AIACC Notes

June 2003 • Volume 2, Issue 1

Report from the Secretariat

Neil Leary and Sara Beresford

Regional Workshops

Investigators from AIACC regional studies in Africa/Indian Ocean, Asia/Oceania and Latin America/Caribbean gathered at recent workshops in Hartebeespoortdam, South Africa, Bangkok, Thailand, and San Jose, Costa Rica, respectively, to present and discuss their first year's research and to lay plans for the next two years of work. The workshops also provided opportunities to make a wider community of stakeholders aware of the work that has begun and to identify opportunities for collaboration, particularly in the context of contributing to national communications under the UNFCCC. In addition to the AIACC investigators, GEF and UNFCCC National Focal Points from some of the countries in which AIACC studies are active, representatives from governmental and non-governmental organizations, representatives of the UNFCCC Secretariat, and other researchers from each region took part in the workshops.

The presentations and discussions at the workshops displayed the substantial progress that has been made by the 24 AIACC regional studies. They have established baseline climatologies for their regions of study, compared baselines to control runs from general circulation models, and constructed some of the scenarios of future climate change that they will use in their research. Primary and secondary data have been collected on the impacts of and mechanisms for coping with climate variability and extremes; models of water, agricultural and vegetation systems have been calibrated and validated; methods for evaluating vulnerability and adaptive capacity have been elaborated; and strategies for projecting scenarios of socioeconomic change have been explored. Most of the presentations made at the workshops, as well as other information about the workshops, are available on the AIACC website.

This Issue of AIACC Notes

In this issue of AIACC Notes, articles from 6 of the regional studies highlight some of the work that is completed and underway. A technique developed by researchers at the University of Cape Town that uses GCM-guided perturbations to construct fine resolution climate change scenarios offers a ready alternative to more complex and demanding downscaling techniques that is consistent with the large scale changes simulated by GCMs. They've produced CDs that can be used to implement their guided perturbation technique to produce high resolution scenarios of climate change in Africa. The CDs include weather station data from across Africa and GCM simulations of future climate change in Africa and are available from the AIACC Secretariat (see Announcements, page 12).

Other articles highlight stakeholder engagement in climate change assessment in the Philippines and Indonesia, past and present changes in climate, rangelands and livestock in Mongolia, adapting tourism in Southern Africa to climate change, linking AIACC research with the National Adaptation Program of Action (NAPA) in Sudan, and coastal impacts of climate change in the Rio de la Plata.

Linking with National Communications and NAPA

Over the past year AIACC has been working with the UNFCCC Secretariat and UNEP to help support National Communications and NAPA. For example, at the April 2003 UNFCCC workshop in Mauritius on the use of new

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GCM-Guided Perturbations for Regional Climate Change Scenarios

Bruce Hewitson, University of Cape Town, South Africa

Each of the AIACC regional studies is faced with the problem of constructing scenarios of climate change with spatial and temporal scales that are appropriate to their investigations of regional impacts and vulnerabilities. Typically, scenarios with much finer resolution than provided by the climate projections of General Circulation Models (GCM) are needed. Many of the AIACC projects began with the intent of using dynamical modeling or statistical methods to downscale GCM projections to the desired spatial and temporal scales. However, downscaling

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Report from the Secretariat (cont.)

guidelines for the preparation of national communications, AIACC participated in discussions with government delegates about scientific capacity building and technical support activities and needs. Recommendations from this meeting to the UNFCCC's Subsidiary Body for Implementation include, among others, (i) strengthening existing national and regional institutions for the preparation of national communications, (ii) increasing resources and funding to report the detailed information and integrated analysis of vulnerability called for in the new guidelines, (iii) expanding programs such as AIACC to include additional regions and countries and encouraging such programs to develop new tools for vulnerability and adaptation assessments, and (iv) providing training in the methods and tools of vulnerability and adaptation assessment.

These are all areas in which AIACC is making contributions through its juried research grants to researchers and institutions in the developing world, its training and mentoring activities, its stakeholder engagement activities, and its activities to synthesize and disseminate information about methods and tools. The most important contributions are happening at the level of the individual studies. Each of the AIACC regional studies is actively working with the institutions and persons responsible for preparing national communications in their countries so that the research and enhanced capacity are available to support national communications.

An AIACC regional study that is undertaking an integrated assessment of climate change impacts and adaptations in the Miombo region of Africa (Malawi, Mozambique, Zambia and Zimbabwe) has made substantial contributions to the preparation of the NAPA guidelines. The project team is continuing to work with UNEP to develop additional materials to assist countries with their preparations of NAPA documents. The AIACC regional study in Sudan is closely coordinating its research with that country's NAPA preparation, providing technical capacity and information about potential adaptation options. It is likely that other AIACC studies, particularly those in Africa, will be able to benefit NAPA's in other countries.

AIACC at the Human Dimensions Open Meeting

Five papers and five posters from AIACC regional study investigators have been accepted for presentation at the 2003 Open Meeting of the Human Dimensions of Global Environmental Change Research Community. Acceptance for participation in this important international scientific meeting, to be held 16-18 October in Montreal, Canada, is one indication of the progress being made by the AIACC studies. Look for paper presentations by Anthony Chen, Hallie Eakin, Patrick Mushove, Juan Pulhin, and Monica Wehbe; also posters by Cecilia Conde, Gustavo Nagy and Alvaro Ponce, Florencia Pulhin, Sheila Roy, and Yongyuan Yin.

Participating in the IPCC 4th Assessment Report

One of the objectives of AIACC is to foster greater participation of scientists from the developing world in the assessment reports of the Intergovernmental Panel on Climate Change (IPCC). AIACC has been represented by several of its Technical Committee members and Science Director at meetings convened in 2003 by the IPCC to begin planning for the 4th Assessment Report. A key objective in participating in the meetings is to help the IPCC realize broader participation by developing country scientists. Some success has already been achieved as several investigators from AIACC regional studies have been invited to participate in some of the expert meetings that are laying the groundwork for the IPCC's report. In coming months the AIACC Secretariat will be working to bring more talented scientists to the attention of the IPCC Bureau. And of course we will also make sure that the scientific results coming out of AIACC research are made available to the IPCC and the scientific community generally.

New AIACC Web Address

As of late June 2003, AIACC's new website address is: http://www.aiaccproject.org/. The previous address will redirect users to the new site. Please update your browser.

The new AIACC DMS Website at CIESIN is also now available at: http://sedac.ciesin.columbia.edu/aiacc/.

GCM-Guided Perturbations for Regional Climate Change Scenarios (cont.)

techniques can be computationally and time intensive and require skills not present in all project teams, skills that cannot be developed in short-order. Consequently, many of the project teams have found that downscaling is not appropriate for them. Fortunately, simpler approaches that produce credible climate change scenarios and that meet the needs of the impacts research can be applied.

