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Low robustness of increasing reservoir capacity for adaptation to climate change: A case study for an agricultural river basin

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With growing concerns of the uncertain climate change, investments in water infrastructures are considered as adaptation policies for water managers and stakeholders despite their negative impacts on the environment. Particularly in regions with limited water availability or conflicting demands, building reservoirs and/or augmenting their storage capacity were already adopted for alleviating influences of the climate change. This study provides a probabilistic assessment of climate change impacts on water scarcity in a river system regulated by an agricultural reservoir in South Korea, which already increased its storage capacity for water supply. For the assessment, we developed the climate response functions (CRFs) defined as relationships between bi-decadal system performance indicators (reservoir reliability and vulnerability) and corresponding climatic conditions, using hydrological models with 10,000-year long stochastic generation of daily precipitation and temperatures. The climate change impacts were assessed by plotting 52 downscaled climate projections of general circulation models (GCMs) on the CRFs. Results indicated that augmented reservoir capacity makes the reservoir system more sensitive to changes in long-term averages of precipitation and temperatures despite improved system performances. Increasing reservoir capacity is unlikely to be “no regret” adaptation policy for the river system. On the other hand, converting the planting strategy from transplanting to direct sowing (i.e. a demand control) could be a more robust to bi-decadal climatic changes based on CRFs and thus could be good to be a no-regret policy.