



# WATER UTILITY EXECUTIVE

WWW.AMWA.NET | SEPTEMBER 2008

## Special Issue: Climate Change

### Project Aims To Catalogue Federal Climate Research

Responding to a disconnect between the myriad federal climate research programs underway and the ability of water managers and their staffs to identify and locate relevant research outputs, AMWA recently hired the University of Colorado to develop a searchable database that will summarize federal water-related Climate Change Science Program (CCSP) and non-CCSP related projects and documents. The final product is expected by mid-October.

*The result of AMWA's endeavor will be a web-enabled database with information searchable by subject-area attributes, including water quality, water quantity, groundwater, drinking water, wastewater, sea level, floods, droughts, precipitation, mitigation, adaption and modeling.*

The CCSP spends approximately \$1.7 billion per year on research, climate modeling, and the creation of decision-support tools that are critical to utilities, water management agencies, scientists and policymakers. Several scientific groups are already urging the presidential candidates to increase funding for the CCSP by 80 percent over the next five years. At least seven federal agencies, including the Departments of the Interior (USGS), Defense (Corps of Engineers), Energy and Agriculture, EPA, NASA and the National Science Foundation, participate in CCSP water cycle research efforts involving groundwater, surface water and water quality.

The result of AMWA's endeavor will be a web-enabled database with information searchable by researcher, project, document title and subject-area attributes. The subject-area attributes include water quality, water quantity, groundwater, drinking water, wastewater, sea level, floods, droughts, precipitation, mitigation, adaption and modeling. AMWA will update the database periodically to include the most recent information.

### Climate Change Policy Advanced For Drinking Water Systems

AMWA's Climate Change Committee produced a draft policy statement to reflect the association's positions on issues related to climate change, particularly as it impacts the nation's drinking water supplies. The statement calls for "a comprehensive, unified, and coordinated federal research program" for developing decision support tools, adaptation and mitigation strategies, and better information on the regional impacts of climate change on drinking water quality and quantity.

Congress is urged to take into account the impacts of climate change on water resources when developing legislation to regulate greenhouse gas emissions and to take steps to mitigate the anticipated environmental damage that warming is expected to cause. Caution is urged in the evaluation of mitigation strategies, such as carbon capture and storage technology, which could result in harm to underground sources of drinking water.

Finally, the statement affirms AMWA's support for its members' efforts to evaluate their own greenhouse gas emissions and take appropriate steps to reduce emissions and increase energy efficiency. It recommends that the federal government offer incentives for carbon-emitting operations, including water utilities, to take proactive steps to reduce their emissions and increase the efficiency of both their plants and their customers' water usage.

AMWA's Policy Committee will consider the statement at the association's 2008 Annual Meeting in October.

The draft policy statement on climate change can be found on page 24 of the Call for Policy Statements in AMWA's August 5 Bulletin, online at [www.amwa.net/cs/bulletins](http://www.amwa.net/cs/bulletins).

The development of this database uncovered other sources of relevant information related to governmental research, although the outputs may not be governmental documents. For example, while the AMWA database will focus on governmental reports, some government employees also author papers that are published in peer-reviewed journals. To ensure database users are aware of this additional information, the database will include links to other web databases of relevant research, such as the USGS site highlighting research related to climate change and water availability ([http://water.usgs.gov/climate\\_water](http://water.usgs.gov/climate_water)) and the Pacific Institute's Water and Climate Bibliography (<http://biblio.pacinst.org/biblio>).

### Strong Utility Interest Reflected In Climate Change Committee Actions

This October's Annual Meeting marks the one-year anniversary of AMWA's newest and largest committee, the Climate Change Committee. The committee has grown from 23 to 35 member utilities and 50 individuals and has played an integral role in shaping AMWA's work on climate change and climate change policy.

AMWA conducted a survey of committee members' needs and activities related to climate change prior to the first committee meeting. The survey was the basis for developing three goals that direct the association's efforts in the climate change arena for the benefit of all members. These goals are:

- AMWA will be a conduit of information for water utility executives.
- AMWA will advocate on Capitol Hill for federal research and policies specific to water utilities and the water sector in general.
- AMWA will help to educate elected officials about the major challenges the water community is facing and will face as a result of climate change.

