

Interactive comment on “Glacial–interglacial shifts in global and regional precipitation $\delta^{18}\text{O}$ ” by S. Jasechko et al.

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Re: C294: 'comments', Ph. Négrel

We thank Ph. Négrel for his positive comments on our manuscript and for his fair and useful suggestions that helped us to improve our manuscript.

Jasechko et al. present a set of literature data regarding stable isotopes in different supports (groundwater, speleothems, ice...). They investigated the glacial-interglacial periods between 50-20ky and 5-0 ky. The compilation, even not fully complete but still impressive, will help using the stable isotopes as a supplementary constraint for investigating the climate and its evolution. The ms. is well written and do not need substantial changes. There is however a need for a more

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convincing demonstration by adding in the main text several items. Among this, the two mains are: - Define in the main text what is the D18O ice age (SS2 supplementary material for giving the readers the complete view of this parameter used in the discussion. In the main text we define $\Delta 18O_{\text{late-glacial}}$ as “Proxy-based meteoric water $\delta 18O$ changes from the latter half of the last glacial time period to the late Holocene are described herein as measured $\Delta 18O_{\text{late glacial}}$, where measured $\Delta 18O_{\text{late glacial}} = \delta 18O_{\text{late glacial}} - \delta 18O_{\text{late Holocene}}$.” The time intervals are described in the preceding paragraph.

Add figure S2 in the main text and corresponding description. We include current Figure S2 in the main text of the revised manuscript.

p837, line 10 please be careful. Here it is stated that the study is conducted using groundwater, ground ice, glacial ice and cave calcite records while p835, line 0-5 it is said that this study focused primarily on groundwater. Clarify and/or homogenize. We revise our previous statement to make clear that our study focuses on groundwater isotope records due to their relative density compared to speleothem and ice core isotope records: “This study examines speleothem, ice core and groundwater isotope records, focusing primarily on the groundwater isotope records due to their relative density in the published literature in comparison to the more limited number of published speleothem and ice core records.”

P838, line 20 it is said that some studies/samples have been removed; a plot of the d2H-d18O would be useful for the reader. It may define the range between the different systems and would enable to view the variations related to the climatic period. We agree that plots of $\delta 18O$ - $\delta 2H$ are useful for visualizing simultaneous changes to $18O/16O$ ratios and to $2H/1H$ ratios. We point future readers to the original published works referenced in our manuscript that each show $\delta 18O$ - $\delta 2H$ plots. Data removed on the basis of possible evaporative isotope effects are included in a series of supplemental figures that show the groundwater age versus $\delta 18O$ or deuterium excess for each aquifer.

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P840, line 7, the differences between the reconstructed and simulated must be pointed out more precisely. It is crucial for the rest of the reading. We include a stand-alone paragraph that clarifies “measured $\Delta 18\text{O}_{\text{late-glacial}}$ ” describes proxy-based values, and “simulated $\Delta 18\text{O}_{\text{late-glacial}}$ ” describes model-based values: “*For clarity, empirical $\Delta 18\text{O}_{\text{late glacial}}$ values that are based on measured isotope contents of groundwater, speleothem, ground ice or ice core records are referred to herein as measured $\Delta 18\text{O}_{\text{late glacial}}$; simulated precipitation isotope compositions obtained from general circulation model results are referred to as simulated $\Delta 18\text{O}_{\text{late glacial}}$. We acknowledge that the general circulation models explicitly analyse the last glacial maximum and the pre-industrial climate conditions (i.e., simulated $\Delta 18\text{O}_{\text{late glacial}} = \delta 18\text{O}_{\text{last glacial maximum}} - \delta 18\text{O}_{\text{pre-industrial}}$), whereas proxy record reconstructions of $\Delta 18\text{O}_{\text{late glacial}}$ integrate hydroclimatology over multi-millennial time scales that are different from the model simulations.*”

P840, line16, undeniably no results in this ms, only a discussion of published results from the literature, delete results from §3 title. While we agree with the Reviewer that the data shown in this study have been presented in previous studies, we feel that our reanalysis of these synthesized datasets, sometimes derived from multiple publications for a single aquifer, warrants presentation of a “results” section for the following reasons: 1) few of the compiled publications explicitly describe the magnitude of $\delta 18\text{O}$ change from the late-glacial to the late-Holocene, especially in light of other regional records, 2) several of the compiled works do not focus on $\delta 18\text{O}$ changes from the late-glacial to more recent times, instead focusing on other uses of the data (e.g., Larsen et al., 2002), meaning that this study is the first to examine these data through a paleoclimate lens.

Larsen, F., Owen, R., Dahlin, T., Mangeya, P., Barmen, G. (2002), A preliminary analysis of the groundwater recharge to the Karoo formations, mid–Zambezi basin, Zimbabwe, *Physics and Chemistry of the Earth*, 27, 765–772.

P844, §3.3 I think Fig S3 would be useful in the main text to illustrate this §. May

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be this regional description can be compacted more. We will add the previous supplemental figures to the main text in our revised manuscript. We thank the reviewer for their suggestion.

P851, Conclusions. I would like to see a more consistent “perspectives” description to put ahead the results of this work in the wider context of studies on climate change We have added new text to the conclusions to place the synthesized isotopic data into context, pertaining specifically to ongoing climate change: *“Regionally-divergent precipitation $\delta^{18}O$ responses to the 4°C of global warming occurring between the late glacial and the late Holocene suggest that continued monitoring of modern precipitation isotope contents may prove a useful for detecting hydrologic changes due to ongoing, human-induced climate change.”*

Interactive comment on Clim. Past Discuss., 11, 831, 2015.

CPD

11, C700–C703, 2015

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