

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

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.

Author Response

We have added the following sentence to this section:

C1

‘Much of this spread is due to differences in the forecast model and assimilation technique, but it should be noted that some of the products (ERA20C and 20CrV3) are not constrained by satellite data in order to give a consistent product over long historical periods; this is a major limitation in the remote Antarctic region.’

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.

Author Response

As noted in the Figure 5 caption, only SAT trends that are significant at the 90% confidence level are plotted, and only areas where both the SAT and SIC trends are statistically-significant at the 90% level (and the SAT and SIC trends are inconsistent) are hatched.

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?

Author Response

We have added the following sentences to our summary for Figure 3:

‘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. An interesting point to note is that although JRA55 performs well with respect to this metric, it has the strongest sea ice bias in March and April. This raises the question of whether the mean state is a good indicator of performance in respect of variability or trends.’

4. L62: particular -> particularly

C2

Author Response

Typo corrected

5. Fig 2e is not labelled with an 'e'.

Author Response

Figure caption added to panel 2e

6. L151: 'Sat' -> 'SAT'

Author Response

Typo corrected

7. L181: This sentence doesn't make sense. I think 'have shown' needs to be removed

Author Response

Correct, we have corrected this sentence which now reads:

'Whilst it has been hypothesized from model simulations that due to complex ocean-sea ice feedbacks, a surface cooling may lead to a loss of sea ice (Zhang, 2007), we note that in this particular region the sea ice loss has been robustly attributed to increasing poleward airflow, which both dynamically constrains the ice extent and advects warm air to the region (Holland and Kwok, 2012; Hosking et al, 2013; Raphael et al, 2016), and would be expected to drive warmer SAT.'

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