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UNCERTAIN CLIMATE CHANGE IMPACTS ON HYDROPOWER PRODUCTION IN THE SWISS ALPS

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This study addresses two major challenges in the field of climate change impact analysis on water resources systems: i) incorporation of the largest possible range of potential climate change scenarios and ii) quantification of related modelling uncertainties. The developed methodology of climate change impact modelling is presented and illustrated through an application to a hydropower plant in the Swiss Alps that uses the discharge of a highly glacierized catchment. This case study has been chosen because it represents an area of water resources management highly vulnerable to climate change and because in Switzerland, hydropower represents about 75 % of consumed electricity. The potential climate change impacts are analysed in terms of system performance for the control period (1960 – 1989) and for the future period (2070 – 2099) under a range of climate change scenarios. The system performance is simulated through a set of 4 model types including the production of regional climate change scenarios based on global warming scenarios, the corresponding discharge model, the model of glacier surface evolution and the hydropower management model. The modelling uncertainties inherent to each model type are characterized and quantified. The obtained results show a statistically significant climate change impact on the hydrological regime: It shifts from the current so-called *a-glacier* regime (maximum monthly discharge in July and August) to a so-called *nival* type (maximum monthly discharge in June). Additionally, the total annual runoff undergoes a significant reduction due to the increase of temperature and evapotranspiration, decrease of precipitation and decrease of the glaciated catchment area. As a result, the system performance of the hydropower production plant decreases significantly.