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Tuesday, Nov. 10
3:30 PM – 5:00 PM
SESSION 35: Modeling and Communicating Science to Policy Makers

The Pursuit of Longer-Lead Water-Supply Forecasts -Statistical Hydrologic Models Coupled with Large-Scale Climate Predictors Derived from Independent Component Analysis - Hamid Moradkhani, Portland State University, Portland, OR (co-author: Matthew Meier)

Interest in water supply forecasting has grown prominently in the western US due to population growth and increasing demands for water. Successful management of the West's water supply is necessary in order to provide an uninterrupted, dependable water supply to meet all downstream needs. One important aspect of successfully managing the West's supply of water is accurate and reliable forecasts of seasonal streamflow volumes. These forecasts are possible in this region because much of the streamflow in this area is a result of the collection of seasonal snowpack over the winter months and the melting of this snowpack over the spring and summer. This pattern of snow accumulation and melt makes it possible for a forecaster to develop water supply forecasts with lead-times of several months. However, there has been increasing pressure on operational agencies to issue longer-lead water supply forecasts that would be released in late fall or early winter preceding the runoff season. Longer-lead forecasts are difficult to make due to the uncertainty in future winter and spring climate conditions and the lack of snowpack information. During the late fall and early winter large-scale ocean and atmospheric information can provide insight into future climate conditions and spring runoff and have been shown to be useful in developing long-lead forecast. In this study, we develop and examine multiple linear regression models that incorporate large-scale climate signals developed using Independent Component Analysis (ICA) with the objective of increasing the skill of longer-lead forecasts. Our study investigates five different statistical procedures – two principal component regression (PCR) methods, partial least squares regression (PLSR), z-score regression, and independent component regression (ICR) – in three different Pacific Northwest basins. Our study found that incorporating ICA large-scale climate predictors into our forecasts allowed a longer lead-time (beginning in September) and also contributed a significant amount of skill during the spring runoff season (through April).

Applying Water Quality model as a Management Tool: a Case Study of Neversink River - Namsoo Suk, Delaware River Basin Commission, West Trenton, NJ (co-author: Feng Shi)

Neversink River is one of the major tributaries of upper Delaware River and defined as Special Protection Waters by the Delaware River Basin Commission. Given the case that several industrial and municipal wastewater treatment plants are seeking expansions beyond their current permits, the existing and projected water quality condition of Neversink River needs to be appropriately evaluated, to ensure that the addressed water quality indices are in compliance with the requirements of "No Measurable Change" at the designated control point. Based upon the research objectives and data availability, the QUAL2K model is selected as an evaluation tool here. The model is first deployed on a portion below the Neversink Reservoir to the mouth of Neversink River, including the main stem and tributaries where significant point sources are located. For achieving the one-dimension distributed simulation, the 70-km long river is divided into 13 reach segments based on the topological relations and channel profiles, and then further divided into a series of discrete cells with approximately 1.5 km length for numerical computation. The principal concerned water quality indicators are concentration of DO, BOD, suspended solids, and forms of nitrogen and phosphorus. Based on the available hydrologic and water quality data, the model is calibrated for two independent dates in 2000 and 2001 to represent the system behavior under both point-source-dominated low flow condition and diffused-source-dominated high flow condition. Three steps, trial calibration, sensitivity analysis and automatic calibration by Evolutionary Algorithm are employed to determine hydraulic and kinetic water quality parameters. The calibrated model is then applied to evaluate the impacts of proposed expansion of dischargers. The modeling result has identified the most intensive pollutant loading zone within the drainage area. The sensitivity analysis shows that in-

stream nutrient concentrations are much more sensitive to load amount than in-stream processes, but BOD, DO and TSS are not sensitive to those external factors. Within this management-oriented modeling case study, the QUAL2K model is well representing the nitrogen and phosphorus, while for other indices, the model requires improvements as the reliable technical approach for substantially underpinning practical decision-making processes such as discharge permit issuance.

“Show Me” – Empowering Decision Makers and Stakeholders with Data Analysis Tools to Further Communicate Science - Peter Sabee, North Jackson Company, Corvallis, OR (co-authors: Kari Paulson, Kamran Syed, Tsolmongerel Papilloud)

The relationship between experts and the rest of society has changed in ways that have far-reaching implications for policy makers and those who seek to influence policy through the application of science. In all areas of society it is now normal for assertions of authority to be questioned. Where the decision maker says “trust me” the response is very often “show me.” Likewise the scientific community, as well as stakeholders using science to influence policy, can be more effective if they can “show” decision makers directly how their analysis of the data has led to a specific policy recommendation. “Showing” the science behind the recommendation can be greatly enhanced and made broadly available through the application of web-based technology. Meeting the challenge of efficiently transmitting data and communicating science is particularly challenging in the field of water resources due to the volume and complexity of datasets. This presentation discusses the state of web-based data sharing and interactive analysis tools and their current and future roles in decision making. Topics to be included are: the use of the web to provide access; the need for speed, simplicity and flexibility; the importance of customization to the communication objective; the value of drop-down menus to guide the discovery process; and the need for platform flexibility to meet the needs of different types of users. The potential to convey the integrity of the data (e.g., inclusion of quality assurance data, comparison to other data sources, outlier analysis, etc.) will also be discussed.

A Community Engagement Planning Process to Connect Science and Community for Water Resource Protection - Zeyuan Qiu, New Jersey Institute of Technology, Newark, NJ (co-authors: Christine Hall, Donna Drewes, Grace Messinger, Kathy Hale)

One of the biggest challenges in water resource protection today is how to empower local communities and various stakeholders with the latest water resource science and technology to take concrete local actions. This presentation discusses a community engagement planning process that communicates the idea of critical source area (CSA) protection based on hydrological science to the local municipalities and assess the technical, social, economic, and institution barriers for local communities to take local actions for implementing the idea. The idea of CSA protection is based on the variable source area (VSA) hydrology, a suite of alternative hydrological science and technology developed and evolved in the last forty years. According to the VSA hydrology, each part of landscapes does not equally contribute to the local water quality issues because of the variability in topography, soil and other natural resource conditions. CSAs are defined as the areas in landscapes that actively contribute to runoff generation and water pollution. Protection of CSAs would help achieve the greater effectiveness in water resource protection. After identifying the CSAs, and examining the existing state, regional and municipal land use plans, zoning and ordinances for water resource protection in three municipalities (Clinton, Tewksbury, Readington) in Rockaway Creek Watershed in Hunterdon County, New Jersey, a community engagement planning process was implemented to communicate various ideas of CSA protection with the three municipalities and to evaluate the opportunities, challenges and barriers faced by municipalities to adopt those ideas. The community engagement planning process consists of a series of meetings with the municipal environmental commissions and planning boards. The concerns and questions raised during those things were followed with careful scientific inquiries and technical assistances in planning and GIS mapping. The engagements with various stakeholders beyond the three municipalities were implemented through two additional stakeholder groups: the Rockaway Creek Watershed Project Advisory Committee and the CSA Management Technical Committee. Although the idea of CSA protection is appealing to the local communities, substantial efforts are needed to help communities overcome those barriers and therefore move from interest to action.