

Public Water Supply Utilities Climate Impacts Working Group”
(PWSU-CIWG)

WHAT CAN WE LEARN FROM OTHER “GROUPS” TO BUILD A VISION FOR OUR FUTURE

Summaries of national, regional and local groups, and some participants’ projects focused on impacts of climate change, climate variability and sea level rise on public water utilities

Pre-workshop documentation for Workshop Two
Thursday, January 20, 2011

Prepared by PWSU-CIWG workshop participants

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Introduction

The UF Water Institute, Florida Climate Institute and the UF IFAS Center for Public Issues Education are partnering with six major public water supply utilities, and three water management districts in Florida to explore interests in and potential benefits of forming a “Public Water Utilities Climate Impacts Working Group.” The working group would focus on increasing the relevance and usability of climate change and variability data and tools to the specific needs of public water supply utilities in Florida.

As an outcome of the first workshop held on September 22nd, 2010 (see the summary report), the participants agreed that the second workshop should include learning about group members' participation in various regional and national organizations, and projects, focused on evaluating potential climate impacts to water utilities. In particular, understanding the goals and missions of these various groups, how they function, how they are funded, and what we might do together that could build on and customize these activities for Florida-specific issues.

Workshop Preparation

Written descriptions of selected organizations/groups that are evaluating potential impacts of climate change, climate variability and sea level rise on public utilities were prepared by working group members using a standard format to summarize history and origin, goals, people, focus and actions, modes of operation, products/outputs and lessons learned relevant to the interests of the PWSU-CIWG. Brief presentations will be made during the workshop by the authors of the brief descriptions. In addition, participants submitted similar information on specific projects being implemented by their institutions that they would like to share with other PWSU-CIWG participants.

During the workshop the presentations and the organizations/groups/and project briefs will provide a basis for discussion and analysis of ideas that will be useful to help inform potential composition, structure, and modes of operation for our Working Group (CIWG). This learning will contribute to the participants determining how the CIWG may best serve the members interests, and potential next steps. This document includes the information provided by participant members. Section I includes brief summaries of Organizations/Groups that are evaluating potential impacts of climate change, climate variability and sea level rise on public utilities. They have been prepared by workshop participants who are active in these organizations/groups and are listed in the order they appear in this document. This is followed by a list of projects submitted by participants.

I would like to thank the authors and presenters for their preparation for this workshop.

SECTION I: Organizations/Groups to be presented at the workshop:

- 1. The Water Research Foundation (WRF)

Douglas Yoder, Deputy Director, Miami-Dade Water and Sewer Department

- 2. The Water Environment Research Foundation (WERF)
Douglas Yoder, Deputy Director, Miami-Dade Water and Sewer Department
- 3. EPA Climate Ready Utilities, National Drinking Water Advisory Council
Douglas Yoder, Deputy Director, Miami-Dade Water and Sewer Department
- 4. Southeast Florida Regional Climate Compact
Larry Johnson, P.E, Palm Beach County Water Utilities Department
- 5. Local Governments for Sustainability, ICLEI Climate Program
Jayantha Obeysekera, SFWMD
- 6. Water Utility Climate Alliance (WUCA)
Alison Adams, Source Rotation and Environmental Protection Manager, Tampa Bay Water

SECTION II: Project summaries submitted by workshop participants:

1. Project: Piloting Utility Modeling Applications (PUMA): Tampa Bay Water-UF Water Institute subproject, Wendy Graham, Director, UF Water Institute
2. Project: A land of flowers on a latitude of deserts: Developing regional climate change predictions to aid conservation and management of Florida's biodiversity, Vasu Misra, EOAS, COAPS & FCI
3. Project: Dynamic Decision Support System (D2S2) Project, Larry Johnson, P.E, Palm Beach County Water Utilities Department
4. Project: Sea Level Rise and Climate Change Issue Coordination, Jayantha Obeysekera, Interdepartmental Climate Change Group, South Florida Water Management District
5. Project: Use of Intra-seasonal and Seasonal Forecasts to Reduce Risk in Regional Public Water Supply Management, Chris Martinez, University of Florida
6. Project: Using Climate Information to Predict and Reduce Residential Irrigation Demands, Chris Martinez, University of Florida
7. Project: Needs, Uses, Perceptions, and Attitudes towards Weather and Climate Forecast Information by Water Resource Managers in the Southeastern United States, Chris Martinez, University of Florida
8. Project: Integrated Climate Change and Threatened Bird Population Modeling to Mitigate Operations Risks on Florida Military Installations, Chris Martinez, University of Florida
9. Project: Idea: Optimum Big Rain Indicator of Extremes for SE USA , James O'Brien, SECC

Section I. Organizations/Groups focused on evaluating potential climate impacts to water utilities in which participants are involved

- 1. The Water Research Foundation (WRF)**
Douglas Yoder, Deputy Director, Miami-Dade Water and Sewer Department
- 2. The Water Environment Research Foundation (WERF)**
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1. Water Research Foundation (WRF), Climate Change Strategic Initiative

Douglas Yoder, Deputy Director, Miami-Dade Water and Sewer Department

1. History and Origin: The Water Research Foundation was created in 1966 as the applied research arm of the American Water Works Association (AWWA). It is a membership organization that includes more than 900 water utilities throughout the world, along with more than 50 consulting and manufacturing firms associated with the water supply industry. Subscriber dues constitute the majority of the annual research budget, which is typically several million dollars each year. The Foundation is now a stand-alone entity. Until two years ago it was known as the American Water Works Association Research Foundation (AWWARF).

2. Goals: The Water Research Foundation mission is to advance the science of water by sponsoring research, developing knowledge, and promoting collaboration. The Climate Change Strategic Initiative was established by the Foundation in 2008. It has objectives as follows:

Objective 1: Enhance and improve water industry awareness of climate change issues and impacts

Objective 2: Provide water utilities with a set of tools to identify and assess their vulnerabilities, and develop effective adaptation strategies

Objective 3: Provide water utilities with a set of tools to assess and minimize their carbon footprint

Objective 4: Communicate information to internal/external stakeholders

3. Partners, Participants, People: The Foundation operates under a Board of Directors selected from the membership and relies on many volunteers with suitable expertise and experience to identify research topics, review and evaluate research proposals, coordinate projects with federal, state, and local agencies and organizations, and make research results practically available to the membership to assist in utility operations.

4. Focus and Actions: The Water Research Foundation funds and oversees applied research projects to benefit the effectiveness and efficiency of water utility operations. Since its inception the Foundation has published more than 800 reports at a cost of about \$460 million. These reports cover the full range of utility issues, from water treatment processes to the expected life of distribution systems and other assets to customer relations management and finance. Through its Climate Change Strategic Initiative it is focusing research resources more specifically on the ways in which utilities can prepare for the impacts of climate change.

5. Modes of Operation: A system of committees in various aspects of utility operations prepares an annual list of research needs based upon input from utility operators, engineering firms, academics, federal and state regulators, and other research institutions around the world. Sponsored research involves the preparation of requests for proposals and competitive selection of research teams to do the work. Unsolicited proposals have historically been funded to support emerging research needs identified primarily in the academic world. Tailored Collaborations are undertaken directly by utilities to solve more immediate problems, the solutions to which are judged to be helpful to water utilities in general.