An important starting point for investigating climate change impacts and vulnerabilities is to first assess the foundational sensitivities of the systems under study to climate and other perturbations. For investigations of foundational sensitivities, a formal downscaling procedure is not a necessity. Perturbations of the climate, constructed to be in accord with large-scale responses of GCMs to greenhouse gas forcing, are appropriate, and perhaps of greater value, for investigation of the sensitivities of systems potentially impacted by climate change. It is in this context that the approach of guided perturbation was developed by AIACC Regional Study No. AF07 and presented at the 2003 AIACC Africa Region Workshop. The concept is more fully presented in EOS (Hewitson, 2003).

Issues of scale

It is important to note that the time and space scales of relevance to the regional issues of the AIACC studies are scales far finer than even the computational resolution of the Global Climate Models (GCMs), let alone the GCM skillful resolution. The adjacent figure shows conceptually the issues at hand, where a GCM has a native resolution that is different from the GCM skill resolution, both of which are often scales not relevant to the user requirements.

A danger exists with the advent of the ready availability of GCM climate change products on the Internet, which invites inappropriate use of these data at the GCM grid scale. For example, comparison of a GCM grid cell value with point station observations is not valid as the GCM grid cell value is firstly an area average, and secondly, not representative of the scale at which the model is skilled. Nonetheless, for the unaware the simplest means of obtaining a regional climate change scenario is to use the values of the GCM grid cell most closely co-located with the region of interest, possibly interpolating this further to a point location. This exacerbates the uncertainty associated with any derived regional scale climate change scenario, and reduces the value of any impact assessment intended for developing policy and adaptation strategies.

Downscaling techniques have been developed as a means to address this problem. However, these methods require significant skill, experiential knowledge, and computational infrastructure for appropriate implementation. More importantly, such techniques themselves introduce uncertainty, and thus careful consideration is required to assess the value added by such a downscaling procedure (Hewitson and Crane, 2003).

In the face of this, it is important to note that much useful information can still be obtained by examining the system sensitivity to larger scale climate perturbations. It is also arguable that the early phase of any impacts study should first be characterized by evaluation of the first order impacts and sensitivities, rather than immediately tackling the complex issues underlying downscaling.

Developing guided perturbations

By using the spatial and temporal scales more commonly associated with the GCM skill resolution, one may develop "guided perturbations" to perturb baseline observational data in accordance with the GCM large-scale anomaly projected for the future, and at spatial scales appropriate to impacts work (assuming the baseline observational data is available!). Using this approach, the impacts researcher is able to investigate the foundational sensitivity of their system under study, based on perturbations that are sensible in terms of the GCM simulated response to global anthropogenic forcing. Primarily one seeks to draw useful information (the first order, or spatial large-scale, response) from the GCM. There is, obviously, additional local scale variance of the climate change signal, but this remains the subject for more refined impact assessment research.

Inherent in using GCMs is the uncertainty from inter-model differences. These differences are, however, valuable and important, and reveal a measure of the uncertainty envelope of projected future climate change. The procedure outlined here is readily applied to multiple GCMs, allowing the user to explore the future envelope of projections. Full details of the method will be available in the support documentation on the AF07 project web site (http://www.csag.uct.ac.za/AIACC/aiacc.htm) by the 3rd-quarter 2003. The summary procedure (from Hewitson, 2003), is as follows, and uses GCM output from the Data Distribution Centre (DDC) of the Intergovernmental Panel on Climate Change (IPCC).

1. First, derive a large-scale spatial response surface from the GCM at a resolution corresponding to the skill of the GCM, or "skill resolution" surface, using a simple spatial filter. The software package GrADS (see http://grads.iges.org/grads/) includes a simple command to undertake this and we apply a 3-by-3 grid cell kernel (the GrADS "smth9" function) to both the control and future GCM simulation output.
2. Having attained a "skill resolution" surface we now express the climate change anomaly as the difference between the large-scale response surfaces for the present and future climate simulation output. For precipitation this may then be further expressed as a percentage change, which is a typical treatment of precipitation anomalies in climate change studies (temperature is more typically treated in terms of the absolute anomaly).
3. Finally, one perturbs an observational data set by the fractional change. This may be applied to observational data at any spatial scale – from station observations to gridded products. An example of the final product, DJF precipitation anomaly at a 10km grid-scale derived from two GCMs is shown nearby.

Application guidelines

The GCM-derived anomaly may be equally applied to single station data or other observational products. The focus above is on the DJF seasonal mean – but this may also be applied at other temporal resolutions. However, it is recommended that sub-monthly time scales should be avoided due to the time-evolution of the GCM not having direct correlation to the observational data.

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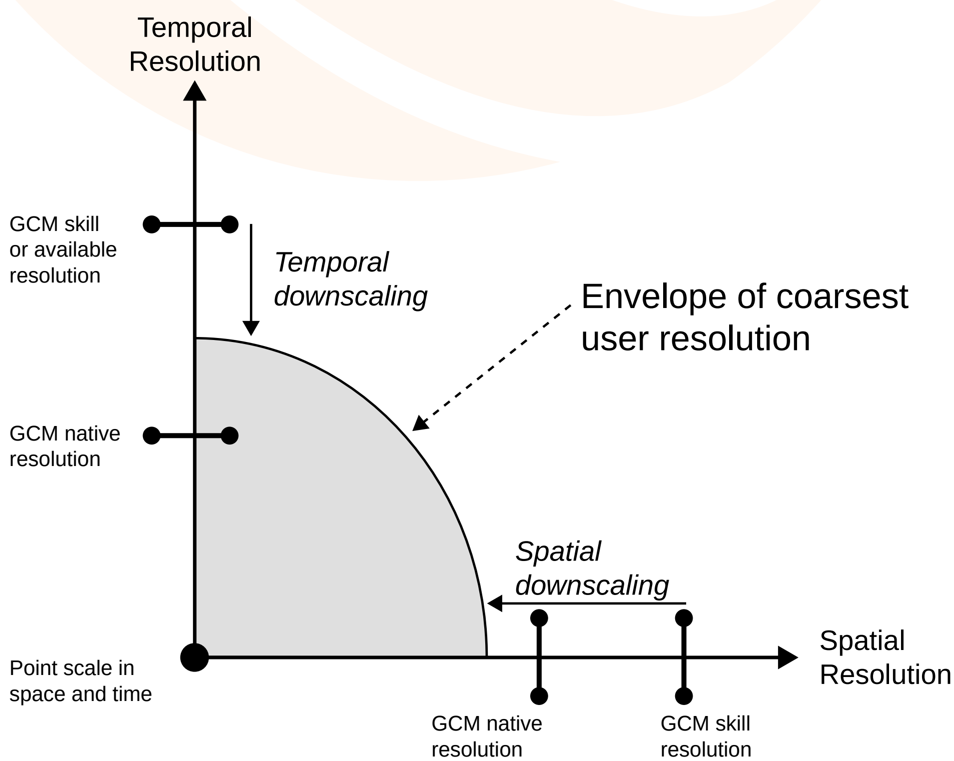
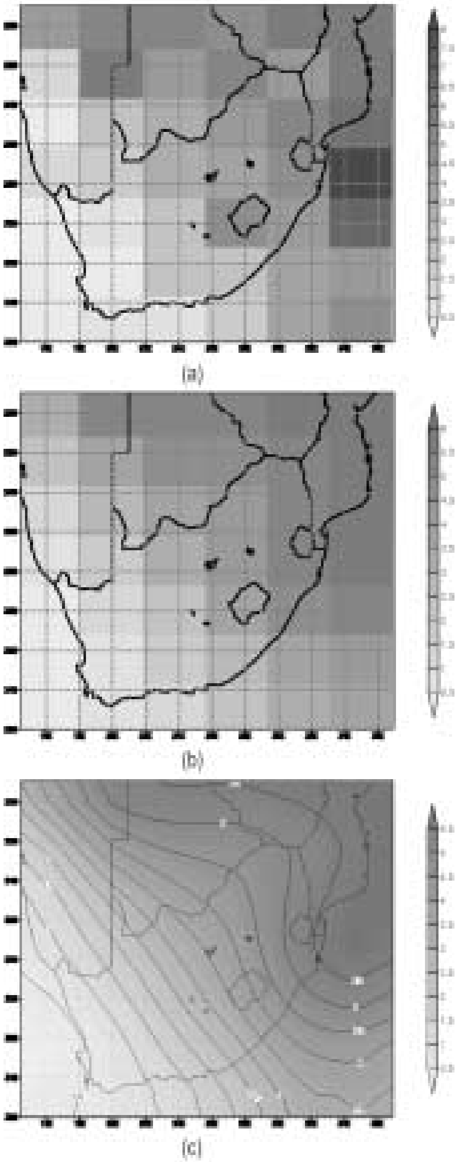


