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Hydrology and Earth System Sciences
Discussions

Interactive comment on "The influence of albedo parameterization for improved lake ice simulation" *by* Alexis L. Robinson et al.

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This manuscript presents an analysis of how a lake-ice model (CLIMo) simulates ice thickness and ice-off dates for two High arctic and two temperate lakes. Two reviewers asked for clarifications about the method and gave constructive feedback on the content of the paper, one recommended major revisions, one rejection.

The objectives of the study are summarized as (introduction): "This research compares ice cover simulations from High Arctic and temperate region lakes to illustrate the latitudinal differences in lake ice properties and presents refinements to CLIMo to better simulate ice thickness and ice-off timing in the temperate region."

As evident from the manuscript and the public discussion, the first part of the above

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Discussion paper

objectives is met in the sense that the paper discusses two different sets of lake simulations. The differences are summarized at the end of Section 4.2: “The white ice formed in the temperate region presents a challenge within CLIMo with regards to adequately simulating thickness throughout the ice-covered season, since the model does not currently include the contributions of midwinter rain or meltwater refreeze on the ice. The current black ice (Arctic-based) parameterization also contributed to underpredicting ice-off dates because the expected black ice (versus the actual white ice) has a lower albedo, which results in a more rapid melt once underway. Therefore, to adequately represent ice thickness and melt simulations in the temperate region with CLIMo, the albedo needs to be parameterized using field data that is representative of temperate lakes.”

The second objective is in my view only partly reached: in fact, rather than refining the model (i.e. the model physics via its parametrization), the paper proposes to replace the default albedo (parameter) values by the average observed values.

The finding that the use of average observed albedo values leads to good model performances for two case studies is certainly valuable; or as stated in the public discussion, “The current paper is the first exploration of adjusting the model for temperature regions.” In other words, this paper represents the application of an existing lake ice model to four case studies, with modified parameter values for the two of them. The model application and performance assessment required an important amount of observational data and data processing.

However, the overall result is in my view, not sufficient to justify a publication in HESS, whose scope is to publish “Research articles [that] report on original research which clearly advances our understanding of hydrological processes and systems, and/or their role in water resources management and Earth system functioning as detailed in the journal’s aims and scope”.

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