Effects of Climate Change On Water Availability

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The 21st century poses extreme challenges for the sustainable management of water resources at all levels from the local to the global scale. Water is a basic requirement for life and effective water management is needed to provide some of society's most basic needs. However, demand for water resources is increasing due to population growth, energy demands, crop production, and overall economic development, while water resources are under pressure globally from over-abstraction and pollution. This is increasingly leading to competition for water at local, regional and international levels. Environmental change is adding additional pressures. Anthropogenic influences are changing land and water systems, redefining the state of drainage basins and the rivers and groundwater aquifers that supply the bulk of renewable freshwater supply to society. Widespread land use changes associated with population increases, urbanization, agricultural intensification and industrialization, are changing hydrological systems in complex ways. On many of the world's major rivers, water management is changing flows, often with severe effects on downstream users, aquatic ecosystems and freshwater discharges to the world's seas and oceans. Superposed on these pressures, climate variability and expected climate change can combine to create extreme and perhaps unprecedented conditions which have high impact consequences for human populations, economic assets and critical physical infrastructure. This unique combination of pressures has exposed weaknesses in current water governance and management. It has increased the awareness of uncertainties, the complexity of the systems to be managed, and the need for profound changes in policy and management paradigms, as well as governance systems.

Obviously, the vast majority of water comes from precipitation – either directly or indirectly through runoff from distant locations. From a climate perspective, it is therefore imperative to understand the natural variability of precipitation in the system, as well as its susceptibility to change from external forcing of the climate system. One of the Grand Challenges for the World Climate Research Programme is devoted to *Changes in Water Availability*. This presentation will detail specific questions guiding climate research in the decade ahead, including:

- How do changes in climate affect the characteristics (distribution, amount, intensity, frequency, duration, type) of precipitation – with particular emphasis on extremes of droughts and floods?
- How do models become better and how much confidence do we have in global and regional climate predictions and projections of precipitation?
- How do changes in the land surface and hydrology influence past and future changes in water availability and security?
- How do changes in climate affect terrestrial ecosystems, hydrological processes, water resources and water quality, especially water temperature?
- How can new observations lead to improvements in water management?
- How can better climate models lead to improvements in water management?