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Multi-model projections of evaporation in a sub-tropical lake

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Evaporation of surface water is critical to the basic functioning of lakes. It directly and, in some cases, substantially modifies the hydrologic, chemical, and energy budgets, making evaporation one of the most important physical controls on lake ecosystems. Predicting lake evaporation response to climate change is, therefore, of paramount importance. Most studies that simulate climate change impacts on lake evaporation have utilised only a single mechanistic model. Whilst such studies have merit, the advantage of applying multiple, independently developed models (i.e., an ensemble approach), is that some of the inherent uncertainties in the individual lake models due to, for example, different model structures, can be reduced thus enabling increased robustness of historic and future projections. In this study, we present results from the Inter-Sectoral Impact Model Intercomparison Project phase 2b (ISIMIP) Lake Sector, where lake evaporation responses to 20th and 21st century (1901-2099) climate change has been simulated with a suite of independently developed lake models under different climate change scenarios (Representative Concentration Pathways, RCP, 2.6, 6.0 and 8.5). Our study focuses on Lake Kinneret (Israel), a sub-tropical monomictic lake of socioeconomic importance. Our simulations are validated during the historic period with bulk evaporation estimates calculated from high frequency meteorological and in-lake observations. Our results demonstrate that the lake models provide an accurate representation of historical variability in lake evaporation, with promising comparisons of the magnitude, timing and seasonality of evaporative water loss. Future evaporation projections at Lake Kinneret show that evaporation anomalies will increase by the end of the century. We show that multi-model projections of lake evaporation can accurately represent the historic period and hence provide reliable future projections that will be vital for water

management.