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Impacts of climate change on reservoir operation and adaptive strategies: the case study of Xin'an River Reservoir

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The impacts of climate change on runoff and reservoir operation are assessed and the adaptive operation rule curves are derived under future climate change scenario. Taking the Xin'an River Reservoir as a case, the Xin'an River hydrologic model is employed to generate the monthly runoff from 2016 to 2045 based on the output of bcc-csm1.1 model under RCP4.5 scenario. On this basis, the impacts of climate change on runoff and reservoir operation are evaluated and the adaptive conventional and optimal operation rule curves are derived, respectively. The results indicate that the mean annual runoff will decrease by 4.96%, the inter-annual and intra-annual variation of runoff will decrease. Compared with the reference period, the mean annual power generation will decrease by 2.65% and intra-annual distribution of power generation will change. Compared with history operating rule curves, the adaptive operation rule curves will increase mean annual power generation by 15.39%, the uncertainty of power generation and the concentration degree of spill are both decreased. Compared with the convention operation rules, the adaptive optimal reservoir operation rules will increase mean annual power generation by 14.51%, decrease mean spill by 50.71%, and the number of spill reduces. Therefore, the adaptive operation rule curves can better adapt to future climate change scenarios and fulfil the potential of reservoir operation.