6. Products/Outputs: As noted above, funded research projects typically result in one or more reports which are reviewed by project advisory committees prior to publication. These reports then become available to the membership and to the public at large. The following projects related to climate change have been funded to date, and more information is available at www.waterresearch.org or at the website still being developed to highlight all available climate change research that is particularly focused on utility issues. <http://www.theclimatechangeclearinghouse.org/ClimateChangeClearinghouse/ForTheWaterCommunity.aspx>

4340	<u>Workshop Focusing on Climate Change Adaptation Strategies and Information Needs</u> Will convene a joint workshop with NOAA, USEPA, NASA, and WERF to explore the implications of climate change to the water sector. Will develop a final research needs report. Research partner: UCAR. To be completed in 2011.	2010	
4239	<u>Climate Change Impacts on the Regulatory Landscape: Evaluating Opportunities for Regulatory Change</u> Will provide a summary of U.S. legislation and regulation that poses constraints to water and wastewater utilities in reducing greenhouse gas emissions. Will provide a summary of unique legislative and regulatory frameworks in other countries and in individual states that could be adapted to the national legislative and regulatory framework. Will identify opportunities for new legislative and regulatory options and flexibility that will help utilities optimize costs and levels of service and reduce environmental impacts. Research partner: AWWA.	2009	
4263	<u>Analysis of Changes in Water Use Under Regional Climate Change Scenarios</u> Will study anticipated water demands and use patterns under a range of climate change scenarios, categorized by specific customer class and industry sector, so that water utilities may better plan for and respond to changing water use patterns as a result of climate change. Will provide recommendations for water utilities to plan for and respond to the anticipated water use patterns, and will identify key concerns and areas for additional analysis by region.	2009	
4264	<u>Changing Mindsets to Promote Design of Sustainable Infrastructure</u> Will define a new planning approach for sustainable systems and design concepts and will set out a comprehensive sustainable planning framework to include a broad suite of considerations. Research partner: NYSERDA	2009	
4265	<u>Impacts of Underground Carbon Geologic Sequestration on the Water Quality of Groundwater</u> Will identify groundwater quality impacts resulting from migration of CO2 from geologic carbon sequestration projects. Will consider impacts of physical and chemical changes associated with varying levels of contaminant migration or displacement associated with underground storage and sequestration of CO2.	2009	
4208	<u>Identifying and Developing Climate Change Resources for Water Utilities: Content for Climate Change Clearinghouse</u> Will identify and develop new content for the WaterRF Climate Change Clearinghouse, which was developed in 2008 as central knowledge repository Website to assist water utilities in assessing and managing the impacts of climate change. Project results will be posted on www.climatechangeclearinghouse.org .	2008	

7. Lessons Learned: There will be continuing applied research needs as individual utilities begin to understand the implications of climate change with respect to their water supply sources, their operating infrastructure, and their future demand forecasting. Having research institutions engaged in this effort now is important to providing the foundation and capacity for future needed research.

2. Water Environment Research Foundation (WERF)

Douglas Yoder, Deputy Director, Miami-Dade Water and Sewer Department

1. History and Origin: The Water Environment Research Foundation (WERF) is a non-profit membership organization created in 1989 to design, conduct, and distribute applied research related to wastewater and stormwater issues and institutions. It is related to but independent of the Water Environment Federation.

2. Goals: WERF strives to be “the objective source for water science” related to stormwater and wastewater. The following objectives are the basis for advancing this goal:

- *Results* that provide value to our subscribers
- *Results* that transmit reliable information as quickly as possible – without cutting scientific corners
- *Results* that spur the next generation of science and technology

3. Partners, Participants, People: WERF has several hundred subscribers, both national and international. They coordinate funding and projects with federal agencies, universities, other non-profit agencies (such as the Water Research Foundation), and industry companies.

4. Focus and Actions: WERF solicits and supports applied research in 13 specific knowledge areas associated with wastewater and stormwater operations and management, including climate change.

5. Modes of Operation: WERF utilizes a cadre of subscriber volunteers to develop, solicit, and oversee specific research projects. The research is done by consultants, academicians, and utilities through a competitive solicitation process. Utilities can initiate projects of individual interest through a Targeted Collaborative Research project. All research is peer-reviewed by experts in the field.

6. Products/Outputs: WERF has published more than 300 research projects valued at more than \$62 million over the past 20 years. The following climate change related projects are part of or related to the WERF portfolio:

‣ [Sustainable Path to Adapt to Climate Change](#)

WERF is providing utility managers with information to adapt their practices to meet environmental challenges related to climate change.

‣ [Guide Provides Information on Impact of Climate Change](#)

WERF, the Water Research Foundation, the UK Water Industry Research and the National Center for Atmospheric Research prepared a series of technical briefs which provide a better understanding of the impact of climate change on the water, wastewater and stormwater sectors.

‣ [Climate Literacy Guide Available](#)

The U.S. Climate Change Science Program recently issued a guide on [climate literacy](#). This guide provides valuable information about the earth's climate and the impacts of climate change.

» [Environment Canada Issues Revision of its FAQ on Climate Science](#)

This easy-to-navigate resource answers questions about human influences on the atmosphere and the impact of climate change.

» [National Water Program Strategy: Response to Climate Change](#)

Related link: download this PDF draft strategy, issued by the U.S. EPA National Water Program.

» [Exploratory Team Report on Climate Change](#)

WERF's exploratory team sees the need to expediently move forward with research on adapting to climate change. The team recommends a research plan for climate change.

» [Effects of Climate Change](#)

Related link from the Climate Change Science Program Office: The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity.

» [Weather & Climate Extremes](#)

Related link from the Climate Change Science Program Office: Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands.

» [Climate Registry](#)

Related link: visit the Climate Registry for information on greenhouse gas emissions protocols and emissions data.

More information is available at the WERF website: www.werf.org

7. Lessons Learned: Wastewater and (particularly) stormwater operations will be impacted by climate change in Florida in specific ways, but with some degree of similarity to water supply issues. These important infrastructure areas need to be included in any more generalized analysis of climate change impacts. Adaptive management is likely to be the effective approach to incorporating climate change issues into overall utility management processes.

3. Climate Ready Utilities Working Group (CRUWG, NDWAC, EPA)

Douglas Yoder, Deputy Director, Miami-Dade Water and Sewer Department

1. History and Origin: The Climate Ready Utilities Working Group (CRUWG) was specifically created by the National Drinking Water Advisory Council (NDWAC) to develop recommendations by which utilities can prepare effectively for the challenges of climate change and ways to recognize utilities for their efforts in this regard. The group was created in October of 2009 and completed its report in November of 2010. The report was presented to the NDWAC in December of 2010 and is being transmitted to the EPA Administrator with a favorable recommendation for implementing the recommendations. NDWAC was created in 1974 as a requirement of the Safe Drinking Water Act, is comprised of 15 members representing state and local water agencies, water related interest groups, and the general public.

2. Goals: The following charter was provided to the Working Group from the NDWAC:

- 1) Defining and developing a baseline understanding of how to use available information to develop climate change adaptation and mitigation strategies (i.e., identify the behaviors that characterize a —climate ready utility for purposes of both adaptation and mitigation), including ways to integrate this information into existing complementary programs such as the Effective Utility Management and Climate Ready Estuaries Program;
- 2) Identifying climate change-related tools, training, and products that address short-term and long-term needs of water and wastewater utility managers, decision makers, and engineers (i.e., explore how to best enable climate ready utility behaviors), including ways to integrate these tools and training into existing programs; and
- 3) Exploring mechanisms to provide recognition or incentives that facilitate broad adoption of climate change adaptation and mitigation strategies by the water sector for incorporation into existing EPA Office of Water recognition and awards programs or new recognition programs.

3. Partners, participants, people: The Working Group consisted of 20 utility executives, water resource agency managers, and environmental organization representatives from across the country.

4. Focus and Actions: This group had a single mission to develop and provide a consensus-based report pursuant to the goals articulated above to the NDWAC. It was supported by a process facilitation team and EPA staff that coordinated technical presentations and the report draft that was finally sent to NDWAC.

5. Modes of Operation: The Working Group met four times between December of 2009 and November of 2010, with sub-committees meeting by teleconference between the regular meetings. The facilitation team identified issues for reconciliation throughout the process, finally leading to a consensus document at the end. The final product includes a variety of accommodations among the stakeholder groups represented by utility operators, utility regulators, environmental group representatives and interested members of the public for whom comment time was provided at each meeting.

6. Products/Outputs: A final report was heard and approved by the NDWAC in December, 2010, and is currently in the transmittal process to the EPA Administrator. It will likely be available on the EPA website in late January.

7. Lessons Learned: Climate readiness is an exercise in adaptive management, but with long lead times and uncertain forecasts for critical change elements, such as the rates of sea level rise, changes in precipitation patterns, and storm activities. As changes occur, it is likely that both natural systems will change and the functionality of human systems (stormwater systems, water and wastewater systems, building codes, transportation systems, economic systems, etc) will necessarily change. Predicting and managing to this “new normal” is the key challenge for utilities and communities alike.

