

# MONSOON REGION CLIMATE APPLICATIONS

## Integrating Climate Science with Regional Planning and Policy

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The North American Monsoon is a prominent seasonal climate signal throughout most of Mexico and the southwestern United States.<sup>1</sup> Emerging results of climate research in the monsoon region, including the North American Monsoon Experiment (NAME), have prompted interest in how to integrate climate knowledge with planning and policy to reduce regional climate-related vulnerabilities and enhance sustainability. NAME is a joint process study of the Climate Variability and Predictability Program (CLIVAR) and the Global Energy and Water Cycle Experiment (GEWEX) process study (information online at [www.eol.ucar.edu/projects/name](http://www.eol.ucar.edu/projects/name)). Several climate and society assessment projects are working to understand monsoon-region stakeholder climate sensitivities and decision-making needs. Motivated by these activities, and building upon other binational workshops on climate, environment, and water

### MONSOON REGION CLIMATE APPLICATIONS: A BINATIONAL WORKSHOP

**WHAT:** Sixty participants met in a binational workshop to forge links between the climate science in the North American monsoon region and the efforts to understand forecast users' vulnerabilities and needs.

**WHEN:** 8–11 May 2006

**WHERE:** Instituto Tecnológico de Sonora, Guaymas, Sonora, Mexico

management,<sup>2</sup> American and Mexican climate and social scientists, resource managers, and policymakers met in a workshop with the overarching goal to integrate climate research with the application of research findings to resource management and decision making.

<sup>1</sup> For the purposes of this workshop, the monsoon region is northwestern Mexico, the U.S.–Mexico border region (a distinct cultural and socioeconomic area), and monsoon-influenced areas in the western United States.

<sup>2</sup> Over the past five years, a number of related binational workshops, symposia, and meetings have been convened by the National Oceanic and Atmospheric Administration (NOAA), National Center for Atmospheric Research (NCAR), Instituto Mexicano de Tecnología del Agua (IMTA), and various University of Arizona groups.

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The workshop was designed to plan activities to 1) foster links between climate science and key research groups (funded by NOAA and others) that are studying climate and society interactions, 2) narrow the communication gap between climate experts and information users, and 3) foster integration of climate science with public policy. In addition, the workshop sought to improve researchers' understanding of user sensitivities to climate variations and forecast needs, and to connect these users with climate scientists and existing programs in the region wishing to engage users. For example, NAME is developing plans for forecasts and other products focused on monsoon and drought, and thus has a critical need to engage potential users of monsoon science to ensure these products are relevant.

Invited talks (translated into Spanish or English) described the region's climatic and societal contexts, climate application research efforts, and recent advances in climate science. Presentations by the American and Mexican commissioners of the International Boundary and Water Commission (IBWC) drew attention to key hydroclimatic issues in the border region, including persistent drought and extreme events, such as floods and hurricanes. Many speakers echoed the themes presented by the IBWC commissioners, including the need to mitigate the impacts of climate variability and to determine how projected impacts of climate change may affect a region that is already stressed environmentally and socially. Speakers described significant social changes mediating vulnerability to climate, including population growth, urbanization, and industrialization. They highlighted the need to plan adaptation to a range of climate impacts; suggestions included developing processes for local and binational water and natural resource management and interagency cooperation, and evaluating alternative planning scenarios.

Climate information stakeholders in the monsoon region include drought and natural hazards managers, water managers (e.g., for urban water, irrigation, reservoirs, transboundary waters, dryland agriculture, and ranching), ecological diversity and sustainability managers (including protected areas and Gulf of California fisheries), coastal managers, and public health officials. Three of these areas were discussed in depth in theme sessions (water, ecosystems, and drought). Participants enthusiastically supported several interconnected proposals, described below, and emphasized the need for stable funding for these activities.

Across these themes, participants emphasized the need for observations with better spatial and temporal

representation of key environmental variables for monitoring and decision support, as well as better mechanisms to access data across the region. Such improvements are needed for numerical modeling and hydroclimate studies, as are data on recent and current conditions for management modeling and planning. Two examples of potentially useful projects are the Extractor Rápido de Información Climatológica, version 3 (ERIC III) database,<sup>3</sup> which provides rapid access to various climate and hydrological data in Mexico, and the National Phenological Network (information online at [www.uwm.edu/Dept/Geography/npn](http://www.uwm.edu/Dept/Geography/npn)), which is monitoring climate change indicators. Session participants also emphasized the need for cross-border products to monitor and examine climate extremes. Two successful efforts to collaborate on useful climate monitoring tools are the North American Drought Monitor (information online at [www.ncdc.noaa.gov/oa/climate/monitoring/drought/nadm/](http://www.ncdc.noaa.gov/oa/climate/monitoring/drought/nadm/)) and the North American Climate Extremes Monitoring Project (information online at [www.ncdc.noaa.gov/nacem/](http://www.ncdc.noaa.gov/nacem/)).

