. Regional cooperation to address trans-boundary issues related to climate change also needs to be promoted.

3.8 Integrating Adaptation into Development Policies

(Session 3B)
Chair: Ian Burton
Reporter: Monica Wehbe

To integrate adaptation into development policies, it is; (1) critical to create public awareness; (2) it is necessary to assess the structure of National Policy in order to systematically integrate climate change into appropriate development plans; (3) international funding agencies need to take a lead in providing a method for integrating climate risk into their infrastructure investments; (4) there is a need for a document in each country that summarizes climate vulnerability costs and opportunities for adaptation; (5) new actors need to be involved in adaptation issues under the new development paradigm: PARTICIPATORY and BOTTOM UP; (6) create or strengthen institutions that provide an interface between planners and CC experts.

3.9 Building Upon the AIACC Project

(Session 3C)
Chair: Walter Baethgen
Reporter: Neil Leary

Participants, sponsors and observers regard the AIACC project to be highly successful in achieving its objectives. Some of the achievements to date of the AIACC project are summarized at the end of this report from the breakout session. Strong support was voiced among the Buenos Aires workshop participants for building upon the AIACC project with a second phase of activities. The sense of the meeting was that the general orientation of a second phase should be similar to that of the current AIACC project, but giving greater emphasis to adaptation issues and moving forward to apply accumulated knowledge in pilot demonstrations of adaptation actions. The objectives identified by workshop participants as important for a second phase are to:

1. Sustain the AIACC network for regional and international cooperation to share information, share and transfer capacities, share data, coordinate training, develop databases of methods and best practices, and implement joint assessment activities;
2. Expand the AIACC network to include new countries and new institutions;
3. Enhance the capacity of newly participating countries and institutions through communicating lessons and methods from AIACC phase-I assessments, technical assistance, training, and scientist exchanges;
4. Advance scientific knowledge about climate change impacts, vulnerabilities and adaptation to fill critical gaps identified by the phase-I assessments, include new sectors and systems, and include new sub-national regions and countries;
5. Support national communications;
6. Deliver usable knowledge to those who can act on it and reduce climate risks; and
7. Partner with stakeholders, practitioners and decision makers to implement and evaluate pilot adaptation actions.

The multidisciplinary assessment teams that participated in the AIACC project have reached a stage at which they can now truly work in an interdisciplinary, integrated way. Working with stakeholders, they can apply these skills and build upon their first phase results to focus on adaptation decision-making needs.

These teams can also serve as valuable resources for extending capacity to new groups and countries that might be brought into a second phase of AIACC. These teams should be used to organize and deliver training, scientist exchanges, technical assistance and other capacity building activities in a second phase of AIACC. It is now feasible to base the capacity building activities of AIACC at centers of excellence within the Latin American and Caribbean regions.

The modality of AIACC is considered to be an important factor in its success. The modality is one in which substantial, centralized funding was granted for a global project that selected regional assessments based upon scientific merit review of proposals and that supported the selected regional assessments with extensive technical assistance, training, and networking functions. If possible, this same modality should be used for a second phase of AIACC.

If there is a new call for proposals, criteria for selection should include (i) scientific merit, including expectation that critical gaps in knowledge will be filled, (ii) relevance to national and regional policy priorities related to adaptation, including support of national communications, (iii) expectation that usable results will be produced, delivered to appropriate stakeholders, and that action will result, and (iv) strong capacity building benefits. Assessment teams that participated in the current AIACC project likely will have some advantage over other groups because of their prior experience and accumulated knowledge. However, efforts should be made to assure that new groups are included in new assessment activities. One possibility is to give preference to proposals from current assessment teams that include new partners (either new institutions or new countries) over proposals from current assessment teams that do not include new partners. This should be a preference, and not a requirement.

Within Latin America and the Caribbean, the Inter-American Institute for Global Change Research (IAI) and AIACC have similar objectives. Many of the participants in AIACC are also active in IAI. AIACC and IAI should work to find ways to complement each other's efforts. The science agenda of IAI is very broad, and covers all research related to global environmental change. In contrast, AIACC focuses on climate change impacts, adaptation and vulnerability and is more strongly oriented toward policy applications than is IAI. In addition, AIACC is designed to serve the needs of national communications to the UNFCCC. These differences define a niche for AIACC in the region that is a strong complement to IAI. It is recommended that AIACC and IAI explore ways in which AIACC might participate in the new Cooperative Research Network of IAI.

Efforts to secure funding for second phase activities might follow two lines. One is to seek large grants for a globally coordinated project that would have the same modality as AIACC. This project would consist of multiple regional assessments oriented as described above and coordination of technical assistance, training and networking to support the regional assessments. A second line is to develop proposals for pilot demonstrations of adaptation projects for submission to the Global Environment Facility under their Strategic Priority for Adaptation (SPA). These might be done jointly under an AIACC umbrella, or separately by individual AIACC regional assessment teams. To qualify for funding under the SPA, projects must have co-financing. The general sentiment at the workshop was to pursue both types of activities.

It is recommended that AIACC organize and participate in events at COP-10 in Buenos Aires, particularly events that focus on science and adaptation, so as to increase awareness of the project and its accomplishments. Increased awareness of the project among COP-10 attendees can be advantageous for securing future funding.

Summary of AIACC Achievements

The presentations made by the regional assessment teams at the Buenos Aires workshop indicate substantial progress in advancing scientific knowledge about climate change impacts, vulnerabilities and adaptation. Giving further evidence of success in achieving this objective are 15 scientific papers from AIACC regional assessments that have been published in peer-reviewed journals, even before the project has come to an end. Another 20 working papers have also been written, many of which are expected to be published in the coming year, and more papers will be written as the projects wrap-up their activities. The IPCC has selected 33 investigators from AIACC assessment teams to be authors of the IPCC's 4th Assessment Report, more than fulfilling the highest expectations for the project to increase developing country participation in the IPCC.

Each of the regional assessment teams has coordinated their activities with national committees, federal agencies and/or focal points who are responsible for their country's national communication to the UNFCCC. In several instances, AIACC assessment teams have been formally invited to participate in planning and to contribute information for 2nd national communications. AIACC is also contributing information to the UNFCCC Secretariat for their compendium of methods and tools for assessment of vulnerability and adaptation.

Training workshops, some centrally organized by the AIACC project office and others organized by some of the regional assessment teams, have trained more than 300 scientists and students in V&A assessment methods, climate change scenarios, and regional climate modeling. These workshops have extended the capacity building reach of AIACC beyond the original 24 regional assessment teams, for example including researchers from Cambodia, Laos PDR, Vietnam and Bhutan. Capacity building efforts have also included raising public awareness through stakeholder participation in workshops and publications for general audiences.

AIACC has developed an extensive global network of scientists, stakeholders and policymakers that shares

results from assessments about vulnerabilities and adaptation strategies, disseminates information about assessment methods, shares technical capacities, and provides training. Members of the network are predominantly in the south, but northern research centers are also represented. There are also networks within the global AIACC network, composed of regional assessment teams and the stakeholders and other partners with whom they have worked within their study areas. These networks can play a valuable role in bringing the best available science to bear in mainstreaming climate change adaptation.

Following are abstracts of the presentations that were made at the workshop. The full presentations are available from www.aiaccproject.org.

4.
Abstracts of Presentations

4.1 Climate Change Assessments and Capacity Building in Latin America and the Caribbean

4.1.1 The AIACC Project

Neil Leary, AIACC Science Director, and Alex de Sherbinin, CIESIN

The AIACC Project, a global enabling project of the GEF, was launched in 2001 by START, TWAS, UNEP and the IPCC. The objectives of the project are to (i) advance scientific understanding of climate change impacts, vulnerabilities and adaptation options in the developing world, (ii) build scientific and technical capacity to support National Communications to the UNFCCC and enhance participation of developing country experts in IPCC and other international science activities, and (iii) develop networks that link science and policy communities to support adaptation planning and action. The project consists of 24 regional assessments and centralized technical assistance, training and networking activities to support the regional assessments. The 24 regional assessments, chosen through peer-review for scientific merit and policy importance, are located in Africa, Asia, Central and South America, and island states in the Caribbean, Indian and Pacific Oceans. The six regional assessments of AIACC located in Latin America and the Caribbean are participating in the workshop in Buenos Aires and will present on their work.

The project has made significant progress toward its objectives. Fifteen scientific papers have been published in peer-reviewed journals, another 20 working papers are in review, and more papers will be written in the coming year. More than 300 scientists, students and stakeholders have participated in and benefited from AIACC training workshops. The IPCC has selected 33 investigators from AIACC regional assessments to be authors of the IPCC 4th Assessment Report. Each of the regional assessment teams is collaborating with the committees, agencies and focal points that are responsible for preparing national communications to the UNFCCC. They are also working with stakeholders to apply the knowledge that they are generating to identify and promote promising adaptation strategies.

Results, methods and lessons from the regional assessments are being documented and are being made accessible to others via the AIACC Data, Methods and Synthesis website (http://sedac.ciesin.columbia.edu/aiacc/). This information is being contributed to the UNFCCC's compendium of methods and tools for assessment of vulnerability and adaptation. Information about AIACC results, methods and lessons will also be disseminated in 2005 via two synthesis reports, one on vulnerability and another on adaptation, technical reports from each of the regional assessments, policy briefs, and participation of AIACC investigators in international and regional scientific and policy meetings.

4.1.2 Mainstreaming Climate Change Adaptation in the Caribbean – the MACC Project

Neville Trotz**,** Caribbean Community Secretariat.

The MACC project is a GEF funded regional project being implemented in twelve CARICOM countries in the Caribbean. Its main objective is to build further capacity in the Small Island Developing and low lying coastal States of the Caribbean for increasing their resilience to climate change risks through the identification and implementation of feasible adaptation options. The project builds on an earlier GEF project, the Caribbean Planning for Adaptation to Climate Change (CPACC) project and the CIDA funded Adaptation to Climate Change in the Caribbean (ACCC) project. Both of these latter projects had as their principal objective building capacity in the region for adaptation to climate change.

The MACC project is implemented by the World Bank and executed by the CARICOM Secretariat. The project is comprised five components:

1) Build capacity to assess vulnerability and risks associated with climate change.
2) Build capacity to reduce vulnerability to climate change (adaptation).
3) Build capacity to effectively access and utilize resources to reduce vulnerability to climate change
4) Public education and outreach.
5) Project Management

Activities under the project will include:

- Prediction of future regional climate through statistical and dynamic downscaling of global climate models
- Development of regional climate change scenarios
- Vulnerability assessments with specific focus on water, agriculture and tourism sectors
- Development of climate impact scenarios for the selected sectors
- Identifying feasible adaptation options for these sectors
- Devising strategies for the incorporation of climate change issues into national development planning
- Supporting regional efforts to develop a regional adaptation strategy and implementation plan.
- Implementation of the regional Public Education and Outreach strategy.

4.1.3 CapacityBuilding for Stage II Adaptation to Climate Change in Central America, Mexico and Cuba

Emilio Sempris**,** Director CATHALAC

Central America, Mexico and Cuba is serving as the pilot region for preparing adaptation strategies, policies and measures in the context of the UNFCCC. This multi-country effort, funded through the enabling activity window of the UNFCCC financial mechanism, will demonstrate how policy for adaptation can be integrated into national sustainable development in at least four human systems: water resources, agriculture, human health, and coastal zones. It builds upon the Stage I vulnerability and adaptation assessments of the Initial National Communications of the participating countries of the region, enabling them to move on to Stage III Adaptation following decision in Article 4.1 of the UNFCCC. The outputs of the full project will also contribute to the Second National Communications to the UNFCCC and will provide relevant information to the GEF regarding the modalities of adaptations projects to be financed.

The project strategy is based on the elaboration, application, and testing of an Adaptation Policy Framework (APF), in five stages (project scoping, assessment of current vulnerability, characterization of future conditions, development and prioritization of adaptation strategies, policies, and measures, and preparation for adaptation). The project is in its first year of execution; exposition units to address human systems have been identified through national consultations among stakeholders. Current vulnerability assessments are being finalized, and preparation to assess future vulnerabilities is in progress.

The eight countries will be better positioned to address their current and future vulnerability, and will have paved the way to integrate adaptation to climate change into sustainable development. It is anticipated that adaptation strategies will be oriented towards increasing the coping range for climate variability by incorporating climate risks into disaster management and preparedness, including forecasting and early warning systems. It is also envisioned that the existing national policies be reoriented so that they also include anticipatory measures and take advantage of adaptation technologies.