4. Southeast Florida Regional Climate Change Compact

Larry Johnson, P.E, Palm Beach County Water Utilities Department

1. **History and Origin:** The Southeast Florida Regional Climate Change Compact represents a joint commitment of Broward, Miami-Dade, Palm Beach and Monroe Counties to partner in mitigating the causes and adapting to the consequences of climate change. The Compact was formalized following the Southeast Florida Climate Leadership Summit in October 2009, when elected officials came together to discuss challenges and strategies for responding to the impacts of climate change. By January 2010 the Compact formally was adopted. Municipal leadership is invited and participates in this important endeavor. The Compact outlines a collaborative effort to participate in a Regional Climate Team toward the development of a Southeast Florida Regional Climate Change Action Plan. The Compact also commits the Counties to work on federal and state climate policies and joint advocacy in Tallahassee and Washington, DC on climate policies related to the shared challenges of climate change.
2. **Goals:**
 - Develop strategies for responding to the impacts of climate change
 - Develop a SE Fl Regional Climate Change Action Plan
 - Work on federal and state climate policies, legislation and rules
 - Pursue state and federal grant funding associated with climate change initiatives
3. **Partners, Participants, people:** The SE Fl Regional Climate Change Compact is made up of representatives from four counties, Monroe, Miami-Dade, Broward and Palm Beach and the South Florida Water Management District (SFWMD). The Summit includes elected officials from each County and many municipalities. A Steering Committee includes senior management representatives from each county and a representative from the SFWMD. Technical committees include representatives of a wide range of organizations, including counties, universities, SFWMD, NOAA, USGS, and the US Army Corps of Engineers.
4. **Focus and Actions:** The SE Fl Regional Climate Change Compact is focused on predicting the amount of sea level rise, identifying the vulnerabilities of the four SE Florida counties to climate change, establishing a regional greenhouse gas emissions baseline, and developing Action Plans necessary to adapt or mitigate those vulnerabilities. Legislative, governmental and grant funding actions will be included in the Action Plans.
5. **Modes of Operation:** The SE Fl Regional Climate Change Compact is a formal organization, established by County resolutions adopted by the four counties. Elected officials attend the annual summits and provide overall direction and oversight. A Steering Committee provides management direction, scope and approval of the compact work products. Several technical committees were established to perform specific functions. These include a Policy Technical Committee to develop state and federal policy positions; a Sea Level Rise Committee to review data and provide a joint recommendation concerning predicted sea level rise for the four counties, a Green House Gas Technical Committee for establishing a regional greenhouse gas inventory; and a Vulnerability Technical Committee to develop methods for analyzing GIS maps and data to develop a uniform method for

predicting areas that may be inundated with sea water due to various ranges of sea level rise in the four counties.

Following development of the Sea Level Rise Predictions, and the Vulnerability maps, it is anticipated that the counties will develop a Regional Climate Action Plan to plan actions that may be taken to mitigate or adapt to climate change impacts.

6. Products/ Outputs: Products include the joint resolution of the four counties know as the “4-County Compact”; two SE Florida Regional Climate Change Summits in Oct 23, 2009 and Oct 29, 2010 where, at 2nd Summit, the SE FL Climate Change Compact partners received the 2010 ICLEI Sustainability Leadership Award; development of a Regional Green House Gas Emissions Inventory is underway; draft recommendations to use the USACOE sea level rise predictions for the planning periods through 2030 and 2060; and draft GIS maps of areas that may be impacted due to sea level rise due to a 1-3 foot sea level rise. In November 2010 resolutions were adopted to encourage the state legislation to establish a renewable energy portfolio standard for the State of Florida and that adopts a standard of 20% renewable energy by 2020 and to enter the counties into the ICLEI Climate Resilient Communities Five Milestone process. The compact members also prepared grant applications for funding of the Compact activities.

7. Lessons Learned:

- There is a vast amount of scientific work related to climate change and sea level rise that includes a wide range of predictions.
- There are potential legal and political impacts of governments adopting predictions.
- The four counties have very different geographical and physical structures that make climate change impacts much different for the four counties.
- Future GIS mapping efforts need to incorporate the impact of drainage structures and other physical barriers to better predict areas of potential inundation.
- A regional compact is valuable to focus attention and resources on this important issue.

5. ICLEI - Local Governments for Sustainability

Jayantha Obeysekera, Department Director, Hydrologic & Environmental Systems Modeling, South Florida Water Management District (information extracted from <http://www.icleiusa.org/>)

- History and Origin:** ICLEI is an acronym for International Council for Local Environmental Initiatives but its official name now is ICLEI-Local Governments for Sustainability. It was established in 1990 at the World Congress of Local Governments convened at the United Nations in New York. ICLEI USA was established in 1995 and it has grown to include more than 600 cities, towns and counties as member. The organization is a leader on climate protection and adaptation, and sustainable development at the local government level. ICLEI USA has seven regional offices in the United States and its southeast regional office is located in Atlanta. Membership in ICLEI is required to benefit from the tools that it has developed. In Florida over 40 cities and counties are members and the annual dues for the membership depends on the size of the population served by the governmental entity. Regional planning organizations can also become members.
- Goals:** ICLEI-Local Governments for Sustainability is a membership association of local governments committed to advancing climate protection and sustainable development. Its mission is to build, serve, and drive a movement of local governments to advance deep reductions in greenhouse gas emissions and achieve tangible improvements in local sustainability.
- Partners, Participants, People:** ICLEI membership consists mostly of local governments (cities and counties) and other local entities. Members are eligible to hold positions within ICLEI and have access to its tools, services, and technical assistance. ICLEI receives funding from private foundations and some agencies of the federal government and have nearly 40 partner organizations.
- Focus and Actions:** The focus of ICLEI work appears to fall into two major categories: Sustainability and Climate. ICLEI has recognized the opportunities that the local governments have in creating sustainable communities and has developed (a) a sustainability index called STAR to gauge the participating U.S communities; (b) five milestones for assessing challenges, establishing goals and developing plans and monitoring performance for sustainability; and (c) a Sustainability Planning Toolkit to help local governments. Focus on Climate includes both mitigation and adaptation; but the primary emphasis appears to be on reduction of green-house gas reduction, although recent activities have included adaptation to climate change including those in the water resources sector. Miami-Dade County is one of eight cities participating in the ICEI's Climate Resilient Communities (CRC) program which has recently published a brief report entitled "Institutionalizing Climate Preparedness in Miami-Dade County, Florida."
- Modes of Operation:** ICLEI is administered by a Board of Directors consisting of local leaders across the country, including mayors, county executives representing each region, and several global representatives. The Board provides the strategic direction to help the members of ICLEI. A

permanent staff of ICLEI offices executes the direction. ICLEI has an excellent website through which many of the tools are made available to its members.

6. **Products/Outputs:** In addition to several successful programs that ICLEI has deployed (e.g. Cool Mayors program), it has developed several tools to help local government implement sustainability and climate projection efforts in their communities:
 - Clean Air & Climate Protection Software 2009 (CACP 2009)
 - Hara Environmental & Energy Management (EEM) Software
 - Climate & Air Pollution Planning Assistant (CAPPA)
 - The Local Government Operations Protocol

7. **Lessons Learned:** ICLEI has been very effective in organizing the local government community to collaborate and initiate sustainability and climate change protection programs in their communities. It has developed several important tools that are useful for the local governments. However, much of the emphasis appears to be on green house gas reduction and related activities. It would be beneficial to PWSU-CIWG if ICLEI focuses on water resources related to adaptation strategies such as water conservation and waste water reuse. In addition, local governments could also use assistance on impacts of sea level rise and storm surges on storm water drainage and saltwater intrusion.

6. Water Utility Climate Alliance (WUCA)

Alison Adams, Source Rotation and Env. Protection Manager, Tampa Bay Water

1. History and Origin: In January 2007, San Francisco Public Utilities Commission hosted the first national Water Utility Climate Change Summit, which was attended by several hundred utility executives, government officials, climate change experts and environmental experts. Shortly after this summit, eight of the nation's largest water providers formed the WUCA to provide leadership and collaboration on climate change issues affecting the country's water agencies. In 2009, two new utilities were added. Today, WUCA is a consortium of 10 water providers.

2. Goals: Mission statement: The Water Utility Climate Alliance is dedicated to providing leadership and collaboration on climate change issues affecting drinking water utilities by improving research, developing adaptation strategies and creating mitigation approaches to reduce greenhouse gas emissions.

The objectives of WUCA are:

- 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 temperatures 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.

3. Partners, participants, people:

WUCA Members are: San Francisco Public Utilities Commission, Central Arizona Project, 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, Southern Nevada Water Authority, and Tampa Bay Water.

