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

Tuesday, June 16
10:30 AM – 12:00 Noon
SESSION 7: How Do Data, Models, and Tools Aid in Adaptive Actions 2

Modeling Climate Change Impact on Urban Runoff - Douglas Beyerlein, Clear Creek Solutions, Inc., Mill Creek, WA

Climate change has the potential to impact urban runoff by changing precipitation volume and intensity and increasing potential evapotranspiration through increased air temperatures. Increased rainfall can lead to increased runoff and flooding in urban communities. The City of Everett, Washington, located 30 miles north of Seattle, is planning to upgrade their stormwater system to account for climate change impacts and contracted with Clear Creek Solutions to model the impact of climate change on urban runoff in the city. Clear Creek Solutions modified long-term hourly historical precipitation and potential evapotranspiration data to incorporate climate change effects in the stormwater modeling of major drainages to Port Gardner Bay. The University of Washington Center for Science in the Earth System Climate Impacts Group has analyzed the response to climate change for the Pacific Northwest, as simulated by several climate models. These climate simulations were prepared by climate modeling centers worldwide for the Fourth IPCC Assessment. From the different models used in climate modeling the UW Climate Impacts Group has selected different models and scenarios to represent the lowest, middle, and highest expected climate warming for the Pacific Northwest: For the purposes of the Everett stormwater modeling work we selected the middle scenario, ECHAM5 SRES A2, and used this climate change scenario to provide input on how to modify existing historical precipitation and pan evaporation data. U.S. EPA has developed the BASINS CAT (Climate Assessment Tool) to modify HSPF meteorological time series data to incorporate climate change effects. CAT does this in two ways: (1) modifying precipitation data, and (2) modifying air temperature data to adjust potential evapotranspiration (PET). HSPF was used with the modified precipitation and potential evaporation data to simulate the long-term hourly runoff for the individual major stream systems to identify flooding problem areas and potential solutions based on the impacts of climate change.

A Methodology for Developing Future Projections of Design Discharges Reflecting Global Climate Model (GCM) results - Mathew Mampara, Dewberry Consultants, Fairfax, VA (co-authors: M. Sreetharan, D. Smirnov)

The Executive Order released in January 2015 establishing a Federal Flood Risk Standard proposes that agencies make a determination if an action is located in a floodplain based, first, on a climate- informed science approach. For riverine flood hazards, the development of a consistent, climate- informed science approach to identify future changes is needed. This paper describes a methodology to develop future 1% chance and 10% chance peak discharge estimate "design discharges" throughout the United States. Generalized Least Square (GLS) multiple linear regression analysis was used to develop climate regression equations that relate 1%-annual- chance and 10%-annual-chance peak discharges at stream gage stations to the watershed characteristics and extreme climate indices of the contributing watershed. The geographic unit used to develop the regression equations is the Hydrologic Unit Code-2 (HUC-2), A total of 7,306 stream gages with 20 or more years of annual peak flow record were selected for this study from the 9,322 stream gages included in the USGS Geospatial Attributes of Gages for Evaluating Stream Flow (GAGES II) database. The presentation will initially focus on elements of the approach including Intergovernmental Panel on Climate Change (IPCC) AR5 Global Climate Models (GCMs) selection, spatial resolution considerations. Following this, discussion will include challenges inherent within the study methodology and areas where refinement is needed.

Modeling Climate Change Impact of Sea Level Rise on Urban Stormwater Systems - Douglas Beyerlein, Clear Creek Solutions, Inc., Mill Creek, WA

The impact of climate change resulting in sea level rise on urban stormwater systems in coastal communities has the potential to increase stormwater flooding by reducing the ability of the existing stormwater systems to drain to adjacent coastal waters. This is the concern of the City of Olympia, Washington, located on Budd Inlet at the south end of Puget Sound. On December 15, 1977, Olympia's highest recorded tide occurred. It was reported that flooding occurred in downtown Olympia as a result of the extreme high tide. Further, this high tide coincided with an intense low pressure weather. This storm may have influenced the flooding that occurred at high tide. Although this scenario is extremely rare, it is an example of how high tides combined with Pacific Northwest storms can contribute to potential flooding in downtown Olympia. The City of Olympia contracted with Clear Creek Solutions to examine the effects of sea level rise on the stormwater system in downtown Olympia. Specifically, the goal was to identify portions of the stormwater system that could potentially create flooding scenarios in conjunction with a heavy rainfall event, where a high tide could adversely affect the ability of the stormwater system to drain the stormwater to Puget Sound. The University of Washington Climate Impacts Group provided to the City of Olympia a set of sea level rise scenarios based on their research. Clear Creek Solutions then used these sea level rise scenarios to model the city's downtown stormwater system. Clear Creek Solutions used SWMM to model 12 different rainfall/high tide scenarios. The models revealed specific locations that are likely to flood in downtown Olympia when heavy storm runoff occurs during a low tide after a high tide. This happens because tidal water enters the stormwater system at high tide and does not drain out before stormwater runoff floods the system. The stormwater system does not have the capacity to drain both the existing tidal water in the stormwater pipe system and the stormwater runoff water entering the system.

Management and Communication of Hydrologic Modeling Projection Results - Jonathan Quebbeman, Kleinschmidt, Fort Collins, CO

Ensemble hydrologic modeling, using multiple Representative Concentration Pathways (RCPs), from multiple Global Circulation Models (GCMs), with spatially-distributed daily output over a century, can result in an inordinate amount of data. Vast amounts of data are useless unless they can be stored, shared, processed, and communicated effectively to the end-users. This presentation will discuss different options for storing spatio-temporal data for easy retrieval and analysis. This includes the use of NetCDF data within ESRI's ArcGIS software, reading and writing NetCDFs using Python, data storage in HDFs, and processing data using Pandas. Through this process, we will demonstrate several exploratory data analysis techniques to visualize, tabulate and analyze large dataset