

Reply to reviewer 1:

L39-46: The wording here is slightly misleading. The Fogt and Connolly (2021) dataset is a blend of the Fogt et al. (2019) spatial pressure reconstruction poleward of 60°S and the 20CRv3 equatorward of 60°S. Thus, everywhere north of 60°S the Fogt and Connolly merged data are exactly the 20CRv3. Poleward of 60°S, their data does agree best with 20CRv3 (it at least shows the least drift in the early 20th century). So perhaps the text could be revised to say, starting at line 42 “Poleward of 60°S, the “Twentieth century reanalysis” for this period fits best with their reconstruction, whereas other products showed spurious trends. However, there are marked differences between all products prior to 1957 south of 60°S due to the sparseness of pressure data...’. The Fogt and Connolly (2021) paper found more agreement in the various products over Southern Hemisphere landmasses in the early 20th century, for what it is worth.

Thanks, we will incorporate the sentence exactly as suggested.

L67: Grateful for you to submit these ship logbook data to ICOADS. Are there additional pressure data in recent releases of ISPDv4 that could also be used in this study, that aren't in ICOADS or assimilated into 20CRv3? Perhaps some early Antarctic data from British and Norwegian expeditions, as examples? Perhaps also the daily data (could maybe be close to the 12Z values) from Orcadas used in Zazulie et al. (2010), which from conversations with Gil Compo aren't included in the early 20th century in 20CRv3?

Thanks for the information. We were not aware of the Orcadas data. Since the project was computationally expensive, we cannot simply rerun the analysis, but we add a reference at the end of Section 2.1.

“Also, a record from Orcadas station is available and probably not included in 20CRv3 (Zazulie et al., 2010).”

Table 1 – need to clarify what 20CRv3+ is in the caption – I assume it is the 20CRv3 with the additional data assimilated. If that is correct, you may wish to introduce the acronym when you first mention this dataset on L51-52.

Thanks, we add to L. 51-52:

“...in the following termed 20CRv3+”.

L187-188: Technically, the above mentioned ship with a correlation to 20CRv3 of 0.71 (Ruapehu) does increase to 0.94 in 20CRv3+. It is the Papanoa ship with $r=0.77$ that actually decreases to $r=0.73$ in 20CRv3+.

Thanks for spotting this! We change the sentence to:

“One ship (Ruapehu) exhibits a correlation of only 0.71 (which then increases to 0.94 in 20CRv3+) ... only for the “Papanoa”, correlation decreases from 0.77 to 0.73”

Fig. 4: I'm having trouble interpreting the reduction of spread figure, perhaps overthinking it. The darker areas are the least reduction of spread based on the legend, which at face value to me would imply that they have had the least impact on the spread as they didn't reduce it much. But yet the text focuses on these as areas of improvement (near Cape Town, and along the ship tracks). Is the figure perhaps showing the ratio of spread, instead of the reduction in spread (which I take as the original spread (variance or standard deviation) minus the new spread (therefore, larger values are more of an improvement)? Please clarify in text or in caption.

You are absolutely right, “reduction of spread” is the wrong expression, it is the ratio of the spread in 20CRv3+ to the spread in 20CRv3. We now write in the caption of the figure:

“Ratio of the average ensemble spread ($\sigma_{20CRv3+}/\sigma_{20CRv3}$)”

And also change the figure accordingly.

Fig. 6a: can you comment in the text about what percentage the SH temperature anomaly is due to the tropical Pacific / La Niña -like cooling (Am I correct to assume this average is area-weighted by the cosine of latitude)? It seems like the zonal mean temperature plot shows much of the cold anomaly is in the tropics. I'm not sure much can be said of the temperature anomalies south of 60°S – what data constrain these over the Antarctic continent (the spread is also huge there!)? You can perhaps add a few sentences here after lines 272-273.

Fig 8 – note misspelling of Connolly in top row.

Thanks! We correct this.

Fig 8 – interesting comparison with the Fogt and Connolly (2021) data here – thanks for doing this! One important note here that is worth mentioning in the discussion following lines 283-284: The Fogt and Connolly (2021) data do include direct observations from Orcadas station, which starts in 1903. These data strongly control the solution of the Fogt and Connolly (2021) data near the Antarctic Peninsula, Weddell Sea / South Atlantic, in particular. Thus the positive pressure anomaly in MAM in Fogt and Connolly dataset near the tip of the Antarctic Peninsula is likely real (based on observations at Orcadas), whereas the strong positive pressure anomaly in 20CRv3+ over the northern Antarctic Peninsula may be overstated. You could quickly make comparisons of the pressure anomalies at the grid point of Orcadas station using the READER archive to verify these results – there is some information! (there are also data at Grytviken in South Georgia, if you want to further verify – these data are NOT used in Fogt and Connolly (2021).)

Thanks for the suggestion, we will try that and add a sentence on the interpretation.

Fig 9 – can you plot the observed SOI from the Australian BOM here as well? <http://www.bom.gov.au/climate/enso/soi/>

Thanks, we will add this data set to the figure.