



An R tool for climate resilience analysis of water resource systems

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A new R-package, *foreSIGHT* (Systems Insights from Generation of Hydroclimatic Timeseries) is presented here for performing climate resilience analysis of systems using a scenario-neutral approach. Scenario-neutral approaches are based on ‘stress testing’ a modelled system using a broad range of hydroclimate scenarios. In doing so the approach enables the identification of critical hydroclimate variables that affect the vulnerability of the system to hydroclimate variation and change. This information can then be coupled with climate projection information to better understand how likely the examined scenarios are to occur.

Scenario-neutral approaches rely on the availability of suitable sets of plausible hydroclimate variable time series (e.g. rainfall, temperature, potential evapotranspiration). Generating hydroclimate variable time series that are capable of strategically ‘stress testing’ a system can require significant technical investment. Likewise, there are logistical overheads in simulating and visualizing system performance resulting from the broad range of hydroclimate scenarios. These simulation and visualization demands form a barrier to wide scale adoption of scenario-neutral approaches.

In response to these challenges *foreSIGHT* has been developed to facilitate using a scenario-neutral approach: from the generation of perturbed hydroclimate time series, to the ‘stress testing’ of the system and finally the incorporation of other sources of climate information (i.e. climate projections). *foreSIGHT* is able to generate perturbed time series using a range of approaches (e.g. simple scaling of observed time series, stochastic simulation of perturbed time series via an inverse approach). The software incorporates a number of stochastic models to generate a variety of different hydroclimate variables on a daily basis (e.g. precipitation, temperature, evapotranspiration) and allows a variety of different hydroclimate variable properties (herein called attributes) to be perturbed. Guidance is provided on the suitability of the chosen models to perturb the chosen attributes and what combinations of attributes can be perturbed simultaneously. *foreSIGHT* automatically generates a comprehensive range of output diagnostics and graphics which can be used to evaluate the perturbed time series prior to the ‘stress testing’ stage. The software allows for the easy integration of existing system models so that ‘stress testing’ can be seamless. There is also an option to run the ‘stress test’ using system models externally. *foreSIGHT* provides a suite of visualization options including overlaying climate projection information. Also provided with the software is comprehensive help documentation, step-by-step demonstrations (e.g. generating perturbed time series, conducting a ‘stress test’, visualization) and an example system model for exploring the modelling framework. As further developments in scenario-neutral approaches occur *foreSIGHT* will be updated to incorporate these advances.