

The Cryosphere Discuss., author comment AC1
<https://doi.org/10.5194/tc-2022-43-AC1>, 2022
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Reply on RC1

Jiule Li et al.

Author comment on "Late Holocene glacier variations in the central Tibetan Plateau indicated by the $\delta^{18}\text{O}$ of ice core enclosed gaseous oxygen" by Jiule Li et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-43-AC1>, 2022

Many thanks for your comments on our manuscript.

In our study we found a close relationship between the oxygen isotope composition of ice core air bubbles and the variation (accumulation or melting) of glaciers in the central Tibetan Plateau. This was based on the analysis about what caused the unusual fluctuation of the $\delta^{18}\text{O}$ of ice core air bubbles compared to the $\delta^{18}\text{O}$ of atmospheric air. As we mentioned in our study, it was not only related to the thickness of the firn layer which could lead to the gravitational settling of oxygen isotope, but also to the complex isotope fractionation processes happened during the closure and storage of air in the ice through a series of physical and chemical processes via strong ultraviolet radiation at high altitude. These processes would happen when the regional temperature was high and there was meltwater in the firn layer. These conclusion was consistent with what you mentioned about the knowledge of the relevant physical processes such as isotope fractionation by dissolution of oxygen gas in meltwater, or gravitational settling, or kinetic fractionation during disequilibrium dissolution of oxygen gas in liquid water. So, it was not just as a proxy for aridity versus intervals of snowfall sufficient to maintain a firn layer, but a proxy for increase or melting intensity of the firn which is closely related to the advance or melting of the glacier.

This conclusion and correlation are strongly supported by the comparison between the variations of $\delta^{18}\text{O}$ of ice core air bubbles and the regional glaciers. So, it could be used to reflect the regional glacier variation in the central Tibetan Plateau.

Thanks again for your comments.