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Climate of the Past Discussions

Interactive comment on "Sea ice led to poleward-shifted winds at the Last Glacial Maximum: the influence of state dependency on CMIP5 and PMIP3 models" *by* Louise C. Sime et al.

Anonymous Referee #2

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Sime et al. use nine different CMIP5-PMIP3 preindustrial and LGM pairs to investigate the changes in Southern Hemisphere jet position and intensity and how would these changes related to the preconditioned jet location (state dependency) and sea ice expansion. This study is established on previous work by the author (i.e. Sime et al., 2013) and many other works by Kidston and Gerber (2010), Chavaillaz et al. (2013), Bracegirdle et al. (2013)....etc. and further suggest that sea ice being an important factor for the deglacial changes in Southern Hemisphere jet. It is, however, a bit weak on the discussion on how this study agree/disagree from previous studies and basin scale detail.

Specific Comments: 1. Do we confident on the actual condition of LGM SH jet condition

regardless of mutil-model mean suggests on no significant changes? If positive, then the conclusion that sea ice expansion holding jet in its present day position would valid otherwise the explanation is only for modeling perspective.

2. In line 117, "data is regridded to a consistent 0.1° resolution before these calculation are performed." I understand this is to separate the jet latitude between runs but wonder if it is legitimate to so. This is a one to twenty scaling after all as most of the model simulations here has a spatial resolution of 2.5°. One generally would not interpolate a T42 simulation to T106. By reading Table 2, it should do the job by interpolating data down to 0.5°. Or it would be nice to show the conclusion is not resolution (aka interpolation) dependent.

3. Section 3.1 describes the state dependency in PI-LGM changes. Can the author comment on why these results being quite different from Bracegirdle et al., (2013)? Bracegirdle et al. (2013) suggest strong dependency of jet over Pacific basin in warming scenario from PI to future condition while this study suggest much weaker state dependency in Pacific. Would this related to the different simulated sea ice and temperature conditions between PI-LGM and RCP-PI? This might further support the argument in Section 3.2.1 and 3.2.2.

4. Continue from previous comment, section 3.2 discuss the impact of sea ice. Is it possible to calculate the percentage of variation explained by state dependency and sea ice separately? In other word, which factor represents a stronger control over PI-LGM jet variability?

5. In reading Figure 5 and 6, it shows a non-proportional changes between temperature gradient structure and U wind changes. Can the author comment on this? For example, COSMO and MPI-ESM both show substantial changes in temperature gradient while MPI-ESM simulate none changes in zonal wind.

6. Suggestion: The authors mention in the manuscript that the changes in sea ice might be important in determining LGM SH jet changes. It can be verify and support by

comparing simulations with different sea ice extent, say LGM-PI-RCPs from extensive sea ice to sea ice free.

7. Very minor: in line 171 and line 300, as far “north” as 57°S, is this a typo of “south” relative to 47°S

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