The goals are the foundation for AMWA's Climate Change Initiatives Plan, a roadmap for the committee and staff which will be updated at least twice a year so that AMWA can remain at the forefront on this issue.

Over the past year, the committee has also been instrumental in the development of AMWA's comments on the Climate Change Science Program (CCSP), the Water Sector Statement on Climate Change and Water Resources, the association's climate change policy resolution, and AMWA's comments on EPA's National Water Program Strategy Response to Climate Change. Committee members have also provided feedback on climate-related legislation.

In the coming year, the committee will review and revise the initiatives plan to identify new action items. There will be additional opportunities for committee members to weigh in on climate change legislation under a new Administration, and the committee is also exploring ways to interact with the International Water Association on this issue. AMWA members interested in joining the Climate Change Committee should contact Erica Brown ([brown@amwa.net](mailto:brown@amwa.net)).

### International Perspectives Add To Water Sector Climate Picture

As a global phenomenon, climate change is a concern for water systems around the world. Australian utilities are among the vanguard of systems acting aggressively to plan for climate impacts, and last year AMWA invited several of these international leaders to its annual meeting to share experiences with their U.S. colleagues. Sean Cox, Director of Gold Coast Water, and James Gill, CEO of Water Corporation of Western Australia, explained how their utilities are responding to water supply effects of global warming.

Cox said Australian utilities have been reducing assumptions on the "safe" yields of their surface water storages, which is forcing them to find alternative means of providing water for cities. To reach the goal of safe, reliable water, he anticipates Australia's water systems will require water grids and diverse water sources, integrated water cycle management, a consistent regulatory regime, unrestricted rural/urban water trading, sophisticated risk management at a portfolio level, clear accountability for long-term planning, integrated water cycle management and holistic linkage with energy management.

Gill described his utility's integrated water supply scheme – "Security through Diversity" – that was developed in response to the extreme climate-related stress in western Australia. His utility is planning for water sources 50 years ahead and its approach takes a whole water cycle perspective. Infrastructure additions include two major seawater desalination plants, and other programs address groundwater replenishment, conservation, trading with irrigators, catchment thinning and wastewater reuse. This August, Gill was awarded the International Water Association's 2008 Grand Award "for mastering the implications of climate change in Australia."

AMWA's 2008 Annual Meeting in New Orleans will feature a presentation on "The Business of Water in Europe" at which Piet Jonker, general manager of the water provider for The Hague, Duinwaterbedrijf Zuid-Holland, will discuss utility management issues, including climate change's impact on the Rhine, a major concern for many European water utilities.

## Water Sector Increases Climate Lobbying On Capitol Hill

While legislators on Capitol Hill in 2008 were increasingly interested in climate change and potential legislative solutions to the problem, AMWA and other water sector associations spent the year working to educate members of Congress and their staffs of the need to pay attention to the potential impacts on water resources.

The coordinated approach began in January, when AMWA accepted the responsibility of organizing water sector associations to jointly develop a unified message articulating the expected effects of climate change on water resources and suggesting how the nation's utilities would like to see these issues addressed by the federal government. In addition to AMWA, the coalition included the American Water Works Association, the National Association of Clean Water Agencies, the Water Environment Federation, the Water Utility Climate Alliance, the National Association of Water Companies, and others.

The groups' efforts culminated with the May release of the Water Sector Message on Climate Change and Water Resources. The sector message, which was sent to all members of the House and Senate, called for the inclusion of expanded water research and adaptation provisions in any comprehensive climate change legislation considered by Congress. In particular, the groups advocated for financial assistance to help utilities adapt to the impacts of climate change and reduce their own direct greenhouse gas emissions, and federal support for the development of new technologies such as desalination and increases in water use efficiency.

THE WATER SECTOR MESSAGE ON CLIMATE CHANGE AND WATER RESOURCES IS AVAILABLE ON AMWA'S CLIMATE CHANGE WEBPAGE AT [www.amwa.net/cs/climatechange](http://www.amwa.net/cs/climatechange).