Schematic representation of downscaling relationships between GCM native and skill resolutions, and that of the requirements of the end-user application. This relationship is not necessarily constant for all variables, and may differ for, say, temperature and humidity. From Hewitson and Crane (2003).

GCM-Guided Perturbations for Regional Climate Change Scenarios (cont.)



Construction of a continuous large-scale spatial response surface. Panel (a) shows the unmodified HadCM3 30-year (1970-1999) December-February precipitation climatology (mm/day) over southern Africa for the control climate. Panel (b) shows the same field smoothed with a spatial moving average. Panel (c) shows the smoothed GCM grid cells as a continuous surface using bi-cubic splines.

For precipitation, a percentage perturbation is advised. In this manner the derived absolute magnitude of the perturbation is naturally a function of the magnitude of the baseline climatology. Consequently, the spatial expression of the derived anomaly has differences even where the spatial component of GCM large-scale anomaly field is the same for different locations. The perturbation thus retains the spatial differences of the existing climate, while maintaining agreement with the large-scale response of the GCM.

The above, while simple, does have one key underlying assumption, namely that the GCM does not misplace, or fail to resolve, the basic climate boundaries. Consider, for example, where a GCM displaces a climate domain (say, maritime) and extends this into the adjacent and different climate region (say, continental arid zone). In this case the derived anomaly will be responding to the GCM simulation of a climate regime inappropriate to the geographic location. Consequently, one cannot emphasize enough the responsibility of the researcher to adequately assess the veracity of the GCM simulation at the time and space scales of intended application.

Summary

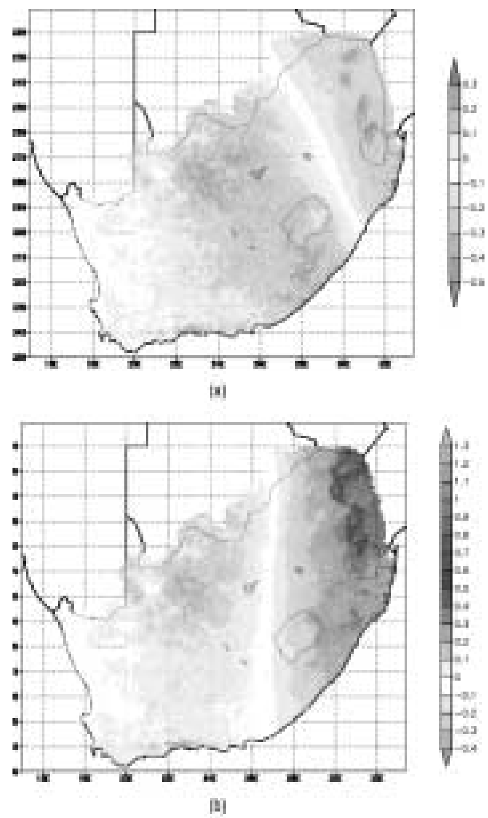
The above outlines a simple procedure to derive plausible, credible, perturbations on which to develop an initial understanding of the regional sensitivities to climate change forcing. This is not a downscaled product in the conventional sense, and does not represent cross scale relationships or local scale feedbacks. Nonetheless, it does represent a regional scale perturbation in accord with the GCM first order response to greenhouse gas forcing. Consequently, this allows one to undertake an assessment of fundamental regional sensitivities to climate change, in a manner that is not arbitrary, but guided by GCMs. For many project applications this is the appropriate starting point, and the guided perturbation concept allows rapid progress to be made in the primary impact assessment focus, with credible climate change forcing, yet without necessitating a complex downscaling procedure.

References

(pre-prints available from hewitson@egs.uct.ac.za)

Hewitson, B.C., and Crane, R.G., (2003): Global climate change: Questions of downscaled climate scenarios for impact assessment, submitted to Bulletin of the American Meteorological Society.

Hewitson, B.C., (2003): Developing perturbations to climate change impacts assessments, EOS vol. 84 no. 35, September 2003.



Construction of a continuous large-scale spatial response surface. Panel (a) shows the unmodified HadCM3 30-year (1970-1999) December-February precipitation climatology (mm/day) over southern Africa for the control climate. Panel (b) shows the same field smoothed with a spatial moving average. Panel (c) shows the smoothed GCM grid cells as a continuous surface using bi-cubic splines.

AIACC's Data, Methods, and Synthesis on the Web

Cynthia Rosenzweig,[1] Ana Iglesias[1] and Alex de Sherbinin[2]

The AIACC Data, Methods and Synthesis (DMS) activity is creating a web-based tool for climate impacts, adaptation, and vulnerability researchers, both within the AIACC community and beyond. The major objective is to communicate and share information among researchers, stakeholders, and decision-makers about the objectives, methods, input data, results and lessons from regional assessments of climate change that are underway as part of the AIACC project.

The DMS was launched in October 2002 as part of a larger capacity-building grant from the U.S. Agency for International Development (USAID). The goal of the USAID grant is to enhance capacity in developing countries for assessing climate change vulnerabilities and adaptation options, engaging stakeholders in the assessment process, and communicating scientific information that can aid adaptation decisions. The DMS activity is carried out by two units of the Earth Institute at Columbia University – the Center for Climate Systems Research (CCSR) and the Center for International Earth Science Information Network (CIESIN).

