

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-234

Anonymous Referee #1

Referee comment on "SELF v1.0: A minimal physical model for predicting time of freeze-up in lakes" by Marco Toffolon et al., Geosci. Model Dev. Discuss.,
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The authors propose a simple model of the seasonal lake cooling leading to formation of the ice cover. The model is calibrated and tested on data from alpine lakes and on outcomes of a one-dimensional process-based model. The model is of potential use in research on the lake ice cover formation and in lake-related applications. The fivefold variability of the main tunable parameter η between the five tested lakes (Table 2) raises however concerns about applicability of the model on large spatial scales. Another point of criticism is the description of model hidden largely in the supplemental, which is rather uncommon for a modeling journal and distracts the reader. Otherwise, the study is well conceived, applies adequate methodology and clearly written. Below are a couple of minor technical remarks.

L42: The description of the models cited in this paragraph needs refinement. "Statistical approach" is not a proper definition here; the model of Rhode (1952) and Billelo (1964) is not statistical. Leppäranta did not propose any model of ice formation in his 1993 paper.

L168: "The model SELF does not admit an analytical solution in closed formed." - the sentence is unclear. Does it mean the equation is not solvable in quadratures? Reformulate in a clearer way.

L238: "a.s.l. (above sea level)" - replace with "above sea level (a.s.l.)"

L249, L286, Fig. 3 and elsewhere: Replace "performances" with "performance".