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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Impacts of changes in groundwater recharge on the isotopic composition and geochemistry of seasonally ice-covered lakes: insights for sustainable management" *by* Marie Arnoux et al.

Anonymous Referee #1

Received and published: 8 July 2017

The manuscript presents the results of a model to simulate the isotopic composition of small groundwater-connected lakes in different locations under different future climate scenarios. The approach is not new, however is interesting for the projections and the considerations discussed for future climate scenarios and recharge conditions. In particular, it provides a useful tool for improving our understanding of catchment hydrological processes. Hence, this is a nice work and warrants publication in this journal. However, I have noted a few issues that need to be addressed before the manuscript is considered for publication. Please see my specific comments below

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Discussion paper

The authors used a lake water budget where the inflow by runoff is considered negligible. This consideration is not explained and there are not geological and hydrogeological description in the paper that could justify this. So, I suggest the author to briefly justify this sentence.

The author assumed a steady state condition for the lakes, it could be under present condition but how it's not clear how this assumption could be true when the authors run future scenario. Under climatic changes and different recharge conditions, are these assumptions satisfied or there is a range in which they could be considered valid? Please, may the authors argument better this part.

In the eq.9 (L231P9) there is the term (–B/V dt), I think that it is not correct because if eq.9 is the solution of eq.8 it means that the eq. 9 is the solution (hence without dt). Please revise or better justify this passage.

The authors do not report the isotopic data, but they say that samples were collected from the top of the epilimnion and from the base of ipolimnion, in case of lake water stratification. But it's not clear what values they use in the model? Average? But in this case for evaporation what values do they use? Please detail this. I suggest also to add a table with isotopic data of lake groundwater and rain water and for Lake Lakasse a figure illustrating the variation of isotopic composition monthly. This could better show the influence of melting periods; hence the authors say that in the 8.5 scenario the isotopic composition would decrease because of melting effect, but in the text, there are not data that support these (or references). Please add data or references.

Do the authors test the sensitivity of the model to investigate the dominant controls on the lake isotope system (a good reference is: Jones et al., 2016. Quaternary Science Reviews, 131:329-340)?

May the authors describe better how they calculate or estimate evaporation (E)?

What values of humidity do the authors use? (ie. from meteorological station?)

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Discussion paper

The authors repeat in the abstract, in the introduction and in the conclusion that the paper illustrated the effect of future trend on lake geochemistry, but in the paper they discuss only the isotopic composition of water and some consideration about phosphorus load. There are not discussion or results about geochemical data (ie. pH, anions, cations, alkalinity, oxygen dissolved in water...), so I advise the authors to add these data or discussion or to delete the sentence.

In my opinion, the last paragraph about phosphorous is not well connected with the previous part dealing with isotopic model and future scenario. I suggest to link these two parts. Moreover, the phosphorous geochemical behaviour should be different in stratified lake with anoxic water at the bottom. It's not so easy to estimate the quality evolution along different lakes. Do the authors consider the lake geochemistry and thermal/oxygen stratification when they discuss about P load on different lakes?

L183P7: Is the accuracy calculated in relation to deviation of international standard? And wahat are the international standards used? What is the reproducibility?

Is the parameter B (L230P9) m3? I think that is should be a Volume/time.

L271P10: Flake? Is it a typo?

Fig.4: what does the box-whisker describe? (average/median and standard deviation/confidence range/non-outlier min and max?)

L474P20: "...significant relationship..." what does it mean statistically? Do authors perform statistical test? And what?

Fig.9: It's not clear what this figure illustrates. Do they points represent P loads? Is it the results of the model? Please, explain better what the figure wants to describe.

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