

Symposium on Climate and Extreme Events in Asia Pacific

Enhancing Resilience and Improving Decision Making

March 19-21, 2003
20th Pacific Science Congress
Bangkok, Thailand

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**Symposium on Climate and Extreme Events in Asia Pacific:
Enhancing Resilience and Improving Decision Making**

**Report of a Symposium conducted as part of the
20th Pacific Science Congress
Bangkok, Thailand
March 19-21, 2003**

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EXECUTIVE SUMMARY

Climate-related disasters can jeopardize social development goals—such as ameliorating poverty; providing adequate food, water, housing, sanitation, and health care; and protecting the environment—as well as economic development investments that provide employment and income. At the same time, the drive for social improvement and economic growth can create new disaster risks (UNDP-BCPR 2004). Thus it is critical to integrate disaster management within the sustainable development agenda.

National, regional, and global agencies are increasingly aware that resilience to climate variability and change is an integral component of sustainable development planning. They also recognize that Asia Pacific communities are among the most vulnerable in the world, particularly small island states and low-lying coastal areas. Hydrometeorological conditions account for 80 percent of Asia Pacific's natural disasters, and the region accounted for over 80 percent of the world's climate-related disasters in 1991–2000 (IFRC 2000). Short-term climate variability—including seasonal monsoons, the El Niño-Southern Oscillation (ENSO), and the Interdecadal Pacific Oscillation (IPO)—is compounded by potential long-term changes in temperature, precipitation, storminess, and sea level associated with global warming. The region is particularly vulnerable because:

- Water resources are already stressed in many Asia Pacific countries;
- Climate-sensitive sectors (e.g., tourism and agriculture) and resources (e.g., coral reefs and fisheries) are at the heart of current and future economic development plans; and
- The rich biodiversity and unique ecosystems of Asia Pacific are sensitive to climate variability and change (with both local and global implications).

During the past decade, a number of research programs were designed to enhance our understanding of the nature and consequences of climate-related extreme events in the Asia Pacific region, and to explore the application of climate information to support decision making. Some of the more prominent examples include: the Extreme Climate Events Program implemented by ADPC/ECE; Climate Forecast Applications in Bangladesh, based on models developed by the University of Colorado's Program on Atmospheric and Oceanic Sciences and Georgia Institute of Technology; the Pacific ENSO Applications Center (PEAC); the East-West Center's (EWC) Pacific Islands regional contribution to the first U.S. National Assessment; and the Pacific Islands Climate Change Assistance Program coordinated by the South Pacific Regional Environment Programme (SPREP). In parallel, regional organizations like ADPC, the South Pacific Applied Geosciences Commission (SOPAC), and EWC's Pacific Disaster Center (PDC) have been developing integrated assessment techniques and new technologies to support comprehensive emergency management in the region.

As described in a UNDP report titled “A Climate Risk Management Approach to Disaster Reduction and Adaptation to Climate Change” (UNDP 2002), the concept of climate risk management—reflecting a more effective integration of climate adaptation with

comprehensive emergency management programs—continues to take shape with the UNDP-BCPR, the International Federation of Red Cross and Red Crescent Societies (IFRC), the International Strategy for Disaster Reduction (ISDR), the World Conservation Union (IUCN), disaster management agencies, and humanitarian relief organizations actively leading those discussions. The regional consequences of climate change, including the effects of climate-related extreme events, are expected to provide an important focus for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, see Appendix C).

One common element of all these discussions is a recognition that adaptation to natural climate variability not only promises to reduce vulnerability in the near term, but also provides insights and experience that will prove valuable in enhancing resilience to long-term climate change as well.

In this context, EWC, ADPC, and the Pacific Science Association convened the *Symposium on Climate and Extreme Events in Asia Pacific: Enhancing Resilience and Improving Decision Making*, as part of the 20th Pacific Science Congress. The Symposium was sponsored by NOAA/OGP, UNDP-BCPR, EWC, and ADPC/ECE (with funding from NOAA/OGP and the U.S. Agency for International Development, Office of Foreign Disaster Assistance).

In the Symposium’s opening keynote address, Dr. Michael (Mickey) Glantz highlighted the importance of addressing the integrated “*climate-society system*.” He emphasized that we must consider societal context, decision-making frameworks, and information needs as well as the ability to monitor, understand, and anticipate changes in the physical climate system. We must create and sustain partnerships among the multidisciplinary community of scientists interested in climate adaptation, and the governments, resource managers, and businesses for whom adaptation represents a matter of survival and sustainable development.

Individual presentations, working groups, and plenary discussions addressed five integrating themes:

- *Communication*—the content, format, and dissemination of climate information to support decision making, as well as the identification of critical information gaps;
- *Participation*—engaging relevant stakeholders and establishing a dialogue with users of climate information;
- *Information use*—how climate information has been and can be used to support decision making, including responses to individual events and the routine integration of climate information in development planning;
- *Institutional capacity*—institutional barriers as well as opportunities to enhance the capabilities of current and emerging organizations;
- *Scientific and technical issues*—critical information gaps and future priorities.

The individual presentations on national and sectoral experiences confirmed the exposure and sensitivity of the Asia Pacific region to climate-related extreme events, and

highlighted opportunities in a number of key sectors: agriculture and food security; drought, flood, and fire management; disaster management; tourism; health; water and other natural resource management; and fisheries. These presentations and subsequent working group discussions also reinforced the central importance of a *highly collaborative, participatory process in which scientists and decision makers share responsibility for developing and applying climate information to enhance the resilience of Asia Pacific communities and improve decision making.*

Symposium discussions highlighted the following points that might be considered ***guiding principles*** for climate information systems.

- ***Address the integrated climate-society system***
 - Climate risk management in a sustainable development context
 - Climate risk management as a valuable framework for building partnerships and guiding climate information systems

- ***Understand vulnerability and focus on building resilience***
 - Place and context matter
 - Understand decision-making framework(s) to help guide climate information development, delivery, and applications
 - Provide mechanisms to continuously assess vulnerability, adjust decisions, identify new opportunities, and routinely integrate new insights and capabilities
 - Emphasize proactive planning

- ***Focus on useful, usable, and actionable information***
 - Scale, timing, format, language, and content of information appropriate to a particular application/user community
 - Products and process responsive to user needs
 - Tools and technology appropriate to a given user and application

- ***Recognize the importance of climate information on a continuum of time scales*** from extreme events through variations in climate on seasonal, intra-seasonal and year-to-year time scales, and climate change on decadal and longer time scales
 - Provide a valuable focus to galvanize the commitment of scientists, government, the private sector, and the public
 - Address today's problems while planning for the future
 - Protect public health and safety, improve decision making in critical sectors, and support long-term planning and policy development

- ***Utilize a team/network approach with partners engaged in an iterative, participatory process***
 - The *process* of communication and dialogue between the providers and users of climate information is at least as important as the individual climate information products
 - Building trust and credibility is essential to success
 - Sharing experiences, expertise, and tools among teams/networks is vital to regional success
- ***Recognize the vital role of trusted information brokers*** (individuals, institutions, associations)
- ***Build on existing systems, institutions, programs, relationships, and networks*** and recognize the necessity of education, training, and capacity building

This provides only a shorthand version of some of the rich discussion that characterized the March 2003 Symposium on Climate and Extreme Events in Asia Pacific. Additional details are provided in the full Symposium Report. The report, as well as Symposium presentations and background materials, can be found online at:

www2.EastWestCenter.org/climate/extreme

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Additional funding was made possible through the Asian Disaster Preparedness Center's Extreme Climate Events Program (ADPC/ECE) with funding from NOAA/OGP and the U.S. Agency for International Development's Office of Foreign Disaster Assistance.

The Symposium Co-Chairs would also like to thank the United Nations Development Programme (UNDP) Bureau of Crisis Prevention and Recovery (UNDP-BCPR) for its financial support, which helped ensure the participation of a diverse mix of representatives from throughout the Asia Pacific region. We would like to specifically acknowledge the work of Mr. Thomas Brennan in securing this support and in contributing directly to the Symposium deliberations, including his excellent closing keynote address.

The Symposium Co-Chairs would also like to express our deep gratitude to the officers of the Pacific Science Association and the organizers of the 20th Pacific Science Congress for their assistance in organizing the Symposium as part of the Congress. In this context, a special thanks goes to Mr. Montri Chulavatnatol, Secretary General of the 20th Pacific Science Congress. In addition, Mr. Anond Snidvongs and Mr. Sasithon Yuwahsool of the International START office in Thailand played invaluable roles as our liaisons with the 20th Pacific Science Congress Organizing Committee.