Each utility is represented by its General Manager (top executive person) and at least one staff person. The staff expertise varies but all staff committee members work in some capacity on climate issues, water supplies and planning for their respective agency. We have a staff chair person and a WUCA chair, who are both from San Francisco Public Utilities Commission. We are in the process of developing partnerships with several different RISAs.

4. Focus and Actions: WUCA's focus for the first couple of years was on completing two reports. The first report, "Options for Improving Climate Modeling to Assist Water Utility Planning for Climate Change" describes what utilities can expect from climate science/research and identified seven recommendations for improving climate modeling to create more useful and reliable projections. The second report, Decision Support Planning Methods: Incorporating Climate Change Uncertainties into Water Planning raises awareness about the need of many water utilities to identify, understand and incorporate new planning methods that help prepare the utility for the range of possible impacts of climate change. WUCA

staff members also are active participants on many climate change related initiatives for example, EPA's Climate Ready Water Utilities Working Group, National Adaptation Summit held May 2010, US Global Change Research Program workshop September 2010, Water Research Foundation Climate Research workshop September 2010, and International Adaptation Forum January 2010. WUCA staff are also participate in several different forums/workshops related to the National Climate Assessment. Annually, we update each organization's efforts on greenhouse gas mitigation activities.

Currently WUCA has two initiatives, Decision Support Planning Methods in depth Case Studies and the Piloting Utility Modeling Applications (PUMA) project. The purpose of the case studies is to deliver practical and relevant information to water utility managers and planners about methods that incorporate climate change uncertainty into water planning. Plan to complete this work in one year.

The purpose of PUMA is to provide water utilities with useful and credible climate projection data in a form and scale that can be used by utility hydrologic models for water supply/watershed assessment analysis, to identify state of the art modeling tools and techniques, to develop and maintain collaborative relationships with regional RISAs and build national RISA collaboration and to inform conversations between climate science users and climate science providers to leverage climate change effects knowledge and unknowns for assessing potential impacts and vulnerabilities for built systems. PUMA held its first workshop December 2010 with climate models, water resources experts, RISA representatives, and the five WUCA utilities engaged in this work. It is anticipated that this project will be completed by the end of 2011.

5. Modes of Operation: WUCA's staff chair is responsible for organizing on-going activities. There are about 20 staff people in WUCA. There are 11 sub committees, not all of them have activity work. We are in the process of creating our strategic plan. The staff chair schedules our monthly conference calls. For the past year, utility staff has been providing about a 40 to 60 minute presentation about the utility, how planning is done, and what role climate plays in their planning. WUCA has developed a Fiscal Agent Agreement whereby one member handles all the money. All projects are funded equally by all WUCA members. At the start both San Francisco and Metropolitan committed \$50,000 each to fund WUCA activities. The GMs of each utility meet annually (in process of moving to semi-annually) to review and approve staff activities that require funding and confirm commitments from each utility. WUCA has a web site <http://www.wucaonline.org>.

6. Products/Outputs: Two white papers, "Planning Methods to Address Climate Change Uncertainties", and "Decision Support Planning Methods: Incorporating Climate Change Uncertainties into Water Planning". WUCA 2010 Greenhouse Gas Mitigation Activities Update. All three documents are available from the WUCA web site.

7. Lessons Learned or Still Learning: Need commitments from top management, especially if funding is needed, need chair person who will keep the ball rolling, need commitment from staff to get the work done, pick can do projects with specific timelines and product outcomes and get those done, have a mission and objectives need to be focused. Communication is very important, our monthly meetings are very important, develop an agenda and stick with it for meetings. Develop partnerships with others depending on focus and need. Share information and knowledge.

Section II. Participants' PROJECTS focused on evaluating potential climate impacts to water utilities

- 1. Project: Piloting Utility Modeling Applications (PUMA): Tampa Bay Water-UF Water Institute subproject**, Wendy Graham, Director, UF Water Institute
- 2. Project: A land of flowers on a latitude of deserts: Developing regional climate change predictions to aid conservation and management of Florida's biodiversity**, Vasu Misra, EOAS, COAPS & FCI
- 3. Project: Dynamic Decision Support System (D2S2) Project**, Larry Johnson, P.E, Palm Beach County Water Utilities Department
- 4. Project: Sea Level Rise and Climate Change Issue Coordination**, Jayantha Obeysekera, Interdepartmental Climate Change Group, South Florida Water Management District
- 5. Project: Use of Intra-seasonal and Seasonal Forecasts to Reduce Risk in Regional Public Water Supply Management**, Chris Martinez, University of Florida
- 6. Project: Using Climate Information to Predict and Reduce Residential Irrigation Demands**, Chris Martinez, University of Florida
- 7. Project: Needs, Uses, Perceptions, and Attitudes towards Weather and Climate Forecast Information by Water Resource Managers in the Southeastern United States**, Chris Martinez, University of Florida
- 8. Project: Integrated Climate Change and Threatened Bird Population Modeling to Mitigate Operations Risks on Florida Military Installations**, Chris Martinez, University of Florida
- 9. Project: An SUS Climate Change Task Force: Science Addressing the Needs of Florida Agencies, Industry, and Citizenry**, Nicole Hammer, Coordinator, Climate Change Initiative, Florida Atlantic University, Florida Center for Environmental Studies
- 10. Project: Long-Term Climate Change Evaluation for the St. Johns River Water Management District (SJRWMD), Water Supply Impact Study (WSIS)**, Tim Cera, P.E., Michael Cullum, P.E., SJRWMD
- 11. Project: Idea: Optimum Big Rain Indicator of Extremes for SE USA** , James O'Brien, SECC

1. Project: Piloting Utility Modeling Applications (PUMA): Tampa Bay Water-UF Water Institute subproject

Wendy Graham, Director, UF Water Institute

1. History and Origin: The Piloting Utility Modeling Applications (PUMA) is an initiative of the Water Utilities Climate Alliance. The purpose of the initiative is to deliver practical and relevant information to water utility managers and planners about methods that incorporate climate change uncertainty into water planning. PUMA held its kickoff workshop in December 2010 and the project is expected to be completed by December 2011. Tampa Bay Water, the UF Water Institute and the Southeast Climate Consortium are participating as SE USA representatives in the PUMA project.

2. Goals: The purpose of PUMA is to provide water utilities with useful and credible climate projection data in a form and scale that can be used by utility hydrologic models for water supply/watershed assessment analysis, to identify state of the art modeling tools and techniques, to develop and maintain collaborative relationships with regional RISAs and build national RISA collaboration and to inform conversations between climate science users and climate science providers to leverage climate change effects knowledge and unknowns for assessing potential impacts and vulnerabilities for built systems. Within the PUMA initiative each RISA-Utility partner is conducting a sub-project that addresses issues important to their region. Lessons learned from sub-projects will be shared among all PUMA participants

3. Partners, participants, people: PUMA participants include climate modelers, water resources experts, representatives from 4 RISAs (NW, CA, NE, SE), and representatives from five WUCA utilities (Seattle, Portland, San Francisco, New York City, Tampa Bay). The UF Water Institute and the Southeast Climate Consortium are participating with Tampa Bay Water in the Tampa Bay Subproject. WUCA hired Stratus Consulting to document the process and develop a white paper at the conclusion of the effort.

4. Focus and Actions: Each utility is working with the RISA in their region to develop a specific scope of work that fits within their interests and overall PUMA goals. The focus of the Tampa Bay Water-subproject is to evaluate the suitability of dynamically and statistically downscaled climate model outputs to drive the Tampa Bay Water Integrated Hydrologic Model in order to explore potential impacts of climate variability and climate change on water availability and water allocation decisions. Climate model outputs proposed for evaluation include:

- NCEP-MM5 Tampa Bay Regional Reanalysis (1986-2008) ..Completed
- WCRP CMIP3 (1950-1999 & 2000-2099) ..In process
- NARCCAP (1971-2000 & 2041-2070) .. Not yet begun
- COAPS Land-Atmosphere Regional Reanalysis: NCEP-Scripps RSM (1979-2001) .. Not yet begun

5. Modes of Operation: Project is being conducted by UF Water Institute through a research contract funded by Tampa Bay Water. Day-to-day work is conducted by Ph.D. student Syewoon Hwang, supervised by Professor Wendy Graham. Jim Jones and Chris Martinez (UF) and Alison Adams (Tampa Bay Water) serve on Hwang's Ph. D. supervisory committee. Regular meetings are conducted with Tampa Bay Water scientists and engineers and major project decisions are discussed and made jointly.