## Strategic Initiative Will Enhance Climate Change Research Efforts

The Water Research Foundation (formerly AwwaRF) announced a sustained commitment to climate change research by making this research area a strategic initiative. The research undertaken through this initiative will add to the Foundation's robust list of climate change projects, including the 2006 document, *Climate Change and Water Resources: A Primer for Municipal Water Providers*. Additional projects scheduled for completion before the end of 2009 include:

- Evaluating Effects of Climate Change on Water Quality Planning Criteria and Design Standards;
- Buyers' Guide to Climate Risk Information for Water Utilities;
- Joint Front Range Climate Change Vulnerability Study;
- Greenhouse Gas Emission Inventory Guidance, Specialty Protocol Development and Management Strategies for Water Utilities;
- Mitigating Impacts of Changes in Watershed Vegetation on Source Water Quality and Quantity; and
- Impacts of Underground Carbon Geologic Sequestration on the Water Quality of Groundwater Supplies.

## EPA Proposes Requirements For Carbon Dioxide Geologic Sequestration Wells

Anticipating that carbon capture and sequestration (CCS) will be a necessary option in the nation's portfolio to help mitigate climate change effects on the atmosphere, EPA proposed new requirements to govern the geologic sequestration (GS) of CO<sub>2</sub>. GS of CO<sub>2</sub> would be regulated under the Safe Drinking Water Act's Underground Injection Control (UIC) program. EPA said that "secure, long-term underground storage of the greenhouse gas is one way scientific innovation could lessen the effects of climate change."

The rule would establish a new class of wells (Class VI) to allow for the permitting of GS of CO<sub>2</sub>. It covers only the injection of CO<sub>2</sub> for long-term storage; the capture and transport of CO<sub>2</sub> are outside the scope of the proposal. Since GS of CO<sub>2</sub> is a threat to underground sources of drinking water, the rule intends to prevent migration of CO<sub>2</sub> to such underground sources through siting and construction requirements and extensive testing and monitoring of sites.

The major elements of the proposal build upon the existing UIC regulatory framework, identifying criteria and standards for Class VI wells. These include: criteria for siting; area of review and corrective action; financial responsibility requirements; injection well construction requirements; sampling and testing prior to injection well operation; injection well operating requirements; testing, monitoring and reporting requirements; injection well plugging, and post-injection site care and site closure.

EPA expects to finalize the rule in 2010. Several CCS pilot projects are underway, but experts say that the technology cannot be completely evaluated for issues related to the construction and operation of such facilities or its impacts on the subsurface geology until a large-scale operation is permitted and underway.

(Continued on page 5)

## Water Utility Climate Alliance

### David Behar, San Francisco Public Utilities Commission

Over the past several years, resource managers have grown increasingly concerned about the effects of climate change on human and ecological systems. No passing fad, the science grows clearer by the day that warming and related changes are already hardwired into the earth's climate and that what we can do to change the future is confined roughly to the period following the presidential election of 2008. This fact of life means at least two things to water utilities: we better start planning for change now, and we need to know what that change will be.

Water utilities will be – indeed already are – among the first responders to the effects of climate change. Many agencies with long-term capital plans are beginning to consider how those plans will serve their customers under future hydrological conditions that are expected to differ from those that existed when water systems were planned and constructed. Stationarity, as the new saying goes, is dead.

#### Getting Organized

On January 31, 2007, leaders of 30 utilities from eight states joined agency officials, climate scientists, NGO representatives, and others in San Francisco for the Water Utility Climate Change Summit. According to climate change veterans in attendance at the two day Summit, it was a “watershed moment” for the water utility community. For the first time, the question wasn't whether climate change is upon us, but what to do about it.

Shortly after, a conversation began among a few of the leaders of the Summit about the threat climate change uniquely poses to drinking water utilities. After months of conference calls, meetings, and research, the group formally announced the formation of the Water Utility Climate Alliance (WUCA) in February 2008. The objectives of WUCA are to:

- Improve and expand climate change research so water managers can consider the potential implications climatic changes may have on water resource planning;
- Promote and collaborate in the development of adaptation strategies and tools to reduce the impacts of rising temperature and changes in precipitation patterns on our infrastructure and water supplies; and
- Identify and minimize greenhouse gas emissions resulting from the operations of WUCA member agencies.