In its early phase, the DMS supports the AIACC projects with information needs through an online database of bibliographic and data resources, and "methods" and "toolkit" pages that describe methods, approaches and software packages that can assist in impacts, vulnerability and adaptation research. Through a survey sent to the 24 project teams, the DMS also disseminates information about their focal areas of research, their work plans, and the climate and socioeconomic scenarios, data sources, and methodologies they employ. These project profiles are accessible through a clickable map and pull-down menus on the DMS activity's home page.

The "synthesis" page of the website currently includes matrices of major systems, sectors and groups addressed by the projects. Over the longer term, this page will be expanded to provide syntheses of research results across the projects. These will facilitate their consideration by international assessment and policy bodies such as the Intergovernmental Panel on Climate Change (IPCC) and UN Framework Convention on Climate Change (UNFCCC).

For more information, please visit the DMS website at http://sedac.ciesin.columbia.edu/aiacc/. New information, bibliographic resources and updates on AIACC projects will be added regularly. Those wishing to sign up under the "network" page will be alerted to these additions as they become available.

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AIACC Coordinating with Sudan's National Adaptation Program of Action (NAPA)

Balgis Osman, Sudan Higher Council for Environment and Natural Resources

Climate change, and the need for adaptation, pose serious challenges to Sudan's overriding development priorities in natural resources management, as it does for many of the least developed countries. The Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC) have established the National Adaptation Programmes of Action (NAPA) to assist the least developed countries to assess and communicate their most urgent adaptation needs. Sudan has initiated its NAPA process to produce a set of adaptation projects that address its highest priorities to propose for international support. This will require information about critical vulnerabilities and the effectiveness of different adaptation options. The AIACC project in Sudan (AIACC Regional Study No. AF14) will help to fill this need for information about vulnerabilities and adaptation options.

Case studies of vulnerability reduction

In Sudan, a number of communities have implemented what are called sustainable livelihood (SL) and natural resource management (NRM) measures to reduce community vulnerability to drought. The AF14 project has identified a number of communities for which such measures have been successful, as determined by the communities themselves, and will select some of these communities for case studies. In conducting the case studies we will obtain detailed information on the implementation of the measures, measure their performance qualitatively and quantitatively, and investigate the factors that contributed to or hindered their performance.

We will also undertake a policy process analysis, adapting the method of Springate-Baginski and Soussan for evaluating livelihood policies. The policy process analysis will include analysis of micro-scale (households and community organizations), macro-scale (up to national), and cross-scale interactions of policy processes and institutions so as to understand how these influence community level measures. The case study and policy analyses will be used to evaluate the potential of SL and NRM measures as adaptations that would increase community resilience to climate related shocks and thereby also lessen vulnerability to future climate change.

Measures that yield benefits today: a link between AIACC AF14 and NAPA

The NAPA process established by the UNFCCC is very deliberately focused on urgent needs for adaptation that offer the potential for immediate benefits for least developed countries. Consequently, strategies to cope with current climate variability and extremes are emphasized in the NAPA guidelines

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Tourism: Searching for Adaptation Options to Climate Change in Southern Africa

Opha P. Dube and Naomi Moswete, University of Botswana

Tourism is a major and growing source of foreign exchange earnings in Southern Africa and is viewed as a viable option for promoting development and income growth in most of these countries. Because of its potential to contribute to development, tourism is one of the activities that is being investigated in our study on climate change impacts, vulnerability and adaptation in eastern Botswana (AIACC regional study No. AF42).

The bulk of the tourism industry in Southern Africa is nature based, focused on wildlife and the wilderness. Game viewing, photographic safaris and licensed safari hunting are some of the popular activities of the wilderness associated with the current tourism industry. To protect the resources upon which this tourism is based, a large portion of the land area has been put aside in national parks and reserves for forest, nature and game; 17% in Botswana, 11% in Tanzania, and almost 13% in Zimbabwe. More recent is the development of trans-boundary frontier parks such as the Trans-Frontier Peace Park between Botswana, South Africa and Zimbabwe on the Limpopo Basin.

Wildlife mobility has been key to survival in drought prone areas, but mobility is now limited

The designated wildlife areas are inadequate for maintaining resilient wildlife resources, particularly in semi-arid lands with highly variable climate. Wildlife mobility was the key survival strategy over drought periods typical in Southern Africa. In the past, when there were no restrictions, animals were able to move as and when needed to locations of more plentiful food and water. The current situation has much of the wildlife restricted to protected areas and this accounts for the high pressure around areas that retain moisture for most of the year such as pans and depressions (Dube & Kwerepe, 2001). In some cases artificial water sources have been provided to alleviate water shortages exacerbated by limited wildlife mobility. Reduced mobility and concentration of wildlife in protected areas have made the wildlife and the ecosystems they inhabit more vulnerable to a variety of stresses that include drought, disease and competition for scarce resources.

Will climate change add to stresses on wildlife?

Will climate change add to the stresses that buffet these treasured but already marginalized resources that are being counted upon to help support growth in tourism and future development?

Initial investigations suggest that future warming over Southern Africa may result in reduced surface and underground water resources. This would in turn have a great impact on the wildlife resources and the associated tourism industry.

An adaptation: transition from wildlife focused tourism to Eco-tourism

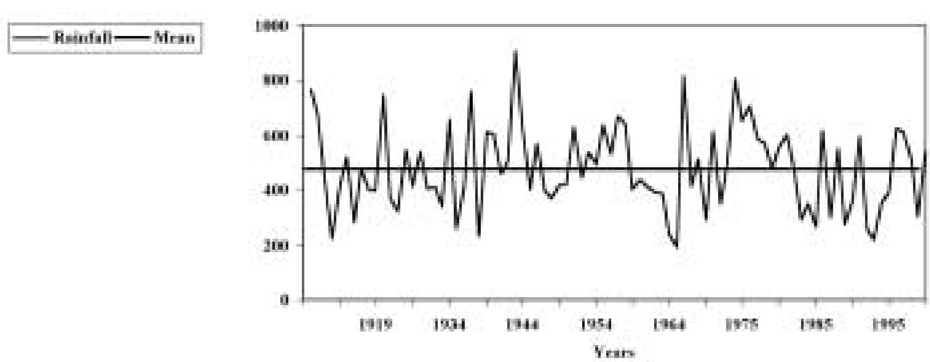
Adaptation strategies are needed to help safeguard the hoped for contributions of tourism to development from potentially adverse impacts of climate change. One strategy is to adapt land management to a changing climate so as to protect the habitats, biodiversity and wildlife that are necessary for nature-focused tourism. But another strategy is to adapt the tourism sector itself. A purposeful change from a purely nature based, wildlife focused tourism industry to more broadly oriented eco-tourism could be a viable option. In eco-tourism the emphasis extends from the physical environment such as geomorphological features, to wildlife and their habitats, and to cultural heritage such as monuments, historic buildings and the arts, religion, food and traditions of local people.

One of the pillars of eco-tourism is maximum economic benefit to the local communities of the host country. This can be achieved by directly engaging communities in the management of the tourism industry particularly where cultural tourism is a source of attraction. Eco-tourism makes use of a wider range of resources as attractions than does the present nature focused tourism of the region, many of which can be less sensitive to a variable and changing climate. Eco-tourism therefore offers a potential adaptation strategy to climate change in rural areas of Southern Africa.

