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# Climate change and hydropower production in the Swiss Alps: quantification of potential impacts and related modelling uncertainties

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Abstract. This paper addresses two major challenges in climate change impact analysis on water resources systems: (i) incorporation of a large range of potential climate change scenarios and (ii) quantification of related modelling uncertainties. The methodology of climate change impact modelling is developed and illustrated through application to a hydropower plant in the Swiss Alps that uses the discharge of a highly glacierised catchment. The potential climate change impacts are analysed in terms of system performance for the control period (1961–1990) and for the future period (2070–2099) under a range of climate change scenarios. The system performance is simulated through a set of four model types, including the production of regional climate change scenarios based on global-mean warming scenarios, the corresponding discharge model, the model of glacier surface evolution and the hydropower management model. The modelling uncertainties inherent in each model type are characterised and quantified separately. The overall modelling uncertainty is simulated through Monte Carlo simulations of the system behaviour for the control and the future period. The results obtained for both periods lead to the conclusion that potential climate change has a statistically significant negative impact on the system performance.

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