4.1.4 IPCC Fourth Assessment Report: Basis, Implementation and Potential Shortcomings

Osvaldo Canziani, Co-Chair IPCC

The IPCC Synthesis Report summarized the findings of the Third Assessment Report, in light of a set of questions the UNFCCC Parties presented through the Subsidiary Body for Scientific and Technological Advice (SBSTA). The questions covered a wide range of issues of interest for the negotiations on climate change, including vulnerabilities to and impacts from climate change, mitigation of greenhouse gases, and adaptation responses. The synthesis report highlighted a number of key uncertainties regarding the science of climate change that are detailed in the reports of the three IPCC Working Groups. Further, Members comments, and the IPCC's own conviction to better focus its assessments on matters of relevance to decision making, brought the Panel to initiate a Fourth Assessment Report (AR4).

The goals of the new assessment will include deeper analyses of a number of issues of interest to the UNFCCC and is founded on increasing interest in global environment issues and the urgency to better understand the causes, trends and effects of climate change and its implications on sustainable development. These issues to be assessed include, in particular, those relevant to Article 2 of the Convention, which concerns avoiding dangerous interference with the climate system, adaptation to climate change, sustainable development, food security, and ecological systems. The potential for, costs and benefits of, and equity implications of policies and measures to mitigate greenhouse gas emissions, including the Kyoto Protocol, will be examined. In the new assessment, the IPCC will seek to integrate analysis and consideration of other environmental issues with

its assessment of climate change, improve the degree of confidence in its conclusions and fill in badly needed information about regional implications of climate change. It should also satisfy the needs of other international conventions and agreements, particularly those stemming from the WSSD ´s WEHAB, MEA and HDP.

The implementation of AR4 aims to make use of all available bibliography, improve the socio-economic scenarios and regional climate models, and enhance the coordination between the working groups, particularly with regards to a number of identified cross-cutting themes. These have been chosen in light of

the pressing problems faced by decision makers, in their goal to better select possible sustainable development trajectories. These cross-cutting issues are: Uncertainty and Risk Management; Regional Integration; Science related to the UNFCCC Article 2 and Key Vulnerabilities; Water; Adaptation and Mitigation; Sustainable Development, and Technology. The implementation of AR4 shall ensure the high quality of IPCC products and safeguard the reputation of the Panel as an intergovernmental body that produces policy-relevant but not policy-prescriptive assessments.

The new assessment will face some potential obstacles, such as the lack of sufficient geophysical, biological, economic and social information; the need for further research, particularly in developing regions; lack of effective interactions with other scientific, technological and technical groups, leading to unnecessary efforts to implement integrated studies. A number of international efforts are underway that are helping to overcome these obstacles. The effective implementation of GCOS and complementary acquisition of the socio-economic information would contribute importantly to AR4. The AIACC Project is filling important gaps in regional information about the vulnerabilities and adaptation options in the developing world. This information is critically important for the success of AR4.

4.1.5 The Relevance of IHDP for Research on Global Change in Latin America & the Caribbean

Barbara Göbel, IHDP Secretariat

Abstract not available.

4.1.6 The Inter-American Institute for Global Change Research, Addressing the Challenge of Global Change in the Americas

Gustavo Necco, Inter-American Institute for Global Change Research (IAI)

The global environmental changes that the Earth is facing today impact the whole range of scales, from the smallest microorganisms, to the largest planetary processes such as the global biochemical cycles. Global environmental change (GEC) is one of the greatest challenges that humanity faces today.

There are many definitions of GEC and we will refer to the one adopted by the IAI, “Changes in the global environment (including alterations in the climate, land productivity, oceans or other water resources, atmospheric chemistry, and ecological systems) that may alter the capacity of the earth to sustain life.”

The IAI is an intergovernmental organization supported by 19 countries in the Americas dedicated to pursuing the principles of scientific excellence, international cooperation, and the open exchange of scientific information to increase the understanding of global change phenomena and their socio-economic implications and to augment the region’s overall scientific capacity. IAI’s mission is to develop the capacity to understand the integrated impact of present and future global changes on regional and continental environments in the Americas and to promote collaborative research and informed actions at all levels. To function as a regional entity and to conduct research that no one nation can undertake on its own, the IAI was conceived as a network of collaborating research institutions working together to implement the Institute’s Science Agenda.

After a short introduction to the issue and challenges of global environmental change, a brief description will be presented on the role, structure, activities and programs of IAI. Further information on IAI and its activities can be obtained at the web URL: www.iai.int

4.2 National Communiations to the United Nations Framework Convention on Climate Change

4.2.1 UNFCCC National Communications Process and Linkages with AIACC

Martha Perdomo, UNFCCC Secretariat

The progress made by non-Annex I (NAI) Parties in the implementation of the UNFCCC, in particular in the submission of their initial national communications, are highlighted in the presentation. Also highlighted are how the new guidelines for preparing these communications have evolved, the different funds available to finance adaptation and the relation between the process of preparing second national communications and the AIACC projects.

An important commitment of developing country parties is to prepare national communications, including programs and actions taken to implement the convention. 78% of NAI Parties (116 in total) have submitted their initial national communications (INC), while three of them have presented their second national communication.

After compiling and synthesizing the information contained in these INC, and after several reports by the Consultative Group of Experts (CGE) new guidelines have been adopted, giving more importance to adaptation options and measures, for the preparation of second national communications. The User Manual prepared by the secretariat will facilitate the use of the new guidelines.

So far, more than 77 NAI Parties have started the preparation of second national communications, using the new guidelines. Uruguay has submitted its second national communication using the guidelines.

Two funds have been established by the convention, the Least Developed Countries Fund for the preparation and implementation of NAPAs and the Special Climate Change Fund, that will fund, among others, the implementation of adaptation activities; monitoring of diseases; capacity building for preparedness and management of disasters; and the strengthening of regional centers for rapid response to extreme weather events. An Adaptation Fund was also established. The Global Environment Facitliy (GEF) has established a new Strategic Priority on Adaptation, "Piloting an Operational Approach to Adaptation," to fund pilot or demonstration adaptation projects.

Projects and programs funded by the GEF, such as the National Communication Support Program (NCSP), and by bilateral donors are in place to assist NAI Parties. Some of them, such as the US Country Studies Program (USCSP), that provided financial and technical support to many developing country parties, for the preparation of their INC have ceased.

The AIACC projects will be of assistance for the preparation of NAI Parties second national communications by introducing new approaches, methods and tools for the assessment and analysis of the best options for adaptation. A second phase of AIACC should reinforce the analysis and selection of suitable adaptation options, involving also those countries that did not participate in the previous phase.

4.2.2 The Second National Communication of Uruguay

Luis Santos, National Environment Directorate, Ministry of Housing, Territorial Regulation and Environment, Uruguay

Uruguay published its Second National Communication in May 2004. The communication was prepared using the new guidelines for non-annex 1 countries that were approved at COP8. The presented information was compiled from ten years of sustained work by the Climate Change Unit of the National Directorate of Environment of the Ministry of Housing, Territorial Regulation and Environment. Several activities, such as the creation of working groups by the Program of General Measures for Mitigation and Adaptation to Climate Change (PMEGEMA) were organized in the process of preparing for this presentation. Working groups of PMEGEMA held a consultation workshop that was attended by a wide-range of participants. This diversity of participates helped PMEGEMA to become a Major Ministerial Interest on November 26, 2003.

The Second National Communication of Uruguay reported the greenhouse gas inventory updated to 2000, measures to implement the Convention, and other information, including information from three regional assessments of the AIACC project that address issues of climate change vulnerability and adaptation in Uruguay (AIACC project nos. LA26, LA27 and LA32). Mitigation measures have been identified for agriculture, forestry, waste, energy and transportation. Also identified are adaptation measures for agriculture, biodiversity, coastal resources, water resources, fishery resources, and human health. Examples of sectoral adaptation measures include promotion of sustainable soil management; monitoring of ecosystem changes,

fisheries, beach profiles and disease vectors; promotion of integrated management for coastal zones and water resources; incorporate climate change considerations into water resource projects; and creation of a human health – climate change working group. Cross-sector adaptation measures include an education and outreach program for raising public awareness, improvement of capacity for development and transfer of ecologically rational technologies, and promotion of research and systematic observation.

The conclusion of the presentation included a proposal to create an organization that would have members of both public and private sectors working together in response to climate change. The hopeful result of the co-management would be to optimize the national and international resources available, while strengthening and maintaining existing national capacity.

4.2.3 Preparations for Argentina's Second National Communication

Carlos Scoppa, Vulnerability Coordinator for 2nd National Communication

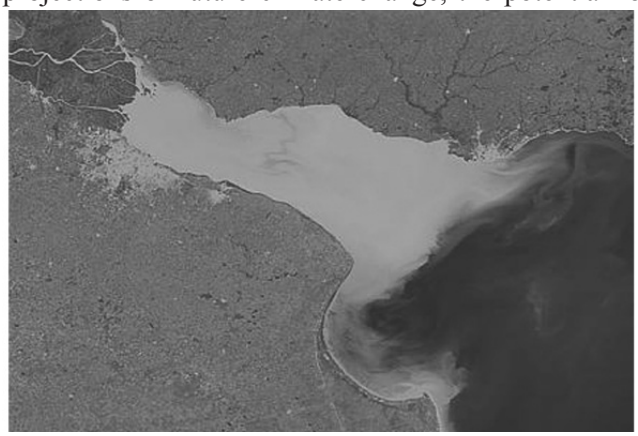
Argentina completed its initial National Communication in 1997. The initial communication included information about climate change vulnerability and adaptation in Argentina, but their treatment was very incomplete. The issues of vulnerability and adaptation will receive much more extensive treatment in the Second National Communication of Argentina. This will include information from vulnerability assessments for the coastal zone of Argentina, the Pampa Bonaerense, agricultural production in the Pampa Humeda, water resources in the Litoral-Mesopotamia, Patagonia, and energy systems and energy infrastructure.

The vulnerability studies will examine a number of key issues. The relative influences of climate change, climate variability (e.g. ENSO) and human actions acting on different systems will be assessed. Socio-economic impacts will be investigated for each of the targeted systems to provide information about the potential damages of climate change, quantified in social and economic terms, adaptive capacity, and costs of mitigation and adaptation. This information will be integrated to provide an overall assessment of regional and national climate change impacts for Argentina.

An Adaptation Policy Framework is being developed for preparation of adaptation strategies and policies. Within this framework, Argentina will identify adaptation strategies that are consistent with national policy interventions and Argentina's sustainable development goals. An output will be a portfolio of adaptation strategies that can be incorporated into a national adaptation program and regional adaptation plans.

In preparations for the national communication, Argentina is adding to its climate modeling efforts and capacities. These efforts will yield improved understanding of climate variability and change processes in the region and regional climate model simulations of future climate change for use in assessing potential impacts and adaptation strategies.

The AIACC assessments in Argentina will make important contributions to our second national communication. The AIACC assessments are providing new information about observed climate trends in the region, projections of future climate change, the potential for



increased storm surges in the Rio de la Plata and attendant flood risks due to climate change, particularly in the Buenos Aires metropolitan area, changes in the biological productivity of the Rio de la Plata, and potential impacts on crop and livestock production and on farmers' livelihoods in the Pampas. The assessments are also generating information about potential adaptation strategies that will be taken into account in the development of Argentina's national and regional adaptation plans.

4.3 Climate Variability, Changes and Scenarios

4.3.1 Climate risk spaces in Mexico and Argentina

Cecilia Conde, UNAM, Mexico, and Roberto Seiler and Marta Vinocur, Universidad Nacional de Rio Cuarto, Argentina
(AIACC Project No. LA29)

Climate risk spaces are used to define climatic conditions that pose risks, or opportunities, for selected crops. These can be compared with projected future

conditions for different climate change scenarios and used to evaluate whether the new conditions signify increases in future risks or opportunities. The method is applied to coffee production in Veracruz, Mexico, and to field crop production in Cordoba, Argentina. Risk spaces are defined in terms of temperature and precipitation anomalies. Information on the physiology of the plant is used to determine optimum and adverse growing conditions. In the case of coffee production, statistical regression techniques are used to estimate empirical relationships between coffee production and temperature, precipitation and socioeconomic variables. This information is used to define climate risk spaces, or those combinations of anomalous temperatures and precipitation that are associated with significant loss of production relative to the norm.

The risk spaces constructed for coffee in Veracruz and crops in Cordoba are presented graphically, superimposing them over observational data in scatter plots with temperature and precipitation anomalies on the vertical and horizontal axes. Scenarios of future climate change can also be plotted in this space. Climate change scenarios for the study sites are constructed from projections of ECHAM, Hadley and GFDL for A2 and B2 emission scenarios. MAGICC/SCENGEN is used to scale the coarse scale GCM outputs to a 1° x 1° grid scale. For Veracruz, statistical downscaling is also used. The estimated changes in future risks/opportunities for agriculture in Mexico and Argentina under these scenarios will be discussed in a presentation to be given in a later session of the workshop (see section 4.5 of this report for paper by the same authors).

