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Impact of the length of time series on simulation-based multi-objective optimization for water resources management

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Multi-purpose reservoir systems are essential parts of water resources systems necessary to secure the supply of potable water, water for food and energy production and provide flood protection. To balance the operation between competing demands, well elaborated operation rules are necessary. Therefore simulation-based multi-objective optimization (SB-MOO) technique is used to find a manifold set of best possible operation rules between competing operational goals.
The used SB-MOO technique is a Monte-Carlo approach and information about the hydrologic conditions is fed implicitly into the optimization by providing an inflow time series. This inflow time series has to be sufficiently long, since crucial information about the possible range of hydrologic states and their occurrence probabilities may be missing.
In a case study for the Lake Tana multi-purpose reservoir system we investigate the impact of the length of the inflow time series. The results of SB-MOO on the basis of 20 year long time series and stochastically extended time series are validated with a reservoir operation simulation over 10000 years. In the case study different numbers of objective functions and decision variables are considered. It can be shown in the simulation, that the reservoir system managed with the operational rules from the SB-MOO with 20 years of inflows underperformes compared to those from the SB-MOO with the stochastically extended data basis when more objective functions and/or decision variables are considered.