Speakers in the theme sessions emphasized the need to improve understanding of the impacts of climate on vulnerable sectors. The talks on ecosystems and sustainability emphasized interactions between biophysical and societal processes and stressors in the context of improving socioecological sustainability in the region. Research and monitoring are needed to develop an integrated understanding of how climate interacts with social, physical, and ecological systems in a region whose key limiting factor is water. Speakers in the water session emphasized the need to understand the impacts of climate for urban and regional planning, to develop pathways for integrating research, and to transfer knowledge to support water management decisions.

Droughts and the monsoons are interconnected because of the monsoon's significant contribution to annual precipitation and water supply in many parts of this region. Drought affects a number of sectors and also has significant cross-border implications, for example, regarding the management of the shared river systems under the U.S.–Mexico water treaty. The commissioners described how the lack of a drought definition under the treaty makes it difficult to manage sharing during shortages. Speakers also described the cross-border socioeconomic impacts of drought, including effects on commodity prices, migrant labor

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<sup>3</sup> The ERIC III database was developed by and available from the Instituto Mexicano de Tecnología del Agua (contact R. Lobato).

patterns, and competition in agricultural markets. Applications research, including improved understanding of drought impacts and vulnerability, could enhance planning and response. Better drought indices also are needed for a range of human and ecological conditions and impacts, and for triggering drought mitigation plans. Drought early warning systems, based on observations and indices, are needed for better preparedness and quicker response.

The session on climate science illustrated the broad array of efforts in the region with near-term applications to societal problems. Among them are GIS applications in hydrology, paleoclimate reconstructions of runoff in border region rivers, hydroclimatology and streamflow forecasting for the monsoon region, precipitation and soil moisture monitoring networks, and Web tools for facilitating the use of climate information. The workshop provided a starting point for organizing applied climate science and connecting it with stakeholders' needs, and was a step forward in introducing social scientists and others to both Mexican and American science efforts.

Workshop participants endorsed the following three specific efforts as being necessary to the ultimate goal of integrating climate science with regional planning and policy to reduce vulnerability:

- An integrated science and assessment program for the region would improve multidisciplinary interactions and integration between basic and applied science. This recommendation could draw upon frameworks developed in the NOAA Regional Integrated Sciences and Assessments (RISA) program. An assessment program would support studies of regional vulnerability to climate, and the understanding of policy, planning, and decision-making contexts. This knowledge is critical to developing and implementing decision support tools to enhance resilience to climate variability and change in the context of multiple stresses on society and ecosystem.
- A regional climate center (RCC) for northwest Mexico and the border region would both facilitate access to data and products, and develop products that transcend the border for the many stakeholders with transboundary interests. Efforts have begun to develop such a center, which could use education and training to enhance the capacity for the use of climate information (online at [saturno.fisica.uson.mx/~transfronterizo/index2.htm](http://saturno.fisica.uson.mx/~transfronterizo/index2.htm)). The center would promote climate research collaboration, development of decision support tools, and climate monitoring and information exchange.

- A regional climate outlook product would help border region decision makers, who need climate information from multiple agencies in Mexico and the United States in a format that is easy to interpret and access. This concept was also endorsed by a binational working group of researchers and operational managers in Hermosillo, Sonora, Mexico, in January 2006. The product, like the climate summaries produced by the NOAA RISA program, would help develop scientific literacy about regional climate and forecasts. Many regional decision makers desire climate information and forecasts, but remain unaware as to where to find and interpret these decision support tools. The RISA experience has shown that scientific information, when presented in a usable fashion in conjunction with cultural and institutional contexts, can help regional decision makers to make better-informed decisions.

To maintain communication among the climate applications community gathered at the workshop, participants endorsed the following actions: 1) organization of regular meetings every 18–24 months, to discuss progress and formulate new collaborations; 2) development of an e-mail listserv and a Web page; 3) sponsorship of special sessions at professional society meetings, including sessions planned for the American and Mexican Geophysical Unions Joint Assembly in May 2006; 4) training and development of climate applications and extension specialists; and 5) training of managers in specific resource management skills (e.g., GIS), to capitalize on opportunities to apply climate knowledge to decision making.

For more information, to see workshop presentations, and to join a listserv on applied climate research activities in the region, see information online at [www.ispe.arizona.edu/climas/conferences/monsoon2006](http://www.ispe.arizona.edu/climas/conferences/monsoon2006).

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