4.3.2 Climate Change Scenarios and Uncertainties in the Caribbean

Anthony Chen, University of West Indies, Jamaica
(AIACC Project No. SIS06)

General problems with GCM scenario generation were reviewed, including inaccuracies in simulating observed climate, differing results across models, and spatial scale. HadCM3 appears to be one of the better models for the simulation of Caribbean climate. Scenario needs of the project are briefly discussed. Some downscaling results using MAGICC/SCENGEN and SDSM are discussed. HadCM3 model outputs and downscaled results using SDSM are compared to observations in Trinidad and Barbados for the baseline period 1961-1990 for mean maximum and minimum temperatures, maximum and minimum values, mean precipitation, maximum precipitation values, percentage of wet days and annual precipitation for the baseline period (1961-1990). Projections for 2020s, 2050s, and 2080s using the A2a and B2 Scenarios are also evaluated. Model outputs match well with observations for annual averages. However, model outputs deviate substantially for seasonal values.

The problems with downscaling are discussed. These include assumptions of stationary state and GCM skill. Local problems include the absence of quality data, available predictors not being the major drivers of climate, lack of resources to do ensembles, lack of adequate understanding of regional climate for reliable

prognosis and seasonal biases in SDSM. One important predictor for small islands that is not readily available is sea surface temperature. Attempts to fill in missing daily temperatures and precipitation data using monthly mean data are discussed. The methodology was reasonable for temperature but inadequate for rainfall. Lack of adequate understanding of regional climate adds significantly to the uncertainties in climate projections. Problems with learning and running SDSM are also mentioned. We conclude that, while GCMs can give good results in some instances, especially for temperature, statistical downscaling adds value to the GCM outputs for use in assessing impacts and vulnerability. There were seasonal biases in calibration, especially concerning precipitation. It is recommended that multiple GCMs be used so as to satisfactorily represent uncertainties about future changes in climate.

4.3.3 Observed Changes in Climatic Variables Relevant for Agricultural Production during 1930-2000 in the Pampas Region of Argentina, Brazil and Uruguay

Walter Baethgen, INIA, Uruguay, and IRI, USA
(AIACC Project No. LA27)

Historical monthly and daily climatic datasets from the study region were used to document the observed changes in monthly temperatures (maximum and minimum) and precipitation, as well as in the frost regime,

absolute maximum and absolute minimum temperatures. We used monthly datasets containing 59 sites for precipitation (31 from Argentina, 15 from Brazil and 14 from Uruguay), and 23 sites for maximum and minimum temperatures (7 from Argentina, 13 from Brazil and 3 from Uruguay). This data was analyzed to study the changes in the observed monthly precipitation and mean maximum and minimum temperatures occurring over the last century. Linear regression models were adjusted to study variables and a non-parametric statistical test (Kendall) was used to test the significance of the association between the study variables and time. When the Kendall test was significant, we used the regression coefficient to plot the spatial variability of the changes occurred in rainfall and temperatures in the last 70 years. The results showed evidence that changes in precipitation and in temperatures were most evident during the austral summer and spring months. In these seasons, precipitation throughout the region had usually increased, maximum temperature has usually decreased and minimum temperature has usually increased. Our results also show that changes in precipitation and in maximum temperature were more evident in the western region of the Pampas in Argentina, which coincides with previous published work.

Historical daily weather datasets were used to study the changes that occurred in the frost regimes during the last 70-90 years. Comparing the situation in 2000 with the early 20th century, we found that the date of the first frost is now later, the date of the last frost is earlier and consequently the period free of frost is now longer. In addition, there are fewer days with frosts and the mean temperature of the days with frosts is now higher. These changes are evident in Córdoba, Pergamino, Santa Rosa (Argentina), Estanzuela and Paysandú (Uruguay). The Brazilian sites are located in places with very few frosts and the changes are not significant. We also found significant changes in absolute and mean minimum temperatures (increases) as well as in absolute and mean maximum temperatures (decreases), especially in Argentina and Uruguay. The most consistent changes are observed in mean minimum temperatures: 8 out of 10 sites showed statistically significant increases.

These changes are crucial for agricultural production and to help us understand some of the changes that occurred in the last century, in crop and pasture productivity. The changes are also a key input for one of the methods we used in our study to develop scenarios of climate change, which consists of projecting these changes for the following 10-20 years ahead using a weather generator.

4.3.4 Scenarios of Climate Change Projected for the Pampas Region of Argentina, Brazil and Uruguay

Graciela O. Magrin, INTA, Argentina

In the southeastern part of South America (southern Brazil, Uruguay and the Argentina's Pampas region) future climatic scenarios were derived in two ways: a) based on changes observed during the 20th century, and b) based on projections from the HadCM3 global climate model.

Important changes in climatic variables were observed in the region between 1930-1960 and 1970-2000. The general pattern shows increases in precipitation, decreases in maximum temperature, mainly during the spring-summer months, and increases in minimum

temperature all through the year. These changes lead to increases in grain yields, in particular in summer rainfed crops (soybean and maize). Based on these changes, synthetic climatic series for the future scenarios were obtained using the LARS stochastic weather generator.

The scenario generated using the LARS stochastic weather generator was compared to projections from the Hadley Center model. The projected changes in climate were quite different between the two. For the LARS scenario, precipitation is projected to increase, in particular between October and March, reaching up to 60mm in the quarter October-December. The Hadley Center model projects slight increases (up to 10 mm) during January-March and decreases (up to 20 mm) in the April-June quarter. The Hadley Center model projects increases in both maximum and minimum temperatures, while the LARS scenario projects minimum temperature increases and maximum temperature decreases. Differences among sites and years were also found.

4.3.5 The South American Monsoon Systems in the Context of Climate Change

Carolina Vera, University of Buenos Aires, CONICET, Argentina

The Variability of American Monsoon Systems (VAMOS) Program, a component of the World Climate Research Program's (WCRP) project on Climate Variability and Predictability (CLIVAR), focuses on the complex issues raised by the need for better understanding, which enables us to make better predictions on the second largest monsoon system on Earth. VAMOS emphasizes the interplay between atmosphere, oceans and continental surfaces to improve understanding in the Americas on:

i) the monsoon systems in the context of the global climate system,
ii) the capacity for seasonal to biannual climate predictions, and
iii) Anthropogenic climate change impacts.

CLIVAR activities and future plans under VAMOS are organized as coordinated components, which focus on different geographical regions but complement each other in science scope. The North American Monsoon Experiment (NAME), and the Monsoon Experiment South America (MESA) are two internationally coordinated efforts that aim to improve the description, simulation and prediction of the American monsoon systems, their variability, and roles in the global water cycle. The VAMOS Ocean-Atmosphere-Land Studies (VOCALS) continues the investigations of the eastern Pacific, known as successful EPIC2001 studies, which elucidated key processes responsible for structure and evolution of the cold-tongue/ITCZ complex in the tropical Pacific Ocean.

The American Monsoon regions are a challenge for Earth system and climate models. For example, the Andes mountain range is a unique feature on Earth due to the fact that it is thousands of kilometers long and not very wide. The representation of the regional characteristics of the diurnal cycle as well as of the activity of very intense *mesoscale* convective systems is also a hard test for the global climate models. In that sense, VAMOS is making progress in the improvement of model components. This progress has been made through the organization of different activities and the collaboration with different modeling groups.

The construction of climate change scenarios based on the current capacity of climate model is essential for the assessments of vulnerability and adaptation in Latin America and the Caribbean that will in turn contribute to the second national communications. Despite their deficiencies in reproducing some key aspects of the regional climate, the climate model runs for present and future climates are the best tools for the construction of such scenarios. In that sense, VAMOS is willing to promote the strengthening in the collaboration with START related programs like the AIACC in making progress in the selection and application of methods and models for constructing climate change scenarios. The organization of workshops to integrate both communities to discuss those issues, as well as the promotion of the exchange among the different countries of regional climate runs, are some examples of joint activities that should be undertaken.

4.3.6 Future Flood Risk and Salinity Front Advancement for the Río De La Plata

Ángel N. Menéndez and Mariano Ré, University of Buenos Aires, and Martín Kind, National Institute for Water (INA), Argentina
(AIACC Project No. LA26)

Numerical models are implemented and exploited to assess future flood risk and salinity front advancement for the Río de la Plata (Argentina and Uruguay), a wide (50 to 200 km) and long (290 km) estuary with an essentially maritime hydrodynamic climate.

The methodology to build flood risk maps for a coastal area like the present one, taking into account the sea level rise, is based on a specially implemented two-dimensional hydrodynamic model (named *RPP-2D*) over a domain extended enough to adequately represent the generation of storm events from wind field data. The model is calibrated to account separately for the effects of the astronomic tidal wave, the storm surges, and the mean sea level. It is later validated by comparing the water level frequency distribution curves obtained from records and from the model, for the 1990-decade, considered as representative of the present time. Storm scenarios are built from a typical storm taken as a base. Their period of recurrence for present conditions is established by using a curve obtained from historical data for maximum water levels in a reference station, in this case Buenos Aires city. Those storms are used to force the model, obtaining then flood maps for present conditions. By assuming that the statistics of storms will be essentially preserved in the present century, and by increasing the mean sea level, flood maps are then obtained for medium and extreme scenarios in the 2030 and 2070 decades.

The methodology to assess the salinity front advancement, due to sea level rise, is based on a specially implemented three-dimensional hydrodynamic model (named *RPP-3D*) over a domain extended enough to include the whole saline wedge. Comparing its performance with the 2D model validates the *barotropic* mode of the model, while making a comparison with measured seasonally averaged isohalines distributions validates the *baroclinic* mode. The application of the model to a future scenario with a 1m mean sea level rise (maximum estimated for year 2100) shows only a minor displacement of the salinity front. For a very large increase of 4 m in the sea level rise (stabilized greenhouse emissions scenario) the displacement is about 50 km, which guarantees no influence on water quality for Buenos Aires Metropolitan Region water intakes.

4.3.7 Southern South American Climate Trends

Inés Camilloni and Moira Doyle,
University of Buenos Aires, Argentina
(AIACC Project No. LA26)

Available observational evidence indicates that southeastern South America is one of the regions in the world showing the largest positive rainfall trends during the last century. In Argentina, these changes started around the 1960s. In last 40 years annual precipitation increased from 10% to 40% in different sub-regions, even in the humid regions of the country. Likewise, there is also evidence of an increase in the frequency of heavy rainfall. In many cases, the increase in heavy rainfall is associated with Mesoscale Convective Systems (MCS). This is important due to the potential capacity of destruction from severe floods. In particular, southeastern South America constitutes a region with a very high frequency of MCSs.

Most of the tributaries of the La Plata River show positive discharge trends in accordance with the observed rainfall trends. Even more, river discharge trends are amplified when compared to rainfall trends. Although this feature can be partially attributed to land surface changes, it has been shown that these changes also take place between subsequent years with little or no land surface change and is an intrinsic feature of the La Plata basin. Thus, the amplification of the hydrological response to positive regional rainfall trends increases the vulnerability to floods in the basin.

Other observational evidence of regional changes is related to the increase in the frequency of devastating floods. For example, 12 of the 16 most extreme discharge events of the 20th century of the Paraná River, the most important of the La Plata tributaries, at the Corrientes gauging station (Argentina), occurred during the last three decades.

Regional mean temperature trends in subtropical Argentina are small when considering extreme temperatures: minimum temperatures show a positive trend and maximum temperatures show a negative one. Towards the south, in the Patagonia region, the trends in the mean temperature become larger.

It is still under scientific study whether the observed changes are induced by anthropogenic emissions of greenhouse gases or due to low-frequency climate variability. Whatever the cause, the great climate change observed in Argentina in the last 40 years with increasing frequency of catastrophic floods constitutes an interesting "laboratory" to assess vulnerability and social and institutional responses to climate change in a developing country.

4.3.8 Climate Change Scenarios for Southeastern South America

Mario Bidegain, Universidad de la Republica,
Uruguay, and Inés Camilloni,
University of Buenos Aires, Argentina
(AIACC Project Nos. LA26 and LA32)

Results from climate change scenarios in the region of southeastern South America defined by the latitudes 20°S to 47°S and the longitudes 45W° to 67°W are described. Differences between the observed climate and the climate simulations with six available General Circulation Model (GCMs) runs from a previous experiment are evaluated.

The models have common errors in reproducing the precipitation over southeastern South America. They underestimate the precipitation over eastern Argentina, Uruguay and southern Brazil, simulating a precipitation field that in mean is about 50% of the observed one. The best simulation field in precipitation comes from the Hadley Centre Model Version 3, which in the area simulates an annual rainfall only 75% of the observed. Another common feature of the models is that they overestimate precipitation in northwestern Argentina and southern Bolivia. The fact that four models have the same error pattern indicates that one or more processes leading to precipitation is not well represented.

