

Interactive comment on “Southern westerlies in LGM and future (RCP4.5) climates” by Y. Chavaillaz et al.

Anonymous Referee #1

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The authors hypothesise that the shift in position of the Southern Hemisphere jet should be comparable between RCP-PI and PI-LGM as these periods experience comparable radiative forcing. However, it is shown that a subset of CMIP5 models have a consistent response to forcing in the RCP-PI case, but not in the PI-LGM. Some models show an unanticipated Equatorward jet shift in the PI-LGM case, which has been attributed by the authors to the presence of strong near-surface warming over Antarctica. The paper has a clear, logical structure, and the inferred role of the cryosphere in influencing jet position and carbon uptake is interesting and novel. I recommend that this paper be published in Climate of the Past after some minor revisions.

P3695, I18: The authors cite Russel et al. (2006b) at this point to support their statement that research on SH westerlies is currently being hampered by poor represen-

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Interactive Discussion

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tation in climate models. The Russel et al. paper deals with CMIP3 models. Has the representation improved at all in the CMIP5 models used in this study? Consider quantifying this, or at least including a reference to a CMIP5 study.

P3698, I22 (Figure 1): Despite the different ice sheet data, GISS actually looks very similar to IPSL/NCAR/MPI, and similar to MIROC, although MIROC appears to have lower horizontal resolution. Do you have any ideas as to why CNRM looks so different?

P3699, I2: Do you have any ideas about why the altitude differences would be so much smaller in CNRM? The spatial pattern doesn't look too dissimilar.

P3699, I8: Out of a total of 12 models, the authors use 3 IPSL models. How independent are these models? RCP-PI IPSL has very large future anomalies relative to the other models shown. The left panel of Figure 6 shows that one of the additional models also has a relatively large position response. Is this a related IPSL model? If so, do the authors worry that the choice of this model in such a small sample is unfairly influencing their correlation coefficients?

P3699, I10: The decision to analyse the 850hPa jet is justified. However, the authors have not made it clear exactly how they are defining the jet stream. Is it the location of the maximum in the 50 year mean of zonal wind at 850hPa? A clear definition at this stage would also allow the authors to refer simply to the 'jet' or 'jet stream' throughout the remainder of the paper, rather than the 'maximum jet position' and the confusing 'jet position maximum'.

Figure 5: It seems more logical to me to group the panels in this figure so that the top two rows are PI-LGM and the bottom two rows are RCP-PI. I think the benefit of being able to easily deduce an ensemble mean response in each of these cases (i.e. a typical RCP-PI and PI-LGM pattern) outweighs the benefits of easily being able to contrast the two time periods from each model.

I also include some technical corrections:

P3694, I10: “hereafter RCP” – you also introduce this abbreviation in Section 2.1. I think it is more appropriate to introduce it in Section 2.1, and refer only to RCP4.5 in the abstract.

P3695, I24: “to reach the atmosphere” – consider changing to “from reaching the atmosphere”.

P3696, I18: Remove the comma from this line

P3697, I18: Change “contrasted” to “contrasting”. Similarly for P3704, I2.

P3698, I7: “. . .had both performed an LGM simulation and the . . .” should be “. . .had performed both an LGM simulation and the . . .”

Figure 2: It is extremely difficult to identify the red line in the RCP-PI IPSL panel.

P3700, I17: Change “. . .on Figure 3 . . .” to “. . .in Figure 3 . . .”.

P3702, I1: “The stratospheric cooling is maximum at high latitudes”. This cannot be concluded from Figure 5, which only shows temperature from 1000-100hPa and therefore excludes the low latitude stratosphere. I would be surprised if lower stratospheric cooling did not have a maximum at high latitudes, and don’t think extending the vertical range would add value to the figure, but it would be good to see it noted in the text that this result is not shown.

P3703, I7: The reference to “Ttrop (right panel)” should be Ttrop (left panel).

Figure 6: What do the filled green and blue squares show?

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