We would also like to extend a special thanks to Dr. Michael (Mickey) Glantz (National Center for Atmospheric Research, USA) for his splendid opening keynote address, and for serving as a member of the Symposium Steering Committee.

We also thank the other members of the Symposium Steering Committee for their valuable contributions prior to and during the March 2003 Symposium, as well as their assistance in the development of this report: Cheryl Anderson (University of Hawai'i, USA), Maxx Dilley (International Research Institute for Climate Prediction of Columbia University, USA), Michael Hamnett (University of Hawai'i, USA), Kamal Kishore (UNDP-BCPR, India), Nancy Lewis (East-West Center, USA), Roger Pielke, Jr. (University of Colorado, USA), and Jim Salinger (New Zealand National Institute of Water and Atmospheric Research). As moderators of the working group discussion on Symposium integrating themes, Cheryl Anderson, Maxx Dilley, Michael Hamnett, Kamal Kishore, and Jim Salinger helped elucidate many of the key findings and recommendations summarized in this report.

ADPC and EWC provided in-kind contributions of personnel time, materials, and organizational support. In this context, the contributions of Glenn Dolcemascolo

(Program Manager of ADPC/ECE) are particularly noteworthy. He was a central member of the Symposium team from the earliest planning meetings, and his insights and expertise were reflected throughout the Symposium.

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Enhancing Resilience and Improving Decision Making*

ACRONYMS

- ADPC – Asian Disaster Preparedness Center
- ADPC/ECE – Asian Disaster Preparedness Center Extreme Climate Events Program
- APN – Asia-Pacific Network for Global Change Research
- ASEAN – Association of Southeast Asian Nations
- DC – Developing countries
- ENSO – El Niño-Southern Oscillation
- EWC – East-West Center
- FSM – Federated States of Micronesia
- GIS – Geographic information systems
- IFRC – International Federation of Red Cross and Red Crescent Societies
- IPCC – Intergovernmental Panel on Climate Change
- IPCC TAR – Intergovernmental Panel on Climate Change Third Assessment Report
- IPO – Interdecadal Pacific Oscillation
- ISDR – International Strategy for Disaster Reduction
- IUCN – International Union for the Conservation of Nature and Natural Resources
(World Conservation Union)
- NIWA – National Institute of Water and Atmospheric Research (New Zealand)
- NOAA/OGP – U.S. National Oceanic and Atmospheric Administration Office of
Global Programs
- PDC – Pacific Disaster Center
- PEAC – Pacific ENSO Applications Center
- SOPAC – South Pacific Applied Geosciences Commission
- SPREP – South Pacific Regional Environment Programme
- UNDP – United Nations Development Programme
- UNDP-BCPR – United Nations Development Programme Bureau of Crisis Prevention
and Recovery
- USAID/OFDA – U.S. Agency for International Development, Office of Foreign
Disaster Assistance

INTRODUCTION AND BACKGROUND

According to the 2000 World Disaster Report issued by the International Federation of Red Cross and Red Crescent Societies (IFRC 2000), over 80 percent of the world's climate-related disasters in 1991–2000 occurred in Asia. While acknowledging the lack of sufficient observational data to accurately assess trends, and the need for enhanced spatial detail in models used to project changes in some phenomena, the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC TAR) provides some estimates of scientific confidence in observed and projected changes in extreme events (IPCC 2001). Many of the conditions discussed—such as more intense precipitation events, increased summer continental drying with associated risk of drought, and changes in tropical cyclone intensities and tracks—have significant potential consequences for countries of the Asia Pacific region. The IPCC TAR also points to likely increases in the extremes of drying and heavy rainfall associated with El Niño and an increase in the variability of Asian summer monsoon rainfall. The El Niño-Southern Oscillation (ENSO) cycle is associated with changes in patterns of extreme events such as droughts, floods, and tropical cyclones that already present significant challenges to Asia Pacific countries.

National governments, regional organizations, and international scientific, development, and donor agencies increasingly recognize the importance of enhancing resilience to climate-related extreme events as an integral component of sustainable development planning. The United Nations Development Programme (UNDP), the Organization for Economic Cooperation and Development, the World Conservation Union (IUCN), the World Bank and regional development banks, and other partners have begun a dialogue on how to integrate adaptation to climate variability and change into poverty reduction and environmental management programs.

The concept of climate risk management—reflecting a more effective integration of climate adaptation with comprehensive emergency management programs—continues to take shape, with the UNDP Bureau of Crisis Prevention and Recovery (UNDP-BCPR), the IFRC, the International Strategy for Disaster Reduction (ISDR), disaster management agencies, and humanitarian relief organizations actively leading those discussions. Early planning for the IPCC Fourth Assessment Report focuses increasing attention on regional consequences with the effects of extreme events highlighted as a particularly important focus (see Appendix C). One common element of all of these discussions is a recognition that adaptation to natural climate variability not only promises to reduce vulnerability in the near term, but also provides insights and experience that will prove valuable in enhancing resilience to long-term climate change as well.

During the past decade, a number of research programs designed to enhance our understanding of the nature and consequences of climate-related extreme events in the Asia Pacific region, and to explore the application of climate information to support decision making, have emerged. Some of the more prominent examples include: the Extreme Climate Events Program implemented by the Asian Disaster Preparedness Center (ADPC/ECE); Climate Forecast Applications in Bangladesh based on models

developed by the University of Colorado's Program on Atmospheric and Oceanic Sciences and Georgia Institute of Technology; IUCN's Southeast Asian Dialogue on Water and Climate; the Pacific ENSO Applications Center (PEAC); regional climate assessments such as the EWC's Pacific Islands regional contribution to the first U.S. National Assessment; and the Pacific Islands Climate Change Assistance Program coordinated by the South Pacific Regional Environment Programme (SPREP). In parallel, regional organizations like ADPC, the South Pacific Applied Geosciences Commission (SOPAC) and the Pacific Disaster Center (PDC) have been developing integrated assessment techniques and new technologies to support the development of comprehensive emergency management programs in the region.

To date, however, no attempt has been made to synthesize the results of these programs in terms of their implications for the development and application of useful climate information in the Asia Pacific region.

To that end, EWC, ADPC, and the Pacific Science Association convened the *Symposium on Climate and Extreme Events in Asia Pacific: Enhancing Resilience and Improving Decision Making* as part of the 20th Pacific Science Congress. The 2½-day Symposium was organized to facilitate the sharing of individual experiences and discussion of integrating themes that will provide a framework for comparing programs and identifying common problems and opportunities.

Symposium Themes

Individual presenters and plenary discussants were asked to address the following integrating themes:

- *Communication*—the content, format, and dissemination of climate information to support decision making, as well as the identification of critical information gaps;
- *Participation*—engaging relevant stakeholders and establishing a dialogue with users of climate information;
- *Information use*—how climate information has been and can be used to support decision making, including responses to individual events and the routine integration of climate information in development planning;
- *Institutional capacity*—institutional barriers as well as opportunities to enhance the capabilities of current and emerging organizations;
- *Scientific and technical issues*—critical information gaps and future priorities.

Symposium Format¹

The Symposium began with an opening keynote address by Dr. Glantz entitled “*Problem Climates or Problem Societies?*” He provided insights into the nature of climate-society interactions that define a community’s vulnerability to changes in climate and set the stage for subsequent discussions of the challenges and opportunities faced in working to enhance the resilience of Asia Pacific communities.

Following Dr. Glantz’ presentation and an overview of the Symposium objectives by the Co-Chairs, the participants heard a series of individual presentations on *national experiences* designed to reduce vulnerability to extreme events through the development and application of climate information. The first of these sessions focused on experiences in Asia, with presentations on climate forecasting and applications in Indonesia, Vietnam, the Philippines, and Bangladesh. The second session on national experiences focused on Pacific Island jurisdictions with insights from speakers representing PEAC, SOPAC, the Federated States of Micronesia (FSM), and Australia.

These national perspectives were then complemented with presentations focused on the challenges and opportunities for climate forecast *applications in climate-sensitive sectors* throughout the Asia Pacific region. This session included presentations on agriculture, water resources, public health, tourism, and urban and coastal infrastructure prepared by representatives of Indonesia, the Philippines, ADPC, FSM, and the Republic of Palau.

