Public Water Supply Utilities Climate Impacts Working Group"

(PWSU-CIWG)

Participants' PROJECT Summaries

Brief descriptions of participants' projects focused on

Evaluation of potential climate impacts to Water Utilities

Prepared by PWSU-CIWG workshop participants

Compiled by Lisette Staal, workshop facilitator, UF Water Institute

Updated May 2011

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
12. **Project: SWITCH Managing Water for the City of the Future,** Kalanithy Vairavamoorthy, University of South Florida
13. **Project: Integrated Modeling for the Assessment of Ecological Impacts of Sea Level Rise**, Dingbao Wang, University of Central Florida

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.

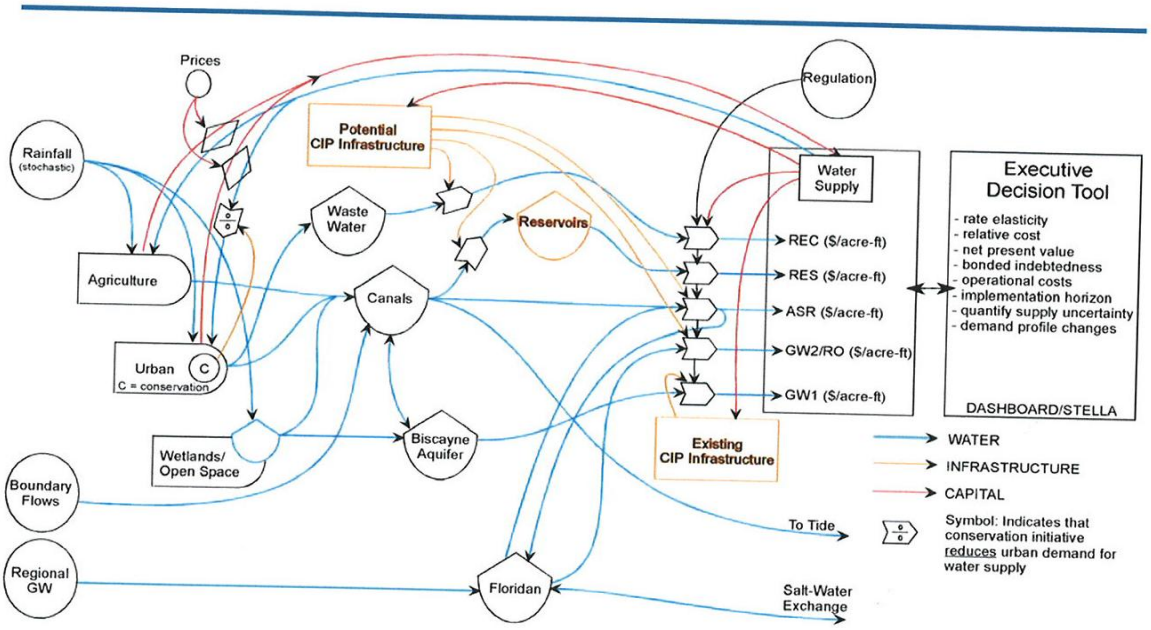

Figure 7. Conceptual systems diagram of LEC water supply.

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 uncertaintyanalysis, 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 documention of results is scheduled for September, 2011, concurrently with completion of the WSIS project.

