American Water Resources Association
2015 SUMMER SPECIALTY CONFERENCE
Climate Change Adaptation
June 15 - 17, 2015
New Orleans, LA

Tuesday, June 16
1:30 PM – 3:00 PM
SESSION 9: How do Data, Models, and Tools Aid in Adaptive Actions 3

Simulating the Effects of Rising Temperature on a Water Quality Impaired, Multi-Reservoir System in the Southeastern US - Kathryn Van Werkhoven, Systech Water Resources, Inc, Walnut Creek, CA (co-authors: S. Sheeder, J. Herr)

The Catawba River, originating in the Blue Ridge Mountains of North Carolina, is controlled by a system of 14 major dams and 11 major lakes along its path to Lake Wateree, South Carolina. Many river reaches and lakes in the basin are listed as impaired by the USEPA for parameters including ecological/biological integrity, fecal coliform bacteria, mercury, eutrophication, turbidity, metals, and nutrients. Recreation and hydropower generated by the river and dams are crucial to the economy of the region, while some tributaries are critical habitat for an endangered freshwater mussel. Preventing further degradation of water quantity and quality in the basin is thus of high concern. Climate change is one of many factors that could affect water supply and quality in the future. Average temperatures are projected to increase from 5 to 9 degrees (F) by 2080, which will in turn cause higher evaporation rates and water temperatures. Precipitation changes remain highly uncertain with the suite of global circulation models predicting both overall increases and decreases in mean annual precipitation. The Watershed Analysis Risk Management Framework (WARMF) was previously implemented for the Catawba River to support nutrient total maximum daily load (TMDL) analysis. The model was calibrated for the lower portion of the basin (including 4 of the 11 lakes) for flow, temperature, sediment, nutrients and phytoplankton. Building upon this existing model and additional tools available with WARMF to develop climate change scenarios, simulations were performed to test the effects of rising temperatures on the river-reservoir system. Temperature changes of 4, 6.5 and 9 degrees by 2080 were used along with multiple sequences of historical meteorology data to generate model inputs. The approach assumes precipitation changes are limited to the variability existing within the historical data. Results will be presented for hydrologic and water quality parameters to demonstrate the range of potential changes in water resources conditions in the Lower Catawba River Basin.

USACE Statistical Tools for Hydrologic Analyses - Kathleen White, U.S. Army Corps of Engineers Institute for Water Resources, Hanover, NH (co-authors: B. Baker, P. Seman, J. Arnold, A. Taylor, D. Friedman, J. Gade)

This presentation will highlight the statistical tools that the U.S. Army Corps of Engineers (USACE) is developing in support of USACE's guidance on incorporating climate change information in hydrologic analyses. The ECB tool was developed for use in implementing the first-order statistical analysis described in the Engineering and Construction Bulletin 2014-10, Incorporating Climate Change Impacts to Inland Hydrology Civil Works Studies, Designs & Projects. The Detection tool was developed for use in identifying nonstationarities in hydrologic times series described in the Engineer Technical Letter 1100-2, Detection of Nonstationarities in Annual Maximum Peak Discharge. Both tools provide consistent and repeatable analytical results to support decision making, reducing the potential for numerical errors associated with data management and inefficient use of resources to develop local solutions that might not be consistent nationally.

Developing a Modeling Framework for Nonstationary Urban Hydraulic Analyses - Ge Pu, Drexel University, Philadelphia, PA (co-authors: N. Devineni, F. Montalto)

Multiple recent national and international climate assessment reports (NCA and IPCC) suggest that the frequency, duration and intensity of future extreme precipitation in the North East US will increase. However, the extent of this increase and its potential impact is still not yet well understood. On the other hand, urban cities like Philadelphia and New York City are extremely vulnerable to these impacts due to their combined sewer overflows (CSO). This is mainly due to the fact that the sewer systems receive higher than normal flows during heavy precipitation. Treatment plants are unable to handle flows that are more than twice design capacity and when this occurs, a mix of excess stormwater and untreated wastewater discharges directly into the City’s waterways at certain outfalls. Cities are concerning about CSOs because of their effect on water quality and recreational uses. Hence, they seek to incorporate the best available information about current and future climate and understand the extent of their impacts on CSOs. This project intend to develop a general modeling framework for integrating multiple sources of information such as rain gauge data, radar information and climate scenarios into spatio- temporal fields for extreme rainfall events with prescribed duration using a Hierarchical Bayesian modeling technique. It aim to develop a stochastic spatio-temporal rainfall field simulator for the analysis of the extreme rainfall precipitation events. The approach here is to minimize uncertainties in stationary hydraulic assessment models with non-stationary ones. Lastly, this project demonstrates the application of this simulator for the design and assessment of existing storm and sewer network under changing climate scenarios. Recommendations and evaluations of this application outcome is evaluated and discussed to provide a critical path towards informing climate adaptation decision on the ground.

Responding to Sea Level Rise and Climate Change, St. Johns River Water Managment District - Michael Cullum, St. Johns River Water Management District, Palatka, FL

The St. Johns River Water Management District is a regional water agency that comprises 18 counties and 3.5 million people in northeast Florida. The mission of the District includes protection of the region's water supply, flood protection, water quality and natural systems protection. As part of that mission, the District is coordinating with four other Water

Management Districts and State Department of Environmental Protection on sea level rise impacts to coastal resources, including flooding and saltwater intrusion into coastal wellfields. In addition, the District evaluated sea level rise and climate change as part of the St. Johns River Water Supply Impact Study, using a combined set of HSPF hydrology models and EFDC hydrodynamic models. Several different surface water withdrawal alternatives were evaluated along with the most likely impact due to sea level rise. The District is also evaluating the effect of sea level rise through development of linked ADCIRC (advanced circulation) and SWAN (simulating waves nearshore) models. The District is evaluating effects of climate variability that influences both extreme events relative to flooding, and long term changes with respect to rainfall and evapotranspiration relative to water supply dependability. The District has evaluated long term changes to precipitation and evapotranspiration through downscaling global climate models in collaboration with the National Center for Atmospheric Research (NCAR). The District is participating with several research universities, water supply utilities and other water management districts in the Florida Water Climate Alliance (WCA) to evaluate potential impacts due to climate change, climate variability, sea level rise and associated uncertainties and risks that pose complex challenges to the planning and operations of Florida's public water supply utilities.