

The overall approach of this study seems to be sound, but the generation of high-resolution data, the construction of the lake thermodynamic model, and the stratification simulation lack sufficiently reliable evaluation and validation. Additionally, many key parameters and settings are not clearly clarified, and the presentation of the projected results is also relatively simplistic.

We thank you for your valuable comments and constructive criticism. Below, we address your comments about the simulations' reliability, model evaluation, and the presentation of the results.

Section 2.1: The lake is divided into four distinct basins, but the basins should be presented in the figure. The lake has an average depth of 3.5 meters and is driven by meteorological factors. However, it remains unclear to what extent the lake is stratified. Are there specific observational data to support this? Since the lake is divided into four basins, one monitoring point seems a bit insufficient to be comprehensive. Additionally, what indicators are being monitored at this single monitoring point in Fig. 1? Although ECMWF and FORESEE are only used for prediction analysis, and direct comparison among multiple schemes can eliminate the influence of their inherent errors, validation against ground observation data is still necessary.

The comments relating to Sections 2.1 and 2.4 are strongly correlated, and we address them together below the next comment.

Section 2.4: Regarding the lake model, it is a one-dimensional model—can it effectively carry out thermodynamic simulations of this lake? Additionally, when setting the model parameters and boundary conditions, the authors cited many references for support, yet there is a lack of observational data to underpin the model construction process. For example, how does this one-dimensional vertical lake model account for lateral inflow and outflow? The previous text mentioned that the lake is divided into four zones. Through different water depth settings, which zone's thermodynamic stratification does this model actually represent? For example, regarding parameters and variables, water density is related to temperature, and the calculation formula should be provided. Additionally, how is the wind speed on the lake surface considered? These key aspects are not addressed.

We believe that the division of the distinct basins is irrelevant given the lake's relatively simple bathymetry. The depth increases quite quickly around the shorelines, and most of the lake's open water areas possess very mild slopes. In addition, the lake's throughflow is negligible. The area of the lake is 596 km² with a mean depth of 3.5 m, while the mean flow of the largest tributary is only 4.5 m³/s, and the outflow is almost zero due to water level regulation. This results in a very high residence time of more than 2 years. Altogether, this means that meteorology uniquely drives the hydrodynamic and thermal dynamics in the case of Lake Balaton. Due to the lake's simple bathymetry – the lake is like a pan – spatial variability plays a weak role in long-term climatic variations, including both temperature evolution and stratification. A good, convincing example of this is that stratification intensity strongly correlates with bathymetry, as shown in Fig. 11 of Lükő et al. (2026), who conducted a 3D model analysis of stratification using varying wind-forcing models for the same period that we used for model calibration.

The chosen monitoring location represents the entire lake well, as it is located in the middle of the basin and has a water depth very close to the lake's average. There, all the necessary

hydrometeorological variables were monitored: wind, air temperature and humidity, four components of radiation, turbulent heat fluxes, vertical profile of water temperature, and sediment heat flux. We didn't intend to show the measurement setting, as it was already provided in the referenced paper (Török and Torma 2025), along with detailed model calibration, validation, and evaluation against ground observations. See Figs. 1, 2, 3, and the supplementary material of Török and Torma 2025. This also included the evaluation of the modeled turbulent heat fluxes at the air-lake interface and the applicability of reanalysis data. Since these results have already been published, we believe it is neither necessary nor appropriate to repeat them in another article. Nevertheless, we will provide a brief summary of the model's accuracy in the revised manuscript.

References:

Lükő, G., Krámer, T., & Torma, P. (2026). Effects of spatial wind variability on currents and temperature dynamics of shallow lakes. *Journal of Great Lakes Research*, 52(2), 102775. <https://doi.org/10.1016/j.jglr.2026.102775>

Török, S. D., & Torma, P. (2025). Long-term changes in summer stratification of a shallow polymictic lake by climate change and anthropogenic water level regulation. *Science of The Total Environment*, 1009(October), 181025. <https://doi.org/10.1016/j.scitotenv.2025.181025>

Section 3.1: What is being validated in the figures and tables (Fig. 3 and Table 1)—water temperature or air temperature? Additionally, for the validation results, it is recommended to present them using scatter plots or similar methods, rather than just probability density curves. Since the key to this study is the generation of high-resolution input data, the reliability of the results generated by the combination of multiple models in this part needs to be thoroughly validated.

In Figure 3 and Table 1, water temperature and stratification are shown as stated in the captions and the text. The recommendation to present the comparison using scatter plots is pointless, since these are the simulation results of the lake model forced by the meteorological time series generated by the weather generator. The weather generator provides synthetic time series for the required variables, as climate models do for the future. The key of weather generation is that we can create time series with subdaily resolution from daily datasets. Still, the generated high-resolution time series don't correspond to the given days. The weather generator generates time series with the same climatic features. With this figure and table, we aim to show that, for the present period, the simulated lake climate conditions in terms of temperature and stratification are well captured by the generated subdaily meteorological time series based on daily inputs, indicating that the weather generator can perform temporal downscaling while retaining the climate.

Section 3.4: Regarding lake stratification, it seems that the paper uses the potential energy anomaly index, which is calculated based on the water temperature profile. First, the specific simulation results of the water temperature profile are not presented anywhere in the text. Second, how this index actually indicates vertical stratification in the lake is not clearly explained. Although this index may be a quantitative measure, there are many well-established indicators for lake stratification that might be more convincing than the one used in this paper, such as the Schmidt Index, Lake Number.

Yes, we agree that it might be beneficial to also show the temperature profiles alongside the potential energy anomaly. However, we didn't want to repeat ourselves, as this had already been done in the referenced papers (Török and Torma 2024, 2025). In the revised manuscript, we will provide figures about the vertical profiles.

The applicability of the potential anomaly index has been demonstrated in several papers for Lake Balaton (besides the mentioned papers, see e.g., Istvánovics et al. 2022). The reason is that the lake has very flat bathymetry. The surface area change as a function of water depth is almost zero (<3%), even outside the range of natural water-level variation. Thus, morphometry doesn't play a visible role in stratification strength. As a result, the Schmidt Number (St) and the potential energy anomaly index (ϕ) provide the same insights into stratification intensities and temporal evolutions. The Lake Number (L_N) and Wedderburn Number (W) are suitable for deep lakes because they use parameters related to the hypolimnion and epilimnion. In such shallow environments, with diurnal setting and breakup of stratification, these layers cannot develop. To prove this, we provide a measured and characteristic time series from the monitoring station below. In the upper panel, lines of different colors show the measured temperatures at different depths, while the other panels show the different stability indices. St and ϕ have the same curves, while L_N and W fail to indicate stratification in several days.