Future changes in mean temperature and precipitation over the region were assessed in this study based upon two recent GCMs: HADCM3 from Hadley Cen-

tre (U.K.) and ECHAM4 from Max Planck Institute (Germany). The models were run with the IPCC A2 and B2 SRES socioeconomic scenarios. Using the original spatial resolution of both models: HadCM3 had a horizontal resolution of 2.5° of latitude by 3.75° of longitude. The model ECHAM4 had a horizontal resolution of 2.8° of latitude by 2.8° of longitude.

Annual temperature across the region may rise by 2020s by +0.5 to 1.5°C and 1.5°C to 3.0°C by the 2050s according to HADCM3 model, and +0.5 to 1.5°C by 2020s and 0.5°C to 2.0°C by 2050s according to ECHAM4 for the high emissions scenario (A2). For the low emissions scenario (B2) there may be a rise of +0.5 to 1.2°C by 2020s and 1.3°C to 2.5°C by the 2050s according to HADCM3 model, and +0.4 to 1.0°C by 2020s and 0.4°C to 2.0°C by 2050s according to ECHAM4.

Projected changes in annual precipitation across the region vary between –0.1 to 0.2 mm/day by 2020s and +0.1 to 0.2 mm/day by the 2050s for the HADCM3 model, and 0.0 to 0.2 mm/day by 2020s and 0.0 to 0.6 mm/day by 2050s for the ECHAM4 model runs using the high emissions scenario (A2). In the case of the low emissions scenario (B2) the variations may be between 0.0 to 0.1 mm/day and 0.0 to 0.3 mm/day by the 2050s according to HADCM3 model and 0.0 to 0.2 mm/day by 2020s and 0.0 to 0.5 mm/day by 2050s according to ECHAM4.

4.4 Scenarios of Socioeconomic Changes

4.4.1 Vulnerability and Adaptation to Dengue Fever in Jamaica: A Socioeconomic Scenario

Charmaine Heslop-Thomas and Wilma Bailey, University of the West Indies, Jamaica
(AIACC Project No. SIS06)

Our research on the vulnerability of communities in Jamaica to dengue fever initially seeks to identify factors that contribute to current vulnerability and capacity to adapt. Results from this research will be used to develop scenarios of future socioeconomic conditions that are relevant for projecting future vulnerability to dengue.

We focus on three communities in the parish of St. James. One community was found within the boundary of the capital city of Montego Bay and the others at increasing distance from the city. We adopt a mixed methodology that includes expert interviews and a questionnaire survey backed up by secondary data to assess the capacity of the communities to respond to any crisis as well as its capacity to respond to the challenges posed by outbreaks of dengue fever.

The results of the study reveal that Jamaica's inability to achieve any real economic growth since the 1970s has affected its ability to respond to crisises, including a dengue epidemic. Interviews with experts from the Ministry of Health (MOH) revealed that resource problems limit the ability of the MOH to respond adequately to present conditions regarding dengue. Routine vector surveillance and control programmes have ceased and public education programmes are also victims of financial constraint. There is no long term planning to meet the possibility of increased dengue transmission that could accompany climate change. The expressed view was that communities must be prepared to take responsibility for mosquito control. This raises the question as to whether marginalized communities, in particular, have the resources to structure and facilitate adaptation.

One of the consequences of the increasing impoverishment of the country is that more people are being put at risk. Processes and factors that interact at different levels – individual, family and community, affect vulnerability. Research appears to suggest that, in tropical endemic countries, transmission intensity is affected primarily by herd immunity. On the basis of immune status, most of the respondents in the three communities are vulnerable. However, certain factors can modify vulnerability. These are the individual and contextual circumstances that have been the subject of investigation in the three communities – poverty, coping mechanisms, water storage, level of protection against the vector, crowding and community interaction. Using vulnerability ranking, the preliminary analysis reveals that the rural community was at greatest risk. Households were grouped into three classes of vulnerability – highly vulnerable, vulnerable and not vulnerable. Households headed by unskilled women working for below minimum wages were among the most vulnerable. Historic and future trends in vulnerability indicators will be examined.

4.4.2 Socioeconomic and Climate Scenarios for Central America

Jaime Echeverría, CRRH, Costa Rica
(AIACC Project No. LA06)

Forty different scenarios of future socioeconomic conditions, and their corresponding emissions of greenhouse gases, are presented in the IPCC's Special Report on Emissions Scenarios (SRES). These SRES scenarios are the basis for climate change projections that are assessed in the IPCC's Third Assessment Report. We make recommendations on

which socioeconomic scenarios to use in to assess climate change vulnerabilities in Central America. The recommendations are based upon review of the assumptions and characteristics of the SRES scenarios and consideration of the Central American situation.

In first instance the methodology used in the elaboration of the scenarios was revised, this is described in order to let the reader understand like these work. Then an analysis of the situation of the countries of Central America in terms of the population's growth and the economy is carried out, using added and available information.

The scenarios of IPCC are grouped in 4 big families, each one based upon a common "narrative history". Each history describes different visions of how the future will evolve, in very general terms, with respect to population, economic growth, regional versus global orientation of development, and environmental policies. One family of scenarios, the A1, is subdivided into three groups that vary in their assumptions about energy technologies and the degree of future dependence on fossil fuels. Each family includes a varied number of scenarios that have been derived by different economic and energy system models. Some of these are "harmonized", that is to say that they share some assumptions about the forces that drive them. In each family there is also an illustrative marker scenario that is considered to best reflect the narrative history of the family.

Considering conditions in the region, it is not likely that there would be large reductions in the rate of population growth, nor is it likely that there would be an accelerated and sustained rate of long-term economic growth. After review of the different scenario families, and recognition that economic growth within Central America is highly varied, it is recommended to use marker scenarios from at least two families. In selecting among the different families of scenarios (A1, B1, A2 and B2), it is considered that the A1 and B1 scenarios are very optimistic in terms of rapid convergence of incomes in the lower income countries toward income levels of the higher income countries. It is recommended to use the A2 and B2 scenarios, as these allow greater divergences among countries and preserve their local identity.

4.5 Climate Change Impacts and Vulnerability

4.5.1 Expected Impacts of Climate Change on Crop Yields in the Pampas Region of Argentina, Brazil and Uruguay

Maria I. Travasso, INTA, Argentina
(AIACC Project No. LA27)

Climate change impacts on crop yields were assessed in seven sites of Argentina, Brazil and Uruguay by means of crop simulation models included in DSSAT. As climatic inputs we used observed data, corresponding to the periods 1931-1960 and 1971-2000, and the future scenarios obtained from LARS weather generator (extrapolating past changes into the future) and projections from the Hadley Center GCM version 3 (HadCM3). Crop model runs were done under rain-fed and potential (water and nutrients non limiting) conditions for maize, soybean and wheat.

The model simulated yield reductions under potential conditions can be explained by the shortening of the growing season because of temperature increases, while simulated yield changes for rain-fed conditions were associated primarily with precipitation variations.

Comparing results obtained under futures scenarios with those from the period 1970-2000, higher rain-fed yields were obtained with LARS for summer crops. This behavior is attributed to the increase in spring-summer rainfall projected by this scenario. Potential yields mostly decreased or slightly increased with the two scenarios because of higher temperatures. However, when the effects of elevated CO_2 on plant functions is included, a generalized increase in yields is evident in the simulations.

4.5.2 Modeling Fusarium Head Blight in Wheat under Climate Change Using Linked Process-Based Models

J. Maurício Fernandes, EMBRAPA, Brazil
(AIACC Project No. LA27)

Fusarium Head Blight (FHB) (*Triticum aestivum* L.), also called wheat scab, is an important disease throughout much of the world's wheat-growing areas. Several *Fusarium* species can cause head blight, although *Gibberella zeae* Schwain (Petch.) (anamorph *Fusarium graminearum* Schwabe) is the predominant pathogen in most of the regions. Contamination of wheat with the Mycotoxin Desoxinivalenol (DON) at levels exceeding the permitted levels results in rejection of sale or severe price dockage by millers and other grain buyers

in some countries that have adopted DON regulations.

FHB is best known as a disease of flowering, being that the anthers are reported as the primary infection site where spores of fungus may land and grow into kernels, glumes, or other head parts. The dependence on weather and the relative narrow window of vulnerability to infection by the fungus makes the pathosystem suitable for mathematical modeling. The aim of this work was to develop and calibrate a FHB simulation model for the conditions of the wheat-growing areas in South America taking into account host, pathogen, and environment interaction.

The Ceres-Cropsim wheat model present in DSSAT 4.0 was used here to simulate growth and development of spring wheat under historical and scenario weather data and soil properties at Passo Fundo (Brazil), La Estanzuela (Uruguay) and Pergamino (Argentina). The wheat model operates on a daily time step and includes growth, phenology, and water balance and nitrogen routines. The Fusarium Head Blight model follows the principles of system analysis. Simulation is started by the time that the first group of heads fully emerges in the field. This

was passed from the Ceres-Cropsim wheat model. The coupling of both heading and flowering models results in the daily proportion of exposed anthers in the field. Inoculum is assumed to be present. Infections take place during an infective event, which is defined by means of a combination of daily records of rainfall in a two-day window. Infection rate is a function of the mean temperature. The disease index is influenced by weather variables such as: the daily mean temperature, daily solar radiation, precipitation, and consecutive rainy days.

Interactions historically were investigated using nine planting dates for each year and from historical weather records (1956 to 2000, Passo Fundo, 1931 to 1999, La estanzuela and Pergamino). Climate change scenarios were originated from the LA27 working group. These scenarios were used to modify the daily climate record from Passo Fundo, La Estanzuela and Pergamino.

The results showed that *Fusarium* head blight incidence was greater in Passo Fundo than in the other locations. There was a trend that FHB was more frequent in the period of 1970 to 1999 than in the pervious period. In addition, FHB incidence was greater under the climate change scenario than the historical weather comparison. The highest incidence of FHB is probably due to the presence of more rainy days during September-November period in the climate change scenario. If , this would have a tremendous impact on wheat production and food safety for this part of the world.

4.5.3 Integrated Assessment of Social Vulnerability and Adaptation to Climate Variability and Change Among Farmers in Mexico and Argentina

Cecilia Conde, UNAM, Mexico, and Roberto Seiler and Marta Vinocur, Universidad de Rio Cuarto, Argentina

(AIACC Project No. LA29)

We present the possible impacts in agriculture production in the central region of Veracruz (Mexico) and in the southern – central region of Cordoba (Argentina). By means of climatic "risk spaces" we detect which conditions might lead to important decreases or increases in crop production (Cordoba) or in coffee production (Veracruz) in the past and possible impacts in the future, using climate change scenarios.

Surveys, focus groups and interviews with producers were used to detect the climatic events that severely affected the agricultural activities in the regions under study. For coffee, temperature and precipitation requirements indicate that increases in precipitation in the past have caused negative impacts in the flowering stage during spring. Coffee producers say that the "flower becomes leaves", indicating that the plant losses their flowers and that, even if leaves develop correctly, coffee production will be lost. Higher temperatures in the summer affect maturity during summer. In winter, frosts can cause important damages or even complete losses. These conditions modify the "risk spaces" we constructed (see our previous presentation) for current climatic conditions.

For crop production in Cordoba, seasonal risk spaces are constructed. We observed that corn production in Laboulaye could be high even in extreme combinations of positive precipitation and positive temperature anom-

alies. Decreases in yields where found when temperature anomalies were positive and precipitation anomalies were negative with respect to normal conditions.

Under climate change, the increase in summer temperature will affect severely coffee production in the central region of Veracruz. This result is obtained from the analysis of the temperature and precipitation requirements of coffee, and also by means of a linear multiple regression equation constructed using climatic variables and socioeconomic variables. The results indicate that the decrease of coffee production might exceed in more than -35% the current production.

For the Cordoba region, climate change conditions for summer were used to detect changes in drought risk. The projected risk decreases for the Echam4 scenario for 2020, A2 SRES, particularly in the central region of Cordoba.

4.5.4 Climate Change Scenarios and Impacts on the Biomes of South America

Carlos Nobre, CPTEC/INPE, Brazil

Natural ecosystems are particularly vulnerable to projected climatic changes that might occur on time scales from few decades to a century as a result of global warming or land use changes. A large portion of plant and animal species could not adapt to abrupt climate change and would be in risk of extinction. We developed a biome model that describes the main biome types as a function of 5 climate parameters (degree-days above freezing, degree-days above 5 C, mean temperature of the coldest month, aridity index (actual evapotranspiration/potential evapotranspiration), and a novel parameter in comparison to similar models in the literature, a soil water seasonality index. This parameter is instrumental in separating out tropical forest from tropical savannas in South America and Africa.