There is need for a critical assessment of the vulnerability to climate and other stresses of different resources of Southern Africa that can serve as attractions for tourists. There is also need for assessment of a range of adaptation strategies that include management of the threatened resources to limit harm as well as strategies that diversify the resources relied upon to attract tourists. In our AF42 investigations in the Limpopo Basin, we are examining these and other questions to advance our understanding of climate change risks and adaptation options that are expected to have applicability in Botswana as well as in the broader region of Southern Africa.

Reference

Dube, O. P. & Kwerepe, R. M., (2000). Human induced change in the Kgalagadi sands: Beyond the year 2000. In S. Ringrose and R. Chanda (eds). Towards sustainable management in the Kalahari region - Some essential background and critical issues. Directorate of Research and Development, University of Botswana, Gaborone, 244-258.



Highly variable rainfall, such as shown here for Mochudi village in the Limpopo Basin, poses a challenge for protecting wildlife. In the past, wildlife coped with drought by migrating across the landscape to find food and water. Today, the patchwork of human land-uses and protected areas that have evolved restricts wildlife mobility. Data is from Meteorological Services, Botswana.

AIACC Coordinating with Sudan's National Adaptation Program of Action (NAPA) (cont.)

(Least Developed Country Expert Group, 2003). The emphasis of NAPA on current climate variability and immediate needs is consistent with the approach of the AF14 project.

In the project we are examining existing practices of communities to find and document proven measures that are yielding benefits today. The lessons that we derive from communities' experiences with SL and NRM measures will be made available for use in Sudan's NAPA.

The Sudan NAPA process will use a consultative process to develop criteria and evaluation tools to identify adaptations that respond to urgent national needs and to prioritize adaptations. As part of the AF14 project, we will apply the same criteria and evaluation tools that emerge from the consultative NAPA process to evaluate SL and NRM measures. This will facilitate the integration of results and recommendations from the AF14 project with the NAPA process in Sudan.

Early Outputs from AF14

The preliminary findings from a pilot case study in a drought prone area in western Sudan indicate that sustainable livelihood analysis can generate insights of community livelihoods through the assessment of a range of capital assets (natural, physical, social, human and financial) which are combined in the pursuit of different livelihood strategies (e.g. conservation, diversification, intensification etc.). These can be assessed at a variety of scales such as household, individual, and committees, and that understanding the policy settings and institutional processes allows for the identification of barriers and opportunities to sustainable livelihood. These and other expected findings can be taken into consideration when conducting the different NAPA activities, namely; establishing institutional structure for the preparation of NAPA, synthesizing available information on impacts and adaptation to climate change, and developing indicators and criteria for prioritizing the adaptation activities.

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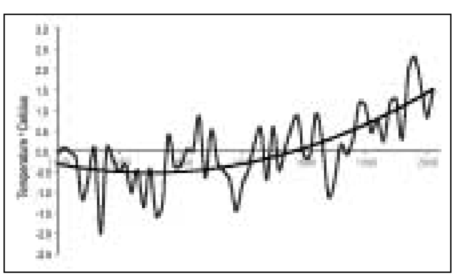
Springate-Baginski, O. and J. Soussan. Livelihood-Policy Relationships in South Asia: A Methodology for Policy Proces Analysis, http://www.geog.leeds.ac.uk/projects/prp/pdfdocs/polmethod.pdf

Past and Present Changes in the Climate, Rangelands, and Livestock of Mongolia

P. Batima, [1] L. Natsagdorj, [1] B. Bolortsetseg, [1] G. Tuvaansuren, [2]
B. Bayarbaatar, B. Erdenetsetseg, and N. Natsagsuren

The traditional pastoral systems of Mongolia are under stress from increasing resource demands, land-use change and mismanagement. Climate change poses an additional stress on these systems. In our study of the potential consequences of future climate change for pastoral systems and possible adaptations (AIACC Regional Study No. AS06), we have begun with an investigation of climatic changes of recent decades and environmental changes that may be related.

During last 60 years the annual mean air temperature increased 1.660C in Mongolia.



Annual mean air temperature anamolies in Mongolia, 1940-2001.

The warming has been most pronounced in winter, with a mean temperature increase of 3.610C. Changes in precipitation have also been observed in parts of Mongolia. Annual precipitation decreased by 3.6 mm/year in last 30 years, with the greastest decrease coming in summer.

Coincident with the changes in temperatures and precipitation are observed changes in snow and ice cover and thickness, peak biomass of grasslands and other ecotypes, plant phenology, and livestock productivity. The factors contributing to vegetation and livestock changes are likely multiple. But many fit a pattern observed globally that suggest changes in climate have played a role.

Stable snow cover forms earlier in the forest steppe and eastern region of the country, but is delayed in some other regions. Snow melt comes 10 days earlier in the western region and 3-5 days earlier in central and eastern regions. Freezing of soils starts 2-6 days later in autumn and the thawing comes 2-6 days earlier in Spring. Spring ice break-up starts 5-15 days earlier depending on geographical location and ice thickness has decreased 40-100 cm.

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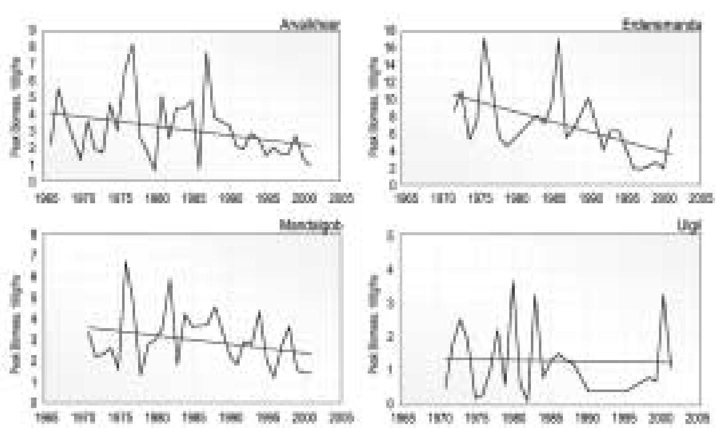


Peak biomass trend in different regions of Mongolia, 1965-2002.

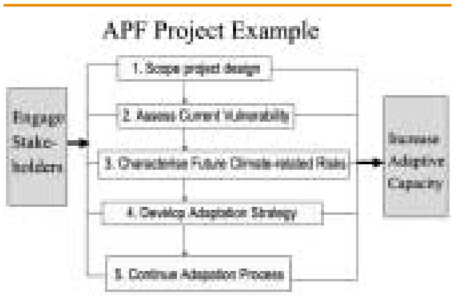
Multi-Stakeholder Engagement in Climate Change Assessments in the Philippines and Indonesia

Sheila Sophia N. Roy,[1] Rodel D. Lasco,[1] Maricel A.Tapia[1] and Rizaldi Boer[2]

Stakeholders in climate change adaptation decisions include those who would make, implement or be affected by those decisions. Their knowledge, experiences, perspectives, motivations and actions will shape the effectiveness of adaptation. Consequently, the engagement of stakeholders in assessing climate change vulnerabilities and adaptation strategies is critical. For this reason, the research team of the AIACC AS21 project in the Philippines and Indonesia are engaging stakeholders in their work, following the steps recommended in the Adaptation Policy Framework of UNDP.