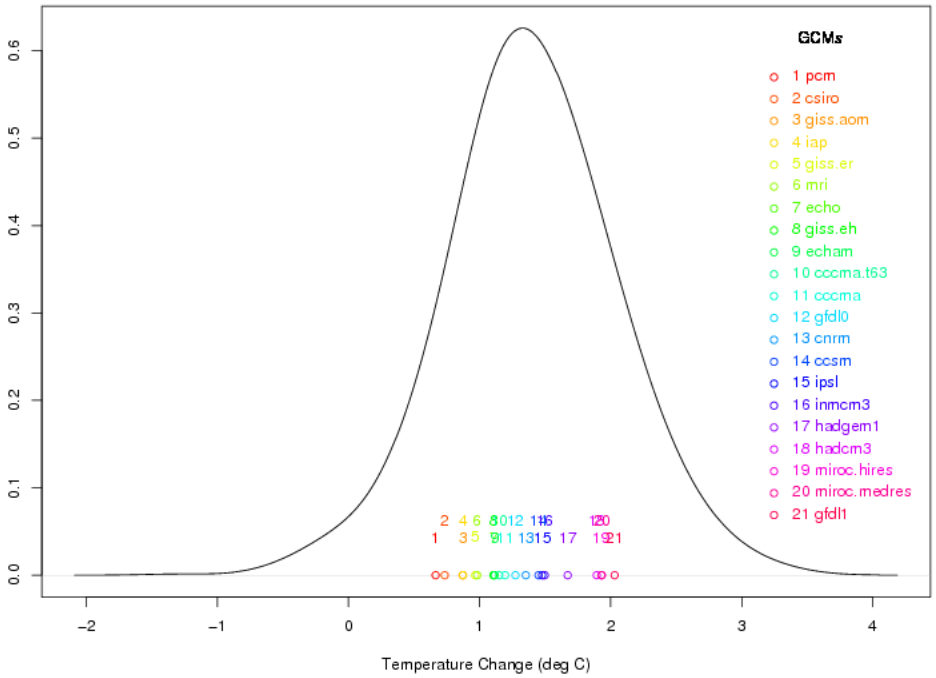

FIGURE 1. BAYESIAN UNCERTAINTY OF GCM TEMPERATURE RESULTS FOR YEAR 2040. ZERO ON X AXIS REPRESENTS NO CHANGE.

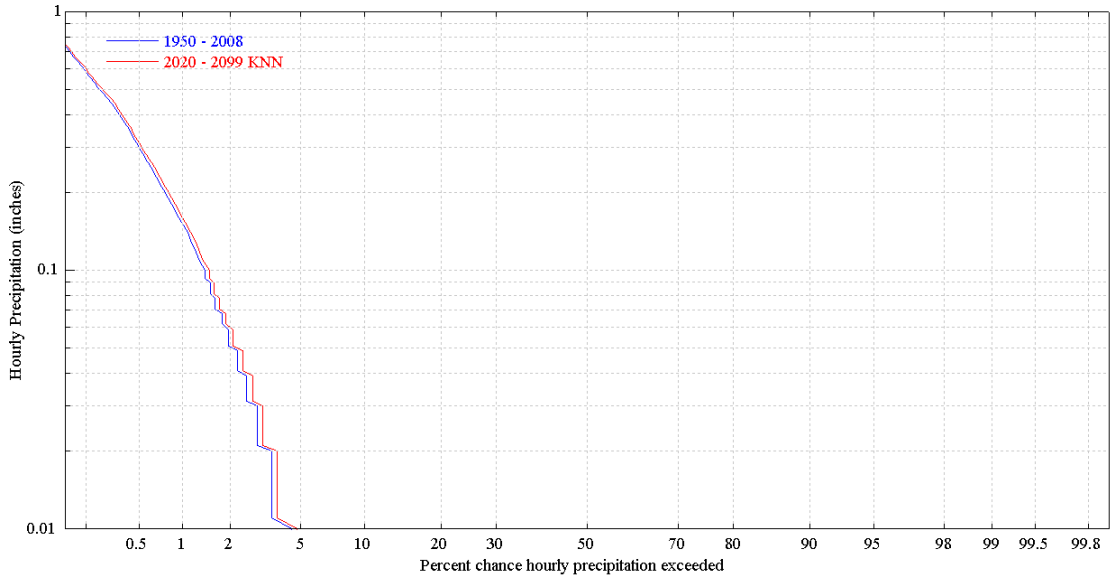

FIGURE 2. COMPARISON OF FREQUENCY EXCEEDENCE OF HOURLY PRECIPITATION BETWEEN SOURCE DATA SET (1950-2008) AND KNN CREATED DATA SET (2020-2099)

