

## ***Interactive comment on “Determining lake surface water temperatures (LSWTs) worldwide using a tuned 1-dimensional lake model (FLake, v1)” by A. Layden et al.***

### **Anonymous Referee #2**

Received and published: 23 November 2015

I have one comment. On p. 8553-8554 (2.2.2 Fixed model parameters), authors listed parameters that remain fixed through the study and stated that water-to-ice heat flux ( $Q_{wi}$ ) of  $5 \text{ W/m}^2$  is applied to all lakes. To my knowledge, it's a strong overestimation. Malm et al. (Temperature and salt content regimes in three shallow ice-covered lakes: 2. Heat and mass fluxes. 1997. Nordic Hydrol., 28, 129-152) have shown temporal-spatial dynamics of  $Q_{wi}$  in shallow lakes. As it comes from their results, which can be considered as typical for shallow boreal lakes,  $Q_{wi}$  values for the main winter course - the ice thickness grows until early-spring radiative warming starts - are on average less than  $1 \text{ W/m}^2$ . During the 'warming' period, when ice starts melting,  $Q_{wi}$  may grow up to  $10\text{-}15 \text{ W/m}^2$  due to rise of water temperature in the gradient layer beneath the

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ice. Concerning deeper lakes ( $D > 15\text{--}20$  m), they usually get ice-covered much later than shallow ones. As a result, a greater loss of heat leads to water temperature in the upper part of a water column close to zero. Thus,  $Q_{wi}$  in deep lakes is close to zero as well. In FLake, ice 'grows' mainly from below unless a snow cover is present, and  $Q_{wi}$  is one of the main parameters in the process. I dare assume that ice thickness in calculations performed was erroneous. This, in its turn, demanded a kind of extra-tuning to adjust ice-off dates to realistic values. All the tuning described inevitably produces unrealistic results on the water temperature vertical profile and depth of the mixed layer. Then, my questions are: 1) what is a main objective of the study? 2) who are expected to be end-users of a tuned model? Both subjects are not mentioned in the text.

For now:

Scientific significance: Does the manuscript represent a substantial contribution to modelling science within the scope of Geoscientific Model Development (substantial new concepts, ideas, or methods)? 3 Scientific quality: Are the scientific approach and applied methods valid? Are the results discussed in an appropriate and balanced way (consideration of related work, including appropriate references)? Do the models, technical advances, and/or experiments described have the potential to perform calculations leading to significant scientific results? 3 Scientific reproducibility: To what extent is the modelling science reproducible? Is the description sufficiently complete and precise to allow reproduction of the science by fellow scientists (traceability of results)? 3 Presentation quality: Are the methods, results, and conclusions presented in a clear, concise, and well-structured way (number and quality of figures/tables, appropriate use of English language)? 3

Technical comment: it would be reasonable to add a reference on the FLake description:

Mironov, D., Heise, E., Kourzeneva, E., Ritter, B., Schneider, N. & Terzhevik, A. 2010:

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Implementation of the lake parameterisation scheme FLake into the numerical weather prediction model COSMO. Boreal Env. Res. 15, 218-230.

and correct 'Mironow' to 'Mironov' in the present List of References.

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Interactive comment on Geosci. Model Dev. Discuss., 8, 8547, 2015.

**GMDD**

8, C3023–C3025, 2015

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