

Hydropower Reservoir Management Under Climate Change: The Karoon Reservoir System

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Abstract This study assesses the performance of hydropower production by reservoirs with and without climate change impacts on river discharge. The case study of this research includes the Khersan 1, Karoon 4, and Karoon 3 reservoirs in Iran. The HADCM3 climate model with A2 greenhouse gas emission scenario is coupled with proportional downscaling to assess the impact of climate change on river discharge and reservoir hydropower production. The IHACRES rainfall-runoff model is implemented for calculating river discharge under climate-change conditions. Reservoir simulation and optimization models are implemented to calculate hydropower production in the base period (1986–2000), future period 1 (2025–2039), future period 2 (2055–2069), and future period 3 (2085–2099). The power production and performance criteria of the reservoirs are calculated using simulation (standard operating policy) and optimization models in the considered periods. Our results show that the largest reductions of reservoir discharge correspond, in decreasing order, to the future periods 3, 1, and 2, respectively. Moreover, the hydropower production obtained with the optimization model is found to be larger than that obtained with the simulation model. The calculated increase in power production in the base period and future periods 1, 2, and 3 is equal to 6, 19, 10, and 22 %, respectively. These results demonstrate the benefit of applying optimization modeling for hydropower production in the Khersan-Karoon reservoir system to mitigate and adapt to climate-change impacts on river discharge.

Keywords Climate change · Reservoir operation · Reservoir system · Hydropower · Simulation · Optimization

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