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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Evolution and dynamics of the vertical temperature profile in an oligotrophic lake" *by* Zvjezdana B. Klaić et al.

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First, we would like to thank Referee #1 for useful comments. Our response is as follows.

Comment: In the paper, the authors do a thorough analysis of a single lake in Croatia. They look mostly at observations in the lake and at a meteorological station located on land to the north from the lake observation point. Authors discuss the evolution of thermocline, pycnocline and investigate properties of internal and surface seiches in the lake. The analysis methods are solid and well explained. It would be easy to reproduce when the data become available, I appreciate the authors' efforts in this regard. I find that the manuscript is well written and I only have a few minor comments

and suggestions. Science: Since the meteorological and lake observation points are not co-located that could introduce uncertainties in the analysis of the causality of forcing on the lake conditions. Have you tried to ensure that those uncertainties are small?

Response: Regrettably, we do not have co-located meteorological and lake-temperature data to assess the possible uncertainties. However, the lake and meteorological measuring sites are very close to each other (distance $\approx$ 1.6 km, Figure 1, right). Generally, we would expect larger differences in meteorological conditions between the two sites if they were separated by one or more topographic obstacles. Topographic obstacle(s) may affect local meteorological conditions due to up- and down-slope winds, blocking of the airflow and other influences. Here, the meteorological site is positioned on the first slope next to the lake and there are no topographical obstacles between the two sites. Thus, we assume that meteorological conditions at the two sites are very similar. Some small differences in meteorological conditions may occur, such as slightly stronger winds over the lake in comparison with winds above the ground (due to the weaker surface friction) or slightly lower/higher air temperature above the lake during the day/night (due to different heat capacity of water and soil). Nevertheless, main characteristics of meteorological forcing, as are, for example, diurnal periodicity of both the air temperature and wind speed and strength of the airflow, which are important for the present study, are expected to be very similar at the two sites.

Comment: When you were selecting independent variables for the multivariate linear model you have rejected air humidity due to the high correlation with air temperature. What is the correlation value? I am concerned as to how the linear relation (10) eliminates all the high-frequency variability from wind and temperature data. Have you divided the data into fitting and validation parts? Validation should be performed over data that were not used during fitting (i.e. estimation of the parameters). Were the data from the monthly routine measurements by the PLNP used during the parameter estimation for the multivariate model?

Response: Based on Referee #2's suggestion, we decided to remove the section 4.5 Multiple linear regression model for near-surface lake temperature from the revised manuscript. Nevertheless, we would like to answer Referee #1's questions regarding multivariate linear model. Yes, we rejected the air humidity due to the high correlation with the air temperature. Correlation coefficient between the air temperature and the relative humidity (calculated from 2920 pairs of hourly data) is R = -0.63. Thank you for drawing our attention to the importance of data division into fitting and validation parts. In the previous manuscript version we did not divide the data. In the meantime, the new dataset (summer 2019) became available, so we validated the model based on the new data. Results are shown in the Fig. 1 of the present response.

Finally, monthly routine measurements of the lake temperature performed by the Plitvice Lakes National Park (PLNP) where not used while building the multivariate model. Model coefficients were determined on the basis of hourly meteorological data and hourly lake temperature data, the latter being calculated from 2-min values obtained in the framework of a temporary measurement program.

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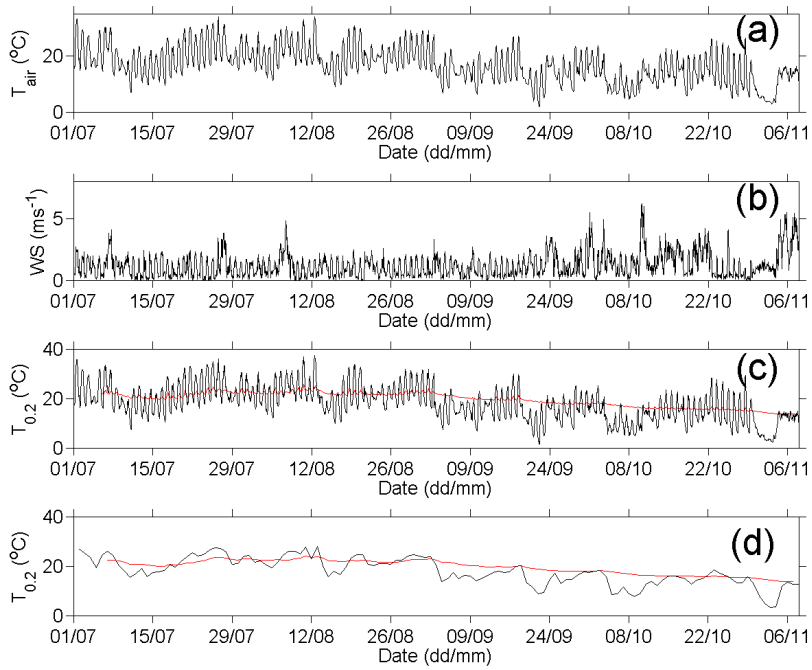

Fig. 1. Observed air temperatures (a) and wind speeds (b). Modeled (black) vs. observed (red) lake temperatures (0.2 m) at hourly (c) and daily (d) resolutions for validation dataset (7 Jul – 6 Nov 2019).