

Interactive comment on* “What was the source of the atmospheric CO₂ increase during the Holocene?” *by Victor Brovkin et al.

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This paper (*Brovkin et al.*, 2019) uses atmospheric greenhouse gases (GHG: CO₂, CH₄, N₂O, plotted in Figure 1b,c of the discussion paper) from spline routines based on various data sets. Since such a GHG data compilation exercise including the calculation of a spline has also been performed in a recent study (*Köhler et al.*, 2017), I asked the corresponding author to get access to their applied GHG time series to evaluate if and how they might differ from the final splines of this other study. I plot them here against these earlier results in the following figures 1–3. Spline routines applied here and there have been the same (developed by Fortunat Joos, University of Bern), but the underlying data and the chosen prescribed cutoff period P_c for the spline routines have been in detail slightly different leading to similar, but not identical

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splines.

For CO₂ (Fig. 1) both splines are nearly identical.

The CH₄ (Fig. 2) record in *Köhler et al. (2017)* is based on the WAIS Divide Ice Core (WDC) for large parts of the Holocene, that resolves multi-centennial variabilities, a small-scale feature that is ignored in the spline used in *Brovkin et al. (2019)*. This comparison also highlights, that the CH₄ data used in *Brovkin et al. (2019)* are not global mean values, but southern hemispheric values. Due to an existing interhemispheric gradient, northern hemispheric CH₄ (e.g. from Greenland ice cores) and therefore also global mean CH₄ values are slightly larger than the CH₄ values of the chosen southern hemispheric spline.

In N₂O (Fig. 3) the millennial-scale variability is slightly shifted in time between both splines, suggesting that the used age model of the underlying data might have been different.

The spline used in *Brovkin et al. (2019)* fall nearly always into the uncertainty bands ($\pm 2\sigma$) of the splines described in *Köhler et al. (2017)*.

For details of the spline method and further citations of the underlying data the reader is referred to *Köhler et al. (2017)*. Layout of figures and captions have been adapted from the previous paper.

I believe these underlying details of the method and data might be of interest to the readers of *Brovkin et al. (2019)*

References

Brovkin, V., S. Lorenz, T. Raddatz, T. Ilyina, I. Stemmler, M. Toohey, and M. Claussen (2019), What was the source of the atmospheric CO₂ increase during the Holocene?, *Biogeosciences Discussions*, 2019, 1–25, doi:10.5194/bg-2019-64.

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Köhler, P., C. Nehrbass-Ahles, J. Schmitt, T. F. Stocker, and H. Fischer (2017), A 156 kyr smoothed history of the atmospheric greenhouse gases CO₂, CH₄, and N₂O and their radiative forcing, *Earth System Science Data*, 9, 363–387, doi:10.5194/essd-9-363-2017.

Figure Captions

Figure 1: Atmospheric CO₂ spline and underlying data (2016 CE – 8,000 BP). Black spline as published in *Köhler et al. (2017)* against time series (gold) used in *Brovkin et al. (2019)*. Error bars around the ice core data points are $\pm 2\sigma$. WDC data have been adjusted to reduce offsets, see *Köhler et al. (2017)* for details.

Figure 2: Atmospheric CH₄ spline and underlying data (2016 CE – 8,000 BP). Black spline as published in *Köhler et al. (2017)* against time series (gold) used in *Brovkin et al. (2019)*. Details on plotted data are explained in *Köhler et al. (2017)*. The maximum ice core data uncertainty ($\pm 2\sigma$) is sketched in the lower left corner. Latitudinal origin of data is indicated by NH and SH, implying northern and southern hemisphere, respectively.

Figure 3: Atmospheric N₂O spline and underlying data (2016 CE – 8,000 BP). Black spline as published in *Köhler et al. (2017)* against time series (gold) used in *Brovkin et al. (2019)*. Details on plotted data are explained in *Köhler et al. (2017)*. The maximum ice core data uncertainty ($\pm 2\sigma$) is sketched in the upper right corner. Filled symbols: data taken for spline; open symbols: data not taken for spline.

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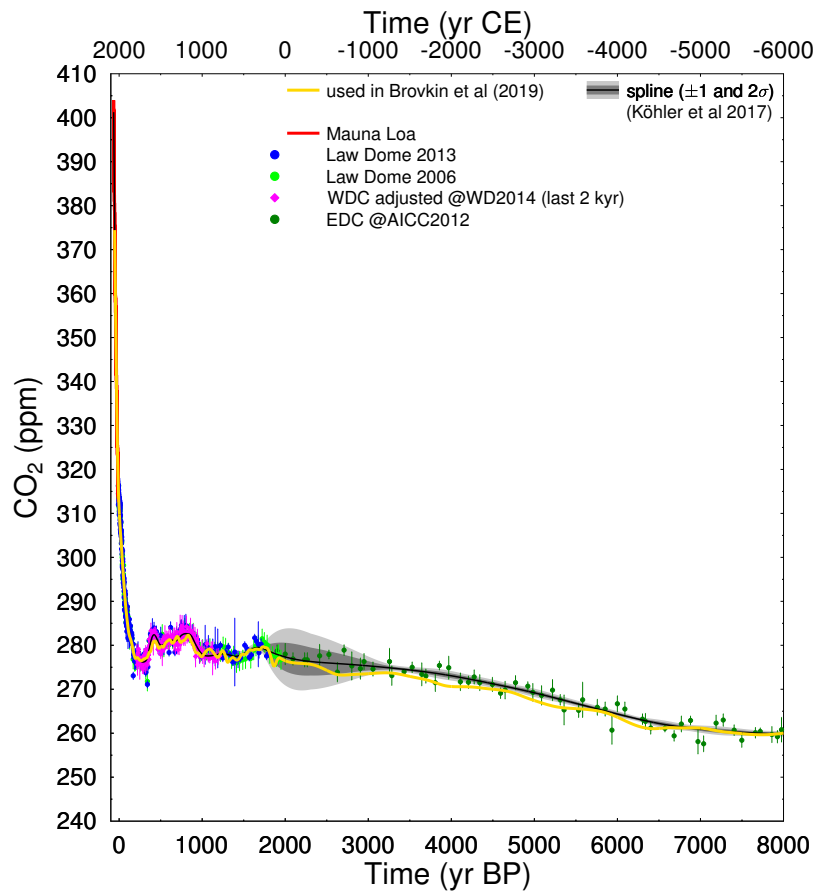


Fig. 1. Figure caption is contained at the end of text.