This model describes quite well the global distribution of biomes and predicts correctly the biome type for 62% of the vegetated surface divided in grid-cells of 200 km x 200 km. That level of agreement makes this biome model as one of the best available of such class of models.

To simulate the potential biome changes up to 2100, future climate projections from 5 Global Climate Models available at IPCC (Canadian, American (GFDL), British, Australian, and Japanese models) for the decade 2091-2100 were used as input to the biome model for South America. Two sets of projections were used, one for the high emissions scenarios (A2) and another one for a lower emissions scenarios (B2). The main results can be summarized as follows: (i) in general, there are much larger differences in results when comparing different models and lesser differences in comparing different emissions scenarios for the same model, (ii) a tendency for a slight southward migration of the Atlantic Forest as temperatures in Southern Brazil, Uruguay and Argentina warms up enough to sustain a subtropical forest, (iii) 4 out of the 5 models indicate a pronounced tendency for 'savannization' of portions of Amazonia due to lengthening of the dry season, and (iv) 4 of 5 models showed a tendency for drier vegetation in the semi-arid Northeast Brazil.

These projections of biome changes do not take into consideration land use change and other disturbances such as fire. In particular for the tropical forests of Amazonia, global warming, deforestation, forest fragmentation and fire can act in synergy to cause a pronounced 'savannization' of the region. That would reduce basin-wide precipitation, result in a pulse of carbon dioxide emissions and, most important, induce a catastrophic decline in species diversity.

4.5.5 Vulnerability of Water Resources and Trophic State of the Santa Lucía River Lower Basin and Estuary to Climate Variability and Change

Mario Caffera, Mario Bidegain, F Blixen, CH López, JJ Lagomarsino, Gustavo Nagy and K Sans Universidad de la Republic, Uruguay
(AIACC Project No. LA32)

This paper describes findings on the vulnerability of water resources in the Santa Lucía river basin (SLRB) to Climate Variability and Change. The SRLB covers an area of 13,681 km^2 in southern Uruguay and is intensively agricultural. It is host to 20,000 ha of wetlands rich in biodiversity and supplies drinking water for 60% of the nation's population. Continental aquatic systems like SLRB are links between atmosphere, pedosphere, biosphere and coastal ocean. We need to understand dynamic responses of these systems, which worldwide are showing syndromes of global change (e.g. river flow changes and eutrophication) and their response to projected scenarios. Lack of information and knowledge about some relevant processes makes it difficult to build vulnerability scenarios. That is why we focus on building scientific capacity to understand basic processes and facts.

For the last 3 to 5 decades the SLRB has been subjected to increasing agricultural intensification, temperature rise of 1º C, 20% increase in average precipitation and seasonal changes, sea level rise (≤10 cm), and

increased ENSO-related variability. Most rates show acceleration since the early 1980s. Droughts, floods and storm surges are affecting settlements, soil erosion, runoff, ecosystems and the trophic state. The trophic state is highly sensitive to an increase in agriculture intensification, precipitations, runoff and soil erosion.

Monthly river heights are consistent with both cold and warm phases of ENSO during the spring (O-N-D), and are in especially good agreement during La Niña events. This is a new finding, since previous research in Uruguay found significant link with ENSO phases only in northern basins. An increase in magnitude of major discharge events is observed in the last 25 years, by means of daily height series. This fact is consistent with the precipitation trends and implies an issue for land use and human settlements. We analyzed the vapour flux regime in lower levels of the atmosphere for events of heavy showers and resulting floods. Primary results suggest that water vapour flux could be adverted from the near ocean region, more commonly than in northern watersheds.

During summer time (D-J-F) and La Niña events, decreases in precipitation and increases in temperature and evaporation impact agriculture and drinking water supply. Accelerated rates of change suggest that these sectors will be heavily impacted in the near future. Losses of coastal land and biodiversity (e.g. estuarine wetlands and birds), damage to infrastructure and blocking of the runoff resulting from sea-level rise could occur in low-lying areas and could increase the risks of floods.

4.5.6 Vulnerability of the northern coast of the Rio de la Plata in the vicinity of Montivedeo

Roberto Kokot, E.A. Forbes, M.J. Dabezies, Gustavo Nagy, Alvaro Ponce, V. Pshennikov and R. Silva
Universidad de la Republic, Uruguay
(AIACC Project No. LA32)

The aim of our research was to build capacity to develop quantitative assessments of coastal vulnerability of the Uruguayn coast of the Rio de la Plata, a microtidal (≤ 0.5 m), river-dominated and wind-controlled large estuarine system. We selected a small area with 80 km of coastline located at the western boundary of Montevideo (35ºS, 56º 10 – 40' W). This section was defined by several environmental and climate change assessments (i.e. National Communications) as one of the most vulnerable of the country. This coast is unique and diverse because it is subject to fluvial, estuarine and coastal marine forcings (tides, storm surges, fluvial discharges, drif currents and changes in salinity). Sand beaches are the prevailing landforms, followed by rocky shores, wetlands, cliffs and sand dunes. Sea level rise (SLR) over the past 100 years was 9.3 cm, below both world average (15 cm) and Buenos Aires SLR (17 cm). Some low lying areas (-0.5 m) very rich in biodiversity are highly vulnerable to moderate sea level rise (≤ 0.5 m) and storm surges. Of particular concern is the continuum wetland – low lying beaches (Playa Penino) located on the right margin and mouth of the Santa Lucia river estuary, which is the habitat for 50% of country's birds species. People are also affected by southern winds and storm surges and are vulnerable to sea level rise, although they are not subject to hazards risks under current conditions.

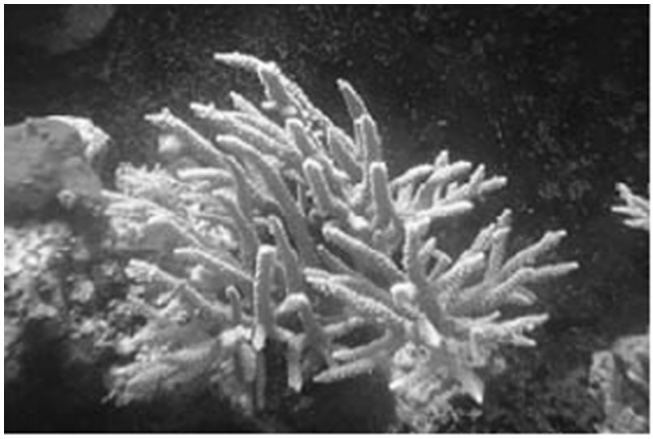
We assessed vulnerability by using a quantitative index (Gornitz Index) which is built by equally weighting seven variables (indicators) of coastal morphology: relief (height), geological setting, geomorphological setting, SLR trend, coastal retreat, tidal amplitude and wave energy. These indicators were estimated and ranked from 1 to 5 for 24 boxes. Because the value of a few of them were too close to limits, we performed three calculations: (1) maximum, (2) most probable, and (3) minimum. Thus, vulnerability of each box is classified as low, moderate and high for three scenarios. Maps were constructed for homogeneous areas. Results confirm previous qualitative assessments: vulnerability is high in low-lying areas of great environmental importance and in a few beaches and cliff areas. The percentage of highly vulnerable boxes is 42, 33 and 0% for scenarios 1, 2 and 3 respectively. Current vulnerability is close to scenario 2, whereas scenario 1 can be considered a plausible combination of indicators for the next 30 – 50 years.

4.5.7 Climate Variability Impacts on Dengue and Vulnerability in the Caribbean

Dharmaratne Amarakoon, Roxann Stennett, Anthony Chen, University of West Indies, Jamaica, and Samuel C. Rawlins and David Chadee, Ministry of Health, Trinidad and Tobago
(AIACC Project No. SIS06)

The occurrence of dengue fever in relation to climate variability in the Caribbean was studied for the period 1980-2002. All of the Caribbean Epidemiology Centre Member Countries (CMCs) that showed prevalence of the disease were included in the study. An attempt was made to supplement the results of climate associations with results from case studies on propagation of vector indices and to identify communities that may be potentially vulnerable.

Results show that the incidences of dengue were higher in the last decade compared to that in the previous decade. The annual patterns of reported cases were nearly periodic and compared closely with periodicity of ENSO events. El Niño and El Niño + 1 (year after El Niño) years seemed more appropriate for dengue outbreaks. A comparison of the annual pattern of variation of the dengue cases with the variations of the precipitation and temperature signaled that warmer temperatures and less abundance in rainfall appear to be influencing the epidemics. Correlation between reported dengue cases and temperature was stronger and more significant than that for precipitation on the annual scale. This was more pronounced in El Nino years and in countries where there had been more frequent outbreaks such as Trinidad, Tobago, and Barbados.



Study of monthly/four-week variability of reported cases indicated a well-defined seasonality in the epidemics. The epidemics appeared to have occurred in the latter half of the year, which corresponds to the receding phase of the wet season in the Caribbean. Populations appear to be at greater risk of dengue transmission immediately after the wet season. A comparison of monthly/four-week patterns of the reported cases with those of temperature and precipitation showed that warming occurs first, then precipitation, and then the epidemic with well correlated lag between the epidemic and the climate parameters. The correlation, however, appeared to be more sensitive to precipitation lag. The observed sensitivity to precipitation may be due to the fact that in any given year there is a greater variability in the precipitation (daily, monthly and seasonally) than that of temperature.

Results obtained in this study on the seasonality, lag and the degree of association of dengue with temperature and precipitation along with future climate predictions might be used to develop early warning systems that can lead to effective programs in public awareness and education on vulnerability, better environmental management and the design of suitable adaptation strategies.

4.5.8 Vulnerability of the Caribbean to Climate Change, The Coastal Zone of Belize

Carlos Fuller, National Meteorological Service, Belize

In 1995 Belize undertook vulnerability assessments in agriculture, the coastal zone and water resources under the US Country Studies Program. The outputs of four global circulation models (GFDL, CCC, UKMO and GISS) were used to simulate a future climate. They predicted an increase of temperature of 2ºC in 75 years under a doubled CO_2 concentration but no definite rainfall signal. The resolution of the climate models were too coarse to satisfactorily resolve the climate of the region then and they are still too coarse. For the purposes of the study, climatologists in the region decided to use a 1 to 2 degree rise in temperature and 10 to 20 per cent change in rainfall. The also assumed a rise in sea level of 4, 30 and 50 cm in 25, 50 and 100 years.

The coastal zone of Belize is the most important socio-economic region of the country. Among the activities undertaken in this region are tourism, farming, fishing, manufacturing and mining. Almost one half of the population lives within the coastal zone in six of the country's ten cities and towns. Among the impacts already noted in the region are two episodes of coral bleaching during the 1990s. Salt-water intrusion has affected the water supply of two of these communities and desalination plants have been installed to meet the demand.

Studies of impacts on yields of beans corn and rice were conducted using the DDSAT crop simulation model. Yield decreases of 10 to 20% were simulated by the model for the scenarios analyzed. Studies on the impact of sea level rise on the coastal zone were undertaken using the AVVA methodology. No impact was noted within 25 years. However, 50 to

100% of the beaches would be inundated within 100 years from a 50 cm rise in mean sea level.

Impact studies should be undertaken for the more economically important crops such as bananas, citrus and sugar. These should be comprehensive studies that also include the effects of salt-water intrusion. Impacts on aquaculture, fishing, and tourism should also be undertaken. In addition, forestry is also demonstrating climatic stress. Impact studies should be undertaken in this area and also on land and marine ecosystems.

4.5.9 Sea Level Rise and Coastal De La Plata River

Jorge Osvaldo Codignotto, CONICET, University of Buenos Aires, Argentina
(AIACC Project No. LA26)

My work examines the vulnerability of the Paraná River and the Samborombón bay from a rise in mean sea level in the delta. For the delta zone, the reconstruction of the position of the coastline was analyzed from 7500 years ago to the present. This reconstruction is necessary since the involved morphology is of very low topography and therefore it is likely to be invaded partially by the sea. The delta is located at the interior of an estuary, whose scarce width protects its front from the erosive phenomenon of the sea level rise. However, in spite of this protection, the delta would disappear quickly with the increment of the sea level.

A great amount of cartographic information was analyzed, resulting in 54 maps in total for the period from 1731 to 2002. We concluded that during the analyzed period, the Paraná delta advance, on the estuary of the La Plata River, was of approximately 30 km. The rate of advance decelerated up until 1950, after which the rate of advance accelerated (see table).

