

# **The Effect of the Choice of Model Calibration Procedure on the Projection of Lake Surface Water Temperatures for Future Climatic Conditions**

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## **Abstract**

This study investigates the influence of the calibration procedure on projections of surface water temperature in lowland lakes using the air2water model, which relies exclusively on daily air temperature as input. The analysis encompasses 22 Polish lowland lakes in the temperate climate zone, with surface areas ranging from 1.5 km<sup>2</sup> to 115 km<sup>2</sup>, and maximum depths ranging from 2.5 m to 70 m. Projections were derived using 14 EURO-CORDEX climate models and 12 optimization algorithms.

Lake surface water temperature and daily air temperature observations for the period 1987–2016 were used for model calibration and validation. Future air temperature time series (2006–2100) from 14 climate models were applied to project future lake surface water temperatures under the RCP8.5 emission scenario.

Results indicate that the projected lake water temperatures highly depend on the calibration method used for a specific model. The differences in mean monthly surface water temperatures under future climate conditions can exceed 1.5°C for small, deep lakes, while for shallow and relatively large lakes, differences are typically lower than 0.6°C for each month. The most pronounced differences occur in winter and in early summer periods that are crucial for aquatic biota. Among the optimization algorithms that resulted in the most significant differences were those that fit historical data well and those that did not reproduce historical data adequately. Therefore, high performance of historical data does not guarantee reliable predictions of future conditions.