The first year of the project saw many efforts to engage stakeholders in scoping the project design through consultations with key decision makers, meetings with community members from the case-study sites, and meetings that brought together representatives from the government, private sector, the science community, and non-government organizations. In addition, the AS21 team has held training activities for scientists in Indo-China to build scientific capacity and for local residents of the case-study sites to build their capacity to understand and use scientific information related to climate change. Members of the local communities will also be engaged in the assessment of current and future vulnerabilities and adaptation strategies through participatory research methods.

In the Philippines, consultations were held in 2002 with senior representatives of the National Irrigation Administration, National Power Corporation, and the Department of Environment and Natural Resources.



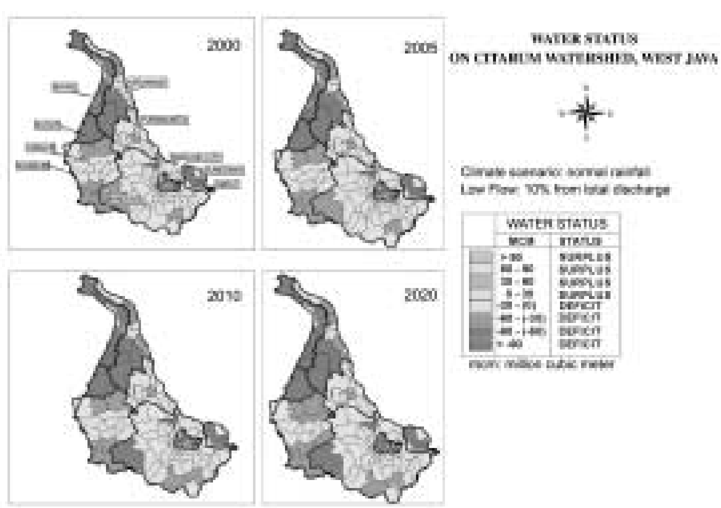
Adaptation Policy Framework Example (UNEP, 2003).

The consultations were important for securing the support of these key stakeholders for the project and initiating discussions for collaborations in the research. It was agreed with these stakeholders that the Pantabangan-Carranglan Watershed would be the case-study site in the Philippines.

Also important is the involvement of local stakeholders, initiated through a local stakeholders' meeting held in August 2002 at the Central Luzon State University in Muñoz, Nueva Ecija. Participants from the municipalities within and near the Pantabangan-Carranglan Watershed attended and discussed issues including the transfer of technology used in assessing climate change impacts, communicating the results to the local people, and the need for a training workshop to equip local people with the knowledge and skills to assess the risks from climate change. As a result of these discussions a training workshop is being held the 3rd week of June 2003. Also, in September 2002 stakeholders from government agencies, NGOs, research institutions and academe met in Quezon City to learn about and discuss the project. Lessons gained from the meeting are now being applied to improve project activities.

In Indonesia a network of government agencies and local authorities has been established to interact with the project researchers and foster collaboration for the research that will be conducted that country. Included in the network are the Bureau of Meteorology and Geophysics (BMG), Directorate of Plant Protection, National Agency on Aviation and Space (LAPAN), Local Agriculture Office, and Local Irrigation Office. The AIACC project researchers and LAPAN have already begun to work together to develop an interface between a high resolution regional climate model and crop simulation models. Close contact with agriculture extension workers and farmers group is also being established. In addition, ICRAF (International Centre for Research in Agroforestry) also provides support for the project.

An initial assessment on the vulnerability of Sumberjaya watershed at Lampung (Southern part Sumatra), and Citarum watershed (West Java) to climate change has been completed and suggests that the Sumberjaya watershed is less vulnerable to climate change than the Citarum watershed. Sensitivity scenario analyses for the year 2020 yielded no or insignificant water deficits relative to demand in Sumberjaya, while deficits were simulated



Water deficits are projected for most of the Citarum watershed of West Java in a scenario that assumes no change in rainfall. Projected water deficits with no change in rainfall suggest that the watershed may be particularly vulnerable to climate change. Water deficits are determined to exist when water demands exceed the reliable discharge, defined as 10% of annual flow.

for all sub-districts in Citarum watershed for the selected scenarios. Because of the seemingly greater vulnerability in the Citarum watershed, and because of opportunities for synergies with other projects supported by START and NOAA, future research of the AS21 project in Indonesia will focus on Citarum watershed. These preliminary results have been presented in a number of forums in Indonesia.

In addition to the research activities underway in the Philippines and Indonesia, the AS21 project is also helping to enhance scientific capacity in the wider region. A training-workshop on climate change assessment methods for Indo-Chinese scientists was held on Nov. 25 – Dec. 6, 2002 at the Training Center for Tropical Resources and Ecosystems Sustainability (TREES), College of Forestry and Natural Resources, UPLB. Two scientists each from Cambodia, Laos and Vietnam participated in the training-workshop. The workshop drew upon previous AIACC training workshops for training material, as well as the experiences and knowledge of the AS21 team. A key output of the training was research proposals from the scientist-participants to assess the impacts and adaptation to climate change in their respective countries. These studies are funded by the AS21 project from their grant from AIACC.

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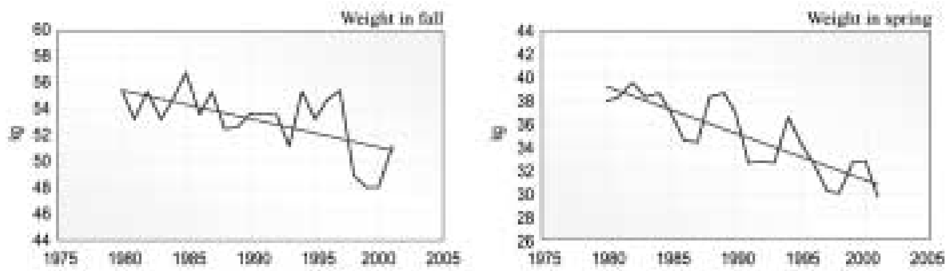
Past and Present Changes in the Climate, Rangelands, and Livestock of Mongolia (cont.)

In the arid and semi-arid rangelands of Mongolia, changes in precipitation are likely to have had a dominant role in these ecosystems relative to temperature changes. Average peak standing biomass has shown a declining trend in a number of regions of Mongolia, as much as 20 to 30 percent over the past 40 years in some places. Plant phenology changes such as earlier or later emergence has been observed. In the forest steppe and steppe, emergence of pasture plants is coming earlier. In contrast, the emergence date of some plant species in the Altai mountains, the desert steppe and the desert has come later.