On the morning of March 20, the third Symposium session focused on the capabilities, responsibilities, programs, and plans of key *regional institutions and programs* engaged in climate and extreme event forecasting, vulnerability assessment, and applications in the Asia Pacific region. This session began with a panel presentation highlighting key issues in the context of four integrating themes—communications, participation, institutional capacity, and scientific and technical issues. In the context of this opening panel, individual Symposium participants then made brief presentations to share some of their own experiences, programs, and plans. Representatives of regional programs and institutions who spoke during this session are as follows:

- Linda Stevenson, Asia-Pacific Network for Global Change Research (APN);
- Taito Nakalevu, SPREP;
- Scott Power, Australia Bureau of Meteorology;
- Jim Salinger, New Zealand National Institute of Water and Atmospheric Research (NIWA);
- Kamal Kishore, UNDP-BCPR;
- Harry Proctor, U.S. Agency for International Development, Office of Foreign Disaster Assistance (USAID/OFDA);
- Glenn Dolcemascolo, ADPC.

¹ The complete Symposium Agenda is included as Appendix A.

Following these presentations, Symposium participants engaged in a facilitated discussion of how the individual and shared assets of these regional institutions and programs might be applied in the context of an integrated program of climate risk management in the Asia Pacific region.

During concurrent, small-group breakout sessions organized around the Symposium's five integrating themes, participants were able to explore some of the climate risk management concepts emerging from the presentations and began to develop a practical framework to help guide the implementation of those concepts in the region. Working group discussions were preceded by formal presentations from the following:

- Cheryl Anderson (Social Science Research Institute, University of Hawai'i), who spoke about the *challenges and opportunities for communications and participation* drawing from experiences associated with PEAC;
- Stan Goosby (PDC), who highlighted the potential value of *recent developments and new capabilities in science and technology* including hazard modeling, geographic information systems (GIS)-based visualization techniques and decision support tools;
- Glenn Dolcemascolo (ADPC), who highlighted some of the issues associated with *institutional capacity building for enhancing resilience to climate-related extreme events*.

Following a closing keynote address provided by Mr. Thomas Brennan (UNDP) on Friday, March 21, Symposium participants heard from an invited panel of experts who provided a summary of the insights drawn from the working group discussions. These closing panel discussants were selected on the basis of individual expertise and connection to programs and institutions that are in a position to further advance the emergence of effective climate information services in the Asia Pacific region. The closing panelists included:

- Mickey Glantz (National Center for Atmospheric Research), who moderated the session;
- Maxx Dilley (International Research Institute for Climate Prediction of Columbia University), who reported on working group discussions of issues associated with *communication and information use*;
- Michael Hamnett (University of Hawai'i), who presented findings from the working group discussions of issues associated with *participation*;
- Kamal Kishore (UNDP-BCPR), who reported on working group discussions of *institutional capacity-building*;
- Jim Salinger (NIWA), who reported on working group discussions of *science and technology* issues.

Following these presentations and plenary discussions, Eileen Shea (EWC), Symposium Co-Chair, provided a summary of the key points presented by the panelists and the findings and recommendations that emerged from the Symposium deliberations in the

form of some guiding principles for mainstreaming climate information to enhance resilience in Asia Pacific communities. The Symposium concluded with closing remarks from Symposium Co-Chairs.

KEYNOTE ADDRESSES

Holding the Symposium as part of the 20th Pacific Science Congress provided an opportunity for two keynote addresses that would be open to all Congress participants. On the morning of March 19, 2003, Dr. Glantz delivered an opening lecture entitled “*Problem Climates or Problem Societies?*” Dr. Glantz’ address provided an historical perspective on societal considerations of climate as a *hazard* to be avoided, a *resource* to be exploited, and a *constraint* on economic development. Dr. Glantz defined climate as comprising variability from season to season and from year to year; fluctuations on the order of decades; and change on the order of centuries. He noted that governments are becoming increasingly aware of the implications of changes in climate on all of these time scales. While highlighting the particular challenges presented by climate-related extreme events (e.g., droughts, floods, and tropical cyclones), Dr. Glantz noted that climate-related extreme events can provide a valuable focus for capturing public and policy attention as well as exposing society’s strengths and weaknesses in evolving appropriate responses.

Rather than a more traditional approach of thinking about changes in climate in isolation, Dr. Glantz encouraged Symposium participants to address the *integrated climate-society system*. This integrated approach requires recognizing that issues of climate vulnerability and resilience reflect changes in both the physical climate system and social factors (e.g., demographics, policies, institutions, and human behavior). Dr. Glantz boldly predicted that the twenty-first century might come to be known as the “Climate Century,” and he encouraged Symposium participants (as well as scientists, governments, and institutions more generally) to:

- Complement scenario-based studies of future climate conditions with *studies of historical and contemporary climate* to develop insights into the nature of the climate-society partnership and identify opportunities to strengthen that partnership;
- Conduct further research on the nature of climate-society interactions and *identify critical cause-and-effect relationships* in the climate-society system;
- Embrace a scientific and public policy approach that addresses both *near-term needs and long-term opportunities*;
- *Recognize the importance of seasonality*—rather than long-term trends—in the climate-society system;
- *Emphasize a proactive, precautionary approach* to dealing with the uncertainties that will continue to characterize our understanding of the integrated climate-society system.

On the morning of March 21, Tom Brennan of UNDP-BCPR provided a closing keynote address on “*Climate and Disaster Management.*” This address placed the Symposium discussions of regional experiences in a broader context of international discussions of climate vulnerability and adaptation and laid the groundwork for the final day of Symposium deliberations. In this context, Mr. Brennan reinforced earlier discussions regarding the climate-related vulnerability of Asia Pacific communities with an emphasis on the significance of climate-related natural disasters such as floods, droughts, and tropical cyclones. Mr. Brennan highlighted the important contribution that climate adaptation can make to broad development goals such as economic development, poverty alleviation, and human development/quality of life. By way of examples, he encouraged Symposium participants to consider pursuit of the following objectives:

- *Short-term:* Improve awareness of climate forecasts and applicability to farming practices and water resource management;
- *Medium-term:* Maximize potential gains from climate forecasts, minimize crop losses from floods and droughts, and preserve assets (housing, livestock, etc.);
- *Long-term:* Incorporate climate change into national land use and economic development planning.

A summary of Mr. Brennan’s assessment of key players and critical actions required to pursue these three objectives is provided in Figure 1.

NATIONAL AND SECTORAL EXPERIENCES: LESSONS LEARNED

The national and sectoral presentations (which are listed in Figure 2) confirmed the exposure and sensitivity of the region to climate-related extreme events. The presentations reiterated the significant costs of extreme events in the region, including damages, recovery costs, and lost income. They also highlighted opportunities for climate forecast applications in agriculture and food security; drought, flood and fire management; disaster management; tourism; water and natural resource management; public health; and energy. Also, nearly every presentation highlighted the central importance of water resources to public health and safety and economic development in the region, and noted that the availability and quality of water resources are significantly and routinely affected by climate variability, especially tropical cyclones in the Pacific Islands and Asian coastal communities.

Figure 1: Short-, medium-, and long-term objectives for climate information services in the Asia Pacific region (as provided by Tom Brennan, UNDP-BCPR, during Symposium closing keynote address, March 21, 2003)

Short-Term Objective	<i>Improve awareness of climate forecasts and applicability to farming practices and water resource management.</i>
Critical Players	Hydrometeorological, agricultural, water resource management, public information, and disaster management agencies.
Critical Actions	<ol style="list-style-type: none"> (1) Enhance short-, medium-, and long-term forecast capabilities (2) Translate forecasts into understandable messages (3) Apply forecasts to decision making at national level (4) Disseminate forecast information to farming/fishing communities
Medium-Term Objective	<i>Maximize potential gains from climate forecasts, minimize crop losses from floods and droughts, and protect assets (housing, livestock, etc.).</i>
Critical Players	Hydrometeorological, disaster management, water resource management and agricultural agencies; agricultural research and extension agencies and programs; housing design companies and agencies; financial institutions; nongovernmental organizations; public works agencies; provincial/municipal/village authorities.
Critical Actions	<ol style="list-style-type: none"> (1) Enhance policy/organizational mechanisms to assure coordinated and comprehensive approach to disaster risk management (2) Develop flood maps/flood referencing tools and flood models (3) Identify and promulgate alternative cropping strategies (4) Further refine forecasts into actionable messages (5) Provide accurate and timely early warning (6) Establish and apply disaster-resistant building codes (7) Implement community-based disaster management programme (8) Assist in flood-proofing vulnerable communities
Long-Term Objective	<i>Incorporate climate change into national land use and economic development planning.</i>
Critical Players	Hydrometeorological, national planning, land use planning agencies, financial and insurance institutions.
Critical Actions	<ol style="list-style-type: none"> (1) Plan and zone coastal communities in accordance with climate change forecasts (2) Establish national insurance schemes to share residual risk

