



## **Multi-criteria objective based climate change impact assessment for multi-purpose multi-reservoir systems**

Ruben Müller and Niels Schütze

TU Dresden, Institute for Hydrology and Meteorology, Department of Hydrology, Dresden, Germany  
(ruben.mueller@tu-dresden.de)

Water resources systems with reservoirs are expected to be sensitive to climate change. Assessment studies that analyze the impact of climate change on the performance of reservoirs can be divided in two groups: (1) Studies that simulate the operation under projected inflows with the current set of operational rules. Due to non adapted operational rules the future performance of these reservoirs can be underestimated and the impact overestimated. (2) Studies that optimize the operational rules for best adaption of the system to the projected conditions before the assessment of the impact. The latter allows for estimating more realistically future performance and adaption strategies based on new operation rules are available if required.

Multi-purpose reservoirs serve various, often conflicting functions. If all functions cannot be served simultaneously at a maximum level, an effective compromise between multiple objectives of the reservoir operation has to be provided. Yet under climate change the historically preferenced compromise may no longer be the most suitable compromise in the future. Therefore a multi-objective based climate change impact assessment approach for multi-purpose multi-reservoir systems is proposed in the study. Projected inflows are provided in a first step using a physically based rainfall-runoff model. In a second step, a time series model is applied to generate long-term inflow time series. Finally, the long-term inflow series are used as driving variables for a simulation-based multi-objective optimization of the reservoir system in order to derive optimal operation rules. As a result, the adapted Pareto-optimal set of diverse best compromise solutions can be presented to the decision maker in order to assist him in assessing climate change adaption measures with respect to the future performance of the multi-purpose reservoir system.

The approach is tested on a multi-purpose multi-reservoir system in a mountainous catchment in Germany. A climate change assessment is performed for climate change scenarios based on the SRES emission scenarios A1B, B1 and A2 for a set of statistically downscaled meteorological data. The future performance of the multi-purpose multi-reservoir system is quantified and possible intensifications of trade-offs between management goals or reservoir utilizations are shown.