Animal husbandry plays special and important role in Mongolia's economy and agricultural sector. Because animals graze year round on native pasture, they are vulnerable to changes in the productivity of pastures, climate variability and extreme climatic conditions. The combined effects of climatic and ecological stresses on animal growth, development, fertility,



Average live animal weight of ewes in Fall and Spring, 1980-2002.

productivity, resilience and adaptive capacity are reflected in the live weight of animals. For this reason, animal live weight is a useful indicator for measuring changes in the pastoral livestock sector.

Animal live weight has decreased during the past 22 years due to decreased pasture carrying capacity as well as other changed climatic factors. The average weight of ewes has decreased by 3.63 kg during the period, or 0.17 kg each year, from an average of nearly 50 kg. Similarly, average live weight declined by 13.8 kg for cows and got lost 2 kg for goats.

Declines in animal weight adversely affect the economic performance of the pastoral livestock system and raise concerns about the pressures being placed on Mongolia's rangelands. The role of climate change in this trend is not yet known and is a subject of investigation in our project.

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Impact of Global Change on the Coastal Areas of the Rio de la Plata

Vicente Barros, Inés Camilloni, and Angel Menendez

Introduction

The Rio de la Plata (RP) is unique; it is by far the widest river in the world with a width ranging from 50Km in front of Buenos Aires, to 250 Km at its outlet on the Atlantic Ocean (Fig. 1); its length is only 300 Km, and it has a very small descent of only 0.01m/Km. These features make the RP responsive to strong southeasterly winds over nearby areas of the Atlantic Ocean with wave tides that increase toward it s inner margins. Because of their origin, the largest wave tides are frequently accompanied by destructive winds that harm coastal facilities. On the Argentine coast these effects are exacerbated by flooding of many sectors of the coastal areas, which stand only a few cm above the RP mean level. These events, known as "south-easterlies," produce significant damage. The rising development of resort areas along the RP coasts, as well as the occupation of other coastal areas for precarious housing by an impoverished population, increases the social and economic impact of these flood events.

Projected climate change is expected to accelerate the present sea level rise, and likely alter the discharge contribution of the RP tributaries in a yet unknown manner. In addition, it could also lead to changes in the wind field over the RP and the neighboring ocean. Because of the RP shape slope, these changes will modify its mean water level as

(continued on page 10)

Impact of Global Change on the Coastal Areas of the Rio de la Plata (cont.)

well as the heights of the wave tides caused by the "southeasterlies." These aspects are being explored in the context of the AIACC LA 26 Project.

Sensitivity of the Rio de la Plata Level to Changes in the Wind Field

The sensitivity of the RP mean sea level to wind field and discharge of its tributaries was explored with a two dimensional (vertically-integrated) hydrodynamic model. The model implementation was based on the HIDROBID software (Menéndez 1990). Its calibration includes: i) water level data from Tide Tables; ii) recorded water level data for a relatively calm wind situations; iii) recorded water level and velocity for relatively storm-free period; and iv) recorded water level for storm events.

Four different scenarios of the RP discharge are presented in the adjacent figure (see right column). One of them, 75,000 m3/s, corresponds to the largest discharges observed during the last century. This discharge level affects considerably the inner part of the RP, being comparable to the expected sea level rise during the next hundred years. These largest discharges last for many months and therefore are likely to be concurrent with "southeasterly" events enhancing their flooding effects. These largest floods have increased in frequency since the 1970-decade increasing the vulnerability of the inner RP coast. The 30,000 m3/s case demonstrates the possible effect of an extraordinary increase in the mean annual discharge. According to the model outcome, only a minor effect on the mean level could be expected at Martin Garcia, but not further downstream, as this effect would be negligible at Buenos Aires. Thus, changes in the overall mean discharge of the La Plata basin seem not to have a deleterious effect on the river level. However, the largest discharge events may have a considerable impact on the inner part of the RP.

Model simulations indicate that the river level response to the increase of the easterly component of wind is felt with more intensity in the RP than on the ocean coast and increases towards the interior of the River. This is a result of the river's shape and it is also observed in the astronomical and wind tide surges. This sensitivity experiment was run with a stationary wind field. Since the effort of wind over surface water is nonlinear with wind intensity, the result presented here must be considered as preliminary as response to a transient wind field likely would be greater.

Trends of sea level pressure fields

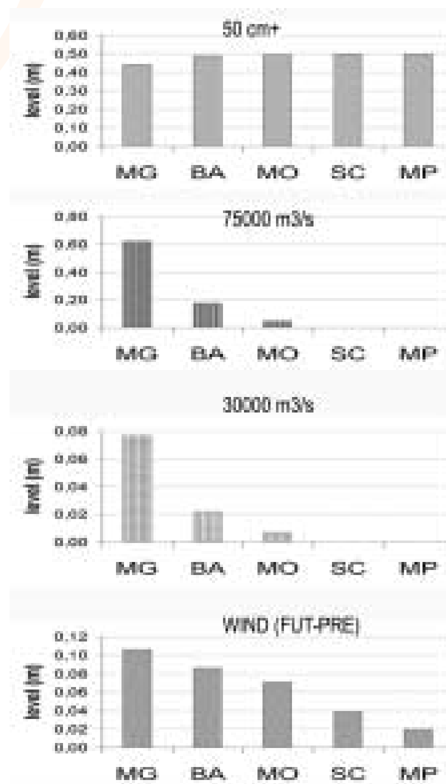
Surface winds are not an available standard output of the GCM scenarios. However, since this variable is strongly coupled with sea surface pressure (SLP) fields, wind fields are derived from SLP scenarios. To begin, the ability of the GCMs to reproduce the present features of the SLP over a region that encompasses the RP was evaluated. SLP scenarios from GCM projections found with the SRES-AZ emissions were taken from the Modelle and Daten (MOD) web page of IPCC (www.dkrz.de/ipcc/ddc/html/SRES/SRES_all.html). GCM outputs were checked against the National Centers for Environmental Prediction (NCEP) readings data. Comparison with monthly and annual NCEP fields indicates that only four models [HADCM3, CSIRO-mk2, ECHAM4, GFDL-R30] have an acceptable agreement with the observed SLP fields in southeastern South America and the adjacent ocean and were able to represent the position of the pressure systems and their annual cycle (Camilloni and Bidegain 2002).

Rotated Principal Component Analysis (PCA) was applied to mean seasonal SLP fields (1960–2000) of both the reanalysis and GCM fields to find the principal models of seasonal and interannual variability. This PCA was not performed on the ECHAM4 output because its experiment started only in 1990. The first two principal components are found to represent well not only the mean annual field for SLP, but also the seasonal variability, explaining more than 90% of the total variance. The GCMs also capture a shift in the maximum axis pressure of 1˚ to 2˚ towards the south. This displacement of the SAH implies an increase in easterly winds that could explain water level increases of 10cm in Buenos Aires and 6cm in Montevideo during the last 50 years.

