

## ***Interactive comment on “A new global reconstruction of temperature changes at the Last Glacial Maximum” by J. D. Annan and J. C. Hargreaves***

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### General Comments

The paper presents a new estimate of surface temperature at the Last Glacial Maximum (LGM) based on a multiple linear regression of model results fitted to observations. Two other methods were also tested. The authors conclude that the Earth was 4 +/- 0.8 deg C colder during the LGM, in contrast to previous estimates. This is an important number to know not only because it puts projected future global temperature changes into perspective. I think that this is the best reconstruction of global LGM temperatures yet, because the authors use a more extensive and newer dataset as well as

better models than previous studies. Uncertainties are quantified and sensitivity tests are performed, which indicate the robustness of the result. The paper is well suited for Climate of the Past. I recommend publication with minor revisions and congratulate the authors on a nice piece of work.

### Specific Comments

The only issue I have with the paper is the claim that the errors of the reconstructions are unrealistic. My problem is that this assessment is based on a comparison to model errors or model spread. I don't think that this can be a criterion to assess errors in the reconstructions because the latter have sources different and independent from model uncertainties. E.g. in MARGO if different proxies in one grid box yield different estimates of the temperature changes this indicates larger uncertainty because of the ambiguities in the different proxies.

### Technical Corrections

Page 32 line 14: delete "s" at the end of consists

Page 32 line 17: replace "Arctic" with "Antarctic"

Page 33 line 11: insert "surface air" before "temperature"

Page 34 lines 20-21: How was the SAT anomaly calculated? Does it include SSTs assuming DSAT = DSST ?

Page 36 lines 13-15: Can you explain the effect of "regression attenuation" briefly for non-statistician readers?

Page 36 line 20: insert "anomaly" after "temperature"

I suggest to put the RMS errors and biases and perhaps also the DSAT estimate from the three different methods into one table for easier comparison.

Page 39 lines 23-26: I wonder how this test would detect overfitting. Would the fit for

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the withheld data stop to improve at some ensemble size?

Fig. 5a: shouldn't the blue line for ensemble size=1 be equal to 2.9, the RMS error from method #2 (page 36)?

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