

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

### **Anonymous Referee #2**

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The authors present an analysis of Southern Ocean surface air temperature (SAT) and sea-ice concentration (SIC) trends in 8 modern reanalysis products. The spatial patterns and magnitudes of SAT trends over the Southern Ocean are shown to vary greatly between reanalyses. They use the observed relationship between SAT and SIC, which is shown to be particularly strong during the sea-ice growth season, to validate reanalysis SAT trends. It is argued that the ERA reanalyses may give a less reliable representation of SAT trends, since they are less consistent with SIC changes. On the other hand, trends in JRA55 are proposed to be more reliable.

Constraining atmospheric trends over the Southern Ocean is a very important topic given the region's key role in global climate and the relative paucity of observations. I think that this paper plays a useful role in evaluating the reliability of SAT trends in

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contemporary reanalysis, and as such will be of use to the wider community of users of reanalyses. The analysis is clearly presented and logical. I therefore recommend its publication in ACP, following just a few minor comments and technical corrections. I hope the authors find these to be useful.

Minor comments:

1. In discussing Fig 1 in Section 1 (showing SAT trends in the reanalyses), I think a note should be made of the fact that ERA20C is reliant on surface observations alone, of which there are very few in the Southern Ocean, so it is perhaps not surprising that it appears as an outlier.
2. It would be nice to see some measure of statistical significance in Fig 5 (for instance, as a gray shaded region). For 30 year time series I would guess that a lot of the correlations are not significant.
3. It is remarked that JRA55 is perhaps the best in terms of consistency between SAT and SIC trends. However, it is notable that it is quite an outlier in terms of the seasonal cycle of ice growth, having stronger growth rates in the fall/early winter than other reanalyses of observations (Fig 2e). I think the paper would benefit from some discussion of this – i.e. is JRA55 more reliable in terms of SAT trends, but perhaps less so in its seasonal cycle?

Technical corrections:

4. L62: particular -> particularly
5. Fig 2e is not labelled with an 'e'.
6. L151: 'Sat' -> 'SAT'
7. L181: This sentence doesn't make sense. I think 'have shown' needs to be removed.

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