

Interactive comment on “Hydrological, chemical and isotopic budgets of Lake Chad: a quantitative assessment of evaporation, transpiration and infiltration fluxes” by C. Bouchez et al.

J. Gibson (Referee)

jjgibson@uvic.ca

Received and published: 8 January 2016

The manuscript presents a newly developed first-order hydrological, geochemical and isotopic mass balance analysis of Lake Chad. The topic is relevant to the scope of the journal, and overall the presentation is excellent and the theory, results and discussion are very informative. While the authors' have done a satisfactory job to include as much detail as possible in a normal length article, I suspect that the broad scope of the paper has made it difficult to cover all aspects of the work in sufficient detail to appease all readers (myself included) with interests in specific aspects of the work (such as in the isotope mass balance). While it might have been useful first to summarize each

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper



component in a separate, more detailed paper, I can also appreciate the added value of an integrated approach and discussion as presented. I therefore recommend publication with minor revisions to address and improve the discussion/presentation of the following issues: The first issue that I have with the paper is that the figures are illegibly small, and it is therefore recommended that they be enlarged (Figure 7 and especially Figure 8) or reformatted if necessary. Currently, it is somewhat difficult to evaluate the results. One issue for the isotope balance is that it is not specified whether humidity has been normalized to the surface temperature of the lake. It is also not clear what value is used herein for θ . The value used by Gat for the Mediterranean Sea is referred to but this value is not likely appropriate for a lake. Also, it appears also that isotopic composition of regional atmospheric moisture was measured approximately monthly and only during 2012. What additional assumptions were used to estimate the isotopic composition of atmospheric moisture and evaporate when the analysis was extended on a daily basis back to 1950s? The sensitivity of the input variables, as summarized in Figure 2, especially vapour do not appear to be reasonable for a daily time step. One issue that is not discussed is if any corrections or adjustments were made in applying the regional atmospheric moisture estimates to solve the lake isotope balance. Due to the large size of the lake, the isotopic composition of the lake evaporate likely plays a significant role in modifying the local atmosphere of the lake, an effect described and quantified by Jasechko et al. (2014) for the Laurentian Great Lakes. Feedback of evaporate to the atmosphere likely also varies depending on the lake state, either normal or shrinking. Were any such corrections made in the analysis, and how sensitive is the model to such uncertainties? It would be beneficial to illustrate and/or discuss this sensitivity. I suggest that if this is too much of a diversion from the context of the paper that some information on this be included in the supplementary material. Cross plots of d2H-d18O showing the isotopic composition of atmospheric moisture, evaporate, lake water and modelled ranges would certainly assist in evaluating the realism of the isotope mass balance simulations. Comparison between the three methods might be improved by showing some cross-plots of selected parame-

ters to give the reader another perspective on uncertainty in the results. Minor issues include: quaternary should be capitalized throughout the paper. Table 1 is informative, but it is suggested that an equivalent table be provided summarizing volumetric fluxes in m^3y^{-1} . References Jasechko, S., Gibson, J.J., Edwards, T.W.D., 2014. Stable isotope mass balance of the North American Great Lakes, *Journal of Great Lakes Research* 40, 336-346, <http://dx.doi.org/10.1016/j.jglr.2014.02.020>.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 11173, 2015.

HESSD

12, C6018–C6020, 2016

[Interactive
Comment](#)

[Full Screen / Esc](#)

[Printer-friendly Version](#)

[Interactive Discussion](#)

[Discussion Paper](#)