Figure 2: Presentations on national and sectoral experiences

- Climate Information Applications in Vietnam (Nguyen Dai Khanh, National Hydro-Meteorological Service of Vietnam)
- Climate Information Applications: Indonesian Experiences (Hery Harjanto, Indonesia Department of Meteorology and Geophysics)
- Responding to Climate Risk in the Philippines (Nathaniel A. Cruz, Philippine Atmospheric, Geophysical and Astronomical Services Administration)
- Climate Forecast Applications in Bangladesh (S. M. Mahbubur Rahman, Institute of Water Modeling, Bangladesh)
- The Pacific ENSO Applications Center and Disaster Management: Lessons Learned from the 1997-1998 El Niño (Michael P. Hamnett, Social Science Research Institute, University of Hawai'i)
- National Experiences in the Development and Application of Climate Information for Reducing Impacts of Climate-Related Extreme Events (Atu Kaloumaira, South Pacific Applied Geosciences Commission, Fiji)
- Australia's Experience in the Development and Application of Climate Information to Reduce Vulnerability to Extreme Events: Risk Management in a Variable, Non-stationary Climate (Holger Meinke, Queensland Department of Primary Industries/CSIRO, Australia)
- Climate Prediction Activities in the South Pacific: The Island Climate Update (Jim Salinger, New Zealand National Institute of Water and Atmospheric Research)
- Challenge and Opportunity of Climate Information Application in the Agricultural Sector: Indonesia (Rizaldi Boer, Bogor Agricultural University, Indonesia)
- Vulnerability and Adaptation in Urban Water Resources Management (Susan Espinueva, Philippine Atmospheric, Geophysical and Astronomical Services Administration)
- Challenges and Opportunities in Climate-Sensitive Sectors: Public Health (Eric Tayag, Philippines Department of Health)
- Climate Change in Palau (Techur Rengulbai, Bureau of Public Utilities, Palau Ministry of Resources and Development)
- CFAB: Climate Forecast Applications in Bangladesh (Glenn Dolcemascolo, ADPC on behalf of ADPC, Georgia Institute of Technology and University of Colorado)

Note: Complete presentations can be found at the Symposium website:
www2.EastWestCenter.org/climate/extreme

Enhancing Information

Asia Pacific experience in the development and use of climate forecasts—most notably forecasts of ENSO—confirms that significant improvements in forecasting capabilities have been made in the past decade, but there are still limitations, including:

- The *limited spatial resolution of most computer models* used in climate forecasting and assessment and the need to transform models of global and regional climate processes (such as ENSO and IPO) into specific information about conditions in a given locale—what the scientific community calls “downscaling”;
- A similar *lack of detailed regional or local information on the impacts* of changes in climate on individual communities, resources, and sectors as well as the options available to mitigate or adapt to those impacts;
- The need to *significantly enhance the resources available for regional assessments of vulnerability and resilience on a variety of time scales*—from individual extreme events through seasonal, intra-seasonal and interannual variability, to long-term projections of climate change associated with greenhouse gases;
- The *lack of baseline data, historical observations, and sustained monitoring of critical climate parameters* such as temperature, humidity, precipitation, tropical cyclones, and sea level, and similar *limitations on historical data and future projections of changing economic and demographic conditions*;
- The need to *document and understand the differences between individual ENSO events* (what one participant called the different “flavors” of ENSO) and to accurately describe the meaning of “normal” (non-event) years;
- The need to *further explore and exploit the capabilities of systems analysis* as an important conceptual approach that can provide an integrated perspective on the integrated climate-society system *and the potential benefits of new information management and data visualization tools (such as GIS) and model-based decision support tools*.

Enhancing Communication

A host of other lessons learned from the Asia Pacific experience relate to the challenges and opportunities associated with *establishing and sustaining a highly collaborative, participatory process through which scientists and decision makers share responsibility for the development and application of useful climate information designed to enhance the resilience of Asia Pacific communities*. In this context, Symposium participants identified a number of factors that appear to be critical for success:

- *Establishing and maintaining an interactive dialogue* between providers and users of climate information services. Many of the examples shared during the Symposium reinforced the concept of *coproduction of knowledge*—an evolutionary process of shared learning and joint problem solving by teams

comprising the providers of climate information and the users of that information (see Figure 3). These teams of individuals and institutions leveraged the special expertise and capabilities that each brought to the table and worked together to identify information needs, develop and evaluate new information products, and use climate information to address the needs of real people in real places.

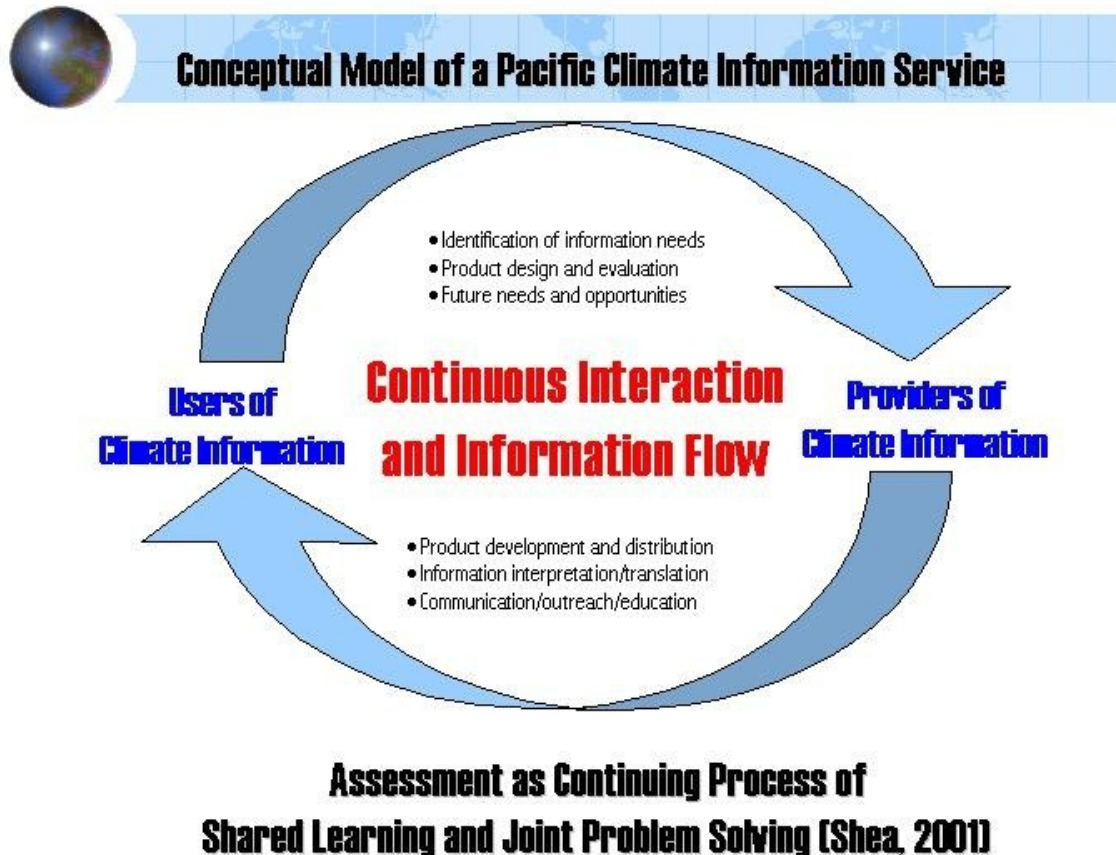


Figure 3: Climate assessment and information services as continuing process of shared learning and joint problem solving (Shea 2001)

- *Developing and sustaining trust and credibility* in the people, processes, and products that comprise a climate information system. One of the early members of the PEAC scientific team, for example, emphasized that *eyeball-to-eyeball contact*—regular communication with users—is an essential requirement, and building such trust is a long-term effort. This also involves:
- *Identifying and engaging trusted information brokers*—individuals and institutions that are already perceived as credible sources of climate (and other scientific) information. Part of that credibility is institutional (e.g., universities or meteorological services with established reputations), but part of it also appears to be personal. The individuals who took the initiative in creating effective climate information systems in Asia Pacific established themselves as reliable members of the community in which they lived and worked, and their work had demonstrated value to the communities and governments of the region. Symposium participants also noted that *press and media, the private sector, traditional teachers, and community leaders* are critical information brokers that have not always been effectively engaged as partners in climate forecasting and information systems. In this context, there needs to be a shared and consistent vocabulary and a commitment to effective translation of climate forecast information into understandable, useful, and actionable messages.²
- Acquiring a *continuum of information that spans time scales* from extreme events (droughts, floods, tropical cyclones) through seasonal to interannual variability to long-term climate change. Symposium participants consistently highlighted the fact that ENSO-based forecasts assist Asia Pacific communities in addressing today’s problems, and provide valuable insights into vulnerability and adaptive capacity in the long term.
- Recognizing that for most decision makers and policy officials, climate is only one factor in a *complex, multi-hazard context*. Most decision makers are addressing a myriad of interacting social, environmental, and economic stresses at any one time. Successfully integrating considerations of climate variability and change as part of a comprehensive risk management program requires an *understanding of the decision-making framework(s)* currently in place, including knowledge of traditional sources of information and approaches to risk management; the timing and nature of key decisions, including critical periods and specific decision points during which climate information can be utilized; and tailoring climate information to meet the specific information needs of a decision maker.
- Reinforcing the *important links between climate adaptation and sustainable development* in the Asia Pacific region and related national and international efforts to implement the United Nations Millennium Development goals.

