Comment on egusphere-2022-184
Anonymous Referee #1

Referee 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-RC1, 2022

Review of the paper by Erb M.P. et al. entitled “Reconstructing Holocene temperatures in time and space using paleoclimate data assimilation”

General comments

The authors apply paleoclimate data assimilation to create a spatially-complete reconstruction of temperature over the past 12’000 years. They use proxy data from the Temperature 12k database and output from HadCM3 and TraCE-21ka. The high temporal resolution of the analysis allows insights into extreme events such as the 8.2 ka cooling period. Relative to the past millennium the study shows a warm peak near 6’400 years ago, which is with 0.09 °C cooler than in previous reconstructions. This is possibly a more realistic value? The paper is precisely written and convinces with a clear methodological concept.

Specific comments

-Line 160, data assimilation: An interesting paper was recently published in Climate of the Past by Franke et al. (Clim. Past 16/2020, p. 1061-1074).
-Figure 1: I do not understand the values -10 to -70 for the Southern Hemisphere on the right ordinate. Because of the inertia due to the huge ocean bodies, I would have expected a delay of the warmest decade in the Southern Hemisphere compared to the north.

-Table 1 / temperature trends 6 - 0 ka: The cooling during the LALIA and LIA was mainly dominated by cold winters. The low value of 34.5% is rather surprising.

-Line 271: I would emphasize that the insolation has strongly decreased during the boreal summer.

-Lines 326-327: This is another indication of the inertia of the Southern (Ocean-) Hemisphere.

-Lines 340-342 and lines 535-545: As Figure 4 in Kaufman et al. (Scientific Data 7:115) shows, it is of considerable importance that a distinction is made between different proxy types.

-Line 374: I would emphasise that Holocene insolation was MASSIVELY greater in the boreal summer.

-Comment to lines 411-412 and section 4.3.: The question arises to what extent the temperature increase in the late Holocene simulated by several models can be attributed to the influence of the Southern Hemisphere with its large oceans. Obviously, the number and quality of proxies from this region is insufficient. In general, the number of winter proxies is also very low. This is disturbing because the temperature variability in winter is high.

-Figure 10: The high number of positive anomalies for the period 0-1 ka is rather surprising.

Technical corrections

-Citation Osman et al.: The name of the paper (Nature 599, 239-244) is missing.