6. Products/Outputs: When complete products will include

- Evaluation of ability of each climate model to reproduce the historical spatiotemporal characteristics of precipitation fields in the Tampa Bay region
- Evaluation of the ability of appropriately bias corrected and spatially disaggregated retrospective climate model simulations to reproduce observed hydrologic behavior when used to drive the IHM
- Evaluation of changes in hydrologic behavior that result from driving the IHM with bias-corrected and spatially disaggregated future climate model predictions

WUCA will publish a white paper documenting the entire PUMA process and its outcomes at the conclusion of the effort.

7. Lessons Learned or Still Learning: Nationally available raw, dynamically downscaled, and bias-corrected statistically-downscaled GCM predictions do not reproduce spatial variability of local precipitation fields important to simulating hydrologic response in the Tampa Bay Region. New spatial disaggregation techniques that reproduce small-scale spatial correlation structure of rainfall are necessary. Therefore direct use of climate information from nationally available web-portals without local evaluation for the specific application of interest is not advisable. Relationships, learning, and co-generation of new knowledge and tools with other climate modelers and water resource managers from around the country is very valuable.

2. **Project: A land of flowers on a latitude of deserts: Developing regional climate change predictions to aid conservation and management of Florida's biodiversity**

Vasu Misra, EOAS, COAPS & FCI

1. **History and Origin:** It was initiated by Thomas Smith of the Southeast Ecological Center (SEC), USGS through email contacts through a common colleague of ours in late spring of 2009 in response to an RFP from the department of interior.

2. **Goals:**

3. **Partners:** T. J. Smith (lead PI), Don DeAngelis (Ecological modeling; SEC), Ann Foster (geographic analysis, wild-fire; SEC), Cathy Langtimm (Manatee modeling, SEC), Dan Slone (individual based modeling, seagrass), Eric Swain (TIME modeling, SEC), Dave Sumner (calibration of rainfall, ET, temperature, SEC), Nathaniel Plant (statistical analyses of uncertainty)

4. **Focus and actions:** How will Florida's biodiversity respond to a changing climate? Which species and habitats will increase and which will decrease? What role does human induced land use – land cover (LULC) change play? Before these questions can be answered, accurate regional climate change scenarios must be developed. We propose to down-scale predictions from a suite of coupled Atmospheric-Ocean General Circulation Models to make regional scale predictions for the Florida peninsula. We will run three scenarios of LULC: past (circa 1900), present, and future (2030-2050). Additional model runs will address the contribution of green house gasses to climate variability and change over the Florida peninsula. Model perturbation experiments will be performed to address sources of variability and their contribution to the output regional climate change scenarios. We will develop scenarios that specifically address potential changes in temperature (land and near sea surface) and rainfall fields over the peninsula. We will provide these scenarios to resource management groups (NGOs, state and federal) via workshops in which the scenarios will be used to predict responses of selected species, habitats and ecosystems. This research addresses one of the fundamental charges of the NCCWSC – downscaling GCMs for regional predictions.

5. **Modes of operation:** Emails, telephone meetings, in person site visits, workshops,

6. **Products:** Two regional reanalyses have been created by dynamically downscaling two existing global reanalyses: the NCEP/DOE Reanalysis II (hereafter R2) and the ECMWF-ERA40 (hereafter ERA40). Both regional reanalyses cover the period 01Jan1979 to 31Dec2001. Two-dimensional fields are output every hour, while three-dimensional fields (temperature, winds, humidity and geopotential) are output every three hours. The performance of CLARReS10 in reproducing the observed spatio-temporal structure of rainfall in the Southeast is illustrated in a poster. For more details visit the following URLs

<http://www.coaps.fsu.edu/pub/Southeast/CLARReS10/> and http://fl.biology.usgs.gov/climate/la_florida.html

7. **Lessons learned:** Forthcoming

3. Project: Dynamic Decision Support System (D2S2) Project

Larry Johnson, P.E, Palm Beach County Water Utilities Department

1. History and Origin:

The Water Research Foundation (AwwaRF), Palm Beach County Water Utilities Department (PBCWUD), Post Buckley (PBS&J) and the University of Florida (UF) conducted a tailored collaboration research project to develop a Dynamic Decision Support System for the Lower East Coast region of South Florida. The project was proposed in 2006, and was completed in 2008. David Yates was a major consultant to develop the model, which uses the Stockholm Environment Institutes (SEI) Water Evaluation and Planning (WEAP) model.

Water Managers often do not have the tools to perform scenario testing and rapid “What-if” alternative analysis needed for decisions. The D2S2 model is intended to provide a systems level analysis tool that can be used for that purpose.

2. Goals:

- Develop a WEAP model for the LEC region of South Florida
- Conduct stakeholder workshops to determine criteria important for decisions
- Develop multi-criteria decision analysis (MCDA) tool
- Perform example analysis showing alternative impacts

3. Partners, Participants, people:

The Water Research Foundation (AwwaRF), Palm Beach County Water Utilities Department (PBCWUD), Post Buckley (PBS&J) and the University of Florida (UF) participated in the tailored collaboration research project to develop a Dynamic Decision Support System for the Lower East Coast region of South Florida. David Yates was a principal consultant to develop the model, which uses the Stockholm Environment Institutes (SEI) Water Evaluation and Planning (WEAP) model.

4. Focus and Actions:

The D2S2 model allows variation of climate, water resources, demands and regulations to evaluate various alternative decisions that a utility may consider, while considering criteria that are important to a wide range of stakeholders.

The WEAP model allows more rapid evaluation of alternatives than more detailed hydrologic models used for detailed engineering analysis.

5. Modes of Operation:

The project included adaptation of the WEAP model using data for the LEC region, including the Kissimmee River basin and Lake Okeechobee. Water Resources, changes in rainfall due to varying climate conditions, varying demands, and varying regulations can be evaluated. A conceptual systems diagram of the model is shown below.

The impact of varying utility decisions, including rate structures, capital programs and operational costs can be evaluated.

6. Products/ Outputs:

Products include the WEAP model adapted for the LEC region of South Florida and the Multi-criteria decision analysis model (MCDA) that allows alternative analysis based on criteria established by stakeholders.

7. Lessons Learned:

- Population and regulatory frameworks are the two most important variables that impact utility
- Stakeholder criteria are important to provide balanced decision making.
- The D2S2 model needs to be updated and additional training materials are needed to make it easier to use.

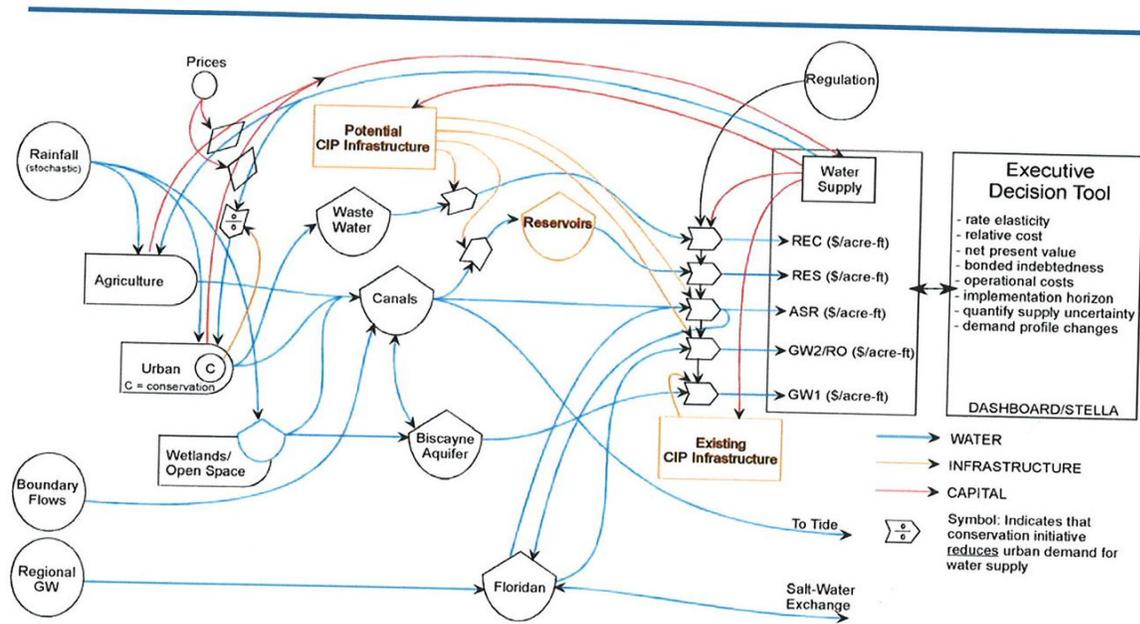


Figure 7. Conceptual systems diagram of LEC water supply.

