

Interactive comment on “Weakened atmospheric energy transport feedback in cold glacial climates” by I. Cvijanovic et al.

Anonymous Referee #2

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Review of ‘Weakened atmospheric energy transport feedback in cold glacial climates’ by Cvijanovic et al. for consideration in *Climate of the Past*.

The ability of the atmosphere to compensate anomalies in northward ocean heat transport in present day (PD) and last glacial maximum (LGM) conditions is investigated. It is found that the atmosphere more readily compensates in PD conditions, i.e. imposes a stronger negative feedback on the ocean circulation, than during LGM conditions. This could imply, though the authors don’t show this, that high-latitude climate is more sensitive to the ocean heat transport during LGM conditions. The authors seek to find the cause of the weaker transport feedback in LGM conditions, and finds relations with mainly to changed sensitivity of dry static energy transported by transient eddies. This is interesting because we normally think of latent heat transport being different in cold

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and warm climates. I find the topic interesting, while understanding the results remains somewhat challenging.

My main concern with the manuscript is that the authors use anomalies in the northern hemisphere temperature gradient as a proxy for the ocean heat transport. It is somewhat arbitrary, and not obviously a good approximation. Even though the model setup only prescribes SST’s and sea ice, the authors could readily diagnose the implied ocean heat transport. For example, to get the implied cross-equatorial ocean heat transport just integrate and subtract the surface heat fluxes in the two hemispheres. Doing so would yield a correct feedback analysis; an ocean flux anomaly at a given latitude is partly compensated by an atmospheric flux anomaly with opposite sign. The feedback factor would be non-dimensional and can be more readily compared between PD and LGM.

While this may fall into the category of major changes, I have my doubts that the authors can manage carrying out the necessary analysis and modify their manuscript within reasonable time limits. But I will leave this decision to the editor and the authors to make.

Minor points:

Page 1236, line 23, which surface feedbacks are meant here?

Page 1242, Try explain the anti-correlated tail north of 60N. It should not be too difficult.

Page 1243, line 25, replace flux with transport.

Page 1245, line 7, sensitivity to what?

Page 1246, line 20, ‘... and we therefore...’ the jump to conclusion is a bit hard here, consider rephrasing.

Table 2, resort the experiments to be monotonic.

Figure 1 is very small.

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Figures 3, 6 and 8 could benefit from using colors, provided they do not cost extra.

Generally, consider reducing the number of abbreviations, parentheses and the 'positive/negative – greater/weaker'-way of writing.

Interactive comment on Clim. Past Discuss., 7, 1235, 2011.