² This concept of actionable messages was reinforced by Mr. Brennan, UNDP Bureau of Crisis Prevention and Recovery, in his closing keynote address.

INTEGRATING THEME DISCUSSIONS

Following the presentations on national and sectoral experiences, Symposium participants engaged in small working group discussions focused on the following integrating themes:

- *Communication* issues related to the content, format, and dissemination of climate information to support decision making as well as the identification of critical information gaps;
- *Information use* issues related to how climate information has been and can be used to support decision making, including responses to individual events and the routine integration of climate information in development planning;
- *Participation* issues related to effectively engaging relevant stakeholders and establishing an interactive dialogue with users of climate information;
- *Institutional capacity* issues, which include institutional barriers as well as opportunities to enhance the capabilities of current or emerging organizations in the Asia Pacific region;
- *Scientific and technical* issues with particular attention to filling critical information gaps and identifying future priorities.

Based on some of the insights from the discussion of national and sectoral experiences, issues of communication and information use were combined, resulting in the organization of four working groups:

- Communication and Information Use, moderated by Maxx Dilley (International Research Institute for Climate Prediction of Columbia University);
- Participation, moderated by Mike Hamnett and Cheryl Anderson (University of Hawai'i);
- Institutional Capacity, moderated by Kamal Kishore (UNDP-BCPR); and
- Science and Technology, moderated by Jim Salinger (NIWA).

During the afternoon and evening of March 20, the working groups explored the strengths, weaknesses, opportunities, and constraints of mainstreaming climate information into decision making to support resilience. Working group moderators summarized the group discussions in plenary on the morning of March 21 (See Tables 1 through 4).

Table 1: Working Group on Communication and Information Use

Communication and Information Use	Strengths	Weaknesses	Opportunities	Constraints
Information on extreme climate events	<ul style="list-style-type: none"> • Credible and reliable scientific information • El Niño is a signal and a source of some skill 	<ul style="list-style-type: none"> • Probabilistic information on ENSO impacts • Low accuracy forecasts of ENSO strength 	<ul style="list-style-type: none"> • Seek for more predictability within climate system • Better climate information, including forecasts • Model improvements 	<ul style="list-style-type: none"> • Information is complex • Low skill of forecasts in places • Limited understanding of climate system
Information on socio-economic factors contributing to climate-related outcomes		<ul style="list-style-type: none"> • Social contribution to losses is not well appreciated or identified 	<ul style="list-style-type: none"> • “Hindcasting” recent extreme climate events provides an opportunity to decision makers to identify strengths and weaknesses, opportunities and constraints in past responses; “look back to look ahead” 	<ul style="list-style-type: none"> • Not enough data (especially on impacts)
Information overall	<ul style="list-style-type: none"> • There is useful information 		<ul style="list-style-type: none"> • Extremes bring communities together: Variability research Change research Policymakers Public Media Corporations 	<ul style="list-style-type: none"> • Climate information is not useful in all contexts

Table 1: Working Group on Communication and Information Use

Communication and Information Use	Strengths	Weaknesses	Opportunities	Constraints
<p>Factors affecting information interpretation</p>	<ul style="list-style-type: none"> • High societal awareness of El Niño impacts and forecast availability • Demonstrations of forecast value in certain situations 	<ul style="list-style-type: none"> • Different national perspectives/experiences in past ENSO events • People act on the <i>previous</i> ENSO event • Low societal awareness of La Niña impacts • If an El Niño is forecast, funds become available to agencies; there may be a reluctance to update the forecasts as El Niño evolves • Updates are not always picked up • Distortion of information due to perception, vested interests 	<ul style="list-style-type: none"> • Recurring climate impacts and losses draw attention to climate and can persuade people to adopt preventive practices • Involve decision makers in data collection, monitoring, and analysis • Document cases where climate information was not used • Regularize to routinely issue updates • Combination of past with future information to formulate messages • (Potential of) better understanding of the meaning of “normal” climate 	<ul style="list-style-type: none"> • Not every ENSO event is the same, nor are its effects and impacts

Table 1: Working Group on Communication and Information Use

Communication and Information Use	Strengths	Weaknesses	Opportunities	Constraints
Demand	<ul style="list-style-type: none"> • Extreme climate event information is highly sought after; demand for information is high. 	<ul style="list-style-type: none"> • Lack of understanding of limitations of forecasting weather, climate, and extremes by the public • Limited private sector involvement 	<ul style="list-style-type: none"> • Maintain awareness of communication sources (magazines) in other fields 	<ul style="list-style-type: none"> • Rising expectations of forecasting groups • Credibility loss when forecast is perceived as bad
Capacity to communicate and meet information demand	<ul style="list-style-type: none"> • Climate research capacity does exist in many Asia Pacific countries. • User <--> provider communication improving • Getting a better appreciation of what information is useful • Some degree of climate information and applications network formation both internationally and nationally with some degree of institutionalization 	<ul style="list-style-type: none"> • Limited understanding of climate–impact links • Ad hoc communication channels • Lack of systemic approach to end-to-end climate and applications information • Communication is difficult due to diversity of uses, users, genders, and sectors. 	<ul style="list-style-type: none"> • Opportunity to target audiences based on increasing understanding of who they are and what kind of information they need, as well as how they get the information • Tailored forecast development and production • Clearer terms and language to communicate better 	<ul style="list-style-type: none"> • User’s needs are diverse and difficult to address • Limited budgets • Human, financial, and infrastructure resources
Information access	<ul style="list-style-type: none"> • Several reliable forecast sources on the Internet 	<ul style="list-style-type: none"> • Too many amateur forecasts on the Internet 	<ul style="list-style-type: none"> • Work closely with media; strengthen mutual awareness 	<ul style="list-style-type: none"> • Media do not really understand El Niño forecasts, and tend to sensationalize El Niño.

Table 1: Working Group on Communication and Information Use

Communication and Information Use	Strengths	Weaknesses	Opportunities	Constraints
Multiplicity of information sources	<ul style="list-style-type: none"> • Many external sources of forecasts (amplifies forecast messages) 	<ul style="list-style-type: none"> • People are confused by conflicting information. • Global information does not always reflect regional contrasts. 	<ul style="list-style-type: none"> • Develop approaches to producing consensus forecasts 	<ul style="list-style-type: none"> • Disparate sources of forecasts
Communication gaps		<ul style="list-style-type: none"> • Confusing and often inconsistent terms used by decision-makers, policymakers, users, end users, intermediaries, public • Communication gap between academic jargon and operational needs 		<ul style="list-style-type: none"> • Communication gap between operational community and media/public/policymakers (language) • Language barriers
Climate variability and change	<ul style="list-style-type: none"> • Climate change is drawing attention and research funding, fostering capacity, and intense concern with impacts in Asia Pacific. 	<ul style="list-style-type: none"> • Not enough known about climate change • High uncertainty • Lack of regional-scale information about climate change 	<ul style="list-style-type: none"> • Gain credibility with climate variability forecasts to generate credibility for climate change adaptation measures • Discuss climate change possibilities through reference to extreme events 	<ul style="list-style-type: none"> • Global warming is changing the averages

Table 2: Working Group on Participation in Mainstreaming Climate and Extreme Event Information into Projects, Policy, and Everyday Practice