Years	Total advance of delta	Avg. Annual rate of advance
1750-1800	9 km	180 m
1800-1850	5 km	100 m
1850-1900	5 km	100 m
1900-1950	3 km	60 m
1950-2002	4.5 km	90 m

On the other hand, in Samborombón bay, the Holocene coastal landforms have developed over an erosion platform on Pleistocene deposits. During the last Pleistocene, transgression seawaters covered the northeastern region of Buenos Aires province. After a regression (decrease in sea level) another transgression took place and established a barrier island about 6890 ^{14}C yrs BP between P. Piedras and Conesa city. This geoform is 5 m high over the actual sea level. The rest of the area (hundred of square kilometers) has a topographical position of 2 m to 0.70 m over the actual sea level. For these reasons, we concluded that the area of the Samborombón bay is extremely vulnerable to the sea level rise according to the scenarios of the IPCC.

4.5.10 Return Periods of Floods over the Coastal Lands of the Rio de la Plata.

Roberto Kokot, Angel Menendez, Enrique D'Onofrio, Vicente Barros and Monica Fiore, University of Buenos Aires, Argentina
(AIACC Project No. LA26)

The coastal area of Río de la Plata is periodically flooded by meteorological tides denominated "sudestadas." The mean water level of the Río de la Plata responds to tides, storm surges and wind waves. The most dramatic change in the mean water level is the storm surge, characterized by a rise in the water level in addition to the normal tidal variations. The periods of recurrence for floods were obtained from historical data determined from tide gauges in Buenos Aires.

The objective was the construction of hazard maps in the coastal area for surges, according to periods of recurrence of 1, 5, 10, 20, 50 and 100 years and to compare them with geomorphologic maps previously arranged. The area includes the Samborombón Bay and the coastal area between Punta Piedras and San Fernando, with contains highly populated urban centers.

The behavior of the Río de la Plata water lever was developed through hydrodynamic models that were validated successfully under wind and astronomical forcing. Topographic maps of the coastal area and its zone of influence were made using 1:50.000 IGM maps, radar images and topographical surveys with differential GPS.

Topographic measurements were carried out to produce detailed altitude level maps of coastal areas subject to possible floods. Information obtained from satellite analysis let us monitor the wetlands and all the other geomorphology units at Bahía Samborombón coastline. This task let us identify the coastline and the inter-phase area over an extensive marsh zone of difficult access.

The Bay Samborombón is a low relief coast with towns at low altitude that include General Lavalle and San Clemente del Tuyú. Regarding the altimetry, two areas can be recognized, the highest north area and the south area with scarce relief regarding the mean sea level. The

low areas will facilitate the direct flood even before the increase of the sea level. On the other hand, in the high areas the effect will be recognized by an increment in the rate of erosion, causing the setback of coastline. In the case of General Lavalle town, where the urban area is surrounded by tidal marshes, it is periodically flooded.

The point is that marine transgression would be caused by sea level rise promoting flooding and marine water advance through natural or artificial drainage. Also, the sea level rise would promote quick erosion with its consequent coastline backward, depending on geologic characteristics of the area.

4.5.11 Case Studies of Social and Institutional Vulnerability: La Boca Neighborhood and Avellaneda Municipality

Claudia E. Natenzon, Natalia Marlenko, Silvia G. González, Diego Ríos, Elvira Gentile, Julieta Barrenechea, Sebastián Ludueña and María Cecilia Boudín, University of Buenos Aires, Argentina
(AIACC Project No. LA26)

In our analysis we consider Social Vulnerability (SV) as one of the four dimensions of environmental risk. Other dimensions are hazard, exposure and uncertainty. SV is defined by social, economical, cultural and institutional conditions of a society, prior to a disaster event, that puts the society in conditions to suffer from damages of different kinds: economical, physiological, health, etc. SV will determine the levels of difficulties and capacities of each social group to recover by itself after the stress and the impacts. The analyzed case studies of La Boca Neighborhood and Avellaneda Municipality let us know some qualitative aspects of the SV: institutional, political and cultural.

Both neighborhoods face flood hazards from "*sudestadas*" and intense rainfall. We examined the institutional and social networks involved in managing flood risks and measures being taken to protect against floods. A common problem is lack of communication among institutions due to distrust and rivalry between the employees of the different organizations. There is also poor communication with the public. Lack of continuity in civil defense policies and changing lines of authority have been problems. In La Boca, lack of technical expertise is a problem. The main action taken in the past has been the construction of coastal defense works, but these have not taken into account the potential for future increases in sea level. On the positive side, La Boca has a strong tradition of social participation and recent changes in municipal government will place urban planning and public works in the same office, which may help to improve flood risk management. Avellaneda Municipality has some advantages in terms of expertise in disaster management and greater coordination of emergency response among relevant institutions.

An important group of historic neighbors has developed some alternative daily strategies (cultural aspects) that reduce the social vulnerability. On the other hand, the public measures that need to be taken concerning "flood management" differ from the global urban environmental policies. There are formal obstacles among the institutions: lack of communication (coordination and articulation), scarce planning, and the successful programs and projects have no continuity with each change of government. This fragmentation of policies

and measurements increases the social vulnerability and generates high degrees of uncertainty, which amplifies the damages of each disaster. Thus, the institutions and their policies are not sustainable in time, because the institutions management style, typical of the national culture, is not adequate for long-term processes. This gives an explanation on why the communication processes to the public do not consider the changes implied by the sea level rise and the climatic changes.

4.6 Adaptation Opportunities and Capacity

4.6.1 Assessing Adaptive Capacity of Farmers in Mexico and Argentina

Hallie Eakin, UNAM, Mexico/USA, and Monica Wehbe, Universidad de Rio Cuarto, Argentina
(AIACC Project No. LA29)

Climatic variables are one of main determinants of agricultural productivity. Yet within regions with similar exposure to climate hazards, the sensitivity of farm systems to climate impacts may vary considerably, as does the capacity of agricultural producers to adapt. These differences are not only explained by differ-

ences in production systems and land use, but also by the dynamic political and institutional settings in which farm systems are evolving. In fact, it is increasingly recognized that despite the important influence of climate on production outcomes, farmers in both developing and industrialized societies are simultaneously weighing the future threat of climatic hazards with economic opportunities and risks of the present.

This presentation focuses specifically on the determination and analysis of those resources and institutional factors that differentiate farm enterprises and farm households in terms of both their sensibility to climate events and their capacity to adjust to changing climatic and market circumstances. Farm systems in Mexico and Argentina are analyzed. Data collected in farm surveys were used to classify farm systems in both locations on the basis of the ownership of and access to diverse physical, natural, capital, human and social resources, which were hypothesized to provide agriculture producers both flexibility within a changing environment and the stability required for planned adaptation to stresses and shocks. The classified farm systems were then compared in terms of their perception of risk, their reported sensitivity to past climatic events and the adjustments they were making in their production systems to respond to both climatic and political-economic challenges. Finally, there was a discussion of the role of landholding size, land use, economic diversification and agricultural technology and services in the evolving vulnerabilities of the farmers in the two locations.

4.6.2 Climate Changes and Water Management: An Overview

Luis Mata, University of Bonn, Germany/Venezuela

The presentation followed the following format:

1. Introduce the water balance equation and the amounts of water stored in the climate system.
2. Heavy precipitation and its impacts: observation and projections; some examples.
3. Floods and droughts (hydrological extremes) in a changing climate—it is not only about amount of precipitation: but the intensity and frequency also should be strongly considered; observation and projections.
4. Persistence (long term range dependence)—an important means to characterize the need for management of water resources, especially with respect to the optimal dimensions of water reservoirs. Global results from a GCM and two SRES scenarios for historical and future time slices.
5. The Article 2 of the UNFCCC: interpretation and its relation with the water sector; potential mitigation and adaptation options.

4.6.3 Adaptive Capacity and Sustainability of Coastal Fishermen of the Uruguayan Coast of the Rio De La Plata River Estuary

Walter Norbis, Gustavo Nagy, Alvaro Ponce, V Pshennikov, G Saona, G Sención, R Silva and J Verocai, Universidad de la Republica, Uruguay
(AIACC Project No. LA32)

Adaptive capacity and sustainability of coastal and estuarine fisheries need study because of the importance of these systems to fisheries and the vulnerability of these systems to hydroclimatic fluctuations and weather instability. Wetland loss, salinity changes, and higher temperatures are all likely to affect those species that either reproduce in wetlands and/or spend their entire lifetimes in an estuary. An artisanal fleet exploits fisheries a few miles off the Uruguayan coast in the estuarine front (EF) off the Rio de la Plata, where resources are concentrated during the reproduction period. We are assessing the adaptive capacity and sustainability of this fleet to climate variability and global changes.

The location of the front, and therefore the spatial variability of fish distribution and recruitment, depends on ENSO-related interannual variability of river flow. Fishing activity and success are limited by Southern winds, which are frequent from October to March, the period of maximum fish availability. Both river flow and wind frequency patterns have changed over the last few decades. Vulnerability assessments suggest that fishermen have low adaptive capacity but empirical evidence is that the sector remains sustainable. Historical adaptation strategy of many of them was to migrate seasonally along the coast following the resources associated with frontal displacement or permanently, to a site seaward of the front. Some other fishermen remain at the frontal zone risking having bad years (e.g., La Niña 1999 - El Niño 2002). During strong ENSO events, their net income is estimated drop by 60%.

For instance, during El Niño 2002, in addition to EF displacement, wind patterns were unfavorable and autonomous adaptation of those who remained at the front was to increase fishing effort, which they have never done before. This adaptation strategy was unsuccessful because cost/ benefit ratio was ≥ 1. Although fishermen and market have adapted to increasing fuel prices up to present, unfavorable cost/ benefit ratio accumulated on a typical 7-years cycle (e.g. 4-5 neutral years and 2-3 ENSO years) imposes

limits to further adaptations to biophysical constraints. Legal and institutional limitations to access fishing area because of security reasons remain a constraint.

We suggest that the impacts of projected increases in both temperature and river flow could be a threat to the sustainability of coastal fisheries. Potential adaptation measures are: i) increase in navigation security, fishing boat dimensions and power, ii) development of fishing-oriented forecasting and early warning.

4.6.4 A Case Study of Water Management: Adaptation and Climate Change in Guanacaste, Costa Rica.

Max Campos, Central America Integration System, Comite Regional de Recursos Hidrualicos, Costa Rica, and Roy Barboza, Central American Bank for Economic Integration, Costa Rica
(AIACC Project No. LA06)

Abstract not available.

4.7 Adaptation, Stakeholders, and Linking to Decision Making

4.7.1 Challenges to Adaptation Research in the Caribbean

Neville Trotz, MACC

Adaptation research in the Caribbean involves the following steps:

1. Determination of the extent of climate risk to which the region is likely to be exposed.
2. Assessment of the vulnerability of the region to climate change
3. Determination of the impacts of climate change on key sectors
4. Identification of feasible options for adaptation to climate change in key sectors
5. Developing strategies for effective stakeholder participation.

Caribbean countries face several challenges in carrying out these activities. These include:

- Lack of capacity in carrying out statistical and dynamic downscaling of global climate models
- Unavailability of region specific climate scenarios
- Suitable methodology for vulnerability assessment that takes into account peculiar circumstances of small island developing states
- Lack of adequate data to support climate research and vulnerability assessments
- Lack of familiarity with use of tools used in vulnerability and impact studies.
- Heavy dependence on expert knowledge in carrying out vulnerability assessments
- Public education and outreach and insinuating climate change issues into the national development agenda.
- Resource availability

4.7.2 Stakeholder Interaction on Issues of Climate Vulnerability: Illustrations from Cordoba Province, Argentina and Coatepec, Veracruz

Monica Wehbe, Universidad de Rio Cuarto, Argentina, and Hallie Eakin, UNAM, Mexico/USA
(AIACC Project No. LA29)

Social vulnerability to climate variability and change is associated with social actors. An integrated assessment on social vulnerability must consider social actors perceptions of climate conditions, changes, risks and response options. Because of this, a participatory methodology is selected. The objectives of the participatory research are to learn what are the climate events that are most critical for farm production in the study areas in Mexico and Argentina, how climate is perceived and impacts are experienced, and how farmers adaptation opportunities and responses are affected by the political-economic context.

The method includes an initial community meeting with stakeholders to gain their participation in the project, household survey, in-depth interviews, group discussions, and community meetings to share and get feedback from stakeholders on interim and final results. The household surveys, interviews and group discussions revealed that climate is identified as a potential threat to livelihoods by many farmer households. However, other factors are identified as threats by more households. For example, 20% of small coffee growers in Veracruz identified climate as a threat, but coffee prices, family illness and unemployment were each identified as threats by more than 50% of households and crop disease by 35%. The specific climate events identified as posing potential negative impacts included heat waves, drought, wind, frost and rain.

