A Regional Approach to Understanding and Forecasting Seasonal Climate Variability for the Benefit of Society: the Inter-American Institute for Global Change Research and the International Research Institute for Climate Prediction

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Introduction

As evidenced by the participation of most of the world's leaders in the United Nations Conference on Environment and Development (UNCED) in Rio Janeiro, June of 1992, the phenomenon of global change is seen by society as one of the most critical challenges facing the world today. The physical planet we live on appears to be undergoing unprecedented fluctuations and changes. Some of these fluctuations are attributed to natural phenomena, yet other's can be associated with human behavior. Whether natural or anthropogenic, these fluctuations significantly affect the life systems this planet supports, including the social and economic systems of humankind. This presents a tremendous challenge to researchers of all disciplines as well as to decision and policy-makers of all nations. Due to the demonstrated impact of global change related phenomena on populations and society, the need to approach these issues in an integrated, interdisciplinary manner, that is, as an inter-related system, has been raised in a number of international fora as essential to mitigating the effects of these changes.

In addition to the multi-disciplinary nature of the global change problem, there is an intrinsic trans-national element to be considered when developing research initiatives intended to address the issue. Physical and socioeconomic evidence of global change related phenomena can be found in all areas of the world. Regardless of whether the particular phenomenon is natural or human-induced, its effects often span traditional geopolitical borders. Because of this, many environmental issues must be addressed, from a physical standpoint, as a global or regional problem, with solutions applied at a national level. We must work together in order to meet the environmental challenges before us today.

The topic of seasonal climate variability provides an excellent example of a physical phenomenon with identifiable socioeconomic impacts which often span broad regional areas. Changes and shifts in precipitation patterns and amounts can greatly affect human populations and their economies. A season with excessively high amounts of precipitation can result in floods, depletion of topsoil and destruction of property; all of which can have a substantial impact on the natural resources and economies of those societies touched by the phenomenon. Whereas, a reduction in precipitation, particularly during an agricultural growing season, can obviously have devastating effects on the people in the region.

An example of the serious consequences which variations in climate can have on human society are related to the 1982-1983 El Niño-Southern Oscillation (ENSO) event which resulted in the catastrophic loss of thousands of lives and billions of U.S. dollars worldwide. The impact of the ENSO event varied throughout the world. For example, severe flooding which occurred in Southern Brazil, Northern Argentina and Eastern Paraguay and disastrous droughts in Indonesia, Southern Peru and Western Bolivia have been attributed to the 82/83 event. There is substantial evidence that in many other areas of the world dramatic shifts from "normal" climate patterns are due to ENSO.

The ENSO phenomenon is global, yet its impacts are regional in nature. This fact demands the establishment of global and regional research initiatives which address the issue on a multidimensional basis. The ability to extend scientific research and programs across geopolitical borders and beyond the management of any single government is critical to the successful execution and application of research in the area of climate variability. Two initiatives -- the Inter-American Institute for Global Change Research and the International Research Institute for Climate Prediction--are currently being developed in response to this need.

The Inter-American Institute for Global Change Research

The concept of a regional network of research centers focussed on the monitoring, understanding and prediction of natural phenomena as well as associated socioeconomic implications to address global change originated within the international scientific community. Discussion among science managers and policy-makers from the governments of the Americas built upon this conceptual framework in the development of the Inter-American Institute for Global Change Research.

On May 13, 1992, eleven countries of the Americas signed the Agreement Establishing the Inter-American Institute for Global Change Research in Montevideo, Uruguay, thus becoming Founding Parties (Article XV of the Agreement designates all nations which sign the Agreement between May 13, 1992 and May 12, 1993 as Founding Parties.) Two additional countries have signed since May 1992 and others are expected to sign in the near future (Appendix A).

The primary objective of the Inter-American Institute for Global Change Research (IAI) is to conduct basic research in global change related fields and to augment the scientific capacity in the region. This objective will be accomplished through the creation of a network of Research Centers dedicated to the study of global change issues that have been identified based on their relevance to the region and potential for contribution to global studies. Results generated from IAI research activities, including data, will be available within the region for analysis and integration in the policy-making processes. Furthermore, the IAI is firmly committed to augmenting

existing opportunities for training and education within the scientific fields important to global change studies. Training and education programs will integrate the individuals, institutions and countries involved in IAI activities while providing technical and information exchanges.

