

## ***Interactive comment on “Validation of reanalysis Southern Ocean atmosphere trends using sea ice data” by William R. Hobbs et al.***

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We thank the Reviewer for their positive and helpful suggestions. We respond to their comments below

-Figure 3: marking a horizontal line with the  $p < 0.05$  significance would aid interpretation. Also in the paragraph that discusses these results, comment on the significance of the correlations.

Author Response

Estimating a statistical significance for the pattern correlations in Figure 3 is very difficult, since it would require a calculation of spatial decorrelation length scales (zonal and meridional) in sea ice and SAT, in order to accurately estimate the degrees-of-

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freedom (i.e. number of independent spatial points in the trend patterns); this is a much more complex task than estimating significance of temporal correlations (as we have done for Figure 5).

Whilst we agree that it would be a nice addition to have such a significance estimate, it would greatly increase the complexity of the Methods (as the Reviewer notes, the intuitive simplicity of the Method is a strength of the paper), and it is our opinion that this would not alter the conclusions.

-Line 133. You conclude that JRA55 and 20CRv3 have the best representations of long-term change over the Southern Ocean. I would clarify the phrasing here that they have the best representation over the study period. As JRA55 goes back to 1958, and 20CRv3 back to 1836, this could send the message to an uncautious reader that this comment applies to earlier periods. Given the lower amounts of data going into both reanalyses in earlier period, we do not know whether this conclusion holds for earlier periods (and you obviously can't test it due to lack of earlier sea-ice data).

Author Response

This is an important caveat, and we have amended the sentence to read as follows:

'Based on this analysis we would conclude that JRA55 and 20CRv3 have the best representations of change since the late 1970s over the polar Southern Ocean, under the assumption that SIC trends should be closely related to SAT trends. We note that this may not hold true for earlier periods which are unconstrained by satellite retrievals, and for which we do not have reliable sea ice observations.'

-Line 134 and 158, write numbers  $< 10$  in full 'Three' and 'Two'.

We have edited the manuscript accordingly

- Table 1: I think the '1980' in the reanalysis period box for MERRA 2 may be in bold

Author Response

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Bold years indicated the first and last year for which data is available from all the re-analyses (1980 constrained by MERRA2; 2010 constrained by ERA20C. However, on consideration we feel the bold type does not add to the information, and have removed the bold type, and amended the Table caption accordingly.

- Figure 1 is labelled as Figure 2.

Author Response

Typo corrected

- In the actual Figure 2, panel e needs clearer description. Define what 'S-RIP' is, and also are the black dots/line observations?

Author Response

Figure 2e legend amended to include 'Observations' for black lines/markers. S-RIP abbreviation is now expanded to Figure 2 caption

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