4. Project: Sea Level Rise and Climate Change Issue Coordination

Jayantha Obeysekera, Interdepartmental Climate Change Group, South Florida Water Management District

1. History and Origin. For more than two decades, the scientists and the engineers at the South Florida Water Management District have conducted extensive research on natural variability of climate to understand the teleconnections linking such phenomena as El Nino, La Nina and Atlantic Multidecadal Oscillation (AMO) to south Florida's rainfall and flow patterns. More recently the SFWMD established an interdepartmental group to coordinate the internal and external efforts on climate change and its impact on SFWMD's mission. The group has written a white paper on the subject and it is under review by the District Leadership Team. Based on the white paper, SFWMD has established a formal project with a project management plan.

2. Goals. The District's Strategic Plan has identified the implications of potential sea level rise as a key area for mission-focused planning. The Sea Level Rise and Climate Change Issue Coordination Project provides the focal point for oversight and coordination (internal and external) of the potential implications of sea level rise and climate change on District planning, outreach, technical analysis, projects, and operations. Specific objectives are:

- Build partnerships to achieve team goals, District priorities and regional objectives
- Develop and implement internal communication procedures
- Update planning efforts and technical information associated with the potential impacts of sea level rise
- Evaluate and develop adaptation strategies that may include operational, demand management, and infrastructure modifications
- Leverage resources that promote shared water resource stewardship strategies
- Develop multi-year work plan

3. Partners, participants and people. SFWMD team consists of up to 10-12 staff members from the following resource areas: Everglades Restoration and Capital Projects, Operations and Maintenance, Regulatory and Public Affairs, Office of Counsel, and Corporate Resources. Kim Shugar, Department Director, Intergovernmental Programs and Jayantha Obeysekera, Department Director, Hydrologic & Environmental Systems Modeling function as the agency leads for climate change efforts. Rod Braun, Division Director, Intergovernmental Policy and Planning, is the Project Manager.

4. Focus and Action. The project provides the focal point for oversight and coordination (internal and external) of the potential implications of climate change, with the primary focus on sea level rise, on District planning, outreach, technical analysis, projects, operations, and intergovernmental coordination. A small technical team also monitors the latest research on climate and sea level rise science and conducts data analysis as necessary. A comprehensive collection of literature has been assembled by the team. Kim Shugar is the SFWMD representative at the South Florida Climate Compact steering committee. Other staff members participate in technical subcommittees of the Compact.

5. Modes of Operation. Interdepartmental Climate Change Group holds bi-monthly meetings. The team also meets with the Project Management Oversight team as necessary. The technical team meets bi-weekly to review technical work. Project Management plan provides a scope and deliverable through 2015. Annual deliverables include, but are not limited to:

- Coordinate efforts with local government committees and task forces
- Track local, state, and federal climate change/sea level rise activities
- Participate in presentations and outreach opportunities as appropriate
- Continue to promote the implementation of water conservation measures and continue the implementation of the District's comprehensive conservation plan
- Conduct annual baseline mapping of the saltwater interface in the Lower East Coast (LEC) and Lower West Coast (LWC)
- Weekly graphing of the water level data from several aquifers in the LWC
- Periodic review of water levels and chloride values in area of concern (i.e. South Miami-Dade)
- Weekly monitoring of and reporting of water levels from sentinel wells throughout the District
- Work with the United States Army Corps of Engineers (USACE) to incorporate sea level rise into the design of Comprehensive Everglades Restoration Plan (CERP) projects following the USACE's guidance memorandum
- Incorporate sea level rise into the design of District projects that may potentially be impacted

6. Products/Outputs. The following has been produced by the team:

- White paper entitled "Climate Change and Water Management in South Florida"
- Several technical papers submitted for possible publications in peer reviewed journals
- Project charter and a Project Management Plan
- A technical report on Sea Level Rise trends, Climate Variability and Trends (in preparation).
- A standardized Digital Elevation Model dataset for coastal regions of Florida (in preparation)
- Baseline saltwater intrusion map (in preparation)

7. Lessons Learned. Many organizations work on climate change and sea level rise topics. It is imperative that state-wide efforts be coordinated through a centralized group such as the Florida Climate Institute. In addition, local agencies require reliable information on regional climate and sea level projections and decision strategies for adaptation.

5. Project: Use of Intra-seasonal and Seasonal Forecasts to Reduce Risk in Regional Public Water Supply Management

Chris Martinez, Wendy D. Graham, James W. Jones, Gregory A. Kiker

1. History and Origin

This project was initiated in 2008 at UF as an expansion of an ongoing project with Tampa Bay Water on using seasonal forecasts. This project is focused on evaluating the use of newly developed retrospective forecast archives to downscale and bias correct forecasts.

2. Goals

- 1) Develop and implement a prototype methodology for incorporating 1-week to 1-month forecasts into Tampa Bay Water's processes of forecasting water demand and making source allocation decisions in Southwest Florida.
- 2) Implement a comparative decision/risk analysis on Tampa Bay Water decision algorithms using historical- and forecast-based climate information for both short-term (1-week to 1-month) and medium-term (1-month to 12-month) time frames.

3. Partners, Participants, People

Tampa Bay Water

4. Focus and Actions

Knowledge/Skills:

Downscaling/bias-correction using analog forecasts

Data and Tools:

Global Forecast System (GFS) retrospective forecast archive

Climate Forecast System (CFS) retrospective forecast archive

5. Modes of Operation

This project is 2 years in duration and is funded through the NOAA Sectoral Applications in Research Program (SARP).

6. **Products/Outputs:** Draft journal article on the application of retrospective forecasts in a localized region.
7. **Lessons Learned:** Project is ongoing.

6. Project: Using Climate Information to Predict and Reduce Residential Irrigation Demands

Gail G. Wilkerson (NCSU), Chris Martinez, Upton Hatch (NCSU), Ryan Boyles (NCSU), James W. Jones, Joshua L. Heitman (NCSU), Charles H. Peacock (NCSU)

1. History and Origin

This project was initiated by researchers at North Carolina State University (NCSU) in response to the 2007 drought and water restrictions adopted in parts of the southeast US.

2. Goals

- 1) Obtain and analyze historical water usage data from cities in North Carolina and Florida to determine outdoor water use patterns.
- 2) Investigate strategies for reducing irrigation water use in urban areas without adversely affecting turfgrass health.
- 3) Determine the possible benefits of using one- to three-month climate forecasts to project potential water demands for residential areas.

3. Partners, Participants, People

City of Raleigh, Cape Fear Public Utility Authority, Tampa Bay Water, Miami Water and Sewer Department

4. Focus and Actions

Knowledge and Skills:

Conditional resampling of historical rainfall and temperature based on probabilistic forecasts, turf watering requirements.

Data and Tools:

Climate Prediction Center seasonal outlooks

Agricultural Reference Index for Drought (ARID)

5. Modes of Operation

This project is 2 years in duration and is funded through the NOAA Sectoral Applications in Research Program (SARP).

6. Products/Outputs

7. Lessons Learned

7. Project: Needs, Uses, Perceptions, and Attitudes towards Weather and Climate Forecast Information by Water Resource Managers in the Southeastern United States

Chris Martinez, Jessica Bolson, Tatiana Borisova, Norman E. Breuer, Pam Knox (UGA), James W. Jones, David E. Stooksbury (UGA), Puneet Srivastava (Auburn)

1. History and Origin

This project was initiated in 2010 at UF as an effort to build capacity for outreach activities across the southeast US in support of the National Integrated Drought Information System (NIDIS).

