IS GLOBAL CLIMATE CHANGE RESEARCH RELEVANT TO DAY-TO-DAY WATER RESOURCES MANAGEMENT?

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Senator Tip O'Neil is quoted as saying "All politics is local." One could also say that, "All water management is local." The huge temporal and spatial differences in water availability and use, along with differences in the ecosystems and the social and institutional fabric across the United States, have traditionally moved water management decisions to a local level. To reduce the variability of water resources and the effects of extremes such as drought and flood, local managers have relied upon infrastructure (e.g. dams and levees) and non-structural measures (e.g. building codes and regulations).

As human understanding of the world's climate variation advances, is there a possibility that extremes of climate could be predicted with sufficient reliability to make local water resource management decisions less risky? How willing, and able, are local decision-makers to incorporate the models and information products of global climate change research? Are the water management "decision calendars" understood well enough to know how to infuse the climate information, in the right form and at the right time, with the reliability to be of use to local water managers? Are the outputs of global circulation models (GCMs) reasonably accurate, and can they be downscaled reliably to the watershed level to be used with confidence by water resources decision-makers?

The Universities Council on Water Resources (UCOWR) organized, with support from the National Science Foundation, a workshop at its 2002 annual meeting in Traverse City, Michigan, to examine the current state of climate change research and its interface with water resources management decision-making, from national, to regional, to state, to local levels. This *Water Resources Update* issue includes the papers presented in Traverse City along with others invited to compliment the workshop in Michigan.

This issue of *Update* is not the first time UCOWR has addressed the topic of climate change and water resources. *Update* Issue Number 112, entitled "Global Change and Water Resources Management" (published in the summer of 1998 and co-edited by Kyle Schilling and Eugene Stakhiv), concludes that "water managers are keeping pace with the expectations of the climate change scientists." They note that climate variability has always been a core concern of water resource managers via quantification through the statistical methodologies of hydrologists and water resource engineers.

The current issue of *Update* revisits the topic by examining the increasing interactions between water resource managers and atmospheric scientists. The five papers herein discuss the topic from the view of hydrologists, climatologists, and social scientists.

Roger Pulwarty discusses the communication of scientific information into the decision-making process and notes that developing a good understanding of the water management decision environment presents a major barrier to developing climate projection products. He further notes that the physical environment at a given stage of technology development sets the theoretical range of choice open to any resource manager. The practical range of choice is set by culture and institutions, which permit, prohibit, or discourage a given choice. Pulwarty argues that an avenue for integration between these two frames may lie in collaborative explorations of information communication and use.

Lawford examines the current and emerging issues related to water and the attention given by national and international organizations, especially in the light of potential impacts of climate change on the world's water resources. He also reviews the role of water on climate issues and vice-versa. He concludes that the climate change issue can be viewed by the water management community as a threat or as an opportunity. Many water managers concerned about changing a system that "is not broke," have distanced themselves from the "climate change" issue, while many others do not fully understand the significance of the issue. A minority have embraced the concept of change and are assessing ways of including climate change research findings into decision-making without compromising the integrity of the water system(s). It is Lawford's opinion that the future

sustainability of water resources rests with that minority of water managers working closely with the science community to look at strategies for managing water in a sustainable way within a context that integrates climate variability and change with other types of change and technologies for maintaining water supplies (e.g. desalinization, conservation).

Rogers, discussing climate change from a developing world perspective, notes that climate change is not the major concern of most people living in the developing world. He then points out that considerable "conventional wisdom" has evolved around the problem of providing water in the developing world. Furthermore, he concludes that the conventional wisdom has the tools needed to help humankind weather the water resources challenge posed by rapid climate change.

Chase, Pielke and Castro ask the question - can we downscale global model findings to be of local relevance? After examining several examples of present day climate simulations, they conclude, for a variety of reasons, that downscaling from current climate change simulations does not provide any additional skillful resolution than what is in the original global model projections. Moreover, these global projections have failed to accurately simulate the observed changes in even the global-averaged tropospheric temperatures in the period 1980-2000. The inability to skillfully predict the recent global averaged temperature changes in the Earth's atmosphere indicates that these models should not be used as a primary tool for projections decades into our future, even at the global scale.

VanRheenen, Palmer and Hahn examine potential climate change impacts on the hydrology and operations of a water system by examining two case studies. While they note that climate change could result in significant shifts in the pattern of water storage and degrade the performance of water supply systems, they also argue that other factors may be as important or more important depending on the particular case, such as increasing water demands. They also note that despite the uncertainties associated with outputs obtained from various global climate models (GCMs), the message drawn from the case studies is that climate change will make managing our water resources more challenging and that ignoring the potential impacts of climate change because of the limitations in current models is an option, but a wiser path may be to develop adaptive management policies that deal with climate change.

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