Histories of climate events and farmers' responses were elicited in interviews and group discussions. Responses to past events such as hail, frost and wind storms that destroyed significant portions of coffee harvests included seeking work off the coffee plantation and selling fruits

such as bananas, oranges and limes. Programs such as IMECAFE encouraged coffee growers to plant a larger portion of their land in coffee and by 1990s 100% of the lands of growers in the study area were planted in coffee. This leaves them without the option of selling fruits and other crops and leaves them vulnerable to poor coffee harvests and volatility of coffee prices. The recent fall in coffee prices has been accompanied by abandonment of 50% of coffee plantations in the study area.

4.7.3 Stakeholder Engagement and Links to Decision-Making for Adaptation to Climate Change/ Variability Impacting on Dengue Fever in Caribbean Countries

Sam Rawlins, Caribbean Epidemiology Centre & The University of the West Indies, Trinidad and Tobago.
(AIACC Project No. SIS06)

Virtually all the Caribbean countries have experienced increases in occurrence and severity of dengue fever (DF) in the last 20 years. Retrospective studies have shown higher increases in years recognized as warmer (El Nino), or the year after (El Nino+1). This has been associated with greater vector (*Aedes aegypti*) production in natural and artificial containers. Predictions of climate conditions conducive to greater production of the vector could be useful in action to prevent DF.

We investigated stakeholders (communities') knowledge, attitude and practices (KAP) in three island populations: Trinidad, Tobago and St Kitts/Nevis. Our interest is in seeking information on their willingness to participate in vector source reduction strategies if the prediction of DF outbreaks could be linked to climate change (CC) features.

The preliminary results from Trinidad were that 48% and 58% of the general and high school communities respectively, thought that CC was due to greenhouse gases, holes in the atmosphere, products of bush fires and automobile exhaust fumes. The general (older) community thought that health issues (38%) were more greatly affected by CC than water resources; agriculture (12.5%), biodiversity; coastal degradation (4.2%). High school students felt that all these issues were equally affected by CC. The general community received their information concerning CC from printed and electronic media (97%), but among students, 27% had no knowledge of CC issues.

Attitudes and practices to prevent DF transmission showed that 63-68% of both communities (high school and general) were prepared to organize an environmental sanitation campaign of DF prevention, if a link between CC and DF could be demonstrated. This was however, questionable since only 31% of students and 80% of the general community currently participated in anti-vector strategies.

Our conclusion is that there exists a glaring lack of available evidence based knowledge for appropriate action by our stakeholders linking CC and DF, since only 11 – 14 % are now aware of this. Surprisingly, the student sector is even more in need of this information and motivation to participate in DF prevention. There is thus,

an urgent need for education and promotion programs to demonstrate the results of the study linking DF and CC for anti-DF action for all sectors of the community.

4.7.4 Stakeholders Perception and Participation in the Integrated Management of Water Resources Under Scenarios of Climate Change: a Case Study of Santa Lucia River Basin

Roberto Torres, Directorate of Water Resources, Ministry of Public Works, Uruguay
(AIACC Project No. LA32)

This paper describes stakeholders' perception and participation in the integrated management of water resources in Uruguay within the context of vulnerability and adaptation to climate change and variability, especially droughts and floods. A brief description is made about the conceptual evolution of water resource management, stakeholders' participation, perspectives, future challenges and commitments with the UNFCC over the last 35 years. Emphasis is given to three main points:

1. The need of an appropriate legal and institutional setting: current legal and institutional structure for water resources, meteorology and climate change is described, as well as the framework for management and assessment.
2. Relationships between scientists, managers and

stakeholders: stakeholders participation in irrigation committees in charge of water and climate extremes (droughts and floods) management is described, as well as the legal framework. The different ways citizens have to participate are discussed (e.g., referendum, administrative procedures, direct participation). The use of water resources in Uruguay and in Santa Lucia basin in particular is presented in numbers, as well as the legal and administrative basis for their use assignment.
3. Access to information and knowledge. The following topics are discussed: generation, demand, access and information outreach of water resources that are compared with available information and knowledge on climate variability.

Some future challenges concerning legislation, information and management of water resources are presented. Finally, some examples of regional projects with neighbouring countries regarding the advance of knowledge and management of water resources are discussed in relation to adaptation to climate change, variability and extremes.

4.7.5 Adaptation to Climate Change: The Argentine Experience

Vicente Barros Univerisity of Buenos Aires, Hernan Carlino, Secretary of Environment and Sustainable Development, and Daniel Perczyk, Institute Di Tella, Argentina
(AIACC Project No. LA26)

Precipitation means and extremes in Argentina have been changing rapidly in the last 40 years, making it one of the regions of the world that has shown the largest positive trend in mean annual precipitation during the last century. Regardless if this important change was related or not to the global climate change, the adaptation responses or the lack of them constitute an interesting experience.

Awareness of changes determines public or private responses. These responses followed after changes were of such magnitude to be perceived by the general public.This took about one or two decades. A public adaptation policy was implemented after the great floods of the great tributaries of the Plata River during 1982/83 and 1992. Structural measures (defenses), and an alert system were organized and have since been improved. As results of this adaptation policy, damages of the 1997/1998 floods were considerably lower than in 1982/83 event. Wetter conditions in the central part of Argentina, together with a rapid adoption of new technologies, allowed for the agriculture frontier to expand to the west. This adaptation was autonomous, done by the private sector, and preceded even the advice of the agriculture experts. The features of this adaptation, autonomy and speed were favored by the short cycle of the agriculture activity, mainly cereals and other grains.

Although climate change perception is generally felt in the extreme conditions, in Argentina adaptation to the more frequent and intense precipitations, which produce considerable and increasing damages are not yet realized. For instance, the new conditions have made a great part of the infrastructure obsolete, as it

was designed for a different climate. Worse than that, part of the new infrastructure is being built according to the rules of art based on the belief of a stationary climate. Part of the reason for the almost nonexistent response is the lack of awareness about the intensity and nature of the observed climate change. In recent years, however, as the idea that the change is more than a humid phase of climate, as it was believed initially, some experts are taking account of the change for planning.

The Secretary of Environment and Sustainable Development is including in its agenda for the next years a policy on climate change adaptation with a focus on developing awareness in the public and key sectors of society. This policy calls for climate change considerations to be included in the planning of infrastructure and to allow effective adaptation to stimulate research on regional climate scenarios.

Appendix 1: Workshop Agenda

Second AIACC Regional Workshop for Latin America and the Caribbean
Regente Palace Hotel, Buenos Aires, Argentina, 24-27 August 2004

Day 1: Tuesday, 24 August 2004

10:00 – 12:00 Registration

2:00 Opening of the Workshop
Chair: Vicente Barros

- ***Honorable Tulio Del Bono***, Secretary of Science and Technology, Government of Argentina
- ***Honorable Atilio Savino***, Secretary of Environment and Sustainable Development, Government of Argentina
- ***Ambassador Raul Estrada Oyuela***, Ministry of External Affairs, Commerce and Culture, Government of Argentina
- ***Professor Pablo Jacovkis***, Dean, College of Sciences, University of Buenos Aires, Argentina
- ***Dr. Neil Leary***, AIACC Science Director, USA
- ***Professor Vicente Barros***, University of Buenos Aires, Argentina

2:45 Climate Change Assessments and Capacity Building in Latin America and the Caribbean
Chair: Osvaldo Canziani

- The AIACC Project. ***Neil Leary***, AIACC Science Director, USA
- "Mainstreaming Climate Change Adaptation in the Caribbean – the MACC Project." ***Neville Trotz,*** Caribbean Community Secretariat
- "Capacity Building for Stage II Adaptation to Climate Change in Central America, Mexico and Cuba." ***Emilio Sempris,*** CATHALAC

3:45 Coffee Break

4:15 Climate Change Assessments and Capacity Building in Latin America and the Caribbean (continued)
Chair: Walter Fernandez

- "Preparations for the 4th Assessment Report of Working Group II of the IPCC." ***Osvaldo Canziani***, Co-Chair, IPCC WGII, Argentina .
- "The relevance of IHDP for research on global change in Latin America and the Caribbean." ***Barbara Göbel***, IHDP Secretariat, Germany
- "The Inter-American Institute for Global Change Research, addressing the challenge of global change in the Americas." ***Gustavo Necco***, Director, IAI , Brazil

5:15 National Communications to the United Nations Framework Convention on Climate Change
Chair: Neil Leary

- "UNFCCC National Communications Process and Linkages with AIACC." ***Martha Perdomo***, UNFCCC Secretariat, Germany/Venezuela
- "2nd National Communication of Uruguay." ***Luis Santos***, National Environment Directorate, Uruguay
- "Second National Communication of Argentina." **Carlos Scoppa**, Argentina

6:00 Close of Day 1
[Side meeting: Discussion of AIACC Synthesis and Follow-on Activities. PIs of AIACC projects are requested to participate. Discussions are open to all workshop participants.]

7:00 Reception

Day 2: Wednesday, 25 August 2004

8:30 Climate Variability, Changes and Scenarios
Chair: Inés Camilloni

- "Climate variability and trends in Mexico and Argentina." ***Marta Vinocur (speaker),*** Roberto Seiler, Universidad de Rio Cuarto, Argentina***,*** and Cecilia Conde, UNAM, Mexico (AIACC Project No. LA29)
- "Climate change scenarios and uncertainties in the Caribbean." ***Anthony Chen***, University of West Indies, Jamaica (AIACC Project No. SIS06)
- "Observed changes in climatic variables relevant for agricultural production during 1930-2000 in the Pampas region of Argentina, Brazil and Uruguay." ***Walter Baethgen***, IRI-INIA, Uruguay (AIACC Project No. LA27)
- "Scenarios of climate change projected for the Pampas region of Argentina, Brazil and Uruguay." ***Graciela Magrin***, INTA, Argentina (AIACC Project No. LA27)

10:15 Coffee Break

10:45 Climate Variability, Changes and Scenarios

(continued)
Chair: Anthony Chen

•"The South American monsoon system in the context of climate change." ***Carolina Vera***, co-chair VAMOS, Argentina.

•"Modeling extreme surges in the coast of the Rio de la Plata." ***Angel Menendez (speaker),*** University of Buenos Aires and INA, Argentina, and Mariano Re, University of Buenos Aires and INA, Argentina (AIACC Project No. LA26)

•"Southern South American climate trends." ***Inés Camilloni***, University of Buenos Aires, and Moira Doyle, University of Buenos Aires, Argentina (AIACC Project No. LA26)

• "Climate Change Scenarios for Southeastern South America." ***Mario Bidegain***, Universidad de la Republica, Uruguay and ***Inés Camilloni***, University of Buenos Aires, Argentina (AIACC Project Nos. LA26 and LA32).

12:15 Lunch

[Side Meeting: Planning for AIACC Synthesis. AIACC PIs and other interested persons.]

1:45 Breakout Sessions 1. *The meeting will break into three small groups to discuss questions related to the topics below.*

1A: Climate Science Capacity in the LAC Region. ***Chair: Carlos Fuller,*** National Meteorological Service, Belize. Discussion of existing capacities in the region for climate system analysis, modeling and scenario construction and needs for enhancing, transferring and sharing capacity. Output: priorities and recommended actions for enhancing, transferring and sharing capacity.

1B: Methods for Climate Change Scenario Construction. ***Chair: Mario Nuñez***, CIMA, Argentina. Discussion of methods and models that are being used in AIACC and other studies in the region to construct regional and local scale scenarios of climate change. Output: lessons for selecting and applying methods and models for constructing climate change scenarios for assessments of vulnerability and adaptation.

1C: Observed Climate Trends and Projected Changes. ***Chair: Vicente Barros,*** University of Buenos Aires, Argentina. Discussion of climate changes observed in the region, associated impacts, and projected future changes. Output: observed changes in climate and robust projections of future changes identified.

