

Interactive comment on “Systematic attribution of observed southern hemispheric circulation trends to external forcing and internal variability” by C. L. E. Franzke et al.

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General Remark:

The authors investigate the origin of the long term secular trend present in the large scale atmospheric circulation regimes in the Southern Hemisphere (SH). They use a new method of detection and attribution based on the Granger causality principle. They found that one of the main driver mechanism of the secular trend is the CO₂, and they contrast their results with the previous attributions with the Ozone depletion.

This is an interesting systematic exploration of the driver attribution that deserves publication but I have a major concern about the choice of drivers. The authors used

C297

CO₂, OMD (I suppose that it is the ozone mass deficit, but never mentioned in the text or captions), solar constant, stratospheric aerosol optical thickness and sulphate aerosols. Although this choice is probably a good sample of the different possible drivers, the authors should make the reader aware that it is a limited choice and other drivers could be responsible of this secular trend.

To my opinion, if you take any series for which you have a similar secular trend then you will attribute the trend of the original time series to this specific predictor. I was therefore wondering why you did not try the time series of sea ice extension displaying a secular positive trend during the last 40-50 years. I suspect that it could provide as good result as the CO₂ increase, and it is probably a more direct mechanism of circulation modifications than the CO₂, whatever the specific origin of the Antarctic sea ice extension increase is (Note that this increase is not well explained by current climate models even when CO₂ increases, rather most of the models predict a decrease of the sea ice extension).

I therefore think that caution should be taken in drawing definite conclusions by considering a limited number of drivers, and I would be very much interested to know what will be the impact of other drivers like the sea ice extent, obviously related to the thermodynamic properties of the underlying ocean (or other drivers directly related to the dynamics and thermodynamics of the ocean).

Minor points:

Line 13, page 676 : a "a" should be removed.

Figure 1. Please define the different curves in the caption.

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