2. Goals

To provide an assessment of the current uses of, needs for, perceptions of, and attitudes towards weather and climate information, forecasts, and derived products by water resource managers in the states of Alabama, Florida, and Georgia, as well as to identify gaps in diagnostic and forecast information currently available.

3. Partners, Participants, People

This project will engage water resource managers (utilities, agencies, hydropower etc.) in the states of Alabama, Florida, and Georgia. This project will work in conjunction with a similar project conducted within the ACF river basin.

4. Focus and Actions

Knowledge/Skills:
Stakeholder assessment.

5. Modes of Operation

This project will use surveys and semi-structured interviews. This project is 2 years in duration and is funded through the NOAA Sectoral Applications in Research Program (SARP).

6. Products/Outputs

Draft survey instrument undergoing IRB approval.

7. Lessons Learned:

This project is ongoing

8. Project: Integrated Climate Change and Threatened Bird Population Modeling to Mitigate Operations Risks on Florida Military Installations

Igor Linkov (COE), Richard Fischer (COE), Greg Kiker, Resit Akcakaya (Stony Brook), Rafael Muñoz-Carpena, Chris Martinez, Keith Ingram

1. History and Origin

This project was initiated in 2008. Climate change is expected to significantly alter low-lying coastal and intertidal areas, which provide significant seasonal habitat for a variety of shoreline-dependent bird populations. Many coastal military installations in Florida contain significant coastal habitat that will potentially be impacted by climate change.

2. Goals

- 1) Assess current vulnerability scenarios and information on selected Florida bases by documenting and reviewing Florida-specific climate, land use databases and information,
- 2) Develop a set of habitat- and species-based models for selected coastal threatened/endangered bird populations
- 3) Assess the current prediction level and assumptions of selected categories of TER-S models for use in benchmarking model performance and uncertainty levels
- 4) Integrate the scientific data, modeling and uncertainty results into a risk-informed, multi-criteria decision analysis system to allow systematic analysis of potential management options.

3. Partners, Participants, People

Eglin AFB, Tyndall AFB, Pensacola NAS

4. Focus and Actions

Knowledge/Skills:

Metapopulation modeling, multi-criteria decision analysis, global sensitivity and uncertainty analysis, climate downscaling.

Data and Tools:

Sea Level Rise Affecting Marshes Model (SLAMM)

SimLab development framework

RAMAS metapopulation model

5. Modes of Operation

This project is 3 years in duration and was funded by the Strategic Environmental Research and Development Program (SERDP).

6. Products/Outputs

Convertino, M., Elsner, J.B., Muñoz-Carpena, R., Kiker, G.A., Martinez, C.J., Fischer, R.A., and I Linkov. Do tropical cyclones shape shorebird patterns? Biogeoclimatology of snowy plovers in Florida. PLoS One, Accepted.

Chu-Agor, M.L., R. Muñoz-Carpenaa, G. Kiker, A. Emanuelsson and I. Linkov. 2010. Exploring sea level rise vulnerability of coastal habitats through global sensitivity and uncertainty analysis. *Env. Model. & Software*. doi:10.1016/j.envsoft.2010.12.003 (in press).

7. Lessons Learned

9. Project: An SUS Climate Change Task Force: Science Addressing the Needs of Florida Agencies, Industry, and Citizenry

Nicole Hammer, Coordinator, Climate Change Initiative, Florida Atlantic University, Florida Center for Environmental Studies

- 1. History and Origin** - In the fall of 2010 the SUS Board of Governors issued a call for proposals entitled the New Florida Cluster Grant. Florida Atlantic University together with the Florida Climate Institute (FCI) proposed to create resources that inform federal and state agencies on the basic and applied climate research activities of the State University System (SUS). The award was granted in November and 2010 with a January start date and a December 2011 end date.
- 2. Goals** - Given that climate change and its impacts are going to be different in different parts of the state, but important almost everywhere, the clustering project is in the process of identifying key contact points (either individuals or centers) across the SUS system and conducting an extensive assessment of SUS climate change research resulting in workshops, white papers and a resource database.
- 3. Partners, participants, people**
 - FAU –Leonard Berry , Nicole Hammer and the Center for Environmental Studies
 - UF- Jim Jones, John Hayes, Keith Ingram, Susan Cameron and Carolyn Cox
 - FSU – Eric Chassinget and Vasu Misra
 - Other State Universities and University of Miami
 - Federal and State Agencies (TBD)
- 4. Focus and Actions**
 - Development of information on university climate change programs (research and education), university climate change institutes and centers, and initiatives state-wide.
 - Assessment of the status of Florida-specific climate change scenarios and development of a strategy for ensuring that users have access to the best science-based climate change scenarios for Florida as they consider options for responding to climate change.
 - Support and enhancement of university cooperation with state and federal agencies in order bring science into decision making and action, improve complementarities, and help avoid redundancies by providing science based white papers on key topics.
 - Conduct two workshops to highlight priority climate change adaptation issues in relation to sea level change, ecological change, and water management in the different regions in Florida.

- Development of a climate change information system and portal that will connect SUS assets with State and Federal agencies and other groups to facilitate active communication among institutions and agencies and assure that the most current science is used for decision making and action.

5. Modes of Operation – E-mail, conference calls, in-person meetings, and workshops.

6. Anticipated Products/Outputs

- A. Identification of key individuals and activities SUS-wide.
- B. SUS workshop early in the process involving 1-4 people from selected university to further identify each university's current and planned activities in this field.
- C. An assessment of the various scenario development efforts across the state (these are multiple, have various premises and often are not compatible with each other) and develop a recommended set of principles to achieve better cross state coordination.
- D. White papers on the following climate change sectors (prime responsibility for this work as indicated):
 - Water management (FAU)
 - Coastal county adaptation (FAU)
 - Biodiversity and land use change (UF)
 - Assessment of climate change scenarios (FSU)
 - Education and Training (UF, FAU, FSU)
- E. Near the end of this one-year project, we will hold a workshop among interested stakeholders that would have the following objectives:
 - To communicate project accomplishments and those of complementary projects in the states
 - To provide a forum for discussion of future needs and goals of the project partners and SUS
 - Identify both formal and informal education and training needs in Florida
 - Document what is learned from the workshop, including the current status of activities.
- F. An interactive information system using data gathered on SUS climate research and implementation an updating process.

7. Lessons Learned - Forthcoming

10. Project: Long-Term Climate Change Evaluation for the St. Johns River Water Management District (SJRWMD), Water Supply Impact Study (WSIS)

Tim Cera, P.E., Michael Cullum, P.E.

It is necessary to separate climate change forecasting into three temporal scales. Water utilities need to identify and track short-term fluctuations in rainfall patterns that influence their ability to store water on a monthly or seasonal basis in order to mediate water shortage conditions for their customers. Utilities must secure consumptive use permits and loans for capital investments based on a medium-term temporal scale of multiple decades. Long-term changes in climate will dictate long-term planning for the ultimate development of alternative water uses on a millennial time frame.

The focus of the WSIS is to understand and quantify the impact of adding alternative surface water use to the current groundwater sources for water utilities within the SJRWMD. The evaluation of alternative surface water sources is due to the continuing concerns that groundwater level changes will have significant impact on upland wetlands and springs by as early as 2013. The SJRWMD develops a Water Supply Plan every five years to estimate the future water needs given the expected economic and population growth. The Water Supply Plan is a medium-term estimation necessary for planning and permitting with a time horizon of 2030. As part of the continuing review of the WSIS, the National Academy of Sciences (NAS) panel has asked that the SJRWMD expand the evaluation to include the potential influence of climate change on surface waters to 2100. In addition to answering this question from the NAS, an understanding of climate change impacts to hydrology is important for the long-term planning needs of the SJRWMD.

The SJRWMD contracted with Dr. David Yates from University Corporation of Atmospheric Research (UCAR) to evaluate available Global Climate Models (GCMs) and develop reasonable future estimates of precipitation and temperature. These time-series are being used as input to the SJRWMD's Hydrologic Simulation Program Fortran (HSPF) models that cover the entire St. Johns River watershed to evaluate the impact of possible future precipitation and temperature changes to regional hydrology. Dr. Yates developed thirty ensemble time-series of daily precipitation and temperature from 2020 to 2100 using a weighted K Nearest Neighbor (KNN) sampling process. The standard KNN sampling process can be used to develop a statistically similar data set to a source data set. For this project, the KNN sample selection process was weighted using results from the GCMs. The source data were from 22 weather stations from 1950-2008.

