Jun 26th, 2:00 PM - 3:20 PM

Time evolving robustness evaluation for risk-based cooperative long-term water supply development pathways that include short-term drought mitigation actions

Bernardo Trindade
bct52@cornell.edu

Patrick M. Reed

Gregory W. Characklis

iEMSs International Congress on Environmental Modelling and Software

9th International Congress on Environmental Modelling and Software
Fort Collins, Colorado, USA, Mazdak Arabi, Olaf David, Jack Carlson, Daniel P. Ames (Eds.)
https://scholarsarchive.byu.edu/iemssconference/2018/

Time evolving robustness evaluation for risk-based cooperative long-term water supply development pathways that include short-term drought mitigation actions

Bernardo C. Trindade[a], Patrick M. Reed[a], Gregory W. Characklis[b]
a Department of Civil and Environmental Engineering, Cornell University, Ithaca, New York, USA (bct52@cornell.edu)
b Department of Civil and Environmental Engineering, Cornell University, Ithaca, New York, USA (patrick.reed@cornell.edu)
c Department of Environmental Sciences and Engineering, University of North Carolina, Chapel Hill, North Carolina, USA (charack@email.unc.edu)

Abstract: Well-coordinated regional short-term drought management actions can be used by water utilities to mitigate water scarcity and financial risk, potentially postponing the need of new infrastructure construction. However, in the longer term, infrastructure expansion is likely to be necessary to address rising water demands. Given their interdependence, it is important to capture how short-term mitigation strategies influence longer term infrastructure development pathways. Our research exploits risk-based triggers for short and long-term actions (respectively, water transfers, restrictions, and financial hedges; and construction of reuse, water treatment, reservoir capacities, etc.). However, a robustness evaluation of these pathways must account for the integrated effects of drought mitigation measures and evolving infrastructure, a case not accounted for by existing assessment techniques. This research proposes a framework for evaluating the robustness of time-evolving infrastructure systems with integrated adaptive short-term actions. The proposed framework is demonstrated on the North Carolina Research Triangle test case, where the future regional infrastructure adaptation pathways must support the multi-jurisdictional decision making across the municipalities of Raleigh, Durham, Cary and Chapel Hill. The Borg Multiobjective Evolutionary Algorithm was used for devising the coupled short and long-term plans, while the recently developed WaterPaths model was used for their evaluation. The insights from this work have general merit for regions where adjacent municipalities can benefit from cooperative regional water portfolio and infrastructure planning.

***Keywords**:* Optimization, infrastructure, planning, management, water, pathways