Geophysical Research Abstracts
Vol. 17, EGU2015-7656-1, 2015
EGU General Assembly 2015

A risk-based framework to assess long-term effects of policy and water supply changes on water resources systems

Elmira Hassanzadeh (1), Amin Elshorbagy (1,2), Howard Wheater (2), and Patricia Gober (3)

(1) Civil & Geological Engineering, University of Saskatchewan, Saskatoon, Canada., (2) Global Institute for Water Security, University of Saskatchewan, Saskatoon, Canada (amin.elshorbagy@usask.ca), (3) School of Public Policy, University of Saskatchewan, Saskatoon, Canada.

Climate uncertainty can affect water resources availability and management decisions. Sustainable water resources management therefore requires evaluation of policy and management decisions under a wide range of possible future water supply conditions. This study proposes a risk-based framework to integrate water supply uncertainty into a forward-looking decision making context. To apply this framework, a stochastic reconstruction scheme is used to generate a large ensemble of flow series. For the Rocky Mountain basins considered here, two key characteristics of the annual hydrograph are its annual flow volume and the timing of the seasonal flood peak. These are perturbed to represent natural randomness and potential changes due to future climate. 30-year series of perturbed flows are used as input to the SWAMP model – an integrated water resources model that simulates regional water supply-demand system and estimates economic productivity of water and other sustainability indicators, including system vulnerability and resilience. The simulation results are used to construct 2D-maps of net revenue of a particular water sector; e.g., hydropower, or for all sectors combined. Each map cell represents a risk scenario of net revenue based on a particular annual flow volume, timing of the peak flow, and 200 stochastic realizations of flow series. This framework is demonstrated for a water resources system in the Saskatchewan River Basin (SaskRB) in Saskatchewan, Canada. Critical historical drought sequences, derived from tree-ring reconstructions of several hundred years of annual river flows, are used to evaluate the system's performance (net revenue risk) under extremely low flow conditions and also to locate them on the previously produced 2D risk maps. This simulation and analysis framework is repeated under various reservoir operation strategies (e.g., maximizing flood protection or maximizing water supply security); development proposals, such as irrigation expansion; and change in energy prices. Such risk-based analysis demonstrates relative reduction/increase of risk associated with management and policy decisions and allow decision makers to explore the relative importance of policy versus natural water supply change in a water resources system.