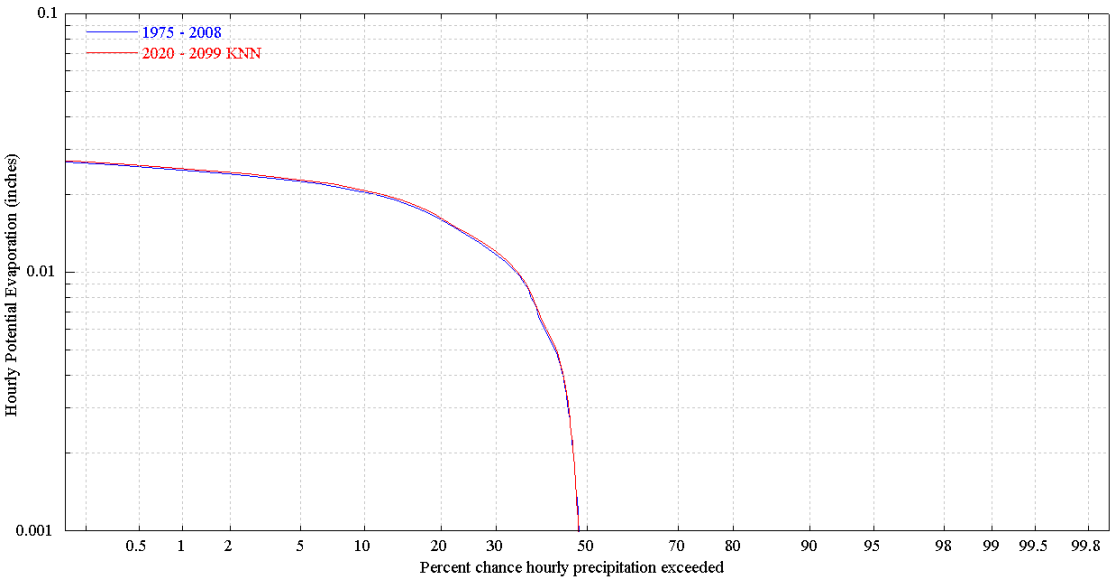

FIGURE 3. COMPARISON OF FREQUENCY EXCEEDENCE OF HOURLY EVAPORATION BETWEEN SOURCE DATA SET (1975-2008) AND KNN CREATED DATA SET (2020-2099)

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

James O'Brien, SECC

1. History and origin: Original idea modivated 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. Parners, 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: Quantatative graphs and information to interested users

7. Lessons learned: to early to understand

12. Project: SWITCH Managing Water for the City of the Future,

Kalanithy Vairavamoorthy, University of South Florida

1. **History and Origin of Project:** SWITCH is an action research programme, implemented and co-funded by the European Union 6th Framework Program. The project started in February 2006 and ended in February 2011**.**

2. **Goals of the Project:** With increasing global change pressures (urbanization, climate change etc.), coupled with existing un-sustainability factors and risks inherent to conventional urban water management, cities of the future will experience difficulties in efficiently managing scarcer and less reliable water resources. In order to meet these challenges,

   The main goal of SWITCH is the development of sustainable and effective water management systems for the 'city of the future'. To achieve this goal SWITCH aims to improve the scientific basis for the development and management of urban water systems, to ensure that they are robust, flexible and adaptable to a range of future global change pressures.

   SWITCH aims to bring about a paradigm shift in urban water management away from existing ad hoc solutions to urban water management and towards a more coherent and integrated approach. This paradigm shift includes: resilience of urban water systems to global change pressures; interventions over the entire urban water cycle; reconsideration of the way water is used (and reused); greater application of natural systems for water and wastewater treatment; governance and financial management structures, covering the entire urban water cycle.

3. **Partners, Participants of the Project:** The SWITCH project involved a cross-disciplinary team of 33 partners from 15 countries around the world. The project worked with stakeholders in 12 cities around the globe (incl. Birmingham; Hamburg; Lodz, Zaragoza, Alexandria, Tel Aviv, Accra; Beijing, Chongquing, Belo Horizonte, Lima, Cali. During the course of the project also the City of Dunedin FL as only US city was associated with the project. The consortium was lead by UNESCO IHE in Delft Netherlands. The Scientific director of the project was Dr. Kala Vairavamoorthy.

4. **Focus and Actions of the Project:** The scientific research needs identified in SWITCH are largely within 5 subject areas:

   - *Sustainable Urban Drainage* - integrated research addressing storm-water not just as a hazard but as a potentially valuable resource.
   - *Natural Systems for Treatment* - researching new solutions to water treatment that use the natural capacities of soil and vegetation to take-up, transform, or otherwise treat pollutants.
   - *Water Sensitive Urban Design* - research focussed on integrating rivers, lakes, banks, and their landscape systems for sustainable ecosystems and to enhance a city's landscape and environment.
   - *Decentralized Wastewater Systems* - exploration of the benefits from decentralising wastewater treatment and the development of technologies to make a decentralised approach effective.
   - *Institutional Systems and Financial Instruments* - research that addresses the social, economic, political, legal and regulatory contexts required to deliver innovative urban water solutions.

5. **Modes of Operation:** Two of the key challenges that the SWITCH approach addresses are the development of relevant new science and the speed up of the uptake of this new science within cities. In SWITCH researchers and practitioners work directly with civil society through 'learning alliances' to provide demand-led research. These are platforms which bring city stakeholders together with researchers. SWITCH believes that by adopting a demand-led approach to its research, it can speedup the process identification, development, and uptake of solutions related to urban water management. It also believes that such an approach will lead to greater impact and more potential for taking innovations to scale through the development of locally appropriate innovations and ownership of the concepts and process. SWITCH emphasizes a strategic planning process that encourages and enables all stakeholders to view the urban water cycle in an integrated way. The SWITCH approach consists of the following elements:

   - An inventory of the major global change pressures that affect the state of urban water systems
   - A strategic planning approach based on a Learning Alliance process and directed at creative visioning, scenario identification and strategy development
   - Recommendations to use a monitoring system of sustainability indicators as well as decision support tool (SWITCH City Water) to evaluate the effect of various strategies and options.
   - Recommendations on the application of a number of innovative (technological) options in future urban water management schemes
   - Early-action demonstrations representing different aspects of the water cycle that are designed for up-scaling at both the local and global level
   - On the basis of the above, a training toolkit is developed with the city learning alliances to maximize the utility and impact of the SWITCH approach.

