EGU24-8417, updated on 10 Sep 2024
https://doi.org/10.5194/egusphere-egu24-8417
EGU General Assembly 2024

Understanding the performance of three 1-D lake models over Yangtze River Basin

Omarjan Obulkasim, **Shulei Zhang**, and Yongjiu Dai
Sun Yat-sen University, China (wubulks@mail2.sysu.edu.cn)

Lake thermal processes greatly impact the local climate and environment and are sensitive to climate change and human interference. The Yangtze River Basin has the highest lake density in China, boasting diverse natural and artificial water bodies; however, there is still a lack of comprehensive understanding and effective simulation approaches for the thermal processes of the various lakes in this area. This study, utilizing observed lake surface temperatures, thermal stratification data, and evaporation data from lakes in the region, provides key parameters for three one-dimensional lake models (namely, Simstrat, CoLM-Lake, and Flake) and comprehensively assesses their performance in the region. The findings indicate that all three models demonstrate robust accuracy in simulating shallow lakes (primarily natural lakes) but show substantial differences in performance when simulating deep lakes (mainly reservoir water bodies). Specifically, Simstrat excels in reproducing the thermal stratification of deep lake. It also demonstrates good performance in simulating lake surface temperature and evaporation, which is primarily attributed to the integration of Monin-Obukhov similarity theory into Simstrat. However, its ability to model temperature diffusion during the colder seasons requires further improvement. CoLM-Lake, while capable of simulating thermal stratifications, shows limitations in maintaining stability in deeper stratifications. Flake, on the other hand, encounters substantial challenges in accurately estimating turbulence effects in deeper lakes, particularly in autumn and winter. This study provides valuable insights for improving the simulation of lake thermal processes, particularly for deep artificial water bodies, which will enhance our understanding of lake thermal changes and their impacts in the Yangtze River Basin.