The scientific agenda of the IAI and the organizational infrastructure through which Institute programs and activities will be implemented has been developed through a series of Workshops and Working Meetings, beginning with the "First Workshop to Develop an Inter-American Institute for Global Change Research", convened July 15-19, 1991 in San Juan, Puerto Rico. The principles which have guided and shaped the IAI's development process -- scientific excellence, interdisciplinary collaboration, open exchange of data and information and commitment to training and education -- were identified by individuals from the twenty-six countries and representatives from international organizations who participated in this First Workshop.

The initial scientific research agenda of the IAI as specified within the Agreement Establishing the IAI, is the result of a multinational and interdisciplinary planning process and is intended to reflect those aspects of global change which have significant physical and socioeconomic impacts on the American Region. As global change is a dynamic issue, it is expected that the agenda will continue to evolve under the guidance and recommendations of the IAI's Scientific Advisory Committee.

Seven research topics have been identified as initial priorities of the IAI;

- Tropical Ecosystems and Biogeochemical Cycles
- The Impacts of Climate Change on Biodiversity
- El Niño-Southern Oscillation and Interannual Climate Variability
- Ocean/Atmosphere/Land Interactions in the Inter-tropical Americas
- Oceanic, Coastal and Estuarine Processes in Temperate Zones
- Temperate Terrestrial Ecosystems
- High Latitude Processes.

The IAI will be governed by the coordinated efforts of a Conference of the Parties, an Executive Council and an Institute Director. The Scientific Advisory Committee (SAC) will advance the development and implementation of the Institute's scientific agenda. It is expected that Research Center Directors will also participate in IAI decision-making processes as the principle contact points for research programs.

The International Research Institute for Climate Prediction

Recent scientific advances in monitoring, understanding and modeling of the El Niño-Southern Oscillation (ENSO) cycle have led to the development of predictive models which have already proved useful in forecasting the warm and cold phases of the ENSO phenomenon. The ability to accurately predict approaching ENSO events a year or more ahead of time is an extremely valuable service to societies whose economies are effected by the variation in climate resulting from ENSO events; early knowledge of the incipient ENSO event would allow decision-makers to take advance action in an attempt to mitigate the socioeconomic impacts associated with ENSO events. The concept of an international entity dedicated to the collection and dissemination of climate variability data has been endorsed by the Intergovernmental Board of the World Climate Research Program's Tropical Ocean and Global Atmosphere (TOGA) Program, the Second World Climate Conference, the ASCEND-21 Conference and finally by the international community represented at the June 1992 United Nations Conference of Environment and Development (UNCED).

In July 1992, a multinational Task Force, convened in response to a recommendation for action by the Intergovernmental TOGA Board, developed a plan for an International Research Institute for Climate Prediction (IRICP). The IRICP is designed as a multinational initiative to advance climate research, develop coupled ocean-atmosphere models to serve as a basis for improved climate prediction on time scales out to a few years and provide the mechanisms for the application of climate information in support of sustainable economic growth and development.

According to the plan to establish an IRICP, the Institute will:

- advance the development of dynamically and thermodynamically consistent couple models of the global atmosphere, ocean, land, to serve as a basis for improved climate prediction;

- explore the predictability of climate anomalies on time scales out to a few years;

- receive, analyze and archive global atmospheric and oceanic data to improve the scope and accuracy of the forecasts;

- systematically produce useful climate forecasts on time scales of several months to several years on global scales; and

- shape and augment these forecasts by incorporating additional physical, agricultural, economic, and other appropriate data, to the explicit social and economic benefit of national societies.

As designed, the IRICP will evolve into a multinational Core Facility that will advance the development of seasonal to interannual climate predictions through coupled modeling and provide these socially and economically useful climate predictions to countries participating in the initiative through a series of globally dispersed Application Centers and operational agencies. The Application Centers will provide data and information regarding regional and local climate forcing factors in an effort to tailor the global predictions disseminated by the Core Facility for a refined product. Climate predictions issued in this way have the potential to provide policy-makers with the means to apply scientific knowledge for such practical economic issues as agricultural policies, energy supply and water availability (Appendix B).

