

**American Water Resources Association**  
**2009 SPRING SPECIALTY CONFERENCE**  
***Managing Water Resources Development in a Changing Climate***  
**May 4-6, 2009**  
**Anchorage, AK**

**Wednesday, May 6**

**10:30 AM – 12:00 Noon**

**Session 31: Changing Climate Impacts on Water Resources and People II**

**1. Effect of Downscaling Methods on the Assessment of the Impact of Climate Change in Watershed Scale Management Models - Shimelis G. Setegn**, The Royal Institute of Technology (KTH), Stockholm, Sweden (co-authors: Assefa M. Melesse, Karim Abbaspour, Bijan Dargahi, Ragahavan Srinivasan)

A major task in water resources related climate change research has been the development of appropriate methodologies to adopt the projected global scale climatic variability to regional scale hydrologic responses in different parts of the world. This process involves interpolation of global general circulation climate model (GCM) results which has been computed at large spatial scale to regional spatial scale, and eventually to watershed processes. Different downscaling methods have strengths and weaknesses in different climatic variables, in different regions and seasons. Major attention should be given to the choice of downscaling method in the analysis of the impacts of climate change on hydrological processes of a particular region. In this study, we will compare differential statistical and dynamical downscaling methods and assess their impact on watershed-scale management models. Uncertainties due to downscaling of large scale to small scale climate variables will be assessed. The downscaled precipitation, temperature and local climate scenarios will be used to drive a physically based distributed hydrological model for the assessment of climate change impacts on the flows and water resources availability of the Blue Nile basin which accounts for more than 60% of the total Nile river flow.

**2. Natural Disasters and Extreme Climate Events: Impacts and Implications for Water Resources Management - Chennat Gopalakrishnan**, University of Hawaii at Manoa, Honolulu, HI (co-author: Jason K. Levy)

An aspect of water resources management that has received relatively little attention in the discourse on water pertains to water and disasters. The destructive potential of water has been well recorded in history going as far back as biblical times. Recent years have witnessed instance after instance of the catastrophic consequences of floods and droughts throughout the world. Particularly noteworthy in this context are the great Indian Ocean tsunami of 26 December 2004, the major Mumbai floods in May 2005, and, in August 2005, the catastrophic hurricane Katrina and the resulting devastating floods in New Orleans. In terms of sheer destruction of physical infrastructure there are few natural disasters on record that match Katrina. Recent estimates put economic losses from the hurricane in excess of US\$200 billion (with hundreds of people reportedly dead), even surpassing the damage inflicted by the Indian Ocean tsunami. Equally destructive are major droughts that have plagued different parts of the world, especially in the African continent, throughout this century causing colossal losses and suffering. Against this background, the proposed paper will examine the impacts of climate change on water, identify and briefly review key policy areas relevant in this context and conclude with a discussion of the implications of these policies for water management. Following introductory comments, the paper provides a brief overview and survey of economic, social and institutional impacts of major water disasters. This is followed by the identification and review of five key policy areas central to developing and implementing effective strategies for disaster management. The policy areas studied in this paper are: 1. Risk Analysis and Management, 2. Vulnerability Assessment, 3. Capacity Building and Resilience, 4. Disaster Reduction- Development Linkage, and 5. Institutional Design. The paper concludes with a study of the implications of the proposed policies for water management. Each of the proposed policies is examined from a conceptual and empirical perspective to determine its implications for water resource management. Based on this analysis, eight specific implications are identified as a basis for developing robust new policies for integrated disaster management in the water domain.

**3. Inter-state Water Agreements in Federal Countries. A Comparative Analysis. - Maria E. Milanese-Murcia**, McGeorge School of Law, University of the Pacific, Sacramento, CA

Disputes between states and provinces which share waters in federal countries have increased considerably during the last decades. The diverse jurisdictions and regulations within a federal state present challenges in water management and make controversies difficult both to resolve and prevent. Water resource agreements are binding on the contracting parties and have been used at different levels – international, national, and regional. These agreements often include similar principles, such as no significant harm, equitable apportionment and cooperation. Inter-state water agreements are instruments designed to solve potential conflicts. However, the question remains whether inter-state water agreements are adequate to resolve the water problems that federal countries face today. Inter-state or inter-province conflicts usually arise from disagreements over allocation and water quality. Countries such as the United States (U.S.) resolve their water allocation conflicts through Congressional action and interstate compacts. However, the increase of water conflicts among states requires solutions for specific problems not contemplated in federal acts or agreements. For this reason, and particularly in common law jurisdictions, court decisions are an important tool in the solution of water conflicts. The U.S. Supreme Court, for example, has established a federal common law of inter-state water allocation. In India disputes that cannot be settled by negotiation will be brought before a Tribunal under the Indian Interstate Water Dispute Act 1956. This article takes a thematic approach to a comparative analysis of inter-state agreements used in a variety of countries. It contains an analysis of selected provisions which commonly feature in inter-state or inter-province water agreements. The main goal of this research is to develop a model to compare, analyze, and explore problems with existing inter-state agreements. The sample includes forty-two inter-state water agreements from nine different countries: Australia, Canada, Argentina, the U.S., Nigeria, India, Germany, Switzerland, Brazil and the U.S.-Canada inter-state/province agreements. The analysis uses sixteen criteria to study and compare each interstate-agreement. This study adapts the variables to an international context allowing a better understanding of inter-states agreements developed in different federal countries. The objective of this study is to extend the results by providing conclusions and recommendations.

#### **4. Managing Florida's Water Resources in an Uncertain Future - Mikel Renner, Southwest Florida Water Management District, Brooksville, FL**

The State of Florida is currently facing many water resource management challenges including shortages due to drought, salt water intrusion and deterioration in quality and limits on the availability of its groundwater sources. Continued pressures from population growth, development styles and potential new challenges resulting from climate change stress the system even further. Florida's water managers must plan for potential increased variability in precipitation regimes, storm events, and rising sea levels. Significant changes in these phenomena from historical patterns are likely to result in changes to the amount of fresh water resources and land available to sustain life and maintain healthy water dependent natural systems. Florida's primary water resource concerns revolve around changes to water dependent ecosystems, impacts to and from human activity and ground and surface water quality. There may be shifts in water demands for agricultural and municipal supply, increased energy consumption for advanced water treatment, transmission and disposal as well as for changing environmental needs. Incorporating methods to quantify and plan for uncertainties and risks related to population growth, climate change and environmental regulations will be critical to maintain the quality of life, economic vitality and environmental sustainability for the state. This is particularly true as our population continues to grow along the coast, where public water and wastewater facilities are located to serve those populations. The rate of climate change and potential consequences over the next 100 years is uncertain, but the more rapid the rate of change, the more quickly Floridians will have to respond to manage Florida's water resources effectively. This presentation will lay out the issues described above and options and strategies for planning and action now. Planning and acting sooner can significantly reduce costs and impacts relative to deferring efforts until later.