3:00 Scenarios of Socioeconomic Changes
Chair: Claudia Natenzon

• "Socioeconomic scenarios for the Caribbean." ***Charmaine Heslop-Thomas***, University of West Indies, Jamaica (AIACC Project No. SIS06)

• "Socioeconomic and climate scenarios for Central America." ***Jaime Echeverria***, Costa Rica (AIACC Project No. LA06)

3:45 Coffee Break

4:15 Climate Change Impacts and Vulnerability
Chair: Agustin Gimenez

• "Expected impacts of climate change on crop yields in the Pampas region of Argentina, Brazil and Uruguay." ***Maria Travasso***, INTA, Argentina. (AIACC Project No. LA27)

• "Expected impacts of climate change on the incidence of crop disease in the Pampas region of Argentina, Brazil and Uruguay." ***M. Fernandes***, EMBRAPA, Brazil. (AIACC Project No. LA27)

• "Agricultural impacts of climate in Mexico and Argentina." ***Cecilia Conde (speaker),*** UNAM, Mexico, Roberto Seiler and Marta Vinocur, Universidad de Rio Cuarto, Argentina (AIACC Project No. LA29)

5:30 Wrap-up of Day 2

• Reports from breakout sessions and further discussion

• Review plans for day 3

Day 3: Thursday, 26 August 2004

8:30 Climate Change Impacts and Vulnerability (continued)
Chair: Graciela Magrin

• "Climate change scenarios and impacts on the biomes of South America." ***Carlos Nobre***, CPTEC/INPE, Brazil

• "Vulnerability of Water Resources and Trophic State of the Santa Lucía river lower basin and estuary to Climate Variability and Change." ***Caffera MR (speaker)***, M Bidegain, F Blixen, CH López, JJ Lagomarsino, ***GJ Nagy (speaker)*** and K Sans. Universidad de la Republica, Uruguay (AIACC Project No. LA32)

• "Vulnerability of the Northern coast of the Rio de la Plata in the vicinities of Montevideo." Kokot R, EA Forbes, MJ Dabezies, ***GJ Nagy (speaker), A Ponce (speaker)***, V Pshennikov and R Silva. Universidad de la Republica, Uruguay (AIACC

Project No. LA32)
• "Climate variability impacts on Dengue and vulnerability in the Caribbean." ***Dharmaratne Amarakoon,*** University of West Indies, Jamaica/Sri Lanka (AIACC Project No. SIS06)

10:15 Coffee Break

10:45 Climate Change Impacts and Vulnerability (continued)
Chair: Gustavo Nagy
• Impacts and vulnerability (Title?). ***Carlos Fuller***, National Meteorological Service, Belize
• "The coast of the Rio de la Plata and the Parana delta front: present evolution." ***Jorge Codignotto***, University of Buenos Aires, Argentina (AIACC Project No. LA26)
• "Return periods of floods over the coastal lands of the Rio de la Plata." ***Roberto Kokot (speaker), Angel Menendez (speaker),*** Enrique D'Onofrio, Vicente Barros and Monica Fiore, University of Buenos Aires, Argentina (AIACC Project No. LA26)
• "Case studies of social and institutional vulnerability: La Boca and Avellaneda neighborhoods." ***Claudia Natenzon (speaker)*** and Silvia Gonzalez, University of Buenos Aires, Argentina (AIACC Project No. LA26)

12:30 Lunch

[Side Meeting: Planning for AIACC Follow-on Activities. AIACC PIs and other interested persons.]

2:00 Breakout Sessions 2. *The meeting will break into three small groups to discuss questions related to the topics below.*
2A: Present Day Climate Risks. Chair: ***Sam Rawlins***, Caribbean Epidemiology Center, Trinidad and Tobago. Discussion of present day climate hazards, vulnerabilities, means of coping with climate hazards, and consequences for poverty reduction, sustainable management of resources, and development. Output: lessons from present day climate hazards identified that can be applied to understanding, managing and adapting to future climate risks.
2B: Methods and Tools for V&A Assessment. ***Chair: Alex de Sherbinin,*** CIESIN, USA**.** Discussion of methods and tools that are being used in AIACC and other studies in the region to assess climate change vulnerability and adaptation, methodological advances, and the UNFCCC's Compendium of V&A Assessment Methods and Tools. Output: recommendations for improving knowledge of and access to V&A assessment methods and tools and identify potential contributions to the UNFCCC's compendium of methods and tools.
2C: Capacity needs for V&A Assessment. ***Chair: Cecilia Conde,*** UNAM, Mexico. Discussion of existing capacities in the region for V&A assessment and needs for enhancing, transferring and sharing capacity. Output: priorities and recommended actions for enhancing, transferring and sharing capacity.

3:15 Coffee Break

3:45 Adaptation Opportunities and Capacity
Chair: Avis Robinson
• "Assessing adaptive capacity of farmers in Mexico and Argentina." ***Hallie Eakin (speaker)***, UNAM, Mexico/USA, and Monica Wehbe, Universidad de Rio Cuarto, Argentina (AIACC Project No. LA29)
• "Climate changes and water management: an overview." ***Luis Mata***, University of Bonn, Germany/Venezuela
• "Adaptive capacity and sustainability of coastal fishermen of the Uruguayan coast of the Rio de la Plata river estuary to hydroclimatic variability, climate changes and other stressors." Norbis W, **GJ Nagy (speaker), A Ponce (speaker)**, V Pshennikov, G Saona, G Sención, R Silva and J Verocai. Universidad de la Republica, Uruguay (AIACC Project No. LA32)
• "A case study of water management, adaptation and climate change in Guanacaste, Costa Rica." ***Max Campos***, Central America Integration System Comite Regional de Recursos Hidrualicos, Costa Rica, and ***Roy Barboza***, Central American Bank for Economic Integration, (AIACC Project No. LA06)

5:30 Wrap-up of Day 3
• Reports from Breakout Sessions & Discussion
• Review plans for day 4

Day 4: Friday, 27 August 2004

8:30 Breakout Sessions 3. *The meeting will break into three small groups to discuss questions related to the topics below.*
3A: Supporting Decision-Making and National Communications with Assessments. ***Chair: Max Campos***, Comite Regional de Recursos Hidrau-

licos, Costa Rica. Discussion of the effectiveness of climate change assessments for supporting decisions that reduce climate risks, their contributions to National Communications, design of assessments to serve decision needs, and the role of stakeholders in assessments. Output: recommendations for improved assessments that better serve decision-making needs and National Communications.

3B: Integrating adaptation into development policies. ***Chair: Ian Burton***, University of Toronto, Canada. Discussion of objectives, means and examples for integrating climate change adaptation with development processes and plans. Output: recommendations for integrating adaptation into development processes and plans.

3C: Building Upon the AIACC Project. ***Chair: Walter Baethgen***, IRI-INIA, Uruguay. Discussion of objectives and modes for follow-on activities to the AIACC project. Output: draft plan for follow-on activities.

9:45 Coffee Break

10:15 Adaptation, Stakeholders, and Linking to Decision Making

Chair: Marta Perdomo

- "Challenges for adaptation research in the Caribbean." ***Neville Trotz***, MACC
- "Stakeholder interaction on issues of climate vulnerability: illustrations from Cordoba Province, Argentina and Coatepec, Veracruz." ***Monica Wehbe (speaker),*** Universidad de Rio Cuarto, Argentina, ***and Hallie Eakin***, UNAM, Mexico/USA (AIACC Project No. LA29)
- "Stakeholder engagement and links to decision-making for adaptation to climate change and variability impacting on Dengue Fever in the Caribbean." ***Samuel Rawlins***, Caribbean Epidemiology Center, Trinidad and Tobago (AIACC Project No. SIS06)
- "Stakeholders Perception and Participation in the Integrated Management of Water Resources under Scenarios of Climate Change in Uruguay: The case for Santa Lucia river basin." ***R. Torres***, Chief of the Uruguayan Directorate of Water Resources. (AIACC Project No. LA32)
- "Climate change in the environmental agenda for Argentina." ***Vicente Barros (speaker)***, University of Buenos Aires, Argentina (AIACC Project No. LA26), ***Hernan Carlino (speaker)***, Secretary of Environment and Sustainable Development, Argentina, and Daniel Percczyk, Di Tella Foundation, Argentina.

12:15 Lunch

1:30 Final Business

Chair: Neil Leary

- Reports from breakout sessions
- Plans for AIACC Synthesis
- Plans for Follow-on Activities to AIACC Project

3:00 Close of Workshop

Appendix 2: Participant List

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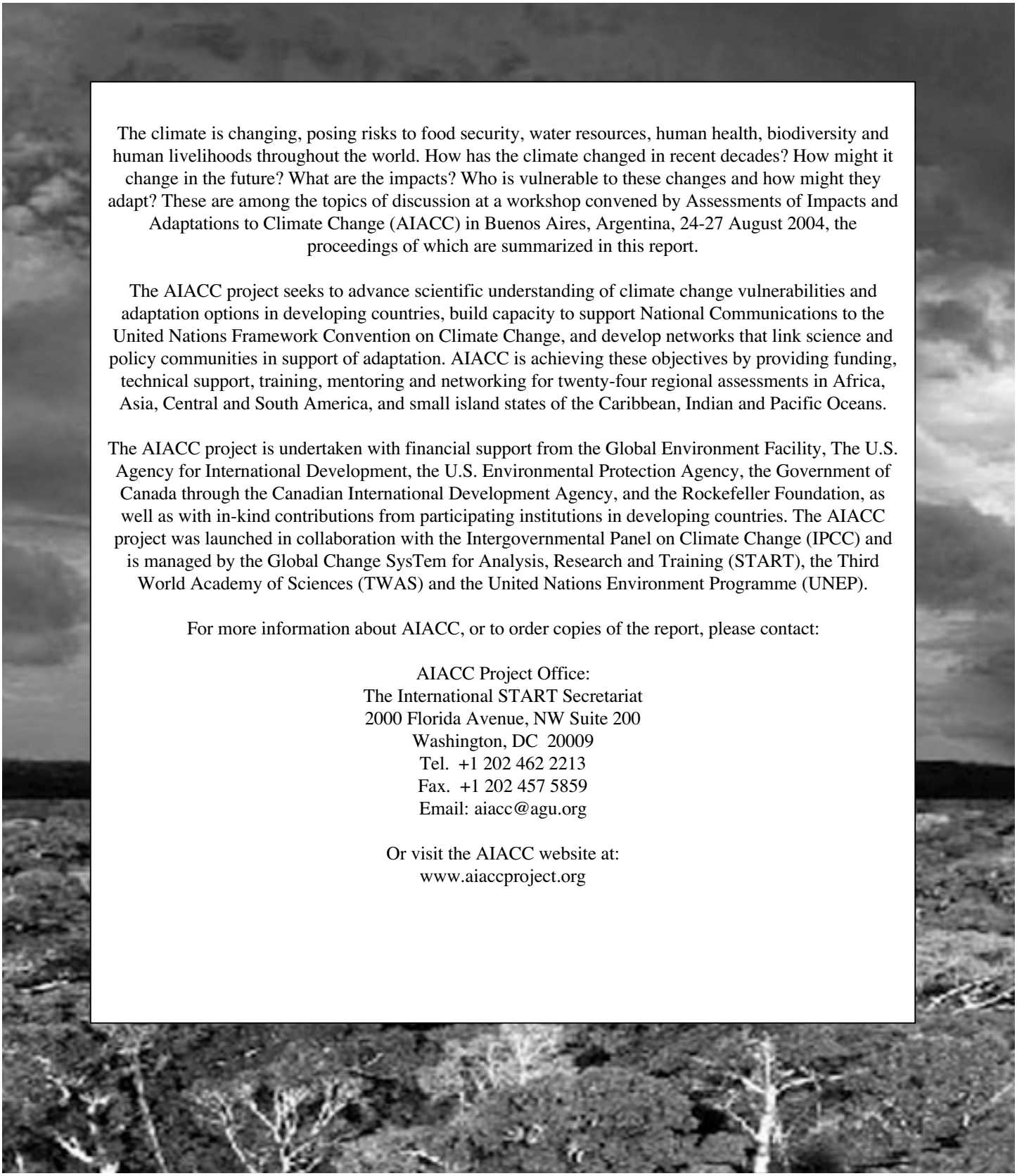

The climate is changing, posing risks to food security, water resources, human health, biodiversity and human livelihoods throughout the world. How has the climate changed in recent decades? How might it change in the future? What are the impacts? Who is vulnerable to these changes and how might they adapt? These are among the topics of discussion at a workshop convened by Assessments of Impacts and Adaptations to Climate Change (AIACC) in Buenos Aires, Argentina, 24-27 August 2004, the proceedings of which are summarized in this report.

The AIACC project seeks to advance scientific understanding of climate change vulnerabilities and adaptation options in developing countries, build capacity to support National Communications to the United Nations Framework Convention on Climate Change, and develop networks that link science and policy communities in support of adaptation. AIACC is achieving these objectives by providing funding, technical support, training, mentoring and networking for twenty-four regional assessments in Africa, Asia, Central and South America, and small island states of the Caribbean, Indian and Pacific Oceans.

The AIACC project is undertaken with financial support from the Global Environment Facility, The U.S. Agency for International Development, the U.S. Environmental Protection Agency, the Government of Canada through the Canadian International Development Agency, and the Rockefeller Foundation, as well as with in-kind contributions from participating institutions in developing countries. The AIACC project was launched in collaboration with the Intergovernmental Panel on Climate Change (IPCC) and is managed by the Global Change SysTem for Analysis, Research and Training (START), the Third World Academy of Sciences (TWAS) and the United Nations Environment Programme (UNEP).

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