With this focused agenda, general manager and senior staff level commitment, and ease of maneuverability, WUCA complements the critical role our water associations, particularly AMWA, play in representing our interests and communicating across agency boundaries. Many WUCA members are also actively involved in AwwaRF's new Climate Change Strategic Initiative, and WUCA participated in development of the “Water Sector Message on Climate Change and Water Resources.”

#### Early Action

The complexities of climate change planning are compounded by the multitude of uncertainties as to what short and long-term changes we can anticipate in temperature, precipitation, hydrologic variability and other factors. Water utility managers need what WUCA calls “actionable science” on climate change, and to a large extent, utilities do not have that today.

WUCA's first focus, therefore, in two sets of comments made to the federal Climate Change Science Program, has been to urge that an increased share of federal resources devoted to climate change research – which totaled \$1.7 billion last year – go toward producing more accurate climate forecasts at a regionally downscaled level (i.e. watershed or county level). We further urged greater communication between the climate science “user community” – that’s us – and climate scientists and their funders. This has not been an area of strength in federal climate change programs to date.

Because we hold no illusions, however, that perfect predictability is around the corner, utilities will be making decisions in a context of climate change uncertainty for some time. Decision support systems, in use for many years in our community, can be adapted to grapple with the unique uncertainties climate change presents and provide guidance for adaptation action. WUCA's first consultant contract will produce a white paper early next year that will identify which decision support approach(es) provide the most robust planning assistance in the context of climate change uncertainty.

The swearing in of the 44th president and the 111th Congress will bring a new policy approach to climate change at many important levels. The water utility community must be organized, articulate, and engaged with policymakers at all levels of government about our urgent concerns on this subject. WUCA, working closely with allies like AMWA, intends to ensure those concerns are heard.

WUCA member agencies include San Francisco Public Utilities Commission (chair), Denver Water, Metropolitan Water District of Southern California, New York City Department of Environmental Protection, Portland Water Bureau, San Diego County Water Authority, Seattle Public Utilities and Southern Nevada Water Authority. For more information, contact David Behar at [dbehar@sfwater.org](mailto:dbehar@sfwater.org).

*(Continued from page 3)*

EPA has requested comments on the proposed requirements by November 24. AMWA is developing comments with assistance from its Regulatory and Climate Change Committees.

MORE INFORMATION CAN BE FOUND AT [www.epa.gov/safewater/uic/wells\\_sequestration.html](http://www.epa.gov/safewater/uic/wells_sequestration.html).

## Following 2008 Debate, Climate Change Legislation Primed To Advance Next Year

The year 2009 could prove to be the year that Congress passes comprehensive legislation to regulate the discharge of greenhouse gasses and mitigate the impacts of climate change, as both the House and Senate appear likely to push the issue after the new Congress and president take office in January.

While no major climate legislation will pass before the end of this year, Congress delved into the issue in 2008 with the

introduction and consideration of multiple climate research and mitigation proposals. In June, the Senate debated a climate change “cap-and-trade” bill for the first time, and a number of representatives and senators have introduced their own climate proposals over the past few months. The continued discussion of these proposals next year will provide drinking water utilities with a unique opportunity to educate members of Congress and the public about the potential ramifications of climate change on America’s water resources.

With congressional Democrats widely expected to increase their majorities in both the House and Senate, it is a near certainty that climate change legislation will appear high on the congressional agenda next year. With that in mind, AMWA will continue to work with its members and other national water organizations to ensure that any forthcoming legislation recognizes the unique challenges that climate change poses for water systems.

TO VIEW AMWA'S STATEMENTS ON SEVERAL PROPOSED CLIMATE CHANGE BILLS, VISIT [www.amwa.net/cs/leginfo](http://www.amwa.net/cs/leginfo).

## AMWA Webpage Delivers The Latest Climate Change News

**A**MWA members looking for current news and scientific reports on climate change and its potential impacts on water resources should visit AMWA's newly redesigned climate change webpage.

Since going live late last year, the page has featured a variety of studies, reports and commentary on the forecasted impacts of climate change on water supplies. The page also features case studies explaining the steps that several AMWA member utilities are already taking to secure their water supplies against

climate change. A constantly updated news stream links to the latest news articles from the U.S. and around the world on the climate-water connection.

