Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-184-RC2, 2017

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 #2

Received and published: 16 July 2017

General comments:

The authors present an interesting study of the variability of the isotopic composition and geochemistry in kettles lakes due to the future variability of recharge and climate. In this aim, the authors compare the measured δ18O and δ2H in several kettles lakes at annual and monthly intervals and the modeled δ18O and δ2H. The modeled isotopic composition of lake is estimated from climate and estimation recharge models. The modeling results are used to determine if the future evolution of the climate and the recharge could modify the isotopic signature of lake and if the isotopic monitoring in

lakes could be an efficient tool to highlights the variability of water budget and quality. The modeling results have be well analyzed and interpreted, and the authors explain well the assumptions and the limits of their results. The authors study also the water quality but only by the phosphorous. This part, for me, is not really on the topic of this article, less argue than the part about isotopic signature, and maybe not necessary.

Specific comments:

The paper is relatively clear, well written, well structured. Nevertheless, some parts are too long and descriptive and has to modify for a better understanding, notably in the part of results and discussion.

Abstract: The abstract is completed and structured, nevertheless the scientific problematic is not really highlighted, could you add a sentence explaining more clearly the problematic of the paper.

Introduction: Line: 86-88: the interest of this sentence and the link with the end of this paragraph is not clear. Please modify this sentence. The study is based on kettle lakes, this methodological choice should be exposed in the introduction.

Methods: Line 187-190 : the sentence is not clear; please modify it. Water mass balance: several assumptions (Is=0, Ir=0) has not justified, could you please add a sentence to justify this hypothesis. Line 251-254: this sentence is not clear; please modify it. Paragraph evolution scenarios: an introductive sentence could allow a better understanding of this paragraph reminding the interest and using of these models in the study. Line 296-297: Please explain the interest to work with two period, a reference period and future period. Indeed, the reference period is largely in the future. Please explain moreover the choice of 2040 for the transition between these two periods. Figure 2: what represent the dotted line? Fig. 3: It's difficult to understand which model is used, could you clarified this in the caption. In the text, we can suppose that the fig.3a is a result of the publication Arnoux et al., 2017b, if it is the case, could you add the citation in the caption?

Results and discussion:

Monthly evolution of lake isotopic composition Line 373: please, remind quickly how the G-index is measured. Fig. 4: the interest of the close-up is relatively low, without its, the figure will be clearer. Fig. 5, line 389-393: the link between the figure and the interpretation is not clear. We talk about on one hand of reference period on the other hand of the future period while in the figure, the difference between reference period and future period is illustrated.

Annual isotopic signature evolution, isotopic signature evolution. This paragraph is not clear. Indeed, first, line 456-458 the authors explains that lakes with a low G-index and a small volume have higher potential variability in isotopic composition than those with a high G-index and high volume but to illustrate the remark, they used two lakes with a similar mean G-index. Secondly, line 463 to 464, the authors write that "when lakes have a high G-index, the groundwater flux tends to buffer lake isotopic variations, and so they tend to be less sensitive to changes in climate data", but the authors don't give some arguments (results or figure). Please, be clearer. Furthermore, this sentence is not consistent with the figure 8, and the explanation line 476 to 477 " lake isotopic composition is more sensitive to changes in recharge for G-indices ranging from 50 to 80%, with a maximum of sensitivity observed for a G-index of around 65 %. Please clarified this paragraph.

Lake quality evolution This part of the article is disconnected of the other results, where the isotopic variability is analyzed. The scientific interest of the part about the P is really lesser than the rest of the article and not necessary.

Conclusion: This part is clear and well structured. Just, please highltied that when you talk about water,quality you study only the evolution of P. Moreover, the sentence, line 573-575, underlines that the part about P is based on several assumptions (not exposed in the article) and that this part is maybe not necessary on this article.

Technical corrections:

Line 188 : two weeks Line 205: avoid that the (δp) is not at the same line that precipitation. Line 211: the equation is in subscript. Line 263: two time-levels Line 333: add parenthesis for Rivard et al., 2014, same line 343. Line 364: check the English Figure 6: be careful the indicated period is different between the text and the caption. Line 462: be careful for the reading of the lake volume. Same line 466

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2017-184, 2017.