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Hydrology and Earth System Sciences Discussions

Interactive comment on "The Southern Annular Mode: a comparison of indices" *by* M. Ho et al.

Anonymous Referee #1

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This paper compares eight different SAM indices with each other and in terms of their relationship with seasonal precipitation across Australia. Although the conclusions reached are somewhat general, and perhaps predictable, they will nevertheless be useful for scientists deciding whether it matters which SAM index they should use to compare against their parameter of interest and, if so, which index is most appropriate or best and where to get hold of it. My principal issue with the paper in its current form is with the pictorial representation of how the differences between the indices and their relationship with Australian rainfall are shown, which I think could easily be improved upon (see below). In the discussion the authors make some interesting and valid points regarding the nature of the SAM and how best to define it. Overall I am happy to recommend that the paper be published subject to a few minor revisions.

Major comments and suggestions:

Page 7469, section 3.1.3: It could be argued that if you are trying to link the SAM to a regional phenomenon, such as Australian climate, that it is better to use a regional SAM index. Hence the non-local, non-annular variability in a hemispheric SAM index can be removed. Perhaps the authors could construct a simple meridional pressure gradient over Australia and see how that compared with the other SAM indices examined.

Figure 3-10: Given that the main aim of the paper is to compare the SAM indices I would prefer that the authors replace Figures 3-6 with equivalents based on 1979-2002 and get rid of Figures 7-10. I think this would prove far more instructive to the reader. A number of papers have demonstrated that SAM-climate relationships vary over time: this might be for another paper, but if the authors wanted to include something here they could look at those SAM indices with greater time periods and split them into two halves to see how temporally stable the relationships between the SAM and the Australian rainfall are.

Minor comments:

Page 7464, line 15: The SAM has also been described as the high latitude mode prior to the AAO/SAM.

Page 7468, line 6: It is more correct to say that the NOAA index is based on fields derived from a numerical weather prediction model that assimilates both satellite data and observations.

Page 7468, line 7: The statement that 'satellite data has been shown to be the most reliable data source for analyzing Antarctic meteorology (King and Turner, 2007, p. 63)' is rather all encompassing. Clearly for that statement to be true depends on the type of meteorology being studied; e.g. boundary-level meteorology is better studied from the surface. What satellite data has done is to fill in the large data voids over the Southern Ocean and hence reanalysis products have improved since their assimilation. Also, there is nothing in the reference that supports the statement.

Page 7469, line 24: There is no regression of the Marshall (2003) index with either temperature or precipitation in that paper. The relevant papers are Marshall (2007) in International Journal of Climatology for temperature and van den Broeke and van Lipzig (2004) in Annals of Glaciology for precipitation, using a climate model.

Page 7473, line 20: replace 'NCEP-NCAR ... station data' with 'NCEP-NCAR reanalysis, which has a positive pressure bias at higher latitudes compared with station data that decreases through time.'

Page 7474, line 19: I don't think it's important that no data points exist in the second and fourth quadrants. Surely it's the distance from the y=x line that matters. Whether the SAM is slightly negative or slightly positive is unlikely to have any meaningful physical manifestation, especially given that the period over which the data are normalized to calculate the SAM, and hence the value of the resultant mean' is arbitrary anyway.

Page 7479, line 16: Again, the sign of the SAM may not be important if the values are close to zero.

Page 7479, line 24: I'm not sure what the authors mean by 'SAM process'. You could argue that will vary depending on whether the SAM is defined as EOF1 or a meridional pressure gradient and as a hemispheric or local 'process'.

Page 7480, line 19: Actually it does mean that SAM indices based on early reanalysis data, and any trends derived using these data, are flawed!

Page 7482, line 10: A point about the SAM is that is has been shown to be 'reasonably' approximated as a meridional pressure gradient. Clearly it would be possible to develop more sophisticated indices but I expect a law of diminishing returns would apply.

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