Participation	Strengths	Weaknesses	Opportunities	Constraints
	<ul style="list-style-type: none"> • Participation can help to do less expensive, more productive projects where the information created is more useful (e.g., Mekong River) • Engages community in identifying solutions for problems they are trying to fix (e.g., land use in Fiji) • Departments of Health have to deal with community and has mechanisms in place to deal with other organizations (e.g., Dengue epidemic) 	<ul style="list-style-type: none"> • Local meteorological services not consulted in information that regional organizations put out, but local meteorological services may have to respond • Weather service has to pay TV to disseminate climate information (e.g., Fiji and other Pacific Island countries) • Among partners, there are strengths and weaknesses; often in partnerships, one has more resources and dictates the process, failing to listen to the weaker partner • Leaders define priorities, but most leaders are not environmentalists. They may limit access to information and participation in climate work. 	<ul style="list-style-type: none"> • Pool resources with other agencies and organizations (e.g., Philippines Department of Health) • Involve everyone in planning at the beginning of the process. Identify stakeholders and sectors, and include them in planning. • Assess the user needs to be able to provide the information that is useful • Make a list of products or information that climate information producers can provide. Intermediary to match the services and needs. • Engage end users. Growing interest from end users in receiving information. Opportunities to tailor-make information. • For Meteorological Services to help media better frame the information so that they report correctly and under- 	<ul style="list-style-type: none"> • Need to secure funding from outside source to engage in “participatory meetings” like Climate Outlook Forums • Not enough resources identified before engaging in participatory activities, so expectations are built without being able to deliver products • ASEAN Specialized Met Center preparing and downscaling information, but not all nations in the region have access to this information • Governments and policy-makers do not necessarily use information in the ways that it is intended. They restrict the sharing of information and this constrains participation. • Political constraints—restriction of information

Table 2: Working Group on Participation in Mainstreaming Climate and Extreme Event Information into Projects, Policy, and Everyday Practice

Participation	Strengths	Weaknesses	Opportunities	Constraints
			<p>stand ENSO</p> <ul style="list-style-type: none"> • For East Timor to structure a system based on best practices and recommendations from Symposium participants • Partnerships in East Timor. Not easy, but there is an opportunity to build a participatory climate system based on partnerships. 	

Table 3: Working Group on Institutional Capacity Building

Institutional Capacity Building	Strengths	Weaknesses	Opportunities	Constraints
Skills	<ul style="list-style-type: none"> • Existing skills • Existing networks • Institutional memory • Traditional methods of forecasting 	<ul style="list-style-type: none"> • Insufficient capacity • No financial capacity • Lack of analytical skills • Lack of skills beyond disciplinary boundaries • Lack of information 	<ul style="list-style-type: none"> • Increased awareness for the need to train • Increased awareness of climate at school level • Information and communication technology 	<ul style="list-style-type: none"> • Lack of high level support • Lack of resources for education and inter-disciplinary work
Resources	<ul style="list-style-type: none"> • Enough resources in some countries to do extra work 	<ul style="list-style-type: none"> • Not well coordinated • Skills lacking 	<ul style="list-style-type: none"> • Examples of success stories • Upscaling from individual cases to broader lessons learned 	<ul style="list-style-type: none"> • Ineffective use of existing resources • Lack of appreciation of interlinkages • Lack of integrated use of existing resources
Mechanisms	<ul style="list-style-type: none"> • Systems and procedures for collecting data • Greater emphasis on end-to-end systems 	<ul style="list-style-type: none"> • Lack of mainstreaming • Different socio-economics pose different challenges 	<ul style="list-style-type: none"> • Build capacities • Look at larger complex systems that cut across disciplinary boundaries 	<ul style="list-style-type: none"> • Few opportunities and incentives for cross-disciplinary work

Table 3: Working Group on Institutional Capacity Building

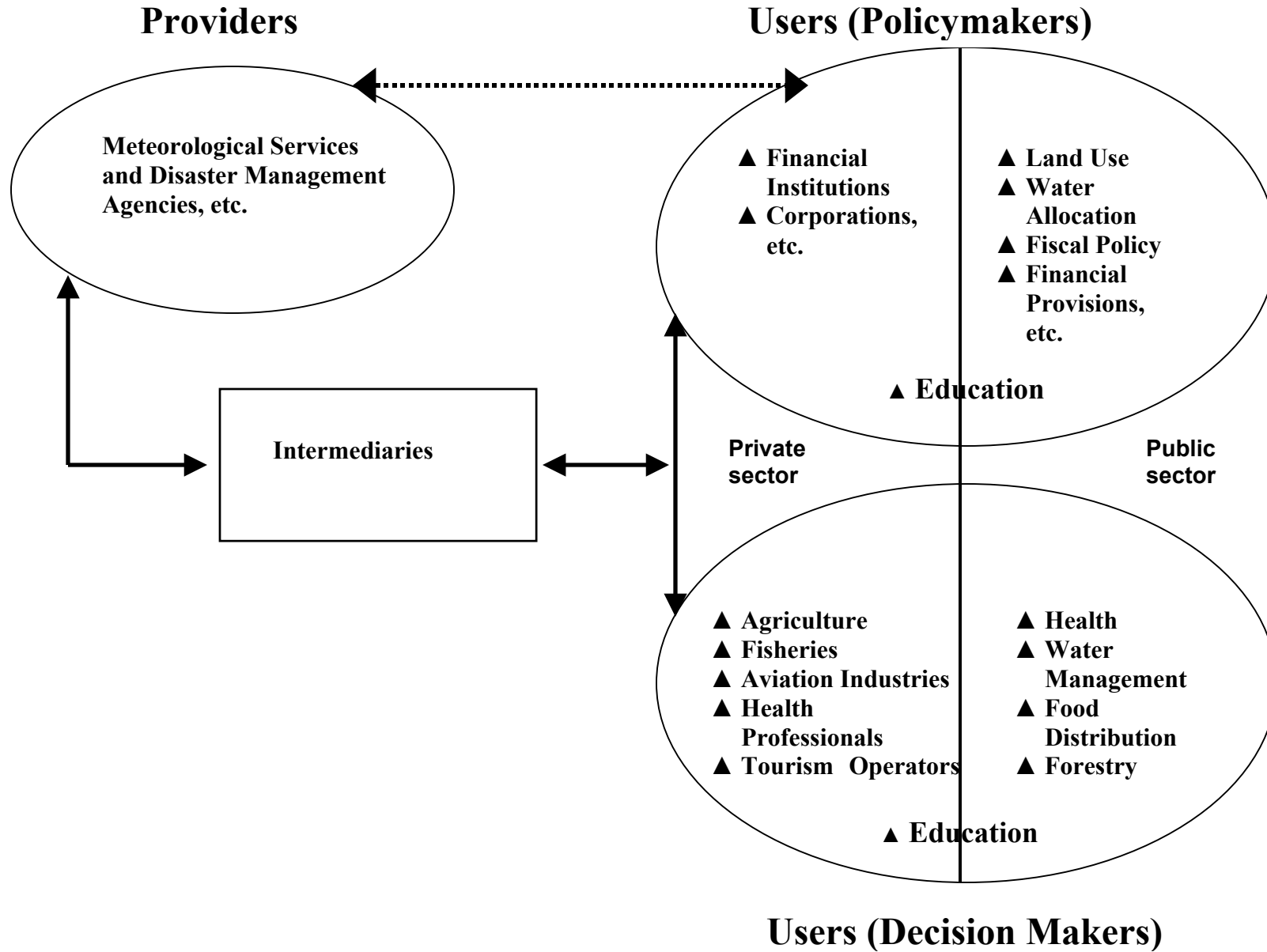


Table 4: Working Group on Science and Technology

Science and Technology	Strengths	Weaknesses	Opportunities	Constraints
	<ul style="list-style-type: none"> • Abundance of modeling tools for prediction (climate forecasts not available 10 years ago) • Systems modeling as a good communication tool, as well as GIS scenarios • Process modeling tools to forecast system response well developed, e.g., hydrology, climate, agro-meteorology • Real and near real time monitoring, e.g., ground and satellite, radar, GPS • Multidisciplinary scientific networking and collaboration for science and policy development • Abundance of applied research programs reaching to national level and below • More development agencies making resources available 	<ul style="list-style-type: none"> • Variation in Internet capacities and capabilities • Science resources not well developed in developing countries (DC) • Lack of awareness in DC because of limited impact studies—which are required in the development agenda. The awareness in developed countries has come from advocacy. • Having strategies to deploy a technology to a region • Lack of local monitoring of climate and sea level in DC • Downscaling of predictions to the local level • Quality and reliability of climate forecasts • Local knowledge and needs not being communicated to the science and technology sector • Understandable communication of science information to the end user 	<ul style="list-style-type: none"> • Coupled analysis of traditional knowledge and scientific approaches • Involve users at local level in data collection • More sectoral analysis at the socio-economic and cultural levels (beyond health, agriculture, and water) • Education on climate issues in schools and community • Education in computer technologies for use of climate products • Large opportunities to mobilize resources for research and applications in climate adaptation • Using scientific tools to improve risk management tools (GIS) • Existence of many regional organizations, e.g., SOPAC, SPREP, APN, ASEAN • Local downscaling of predictions 	<ul style="list-style-type: none"> • Funding • Tremendous variation of human resources in the region • Mindset of local users, and at every level, of traditional versus scientific; acceptance (doubt) of new technologies • Dealing with scientific uncertainty • Which scientific institutions are responsible in an operational setting and legal authorization • Lack of local modeling and information • Scientific knowledge gaps and understanding of the climate system • Donor resources are often restricted in many ways • Communication of science in plain language • Information overload to national government, local government, and end users

