EGU21-1426
https://doi.org/10.5194/egusphere-egu21-1426
EGU General Assembly 2021

Ensemble climate projections on stratification dynamics in Germany's largest drinking water reservoir and potential adaptation strategies

Karsten Rinke[1], Tom Shatwell[1], Jun Ma[2], Yaqian Xu[2], Fangli Su[3], and Chenxi Mi[1]

[1]Helmholtz Centre for Environmental Research, Department of Lake Research, Magdeburg, Germany
[2]Hubei Key Laboratory of Ecological Restoration of River-Lakes and Algal Utilization, Hubei University of Technology,Wuhan, China
[3]College of Water Conservancy, Shenyang Agricultural University, Shenyang, China

The thermal structure in reservoirs affects the development of aquatic ecosystems and is substantially influenced by changing climate conditions. At the same time, reservoir management strategies can also affect the thermal structure of the water body and may enable adaptation strategies in a warmer world. We applied a two-dimensional hydrodynamicmodel to explore the response of the thermal structure in Germany's largest drinking water reservoir, Rappbode Reservoir, to future climate projections and different water withdrawal strategies. We used projections for representative concentration pathways (RCP) 2.6, 6.0 and 8.5 from an ensemble of 4 different global climate models taken from the ISIMIP project. Simulation results showed that epilimnetic water temperatures in the reservoir strongly increased under all three climate scenarios while the magnitude of warming directly corresponds to the increase in air temperatures. Hypolimnetic temperatures remained rather constant under RCP 2.6 and RCP 6.0 but increased markedly under RCP 8.5. Under the intense warming in RCP 8.5, hypolimnion temperatures were projected to rise from 5 °C to 8 °C by the end of the century. Moreover, the results suggested that surface withdrawal can be an effective adaptation strategy under strong climate warming (RCP 8.5) to reduce surface warming and even avoid hypolimnetic warming. This study documents how global scale climate projections can be translated into site-specific climate impacts to derive adaptation strategies for reservoir operation. Moreover, our results illustrate that the most intense warming scenario, i.e. RCP 8.5, demands far-reaching climate adaptation while the mitigation scenario (RCP 2.6) does not require adaptation of reservoir management before 2100.