

General opinion

This manuscript (hess-2016-692; Water resources in the Badain Jaran Desert, China: New insight from isotopes Xiujie Wu, Xu-Sheng Wang, Yang Wang, and Bill X. Hu) is a concise presentation of the application of well-established isotope techniques in identification of groundwater sources for a group of desert lakes in China. A relatively small amount of isotopic data points to recent precipitation being the sole source of water in the coupled groundwater-surface water system. The isotopic evidence for that seems to be unequivocal, however, some questions (see specific comments) should be addressed in order to strengthen the line of reasoning. On the other hand, data on stable isotopic composition of DIC are not used at all and the part explaining ^{14}C patterns requires some elaboration. Interpretation of presented data could be supported with a more detailed description of the hydrological setting and limnology of the lakes. Text reads well, it is comprehensible and clearly presents the context, goals and conclusions of the study, however the description of the sampling campaign needs to be improved.

My recommendation is to accept the manuscript after major revision.

Specific comments

1. Given that only few lakes were sampled a question arises, not addressed in the manuscript, if results of this study apply to all lakes of the Badain Jaran Desert. How big is the part of the desert where the lakes occur? It is not delineated on Fig. 1. Is the hydrogeological setting uniform throughout that part of the desert, so that the recharge – discharge pattern proposed in the manuscript might apply for the whole area?
2. Did conditions of evaporation during the evaporation experiments correspond to the period of infiltration (also for recharge areas in the mountains)?
3. (p. 2, line 25-27) Does this sentence refer to Qilian Mountains mentioned further in the discussion?
4. (p. 3, lines 8-9) What is the relevance of the information on the depth of root penetration?
5. Chapter 3.1 Field Sampling. This part lacks some detail on the study area and sampling procedures. How many lakes were sampled? Five, or also some other of the “various” lakes? Provide their surface areas, maximum depths and volumes if known and explain if these characteristics are typical for the region. Provide information on wells depths and screening intervals as this is important in evaluation of well samples. Are the wells regularly used? If not, then 20 minute long pumping (with a peristaltic pump?) might not be enough to obtain a representative water sample from the aquifer.
6. (p6, lines 23-25) Was the good vertical mixing of lake waters confirmed by measurements of temperature and conductivity?
7. (p. 9, lines 13-14) Are there any data on groundwater flow directions/hydraulic heads in the lake area to support this notion? Generally, the hydrogeological conditions are poorly explained in the manuscript.

8. (p.10, lines 5-14) The bicarbonate and $\delta^{13}\text{C}_{\text{DIC}}$ data do not support the gradual dilution of ^{14}C with the old inorganic carbon derived from carbonate dissolution along the entire groundwater pathway. Both parameters change significantly only between points WS2 to WS1 pointing to isotopic exchange as a cause of the apparent increase of radiocarbon ages between WS4 to WS2. This discussion would benefit from any quantitative considerations on the isotopic evolution of DIC along the transect. However, the conditions of carbonate dissolution and isotopic exchange are controlled by aquifer properties which are not described in the manuscript.

9. (p.10, lines 27-29) The vertical homogeneity of lake water implies only good vertical mixing. The (isotopic?) steady state is a separate issue and can be assessed only from the temporal patterns. Is there any evidence for lake waters being in the steady state? By the way, what causes vertical mixing of the lakes? Wind or diurnal water temperature fluctuations?

10. Figs. 1B and 8 are not consistent with respect to the relative positions of wells and the Sumu Jaran Lake. The lake is located between W3 and W2 in Fig. 1B and to the west of W1 in Fig.8.

Technical comments

(p. 1, line 26) please remove "arid regions"

(p. 7, line 22) "and ARE strongly"

Fig. 7. Should be "brackish" not "blackish"