Table 4: Working Group on Science and Technology

Science and Technology	Strengths	Weaknesses	Opportunities	Constraints
	<ul style="list-style-type: none"> • Strong human resource base now in climate science, which is very available internationally • Good computer technology and transfer of technology to personal computers available • Healthy interest from climate science and scientists to apply the science 	<ul style="list-style-type: none"> • Lack of knowledge of local language across cultural and linguistics gaps • Lack of analysis of traditional technologies and observations of environmental change • Application models and decision support tools require further development • Fear of hidden costs of computers and technologies 	<ul style="list-style-type: none"> • Filtering of information • Better development of climate response systems 	

As reflected in Tables 1 through 4, the themes used to organize these small-group discussions are not mutually exclusive; many of the groups touched on similar challenges and opportunities. Essential factors mentioned by all four working groups included:

- *Training, education, and capacity building* in all components of an effective climate information system designed to enhance the resilience of Asia Pacific communities, governments, and businesses;
- *Enhanced information on regional and local impacts* of climate variability and change and *more detailed information on the nature of climate-society interactions* at each level;
- *Early and sustained engagement of users* to identify information needs, develop and evaluate tailored information products, and explore future applications;
- *Continuous communication*, even between climate events (e.g., between ENSO events), and *building and sustaining interpersonal communication skills*;
- *Understanding, articulating, and supporting the roles and responsibilities* of key institutions in the climate-society partnership in each given place and/or sector—i.e., who is responsible and what they are doing;
- *Leadership* in government, scientific organizations, communities, and businesses;
- *Transforming data and information into knowledge* that can be used to support decision making, including issues related to identifying, developing, and applying *tools and technologies that are appropriate to each location and user group*;
- A focused effort to *more effectively engage the private sector* in climate information systems and adaptation programs and activities;
- *Developing a shared vocabulary* that is easily understood by multidisciplinary teams representing both providers and users of climate information;
- *Commitment to a process of shared learning and joint problem solving* (co-production of knowledge and shared responsibility for action);
- *Documenting, analyzing, and sharing individual experiences* to develop guiding principles for mainstreaming climate information into decision making in the Asia Pacific region.

GUIDING PRINCIPLES FOR MAINSTREAMING CLIMATE INFORMATION

The Symposium provided an opportunity to begin articulating *guiding principles* for developing and using climate information to enhance resilience in the face of climate variability and change. Eileen Shea, Co-Director of the Symposium, described some of these guiding principles during the closing plenary session (see Figure 4).

Symposium participants committed themselves to implementing these guiding principles in their programs and institutions. Since March 2003, they have undertaken a number of activities that continue the spirit of regional collaboration and capacity building, including:

- Presenting initial Symposium findings and recommendations at a number of regional, national, and international discussions of climate adaptation;
- Integrating Symposium insights into planning for national and regional climate services programs;
- Incorporating Symposium insights and guiding principles into planning for the ADPC Climate Risk Management Program, which is the successor to ADPC/ECE, and related planning for a collaborative regional climate risk management program involving EWC, ADPC, PDC, and a number of other institutions represented at the Symposium;
- Developing plans for a June 2004 Pacific Island Training Institute on Climate and Extreme Events organized by EWC, NIWA, and the University of the South Pacific with support from the APN CAPaBLE program and NOAA;
- Incorporating Symposium insights and guiding principles into EWC's review of PEAC's first 10 years of operation, with an eye toward developing recommendations for climate forecasting services in the U.S. National Weather Service Pacific Region;
- Developing a regional Dialogue on Water and Climate initiated by IUCN that targets further development and application of climate and water risk management in emerging NAPA and IWRM plans.

Figure 4: Some guiding principles for mainstreaming climate information in Asia Pacific: improving decision making and enhancing resilience

- ***Address the integrated climate-society system***
 - Climate risk management in a sustainable development context
 - Climate risk management as a valuable framework for building partnerships and guiding climate information systems
- ***Understand vulnerability and focus on building resilience***
 - Place and context matter
 - Understand decision-making framework(s) to help guide climate information development, delivery, and applications
 - Provide mechanisms to continuously assess vulnerability, adjust decisions, identify new opportunities, and routinely integrate new insights and capabilities
 - Emphasize proactive planning
- ***Focus on useful, usable, and actionable information***
 - Scale, timing, format, language, and content of information appropriate to a particular application/user community
 - Products and process responsive to user needs
 - Tools and technology appropriate to a given user and application
- ***Recognize the importance of climate information on a continuum of time scales*** from extreme events through variations in climate on seasonal, intra-seasonal and year-to-year time scales, and climate change on decadal and longer time scales
 - Provide a valuable focus to galvanize the commitment of scientists, government, the private sector, and the public
 - Address today's problems while planning for the future
 - Protect public health and safety, improve decision making in critical sectors, and support long-term planning and policy development
- ***Utilize a team/network approach with partners engaged in an iterative, participatory process***
 - The *process* of communication and dialogue between the providers and users of climate information is at least as important as the individual climate information products
 - Building trust and credibility is essential to success
 - Sharing experiences, expertise, and tools among teams/networks is vital to regional success
- ***Recognize the vital role of trusted information brokers*** (individuals, institutions, associations)
- ***Build on existing systems, institutions, programs, relationships, and networks*** and recognize the necessity of education, training, and capacity building

CONCLUSION

The Symposium brought together a diverse mix of scientists, resource managers, and government officials from 17 nations as well as representatives from a number of regional and international scientific, development, and environmental organizations. The participants shared individual experiences and explored lessons learned from both successes and failures in early efforts to use information about climate variability and change to reduce vulnerability in the region. Through their interaction, Symposium participants committed to a new level of collaboration and identified a set of guiding principles for a climate information system designed to enhance resilience and improve decision making.

During his opening keynote address, Dr. Glantz highlighted the importance of addressing the *integrated climate-society system*. To effectively enhance resilience and improve decision making, we need a collaborative program that considers societal context and information needs as well as changes in the physical climate system. Creating and sustaining the partnerships required for such an endeavor is both a grand challenge and an unprecedented opportunity for the multidisciplinary community of scientists interested in climate adaptation as well as the governments, resource managers, and businesses for whom adaptation is a matter of survival and sustainable development.

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**APPENDIX A
SYMPOSIUM AGENDA**

**SYMPOSIUM ON CLIMATE AND EXTREME EVENTS IN ASIA PACIFIC:
ENHANCING RESILIENCE AND IMPROVING DECISION MAKING**

**20th Pacific Science Congress
Bangkok, Thailand
March 19-21, 2003**

Wednesday 19th March

- 8:30 - 9:30** *Plenary Keynote: “Problem Climates or Problem Societies?”*
Dr. Michael Glantz, National Center for Atmospheric Research, USA
- 10:15 - 10:30** *Symposium Objectives and Integrating Themes*
Eileen Shea, East-West Center, USA
- 10:30 - 12:00** *Session One: Asian experiences in the development and application of climate information for reducing vulnerability to extreme events*
- Facilitator: Glenn Dolcemascolo, Asian Disaster Preparedness Center, Thailand
- “Climate Information Applications in Vietnam”
Nguyen Dai Khanh, Vietnam Institute of Hydrological and Meteorological Research
- “Climate Information Applications: Indonesian Experiences”
Hery Harjanto, Indonesia Department of Meteorology and Geophysics
- “Responding to Climate Risk in the Philippines”
Nathaniel Cruz, Philippine Atmospheric, Geophysical and Astronomical Services Administration
- “Climate Forecast Applications Bangladesh”
S. M. Mahbubur Rahman, Institute of Water Modeling, Bangladesh
- 12:00 - 13:30** Lunch
- 13:30 - 15:00** *Session One, cont. Pacific experiences in the development and application of climate information for reducing vulnerability to extreme events*
- Facilitator: Glenn Dolcemascolo, Asian Disaster Preparedness Center, Thailand

“The Pacific ENSO Applications Center and Disaster Management: Lessons Learned from the 1997-1998 El Niño”

Michael P. Hamnett, University of Hawai‘i and PEAC, USA

“National Experiences in the Development and Application of Climate Information for Reducing Impacts of Climate-Related Extreme Events: Pacific Islands”