The first part of the project was to evaluate the performance and characterize results from the GCMs to represent Florida. Figure 1 shows an example of the Bayesian uncertainty analysis of 21 GCMs temperature estimates for the year 2040. This Bayesian analysis was performed for each decade in the prediction period and the results used to weight the KNN sampling process.

Initial comparisons between the source and KNN data sets show only small differences, though the SJRWMD is still in the middle of looking at the impact on regional hydrology (Figure 2 and 3). Note that the small changes in potential evaporation (Figure 3) are likely because relative humidity is limiting to potential evaporation rather than the temperature.

The modeling evaluation and documentation of results is scheduled for September, 2011, concurrently with completion of the WSIS project.

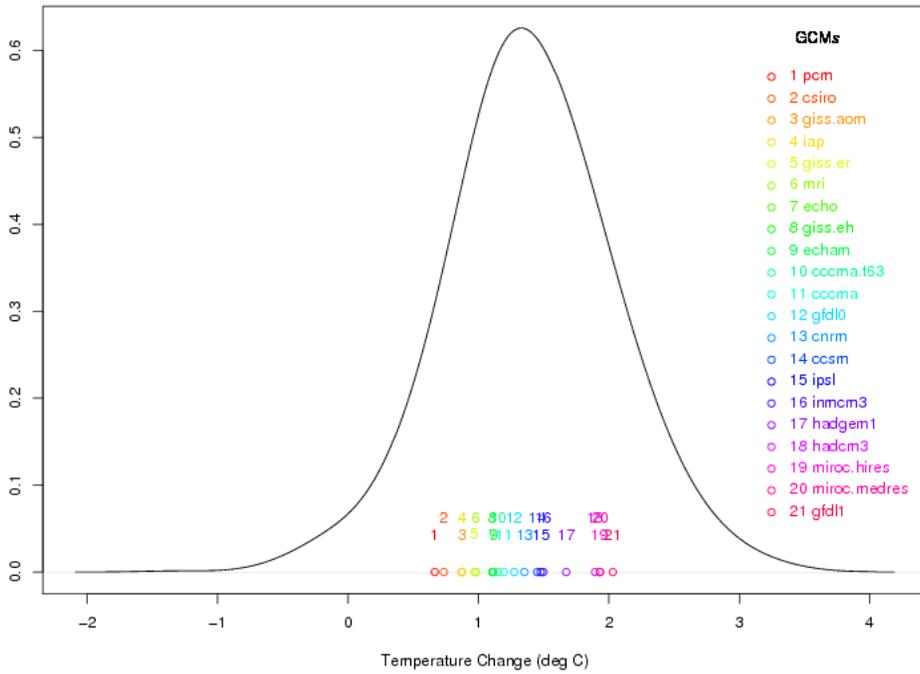


FIGURE 1. BAYESIAN UNCERTAINTY OF GCM TEMPERATURE RESULTS FOR YEAR 2040. ZERO ON X AXIS REPRESENTS NO CHANGE.

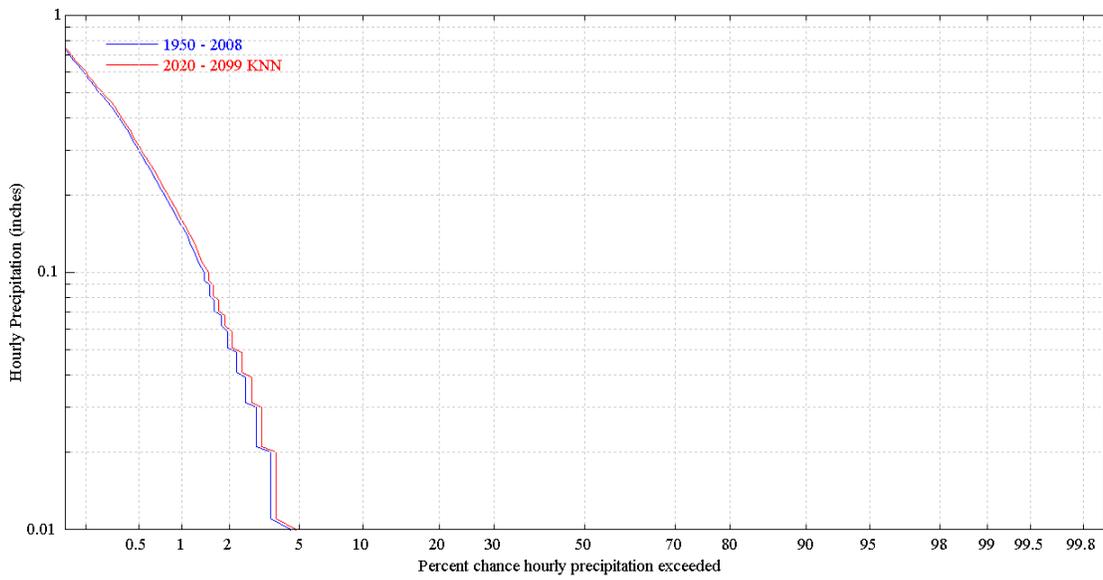


FIGURE 2. COMPARISON OF FREQUENCY EXCEEDENCE OF HOURLY PRECIPITATION BETWEEN SOURCE DATA SET (1950-2008) AND KNN CREATED DATA SET (2020-2099)

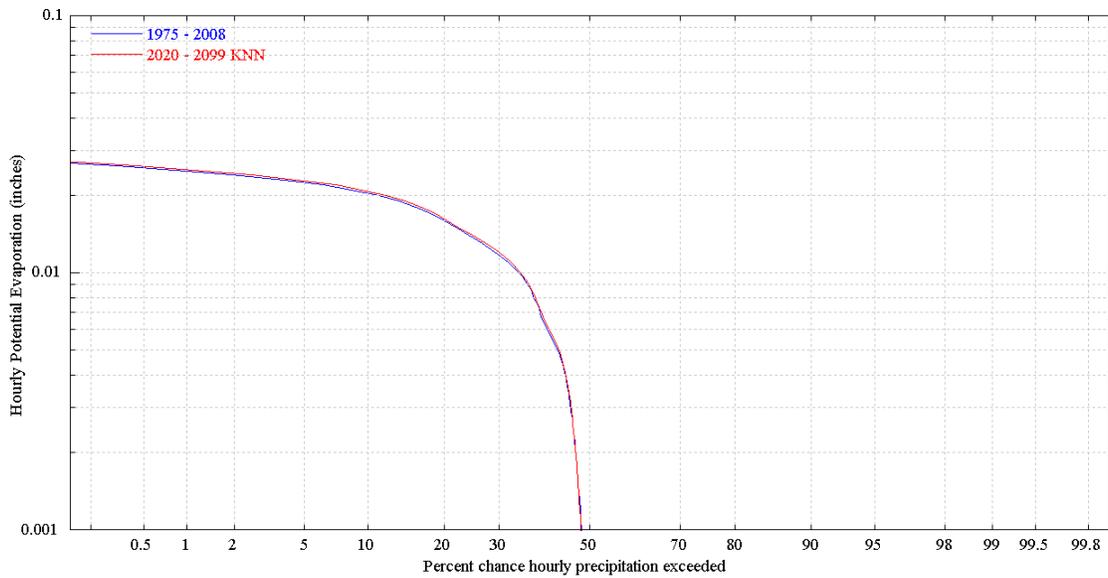


FIGURE 3. COMPARISON OF FREQUENCY EXCEEDENCE OF HOURLY EVAPORATION BETWEEN SOURCE DATA SET (1975-2008) AND KNN CREATED DATA SET (2020-2099)

11. Project: Idea: Optimum Big Rain Indicator of Extremes for SE USA

James O'Brien, SECC

1. History and origin: Original idea motivated by members of CIWG. It will provide accurate probabilistic information on occurrences of extreme rainfall locally by month based on climate, climate variability and climate change.
2. Goals: provide quantitative information to users in SE USA
3. Partners, participants, people: COAPS SCIENTISTS for now.
4. Focus and Action: Provide lectures, graphs, numbers to interested parties. Publish papers, Give a talk at a CIWG meeting!
5. Modes of Operation: Usual for SECC. Try to find users and teach them the use of the information
6. Products and outputs: Quantitative graphs and information to interested users
7. Lessons learned: too early to understand