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The impact of climate change on the hydropower potential of the Three Gorges Reservoir

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The Three Gorges Project, world's largest hydropower project, is a major alternative energy source that serves to meet growing electricity demand of China. However, significant decline of annual and autumn inflow to the Three Gorges Reservoir (TGR) have been observed in recent decades (1991-2010) when compared to the design period (1951-1990). It is highly necessary to answer that whether the decreasing inflow will continue in the future climate, and how will the hydropower potential respond to the projected inflow changes. To address this issue, we evaluate changes in hydropower generation according to the ensemble average of 21 CMIP5 General Circulation Model projections under representative concentration pathway scenarios over the watershed in the 21st century. The results indicate that more severe shortages in power generation have to be expected. Annual power generation are projected to decrease by 1.9∼8.0% in the coming decades (2011-2040) compared to the design period. The long-term future (2041-2100) climate tends to increase annual power generation by 9.3∼24.4%. However, it will also greatly raise summer inflow to the TGR, posing more flood risks for the project. As a counter measure, multi-reservoirs regulations upstream of TGR potentially can mitigate the decline of annual power generation and strengthen its capability of flood protection.