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Climate of the Past Discussions

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Interactive comment

Interactive comment on "The penultimate deglaciation: protocol for PMIP4 transient numerical simulations between 140 and 127 ka" *by* Laurie Menviel et al.

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In section 3 it is described which greenhouse gas records should be used as forcing for these transient simulations across Termination II. I suggest to revise this section by refering to a recent paper I published together with colleagues, in which the greenhouse gas (GHG) records of the last 156 kyr have been compiled (Köhler et al., 2017). Interestingly, this paper is already cited in the discussion paper.

The intention of this data compilation publihsed in Köhler et al. (2017) was exactly to give transient simulation studies the best choice of GHG as forcing at hand. I recommend to use the calculated splines which are given with temporal spacing of 1 yr. For

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those interested in the effect of uncertainties in the GHG there is also an uncertainty coming together with the spline of each GHG (CO_2, CH_4, N_2O). These splines also take care of the problem that one data set might include different local maximum values than others (e.g. CO_2 during the last Interglacial in Lourantou et al., 2010 versus Schneider et al., 2013).

For the problem of missing N_2O data before 134 kyr BP Köhler et al. (2017) gives no alternative solution than presented here (using the LGM N_2O value of 201 ppb for the times before 134 kyr). However, to avoid any artificial rapid jumps I suggest to linearly increase N_2O from 201 ppb at 140 kyr to 218.74 ppb at 134.519 kyr BP, which is the oldest value of the N_2O spline.

Both CO_2 and CH_4 undergo some abrupt changes around and before 140 kyr BP, which is in the paper suggested as the time at which the transient simulation start and for which conditions the models should spin up. However, these changes in the GHGs make it difficult to pick values for the spin up. To avoid rapid change in the GHGs I nevertheless suggest to take the values which are given by the splines at 140 kyr BP, which are 192 ppm (CO_2) and 425 ppb (CH_4), which differ from the values suggested in the paper (Table 1). Alternatively, one might think about taken a different time for which all boundary conditions (GHGs, orbital parameters, ice sheets) have to be taken for the spin ups (e.g. 141 kr BP during which CH_4 (341 ppb) and CO_2 (186 ppm) are in local minima). A second alternative would be to average both GHGs over a longer time span, e.g. across 2 kyr (from 139-141 kyr BP leading to 191 ppm (CO_2) and 385 ppb (CH_4), and linearly interpolate from those average values used during spin up and at 140 kyr BP until the onset of the pure use of the transient GHGs at 139 kyr BP. Otherwise the abrupt jumps (of the example above of +6 ppm (CO_2) and +3 ppb (CH_4 within 1 year) might lead to artificial responses in the simulated climate system. One might also think about averaging the GHG for some periods before 140 kyr (e.g. 140-142 kyr BP), but nevertheless one might need a linear interpolation from the average values used during spin up to first meaningful values of the transient runs to avoid

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artifical jumps in the GHG radiative forcing.

Data connected with Köhler et al (2017), including raw data and final splines, are available at https://doi.org/10.1594/PANGAEA.871273.

References

Köhler, P., Nehrbass-Ahles, C., Schmitt, J., Stocker, T. F., and Fischer, H.: A 156 kyr smoothed history of the atmospheric greenhouse gases CO_2, CH_4, and N_2O and their radiative forcing, Earth Syst. Sci. Data, 9, 363-387, https://doi.org/10.5194/essd-9-363-2017, 2017.

Lourantou, A., Lavric, J., Köhler, P., Barnola, J.-M., Paillard, D., Michel, E., Raynaud, D., and Chappellaz, J.: Constraint of the CO_2 rise by new atmospheric carbon isotopic measurements during the last deglaciation, Global Biogeochemical Cycles, 24, https://doi.org/10.1029/2009GB003545, 2010.

Schneider, R., Schmitt, J., Köhler, P., Joos, F., and Fischer, H.: A reconstruction of atmospheric carbon dioxide and its stable carbon isotopic composition from the penultimate glacial maximum to the last glacial inception, Climate of the Past, 9, https://doi.org/10.5194/cp-9-2507-2013, 2013.

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