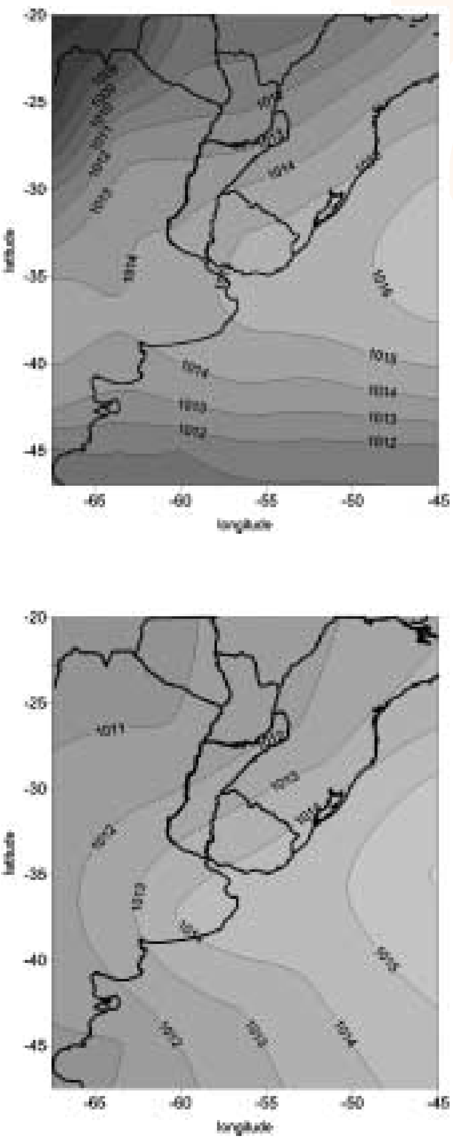
Future scenarios of sea level pressure and wind fields

The main SLP fields of the SRES-A2 scenarios of the four models show that the shift towards the south of the western border of the SAH continues to 2100. The adjacent figures (see right column) depict this displacement for the HADCM3 experiment.

The SLP pattern evolves according to the model experiment, but all models show an overall trend to the south of the SAH circulation



Model domain and results from sensitivity experiments. 50cm+ stands for a scenario of 50cm rise in the mean sea level. Wind refers to the result of increasing the easterly component from 3 to 4 m/s. 30,000 and 75,000 m3/s stands for two tributaries contribution scenarios of about 2˚ to 3˚ in 150 years. As displayed in the figures, this trend is more pronounced to the east of the analyzed region. The importance of this shift in the climate of southeastern South America can be roughly assessed considering that the present seasonal shift is about 8˚. One outcome of this climate change will be the increase of the easterly wind component over the RP and the consequent rise in its mean level. Since the RP is the focal area of this study, the meridional gradient of pressure over the RP area was calculated as an indication of the easterly wind component, (see table in right column). In the case of the HADCM3 experiment, this gradient almost doubled in 150 years.



Mean sea level pressure for the HADCM3 experiment

Period	1950-59	1960-69	1970-79	1980-89	1990-99	2000-2050	2050-2099
Meridional SLP gradient (hPa/1000 km)	1.94	1.88	2.20	2.36	2.16	2.76	3.88

Meridional gradient over the Rio de la Plata as simulated by the HADCM3 experiment

Social vulnerability

The largest tide flood caused by a southeasterly event measured at 3.90 m over mean sea level (at Buenos Aires port). The number of southeasterly events that surpassed the alarm level increased during the last three decades. If, in spite of that, the conservative assumption is made that in the next hundred years the largest floods are not going to be greater than in the past century, then the combined effect of mean sea level rise, stronger mean easterly winds, and eventual large discharges may lead to some flood events with water level near 5m over present mean sea level at Buenos Aires.

A large area of the Great Buenos Aires city is below the 5m-altitude cote, including an important part within the administrative boundary of the city itself. The potential vulnerable areas are not only in coastal areas of the RP, but extend to in the heavily populated margins of the Riachuelo-Matanzas River and along the Reconquista River, an area of many precarious settlements of an impoverished population. The total population now living in the Great Buenos Aires below the 5m cote over present mean sea level is almost 1,500,000.

For the administrative units with area below 5 m over mean sea level a social vulnerability index was developed including indicators related to: a) demography b) living conditions of the population, and c) structural production and consumption processes.

Further research

To asses the vulnerability to flooding under an context of climate change, Project LA 26 will develop future scenarios of the permanent impact of the sea level rise and of transient impacts through the enhancement of tide floods provoked by the southeasterlies in a GIS base. Return periods of the floods will be calculated with high spatial resolution for present conditions and for future scenarios at different crossing times. This information, together with the social vulnerability index, will provide the basis for the development of one or more indices of vulnerability to climate change.

A quantitative approach, using GCM scenarios, is being developed to assess future changes both in SLP and surface wind fields. Trends, like those shown in Fig. 3, appear also in the 1850-2100 PCA of MCG results. Finally, because of the non-linear response of the water level to the surface winds, it is necessary to run decades-long transient experiments with the hydrodynamic model to assess the response of the mean RP level to surface wind.

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AIACC Announcements

Advanced Institute on Vulnerability to Global Environmental Change

START and the International Institute for Applied Systems Analysis (IIASA) invite applications to an Advanced Institute on Vulnerability to Global Environmental Change. The Advanced Institute has three components: a three-week long Seminar to be held 3-21 May 2004 at IIASA in Laxenburg, Austria, a small research grant program for Seminar participants, and a culminating workshop that will follow completion of the research.

In the Seminar, applicants selected to be Institute Fellows will examine the theoretical foundations and methods of vulnerability analysis, evaluate and derive lessons from case studies, and learn selected analytic tools with the objective of building a base of knowledge and skills from which to conduct research on vulnerability. Institute Fellows who successfully complete the Seminar and who prepare a high quality research proposal will be eligible to receive a 1-year research grant of $10,000 to $15,000 (USD) to carry out their proposed research. A culminating workshop will be held approximately 18 months following the Seminar at which Institute Fellows will present their results and discuss their research experiences. The Advanced Institute is funded by a grant from the David and Lucille Packard Foundation.

More information and application materials may be found on the START website (www.start.org) under the link "What's New." Applications are due 15 October 2003.

African Weather Station Data and Climate Change Projections Available on CD

The Climate Systems Analysis Group of the University of Cape Town has produced a set of CDs to assist researchers constructing scenarios of climate change in Africa. The CDs include long-term, historical station data from weather stations across Africa and GCM projections of future climate change for the continent that have been extracted from the global datasets available on the internet from the IPCC's Data Distribution Centre. Monthly means of minimum and maximum surface air temperature, total precipitation and sea surface temperature through the year 2100 are provided from simulations of six GCMs forced with SRES emissions of greenhouse gases. The CDs also include algorithms that can be used to construct high-resolution scenarios of climate change using the GCM-guided perturbation method described elsewhere in this issue of AIACC Notes. The CDs are a product of AIACC Regional Study No. AF07. They can be requested by contacting the AIACC Secretariat: aiacc@agu.org.

New AIACC Web Address

As of late June 2003, AIACC's new website address is: http://www.aiaccproject.org/. The previous address will redirect users to the new site. Please update your browser.

The new AIACC DMS Website at CIESIN is also now available at: http://sedac.ciesin.columbia.edu/aiacc/.