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Accounting for global-mean warming and scaling uncertainties in climate change impact studies: application to a regulated lake system

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Abstract. A probabilistic assessment of climate change and related impacts should consider a large range of potential future climate scenarios. State-of-the-art climate models, especially coupled atmosphere-ocean general circulation models and Regional Climate Models (RCMs) cannot, however, be used to simulate such a large number of scenarios. This paper presents a methodology for obtaining future climate scenarios through a simple scaling methodology. The projections of several key meteorological variables obtained from a few regional climate model runs are scaled, based on different global-mean warming projections drawn in a probability distribution of future global-mean warming. The resulting climate change scenarios are used to drive a hydrological and a water management model to analyse the potential climate change impacts on a water resources system. This methodology enables a joint quantification of the climate change impact uncertainty induced by the global-mean warming scenarios and the regional climate response. It is applied to a case study in Switzerland, a water resources system formed by three interconnected lakes located in the Jura Mountains. The system behaviour is simulated for a control period (1961–1990) and a future period (2070–2099). The potential climate change impacts are assessed through a set of impact indices related to different fields of interest (hydrology, agriculture and ecology). The results obtained show that future climate conditions will have a significant influence on the performance of the system and that the uncertainty induced by the inter-RCM variability will contribute to much of the uncertainty of the prediction of the total impact. These CSRs cover the area considered in the 2001–2004 EU funded project SWURVE.

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