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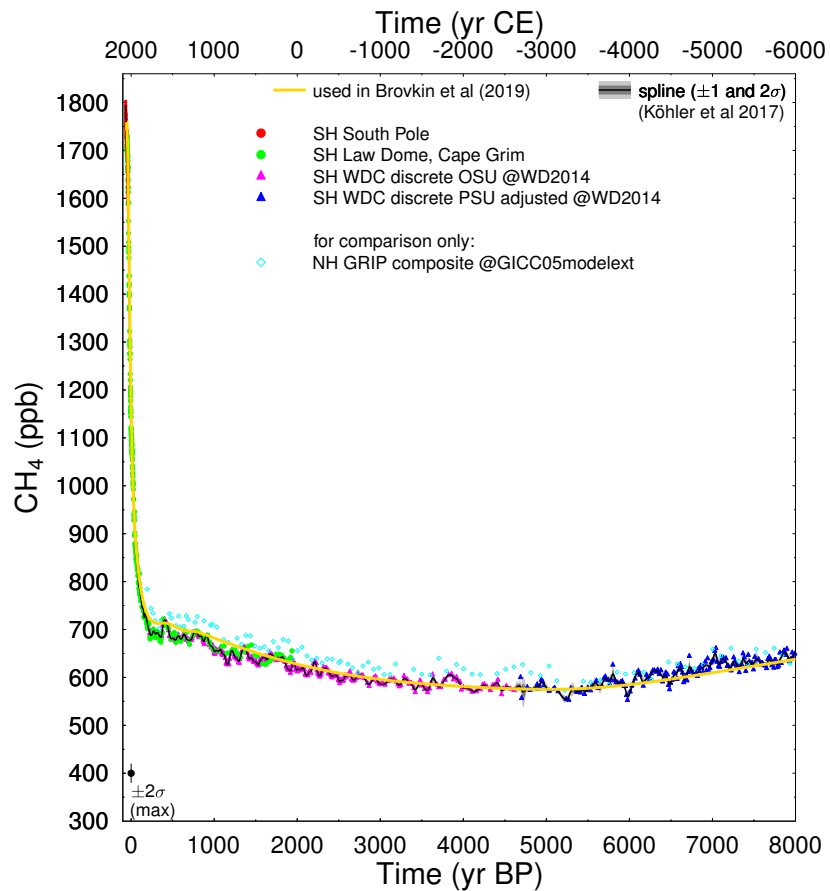


Fig. 2. Figure caption is contained at the end of text.

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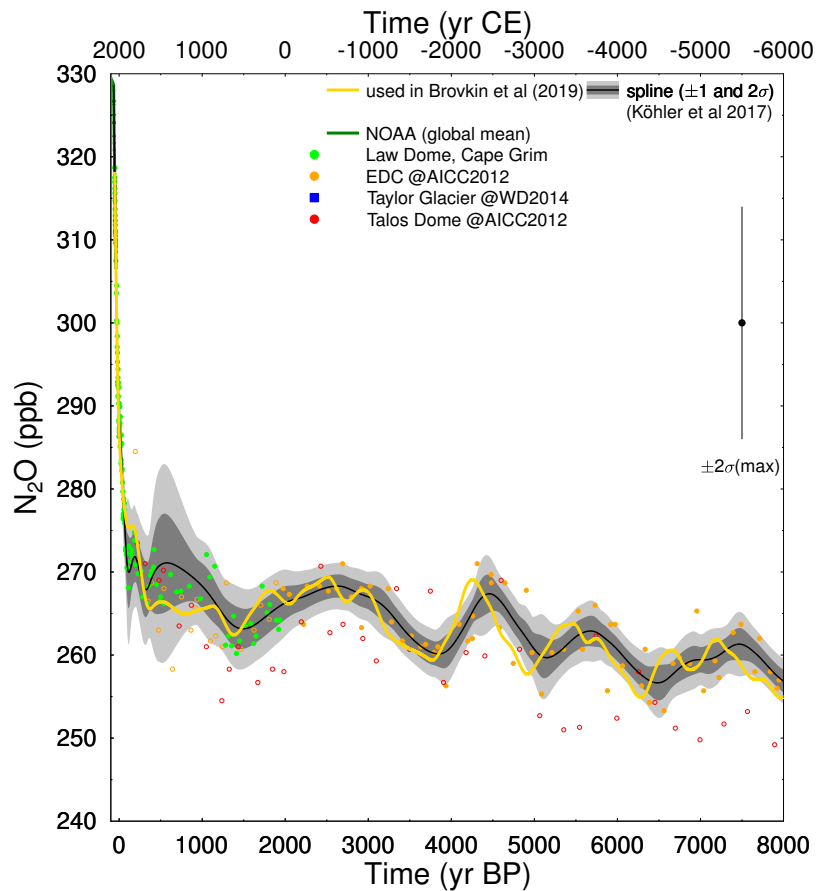


Fig. 3. Figure caption is contained at the end of text.

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