

This manuscript presents a valuable study of the impact of various LGM boundary changes on d18O in precipitation. The separation of boundary condition changes allows the authors to attribute the various d18O changes. It is an important study for paleoclimatologists looking to interpret LGM observations of d18O changes from around the globe. As such, I am enthusiastic about the work, and support the publication of the manuscript.

The overall structure and organisation of the manuscript is fine. However, the current version of the manuscript is let down in several places by poor writing, a lack of explanation, occasionally inaccurate statements, and referencing. These are generally minor problems, but they do detract from the value of this work. Some of these problems are identified below. However, the manuscript would benefit from the authors undertaking a more careful editorial checking of the manuscript - the list below is indicative rather than fully exhaustive. Some more consideration of available d18O LGM observational evidence and relationship between this study and that evidence would also be beneficial.

Abstract p1320, l10 are 'temporal' variations in isotopes analyzed? If not modify the sentence.

p1320, l25 Stenni 2001 is not the best reference – include more relevant ones (e.g. appropriate EPICA papers).

Various unreferenced statements/sentences in the introduction require references.

p1321 line 10-11, clarify.

p1324 l9 ref or describe 'conservation' calculations/results.

Section 2.2. The LGM SST changes that drive most of your results need to be shown – new figure.

Section 3. Statements like p1326, l10-13 would be useful to have a sentence explaining why these d18O changes occur.

p1326, l28 depletion looks strong non-uniform (may depend on your sst forcing).

4.1 Temperature changes are mainly dependent on your LGM SST forcing (which needs to be shown). Which itself will be largely dependent on the ocean model. Be careful about how you describe these changes. Some sort of comparison with LGM SST observations would be very useful.

P1327, l16 subtropics ->mid latitudes? (~50deg)

4.2 Discussion of percentage changes in precipitation may be clearer for polar regions, where absolute changes are small.

4.3 Some rewording required to clarify that this is an attribution study.

P1329, l9 sentence to explain why GHG changes on own have little impact.

P1329, 5.1, l11-12, why? Sentence to explain.

P1330, l4-5, explain why.

5.7 Change title to reflect fact that you are examining spatial relationships. To enable a more accurate comparison with observed spatial relationships, try calculating spatial relationships using simulation results interpolated to Masson-Delmotte observational sites. See also Sime et al 2008 for more on simulated versus observed spatial and temporal relationships (Sime, L. C., Tindall, J. C., Wolff, E. W., Connolley, W., and Valdes, P.J., (2008) Antarctic isotopic thermometer during a CO2 forced warming *Journal of Geophysical Research*, 113, (D24), 10.1029/2008JD010395).

6.2 The value of the presentation of seasonal responses is not very clear. Some clarification on why the authors choose to provide these results would be helpful.

7.1 p1338, l16-18 This is due to the ocean-model derive sst forcing you apply. Careful about how you describe this (it is not really a result of your study).

P1339, l25, "Yet" -> "However"

P1340, l12-13, explain/ref? And check this paragraph, esp relationship between last two sentences.

7.2 Check seasonality changes of precip using percentages rather than absolute numbers.

7.3 Change title to reflect that you are discussing geographical relationships. See Werner, M., P.M. Langebroek, T. Carlsen, M. Herold, and G. Lohmann, Stable water isotopes in the ECHAM5 general circulation model: Towards high-resolution isotope modeling on a global scale, *Journal of Geophysical Research*, 116, D15109, doi:10.1029/2011JD015681, 2011 (plus references within). Plus the Sime et al (2008) paper above. Adjust paragraph accordingly after reading.

7.4 l12, there are no ice cores from the Laurentide ice-sheet (it no longer exists).

P1344, l6 LGM moisture changes over South America were regionally variable.

P1345, l11 spatial or temporal?

P1345, l16-18, Explain better.

Fig. 6. Caption. 'The geographical (or spatial) relationship'?

Fig 8. Would be easier to interpret if presented as anomalies (relative to Fig 7).

Fig. 9. and 10. A problem with the shading for your positive values (all one shade).

Fig. 11. and 12. Very difficult to see. Less arrows and a large plot size would help.

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