6. **Products/ outputs:** SWITCH has developed a great body of work. Major Outputs are:

- Learning Alliance Handbook.
- A Global Training package Integrated Urban Water Management
- City Water Tool
- Manual sustainability indicators
- Transition manual
- GIS tool assessing stormwater management options (including 1D/2D surface flooding model)
- Guidelines for selection of natural WWT systems
- Guidelines for design, operation and maintenance of SAT and hybrid SAT systems
- Framework for ecohydrological approaches in cities
- Inventory and assessment of sanitation systems with source separation
- Guidelines urban agriculture
- 12 City case studies
- Over 80 publications on integrated urban water modeling

7. **Lessons Learned**

- A main focus areas of SWITCH was the reconsideration of the way water is used and reused. The research based on the assumption that 'All water is good water' and SWITCH developed strategies that maximize the benefits of water services while minimizing the usage of both water and energy (recycling of wastewater, use water multiple times etc.).

- In SWITCH energy efficient treatment options are being developed around natural systems, capable of removing multiple contaminants in a single system. Innovations in this area include constructed wetlands, soil aquifer treatment and river/lake bank filtration.
- SWITCH stress the importance to recognize the high-level relationships among water resources, energy, and land use in an urbanizing world. It is recognized that water and its interactions with other sectors is a central focus in the development and redevelopment of urban areas in the developed and less developed world.
- SWITCH developed an integrated modeling approach – CITYWATER, that enables analysis of the entire water cycle and improved the comprehensibility of complex set of spatial information. This enables decision makers to develop optimal designs while also appreciating the uncertainties associated with global change pressures.
- SWITCH considered the resilience of urban water systems to global change pressures and related uncertainties. SWITCH has developed a framework that can generate flexible urban water systems that are robust and adaptable to new, different, or changing requirements. This suite of options promote "security through diversity" and include options for wastewater reclamation/reuse, and a combination of end-use efficiency, system efficiency and storage innovations.
- There is strong evidence that cities are engaging users of research in non-traditional and more effective ways leading to more potential for impact. SWITCH seems to be making progress on the key issue of getting research into wider use, with the intention of securing greater impacts.

13. **Project: Integrated Modeling for the Assessment of Ecological Impacts of Sea Level Rise,** Dingbao Wang, University of Central Florida

1. **History and Origin** -
   The 5-year projected was initiated by Scott Hagen and funded by the NOAA / NOS / CSCOR / Ecological Effects of Sea Level Rise program in 2010. The project is focused on evaluating the impacts of global climate change on the three National Estuarine Research Reserve Systems in the northern Gulf of Mexico.

2. **Goals –**
   The goal of this research is to provide managers with the scientific knowledge and tools, including ecological models, to prepare for the impacts of sea level rise and storminess with more certainty in scale, timing, and local detail.

3. **Partners, participants, people -**
   Partners: Scott C. Hagen (lead PI), Graham Lewis (NWFWMD), Ron Bartel (NWFWMD), Brian Batten (Dewberry), Denise DeLorme (UCF), Wenrui Huang (FSU), James T. Morris (USC), Don Slinn (UF), Jerry Sparks (Dewberry), Linda Walters (UCF), Dingbao Wang (UCF), John Weishampel (UCF), George Yeh (UCF)

4. **Focus and Actions -**

- Knowledge/Skills: hydrodynamics and transport modeling, and marsh equilibrium modeling
- Tools: ADCIRC-2DDI, POM, EFDC, SWAN, Fusion, WASH123D, Marsh Equilibrium Model II
- Data: Land cover, LiDAR, RADARSAT, historical and synthetic hurricanes, shoreline erosion, water quantity and quality, regional climate model outputs

5. **Modes of Operation -** Emails, telephone meetings, in person site visits, workshops

6. **Products/Outputs -** Key products of the project:

   (1) A coupled model of hydrodynamics, salinity, sedimentation, and vegetation dynamics;
   (2) Classified maps of the present coastal landscape that show high and low risk areas.

One particular output is the rainfall patterns change in the Apalachicola River Basin (ARB). Based on simulations of a regional climate model and statistical downscaling, the spatial and temporal pattern changes as well as the rainfall intensity-duration-frequency curves are assessed for ARB.

7. **Lessons Learned -** Forthcoming