Information featured on the page and its archives includes:

- Reports by the U.S. Climate Change Science Program.
- *Ensuring a Sustainable Future: An Energy Management Guidebook for Wastewater and Water Utilities*, an EPA workbook to help utilities use EMS to reduce energy use.
- EPA Office of Water's draft *National Water Program Strategy: Response to Climate Change* and AMWA's comments on the draft strategy.

## Climate Model Downscaling And Adaptation Planning

Joel Smith, Vice President, Stratus Consulting Inc.

Can "downscaling" of climate modeling provide regional estimates of changes in precipitation sufficient for water resources planning? Recent interviews with a number of atmospheric scientists – all of whom are experts on climate modeling and some of whom have built and applied downscaling techniques – give some important insights.

General Circulation Models (GCMs – climate models) divide the world into grid boxes, assuming a uniform topography and projecting a single change in climate for each grid box. These grid boxes are several hundred kilometers across. Many important topographic features that can have a strong influence on regional climate such as mountains, lakes, and shorelines are poorly resolved. In addition, climate models parameterize complex phenomena such as precipitation, which have high spatial heterogeneity.

Downscaling uses outputs of GCMs to yield forecasts of climate change at higher resolution. Two techniques have been employed. One is statistical downscaling, whereby variations in variables such as pressure are correlated with temperature and precipitation at a particular location (typically a weather observation station). The statistical relationship between the site-specific variables is then applied to mesoscale GCM projections to derive estimates of future site-specific climate. The key assumptions here are whether the derived statistical relationships will hold in the future and whether the GCM mesoscale output is reliable.

The second technique is dynamic downscaling, which involves the use of high resolution regional models. These models, called regional climate models (RCMs), incorporate topography and have grid boxes of between 10 and 50 km across. RCMs must be driven by boundary conditions derived from GCM projections, so, once again, a key assumption is that the GCM outputs are reliable.

The two approaches have a number of advantages and disadvantages. An advantage of statistical downscaling is that it is relatively inexpensive. A disadvantage is that it gives projections for only a particular location, although multiple locations can be analyzed to yield regional projections. The advantage of RCMs is that they can capture complex and nonstatic relationships between mesoscale and regional climate. A disadvantage of RCMs is that they are more complex and expensive.

(Continued on page 7)

- Climate presentations by AMWA member utilities.
- A series of reports from the Intergovernmental Panel on Climate Change and the U.S. Geological Survey on the potential impacts of climate change on water resources.
- AMWA's December 2007 white paper, *Implications of Climate Change for Urban Water Utilities*, and a May 2008 statement on climate change sent to Congress by AMWA and a coalition of water and wastewater organizations.

AMWA'S CLIMATE CHANGE WEBPAGE IS AVAILABLE TO MEMBER UTILITIES AND THE PUBLIC AT [www.amwa.net/cs/climatechange](http://www.amwa.net/cs/climatechange).

## Federal Agencies Plan Cooperation

A recent federal interagency memo directs five agencies – EPA, National Oceanic and Atmospheric Administration, U.S. Army Corps of Engineers, and Departments of Agriculture and the Interior – to cooperate in adapting water program management to reflect changing climate conditions. The memo outlined 15 specific action items on how the agencies can cooperate to address impacts such as rising sea levels, changes in rain and snow amounts, changes in storm intensities and warmer water and air temperatures. Proposed action items include developing common standards, definitions and progress measures, as well as joint projects.

## Climate Model Downscaling And Adaptation Planning (Cont.)

If the GCMs do not accurately forecast changes in mesoscale climate, downscaling will not fix the problem. A central question is whether GCMs produce consistent and reliable projections of changes in circulation patterns. If models project different circulation pattern changes, then downscaling will yield different regional projections, depending on the GCM used. More than just consistency is required. If GCMs are consistent with each other but repeating errors, then downscaling will also yield inaccuracies. As an example, most GCMs project the southwestern United States will see a reduction in precipitation. The GCMs, however, tend not to simulate an important circulation factor in the region, the Southwest Monsoon, very well. The monsoon is a major component of annual precipitation. This inaccuracy makes the models' projections of a decrease in precipitation less reliable.

