Water Resources in the 21st Century

A Policy Statement of the American Meteorological Society
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The provision of adequate fresh-water resources for people and ecosystems will be one of ***the most critical and potentially contentious issues facing society and governments at all levels during the 21st century.*** Water is fundamental – for agriculture, energy production, sanitation, ecosystem health, transportation, and recreation. Yet the limits of this irreplaceable resource are not well understood or appreciated. Water resource managers face daunting challenges from population growth and migration, land use changes, and pollution locally, nationally, and globally — problems likely to be exacerbated over the next several decades by climate change.

In light of this developing water crisis, the American Meteorological Society (AMS) issues this statement as a call to action. The AMS is committed to work with organizations at all levels in the public, private, and academic sectors, and seeks the support of the Congress, the Administration, and international partners in pursuing sustainable solutions. The Society sees both challenges and opportunities and recommends paths forward in the following critical areas:

Communication

Decision makers and the public do not fully appreciate the urgency and complexity of water resources issues or the role that science can play in addressing these issues. Further, hydrologists, meteorologists, climatologists, and social scientists traditionally have approached water resource issues from very different perspectives and so have missed important opportunities to advance scientific understanding.

- **A broad range of public and private-sector partners, working with the AMS, should exploit multiple avenues to educate decision makers and the public about water availability and the factors that alter it. These partners should also find new ways to facilitate communication among practitioners involved with the various aspects of water resources to accelerate progress in addressing water resource issues.**

- **Universities should establish interdisciplinary programs that link atmospheric and hydrological sciences and develop cross-disciplinary degree programs in water resources that incorporate the relevant social, human health, and engineering sciences.**

Observations

The coordinated and sustained network of land, ocean, and atmospheric observations essential to understanding and predicting variations and changes in water on global, regional, and local scales has yet to be achieved. Significant improvements could be realized through optimal observing network design, which would combine remote-

sensing observing technologies (e.g., radar, profiler, satellite, and GPS) with strategic enhancements in existing in situ networks. Further, significant benefits would accrue from aggregating the myriad of observations that are being acquired by a wide range of agencies, institutions, and governments, some of which are neither freely available nor accessible to potential users. New data access and data manipulation technologies currently in development would allow disparate observations in varying formats to be combined into coherent data sets.

- **A consistent commitment to completing and sustaining the required observational networks and exploiting new data access and manipulation technologies is crucial and must be provided now. Moreover, there must be ongoing evaluation of the effectiveness of new and existing network components in meeting user needs.**

- **Open data-access policies must be vigorously pursued.**

- **Stronger partnerships among federal, state, local, academic, and private organizations that manage observing networks must be developed.**

Research and Operations

Water management can be partitioned into two broad arenas: operations and planning. Water managers face challenges in both. For operations, hydrological forecast accuracy is limited by the lack of quantitative forecast skill for all types of precipitation. Water managers also face the challenge of planning for environmental change and its implications for water: Examples are changes in climate, land, and human use, which can have profound, synergistic effects on water availability. Models that integrate such effects are in their infancy. Furthermore, water planning and water availability forecasts are almost entirely based on historical observations that are assumed to be representative of future conditions, the so-called "statistical stationarity" assumption. These practices are no longer defensible in the face of major environmental changes. Finally, current research strongly suggests that there is untapped forecast potential based on dynamical processes on timescales ranging from flash floods to multiyear droughts, but considerably more basic and applied research will be required to exploit that potential.

- **A renewed effort to improve quantitative precipitation and hydrological forecasts for lead times from minutes to months should be implemented immediately.**

- **Federal agencies should mount a major research effort to develop new methods to replace the current hydrologic forecasting methods that are based on the assumption of statistical stationarity.**

- **Significant investments in new modeling tools that can represent multiple and complex physical and societal interactions should be made to adequately assess the potential impacts of these changes and guide land use and water management decisions.**

As a whole, these recommendations can lead to a better understanding of the complex factors affecting water resources and thus foster better water management decisions**.**

[This statement is considered in force until May 2011 unless superseded by a new statement issued by the AMS Council before this date]