CLIMATE AND WATER IN TRANSBOUNDARY CONTEXTS
An Introduction

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In many parts of the world, population growth, urbanization trends, and economic development and restructuring have elevated water resource issues to unprecedented importance. Even modest variations in supply or demand can generate large social consequences. As management and control of water resources has grown as a political and economic force in most parts of the world, understanding the potential impacts of current and future climate conditions on hydrologic processes and water supplies has become ever more critical.

The often-stated observation that global processes happen in local places is especially salient with regard to the climate-hydrology-water resources nexus. Thus, the imperative grows to connect global and synoptic-scale climate with regional-scale hydrologic processes and regional to local-scale water resource management practices. At the regional scale, for example, different communities may hold very different expectations with regard to environmental issues such as water use. These expectations, in turn, may be related to different strategic approaches, such as full present-day exploitation versus conservation or preservation for the longer term. Contradictions between different strategies may be most tractable at regional scales. Recognition of the importance of regional-scale efforts to address such issues is becoming increasingly evident (see, e.g., Intergovernmental Panel on Climate Change [IPCC] 1998, 2001; Messerli and Ives 1997).

Geographical areas where political boundaries exist are affected by the differing interests, perspectives, and goals of the people living and operating on either side of those boundaries. Individuals on both sides are likely to be influenced by similar weather and climate patterns, on a broad range of time scales ranging from subseasonal (e.g., flood events) to seasonal (e.g., dry spells), annual and interannual (e.g., El Niño/Southern Oscillation...
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[ENSO] events), and decadal or more (e.g., extended dry or wet periods). However, responses to the impacts of these externalities on regional and local resources can be—and often are—radically different. The increasingly complex interactions among different sectors of society regarding the myriad human needs and demands for water, in juxtaposition with the large range of natural climatic variability and its fundamental controls on hydrologic systems, calls for research approaches that emphasize integration across disciplines and interaction with the people the research is intended to benefit (see, e.g., Pulwarty 2001; Miles et al. 1998; Liverman and Merideth 2002).

Resolution of competing demands in contexts of water scarcity likewise demands consideration of historical patterns of water use against the potential for radical changes in water availability arising from decadal and longer-term climatic variations. From this perspective, three areas of water resource management urgently call for comprehensive regional assessment. First, in many parts of the world, extreme exploitation of water magnifies the practical effects of climate variation on water supplies. In many cases, the water being exploited crosses one or more internal or international boundary (Varady and Morehouse, in press). Second, a plethora of often conflicting regulatory and other institutional structures and mandates constrains environmental protection efforts and interregional and international water transfers. These structures and mandates, typically manifested in the form of legislative acts, international treaties and protocols, and administrative rules and procedures, circumscribe the range of management options available to water managers. Third, in some cases, areas that have traditionally been regarded as regional entities, based on various criteria ranging from historical patterns and precedents to expressly articulated economic development strategies, are undergoing dramatic economic, social, and political changes. Such changes may reinforce (for example, socioeconomic ties in the U.S. state of Arizona and the Mexican state of Sonora) or potentially weaken (e.g., the Columbia River Basin) regional ties. In other cases, socially defined “regions” may be emerging where none existed before (e.g., the La Plata River Basin in South America). All such changes have significant implications for management of shared natural resources and call for new kinds of analyses, and a more comprehensive, integrated analytical framework than has been available in the past.

Ideally, this kind of integrated framework includes not only individuals specializing in climatology, hydrology and hydroclimatology, ecology, engineering, and related fields, but also social scientists and economists, water managers, policy makers, and representatives of key user communities. In reality, differences in governance structures and social relations more generally may pose significant barriers to full integration across all of