Jun 26th, 3:40 PM - 5:00 PM

# An R tool for scenario-neutral climate impact analysis of water resource systems

Bree Bennett
*University of Adelaide*, bree.bennett@adelaide.edu.au

Sam Culley
*University of Adelaide*, sam.culley@adelaide.edu.au

Seth Westra
*University of Adelaide*

Holger R. Maier
*University of Adelaide*

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/*

# An R tool for scenario-neutral climate impact analysis of water resource systems

**B. Bennett [a], S. Culley [a], S. Westra [a] and H.R. Maier [a]**
*a. School of Civil, Environmental and Mining Engineering, The University of Adelaide, South Australia (bree.bennett@adelaide.edu.au, sam.culley@adelaide.edu.au, seth.westra@adelaide.edu.au, holger.maier@adelaide.edu.au)*

**Abstract:** *fore*SIGHT (Systems Insights from Generation of Hydroclimatic Timeseries) is a new R package for performing climate impact assessments using a scenario-neutral approach. These approaches 'stress test' a modelled system using a broad range of hydroclimate scenarios, and thus rely on the availability of suitable sets of plausible hydroclimate variable time series. The range of hydroclimate scenarios examined can be characterised by statistical measurements of the variables (e.g. mean temperature, annual precipitation volume), which are referred to as climate attributes. Stress testing a system against a wider range of climate attributes allows for more modes of failure to be discovered. However, there are significant technical challenges in creating the necessary hydroclimate scenarios to explore system sensitivity. Likewise, there is significant and computational overhead in simulating and visualizing system performance in response to these large sets of hydroclimate scenarios. In answer to these challenges *fore*SIGHT generates perturbed time series using a range of approaches (e.g. scaling of observed time series, stochastic simulation of perturbed time series via an inverse approach), incorporating a number of stochastic models to generate different hydroclimate variables on a daily basis (e.g. precipitation, temperature, evapotranspiration). When the inverse approach is employed to create the stochastic hydroclimate time series, it utilises formal optimisation techniques with the stochastic models to meet the desired attributes. Crucially, this allows a variety of different hydroclimate variable properties to be perturbed (e.g. means, percentiles, persistence). This allows for a greater exploration of system sensitivity. The software allows for the integration of existing system models, both internally in R and externally, and provides a suite of visualization options for the results of a scenario-neutral analysis. This is demonstrated on a simplified water supply system with a climate dependent demand model, where different management configurations are evaluated, and visualised with climate model projections to add context. The necessary optimisation techniques to create perturbed time series are demonstrated using five sites around Australia.

***Keywords*:** Climate change impact assessment; Inverse approach; Stochastic rainfall