EGUsphere, author comment AC1
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Reply on RC1

Michael P. Erb et al.

Author comment on "Reconstructing Holocene temperatures in time and space using paleoclimate data assimilation" by Michael P. Erb et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-184-AC1, 2022

Thank you for these useful comments. The responses to your comments are below.

- Line 160, data assimilation: Franke et al., 2020 is a good suggestion. We will cite it.

- Figure 1: The figure is showing the calibrated data from the Temperature 12k database. Each record is represented as a colored horizontal line, with records arranged from north to south. The right y-axis helps show the latitude of the records. I will add additional text to the caption to clarify the right y-axis. As for Southern Hemisphere changes, the Southern Hemisphere mid-latitudes arguably do show a later timing of max temperatures than the northern mid-latitudes (compare the location of the black vertical lines), but it is noisy. This comparison would be aided by a larger network of Southern Hemisphere records.

- Table 1: Most of the proxy records come from the Northern Hemisphere, where winter insolation increased through the late Holocene and summer insolation decreased. Because of these insolation trends, it is not surprising that more of the annual and summer records show cooling than the winter records. It's possible, however, that other changes would be seen in a more spatially-complete proxy network.

- Line 271: We will emphasize the decrease in boreal summer insolation. For reference, boreal summer insolation is typically ~450 W/m2 and was ~25 W/m2 greater in the early Holocene, a difference around 5%.

- Lines 326-327: We agree. We will reinforce this point in the sentence.

- Lines 340-342 and lines 535-545: That's a good point: differences in proxy types may help explain some of the spatial variability in the Temperature 12k proxy database. Regardless, Fig. 4 in Kaufman et al. 2020 also shows a fair amount of similarity between composites using different proxy types.

- Line 374: We will emphasize this.

- Lines 411-412 and section 4.3: The issue of spatial and seasonal biases in the proxy network is an important one. As you mention, Southern Hemisphere and winter records are under-represented in the Temp12k database, and it would be great to have more. With that said, some reconstruction methods account for these biases: in the data

assimilation, spatial covariance patterns are used to help infer Southern Hemisphere temperatures; in Kaufman et al. 2020 ("Holocene global mean surface temperature, a multi-method reconstruction approach"), proxies are composited into latitudinal bands and averaged together using the relative area of each band, which gives the Southern Hemisphere signal the same weight as the Northern Hemisphere signal. In the data assimilation, covariance patterns are also used to account for proxy seasonality. More proxies would certainly be helpful, however. We will add additional discussion of biases to the paper.

- Figure 10: Yes, the variety of proxy temperature signals at 0-1 ka emphasizes the large amount of spatial variability in the proxy database.

- Line 463: Thank you. We will check to see whether additional new papers should be cited. Matero et al., 2017 is already cited.

- Citation Osman et al.: We will fix this citation.