Another possibility is that GCMs could agree on projected changes in circulation patterns around a region of interest while disagreeing on projections of temperature and precipitation. This might result from the poor representation of regional topographic features in GCMs. In that case, the introduction of regional scale topography in RCMs could yield more accurate projections.

Downscaling is a promising way of developing consensus on future changes in climate at a regional scale. Yet, the current state of modeling needs improvement. The available tools can provide insights and be used to suggest a range of possible changes. The fact that we have many GCM projections of future climate is a benefit, because comparing different models and quantifying intermodel differences allows assessment of the reliability of individual GCMs, and, hence, of downscaling derived from these GCMs.

Given the complexity of deriving inputs to water resources planning from the “top-down” by downscaling of climate model outputs, it is worthwhile to first do some “bottom-up” analysis in order to obtain a firm sense of what you are trying to learn from climate modeling. Starting with existing water supply planning tools, ask what changes in climate would be most threatening to long-range plans. Also, ask what adaptations you would make to cope with such adversity and at roughly what cost. Then turn to climate models with a more specific set of questions, a sense of what's at stake, and a sense of how much of an answer you need to make adaptation decisions.

Editor's Note: Joel Smith was Lead Author for the Fourth Assessment Report of the United Nation's Intergovernmental Panel on Climate Change (IPCC) which was awarded the 2007 Nobel Peace Prize. The IPCC does not conduct research on its own, but rather reviews and assesses the most recent scientific, technical, and socioeconomic information relevant to the understanding of climate change.

## Key Climate Change Reports For The Water Sector



### **Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change**

U.S. Global Change Research Program

[www.usgcrp.gov/usgcrp/Library/nationalassessment/overview.htm](http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overview.htm)

Originally published in 2000, this landmark assessment was updated in 2004 to reflect the advancing sophistication of climate science and scientists' increased ability to project some changes at the regional scale, to identify regional vulnerabilities and to assess potential regional impacts. Of particular interest is a chapter on the water sector which covers competition for water supplies; surface water quantity and quality; groundwater quantity and quality; floods, droughts and extreme precipitation; ecosystem vulnerabilities; and adaptation strategies. This overview report was written by a committee of experts drawn from government, universities, industry and non-governmental organizations.



### **The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity**

U.S. Climate Change Science Program

[www.climatescience.gov/Library/sap/sap4-3/default.php](http://www.climatescience.gov/Library/sap/sap4-3/default.php)

Sponsored by USDA, this assessment is one of a series of 21 synthesis and assessment products being developed under the auspices of the U.S. Climate Change Science Program (CCSP), which coordinates the climate change research activities of U.S. government agencies. Both the quantity and quality of water resources are assessed in the report, which looks at the factors influencing water resources that are sensitive to climate change; how climate change can influence stresses on water resources; and systems to monitor stress indicators.



### **Climate Models: An Assessment of Strengths and Limitations**

U.S. Climate Change Science Program

[www.climatescience.gov/Library/sap/sap3-1/final-report/default.htm](http://www.climatescience.gov/Library/sap/sap3-1/final-report/default.htm)

In this assessment of the science of climate modeling, the CCSP describes the maturing of climate models and their increased ability to simulate current climate. While climate modeling has been steadily improving over the past several decades, the pace has been uneven. This is particularly true of climate model simulation of precipitation which has improved but is still problematic. The report includes a description of emerging techniques to improve regional climate prediction and overall trends in climate model development.



### **Weather and Climate Extremes in a Changing Climate**

U.S. Climate Change Science Program

[www.climatescience.gov/Library/sap/sap3-3/final-report/default.htm](http://www.climatescience.gov/Library/sap/sap3-3/final-report/default.htm)

Extreme weather and climate events are among the most serious challenges to society in coping with climate change, and this report looks at the trend toward more extremes and their associated outcomes. Both temperature and precipitation extremes are discussed, including increases in heavy downpours, droughts and hurricanes, as well as shifting storm tracks and extreme winds. The report proposes measures to improve the understanding of weather and climate extremes.