Atu Kaloumaira, South Pacific Applied Geosciences Commission, Fiji

“Australia’s Experience in the Development and Application of Climate Information to Reduce Vulnerability to Extreme Events”

Holger Meinke, Queensland Department of Primary Industries/CSIRO, Australia

“Climate Prediction Activities in the South Pacific: The Island Climate Update”

Jim Salinger, New Zealand National Institute of Water and Atmospheric Research

15:00 - 15:30 Coffee

15:30 - 18:00 *Session Two: Challenges and opportunities for applications in climate-sensitive sectors*

Facilitator: A. R. Subbiah, Asian Disaster Preparedness Center, Thailand

“Challenges and Opportunities in Climate-Sensitive Sectors: Agriculture”

Rizaldi Boer, Bogor Agricultural University, Indonesia

“Vulnerability and Adaptation in Urban Water Resources Management”

Susan Espinueva, Philippine Atmospheric, Geophysical and Astronomical Services Administration

“Challenges and Opportunities in Climate-Sensitive Sectors: Public Health”

Eric Tayag, Philippines Department of Health

“Climate Change in Palau”

Techur Rengulbai, Ministry of Resources and Development, Palau

“CFAB: Climate Forecast Applications in Bangladesh”

Glenn Dolcemascolo, Asian Disaster Preparedness Center (on behalf of ADPC, Georgia Institute of Technology and University of Colorado)

Thursday 20th March

10:30 - 12:00 *Session Three: Capabilities, responsibilities, programs, and plans of key regional institutions and programs engaged in climate risk management, forecasting climate and extreme events, vulnerability assessment, and applications*

Communications Challenges and Participation Issues—**Cheryl L. Anderson**, Social Science Research Institute, University of Hawai‘i, USA

Institutional Capacity—**Glenn Dolcemascolo**, Asian Disaster Preparedness Center, Thailand

Scientific and Technical Issues—**Stan Goosby**, Pacific Disaster Center, USA

Presentations from organizations engaged in climate risk management and the development, dissemination, and use of climate forecast and assessment information:

Linda Stevenson, Asia-Pacific Network for Global Change Research

Taito Nakalevu, South Pacific Regional Environment Programme

Scott Power, Australia Bureau of Meteorology

Jim Salinger, New Zealand National Institute of Water and Atmospheric Research

Kamal Kishore, Bureau of Crisis Prevention and Recovery, United Nations Development Programme

Harry Proctor, U.S. AID, Office of Foreign Disaster Assistance

Glenn Dolcemascolo, Asian Disaster Preparedness Center

12:00 - 13:30 Lunch

13:30 - 15:00 *Working group discussions of Symposium integrating themes*

Overall Facilitator: Eileen Shea, East-West Center

- Communication and Information Use, moderated by **Maxx Dilley** (International Research Institute for Climate Prediction);
- Participation, moderated by **Mike Hamnett and Cheryl Anderson** (University of Hawai‘i);
- Institutional Capacity, moderated by **Kamal Kishore** (UNDP Bureau of Crisis Prevention and Recovery); and
- Science and Technology, moderated by **Jim Salinger** (New Zealand National Institute of Water and Atmospheric Research).

15:00 - 15:30 Coffee

15:30 – 17:30 *Working group discussions of integrating themes, continued*

Friday 21st March

10:30 - 11:15 *Plenary Keynote: “Managing Climate Risk”*
Tom Brennan, UNDP Bureau of Crisis Prevention and Recovery

11:15 - 12:00 *Closing Panel: Findings and recommendations from working group discussions of strengths, weaknesses, opportunities, and constraints*

Facilitator: Mickey Glantz, National Center for Atmospheric Research, USA

Panelists:

Participation Issues, **Michael P. Hamnett**, University of Hawai‘i and PEAC, USA

Institutional Capacity Building, **Kamal Kishore**, UNDP Bureau of Crisis Prevention and Recovery, India

Science and Technology, **Jim Salinger**, National Institute of Water and Atmospheric Research, New Zealand

Communication and Information Use, **Maxx Dilley**, International Research Institute for Climate Prediction, USA

12:00 - 13:30 Working Lunch

13:30 - 15:00 *Conclusion and Symposium Closing Remarks*

Eileen Shea, East-West Center

A. R. Subbiah, Asian Disaster Preparedness Center

**APPENDIX B
LIST OF PARTICIPANTS**

**SYMPOSIUM ON CLIMATE AND EXTREME EVENTS IN ASIA PACIFIC:
ENHANCING RESILIENCE AND IMPROVING DECISION MAKING**

20th Pacific Science Congress

**The Sofitel Central Plaza Bangkok Hotel
Bangkok, Thailand
March 19-21, 2003**

AUSTRALIA

1. Dr. Holger Meinke

Principal Scientist, Cropping Systems Modeling
and Climatology (APRSU and QCCA)
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APPENDIX C

MESSAGE FROM DR. R. K. PACHAURI Chairman, Intergovernmental Panel on Climate Change (IPCC)

I am deeply disappointed that other commitments will prevent me from joining you at Bangkok for the Symposium on Climate and Extreme Events in Asia Pacific. This indeed is a very timely meeting, given the fact that the world is witnessing an increasing frequency and severity of extreme events in various parts of the globe. The World Meteorological Organization (WMO) monitors and maintains data on extreme events, and has observed that there has been a doubling of such events in the last 10 years. It is particularly relevant that the Symposium is focusing on the Asia Pacific region, because not only does this region experience a large number of extreme events, but a substantial fraction of the population in the Asia Pacific region is highly vulnerable to their impacts, because of widespread poverty and lack of infrastructure and institutional capacity for coping with these impacts.

The impacts of climate change in general would be serious for the countries of this region, because not only is the nature and extent of climate change specific to different parts of this region a cause for concern—such as changes in precipitation patterns and significant increases in temperature—but given the fact that agriculture and water resources would be affected adversely by climate change, focusing on these issues becomes urgent. Societies in the Asia Pacific region will have to adapt to climate change, irrespective of mitigation measures that are taken globally to tackle this problem.

The Fourth Assessment Report of the IPCC will make a major attempt to emphasize regional dimensions of climate change and its impacts, and to that extent the Symposium is being held in Bangkok, I am sure will add to the understanding and knowledge of the scientific community. I would greatly look forward to receiving the material presented and the outcomes produced at the Symposium. I would like to wish the organizers and participants of this event my very best on this occasion.

In March 2003, the East-West Center, the Asian Disaster Preparedness Center, and the Pacific Science Association convened a **Symposium on Climate and Extreme Events in Asia Pacific: Enhancing Resilience and Improving Decision Making**, as part of the 20th Pacific Science Congress. Individual presentations, working groups, and plenary discussions addressed five integrating themes:

Communication issues related to the content, format, and dissemination of climate information to support decision making, as well as the need to identify critical information gaps;

Participation issues related to engaging stakeholders and establishing dialogue with users of climate information;

Information use issues related to how climate information supports decision making, including responses to individual events and the routine integration of climate information in development planning;

Institutional capacity issues, including barriers and opportunities for enhancing the capabilities of existing and emerging organizations; and

Scientific and technical issues, with particular attention to critical information gaps and future priorities.

As noted by Mickey Glantz during his opening keynote address, it is important to address the *integrated climate–society system*. We must undertake a collaborative program that considers societal context, decision-making frameworks, and information needs as well as enhancing the ability to monitor, understand, and anticipate changes in the physical climate system. Creating and sustaining the partnerships required for such an endeavor is both a grand challenge and an unprecedented opportunity for the multidisciplinary community of scientists interested in climate adaptation and for the governments, resource managers, and businesses for whom adaptation represents a matter of survival and sustainable development.

The Symposium brought together a diverse mix of scientists, resource managers, and government officials from 17 nations as well as representatives from a number of regional and international scientific, development, and environmental organizations. The participants shared individual experiences and explored lessons learned from both successes and failures in early efforts to use information about climate variability and change to reduce vulnerability in the region. Through their interaction, Symposium participants committed to a new level of collaboration and identified a set of guiding principles for a climate information system designed to enhance resilience and improve decision making.

The Symposium was sponsored by the Office of Global Programs of the U.S. National Oceanic and Atmospheric Administration (NOAA/OGP), the United Nations Development Programme Bureau of Crisis Prevention and Recovery, the East-West Center, and the Asian Disaster Preparedness Center's Extreme Climate Events Program with funding from NOAA/OGP and U.S. Agency for International Development Office of Foreign Disaster Assistance.

Symposium presentations and background materials, can be found online at:

www2.EastWestCenter.org/climate/extreme

This report can be found online at the East-West Center website:

www.EastWestCenter.org