The Relationship Between the IAI and the IRICP

The study of seasonal to interannual climate variability is the common ground between the IAI and the IRICP. Collaboration between the two initiatives will occur to maximize the potential for advanced research in climate variability and the application of research results in the American Region.

An IRICP Application Center in the American Region would be co-located or perhaps fully integrated with the Research Center which has the lead responsibility for the ENSO topic for the IAI. As an IAI Research Center, the site would conduct basic interdisciplinary research on climate variability within the region; as an IRICP Application Center, the site would receive and analyze the Core Facility's global ENSO predictions and tailor them to the needs of the region. The research conducted at the Center under the mandate and auspices of the IAI would contribute valuable data and information for the analysis and regional tailoring of the IRICP Core Facility's ENSO forecasts.

Collaboration between the IAI and the IRICP will no doubt result in mutual benefit for these two autonomous institutions. The IAI is a multinational entity that focusses on the conduct of basic interdisciplinary scientific research on global change related phenomena within a regional framework. When mature, the IRICP will focus on the creation and dissemination of ENSO forecasts and climate prediction information for the benefit of participating nations, *including* those in the American Region.

The Status of the IAI and the IRICP Initiatives

The Agreement Establishing the Inter-American Institute for Global Change Research will enter into force immediately following ratification of the Agreement by six Signatories; as of March 1993, three countries have ratified and others are expected to follow shortly. The First Meeting of the Conference of the Parties will occur no less than sixty days following the entry into force of the Agreement. The Implementation

Committee of the IAI is currently preparing recommendations for the First Meeting of the Conference of the Parties intended to ensure that the IAI can become operational as rapidly as possible. Inquiries regarding the IAI should be directed to Dr. Robert Corell, Chairman of the IAI Implementation Committee at (202) 357-9715 or by fax at (202) 357-9629.

The plan to create an International Research Institute for Global Change Research is being distributed for the consideration, evaluation and modification of interested scientists and government officials. The Task Force will present the proposal at the Intergovernmental TOGA Board Meeting, April 19-21, 1993 for the review of participants. Inquiries regarding the IRICP should be directed to Dr. A.D. Moura, Chairman of the ITB-recommended Task Group, at (301) 427-2089 ext. 44 or by fax at (301) 427-2082.

Summary

The severity and particular character of the impacts of seasonal to interannual climate variability differ throughout the world. The earth, like a small scale ecosystem, is an integrated, inter-related system, sensitive to even slight variation in the normal patterns of precipitation. All of the world's populations greatly depend upon this fragile system for survival. As climate variability is beyond the realm of human control, the most efficient response to the challenge of mitigating its effects on populations and society is to adapt to the changes. The ability to monitor, model and predict incipient variations in climate is a valuable tool to adapting to climate variability. Together, the IAI and the IRICP will further advance the development of predictive capabilities through the collection, analysis and dissemination of climate variability information.

Participation in multinational scientific cooperative efforts like the IAI and IRICP can greatly benefit governments, scientists, resource managers and educators concerned with global change related phenomena and impacts. The ready access to data and information, technology and training and education programs fortifies the participating national scientific communities and creates a bank of knowledge to which policy-makers can refer when constructing national missions and policies regarding the environment as well as the economy. In certain cases, nations involved in such initiatives have augmented opportunities to access international and, depending on the initiative, foreign funding sources, such as the Global Environment Facility. Finally, the establishment of a multilateral network constructed of either *inter-regional* links, as developed by the IAI or *intra-regional* links, as facilitated by the IRICP, may eventually extend beyond the base initiative's initial focus on global change related phenomena to other realms of collaboration.

APPENDIX A

Inter-American Institute for Global Change Research

Signatory Countries as of March 1993

1. Argentine Republic
2. Republic of Bolivia
3. Federal Republic of Brazil
4. Republic of Chile
5. Republic of Costa Rica
6. Dominican Republic
7. Republic of Ecuador
8. The United Mexican States
9. Republic of Panama
10. Republic of Paraguay
11. Republic of Peru
12. United States of America
13. Oriental Republic of Uruguay

FORECAST OF SEASONAL CLIMATE VARIABILITY:

THE INTERNATIONAL RESEARCH INSTITUTE FOR CLIMATE PREDICTION