

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

Anonymous Referee #2

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This study compares SAM indices from various datasets and their relationship with Australian rainfall. While the premise of the study is worthwhile, at this point it is not suitable for publication and requires major revisions prior to acceptance.

Major comments: The main premise of the study is to compare different definitions of SAM and their relationship with Australian rainfall. To attain this goal, all other differences apart from definition should be removed. Hence, rather than use existing SAM indices available online, it is suggested that the authors calculate the SAM indices directly themselves using a consistent dataset (eg. NCEP/NCAR reanalysis) and time period (eg. 1979-2002). While this will not be possible for all indices, it is achievable for the indices using gridded data and would allow a cleaner comparison ensuring that similar base periods are used. It is also recommended that these indices are used for the correlation comparison figures (Fig 3-6) rather than mixing indices with different

time periods. This will give a better visual comparison of the differences between the indices compared to the current Fig 7-10 which show small differences in correlations which are insignificant to begin with and hence could simply be noise. In fact, the major features of the SAM-rainfall correlations appear remarkably consistent across indices so controlling for time period and dataset will presumably increase this consistency. From the analysis provided, the main result appears to be that the Fogt and JW58 indices are quite different from the others, yet no speculation on why this would be is given. Presumably it is partly due to the use of ERA-40 and various station data compared to the NCEP/NCAR reanalysis used for the other indices. It is suggested that a comparison of the NCEP gridded indices with ERA-40 versions is carried out as this may help elucidate a root cause of the differences with the Fogt and JW58 indices.

Significance of the correlations should also be assessed and noted on the figures with either contours or stippling. The fact that very few correlations are significant should be pointed out at the beginning of the discussion section.

The other major comment is that references are often cited in one long list even though multiple points are made in a sentence and all the references don't necessarily cover all points. References are also often inappropriately cited, many of which are pointed out below. The introduction requires a thorough revision.

Some discussion should also be given regarding the potential predictability of the SAM, or lack thereof, compared to ENSO. The SAM arises due to internal atmospheric dynamics and is therefore thought to have little predictability past numerical weather prediction timescales. See eg. Watterson (JGR, 2001). This limits its usefulness for climate prediction compared to eg. ENSO.

Minor comments: p7462, l5 - It could be argued that Hendon et al (2007) have robustly quantified the relationship between the SAM and Australian rainfall, assessing significance in the relationship with Australian rainfall over the satellite era

p7462, l8-9 - it's not clear that the strengths and weaknesses of the various indices

are assessed in the paper, in fact it seems an impossible task given that all are valid depictions of the SAM

p7463, I1 - refer to Risbey et al (2009) here

p7463, I8 - I don't think 'confusion' is the right word here, each SAM index was developed with a specific focus in mind and will highlight a certain aspect of the annular mode. Rephrase.

p7463, I12 - L'Heureux and Thompson (J Climate, 2006) should be cited here for a study that examined the link between SAM and ENSO.

p7463, I18 - References are again lumped together for papers that don't cover both regions. Also, Hendon et al (2007) did not link the recent rainfall declines to the SAM, in fact they specifically avoided doing so given there was no trend in the wintertime SAM during the period they looked at. Reference should be removed from this statement.

p7463, I20 - McGowan et al 2010 do not show any projections of the SAM under global warming. Remove reference from this statement.

p7464, I16-20 - the definition of the SAM given here seems quite confused and it is difficult to understand what the authors are trying to say. The SAM describes shifts in atmospheric mass north and south or, alternatively, movements of the westerly jet north and south with corresponding changes in the pressure pattern. The description of an alternating pattern needs to be put in context with these movements. Also the SAM is defined as longitudinally symmetric so describing it as a wave-like structure is incorrect and the winds weaken north of 40S in only one phase of the SAM. Since the rest of the paper focuses on definition based on the pressure and geopotential height fields it is suggested this section is rewritten with a focus on those fields.

p7464, I19 - remove "(west to east)"

p7464, I23 -> p7465, I14 - these two paragraphs are too text-book-like even for this journal

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p7464, l17->21 - The shift of the storm track and phase of the SAM correspond, but it has not been shown that one leads to each other. Suggest rephrasing. Also, Marshall (2003) did not look at storm track shifts so this reference needs replacing.

p7465, l25 - McGowan et al (2010) do not look at seasonality in SAM teleconnections. Replace reference.

p7466, l5-9 - Gillett et al (2006) do not isolate the relationship of the SAM with different seasons. Meneghini et al (2007) use a regional index which should be noted here.

p7466, l19-27 - it is just as likely that the different indexes and time periods used in the various studies lead to their different conclusions

p7467, l5-7 - point out that the time periods analysed are also often different in these studies

p7468, l1-15 - the NOAA SAM index is based on NCEP-NCAR Reanalysis, not direct data as indicated here

p7472, l4 - a reference is needed for the rainfall dataset

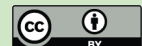
p7480, l24 - why is the Marshall index the most accurate? This statement is speculative and contradicts earlier statements that the NOAA index is the most reliable.

p7481, l8 - the choice of the Marshall index as the most reliable appears very subjective and not based on any of the calculations produced in the paper. More justification is required or this statement should be removed.

It is difficult to see distinctions in the colour shading in the geographical maps. Suggest rescaling.

Cai et al 2011 and Feng et al 2010 are also relevant studies and should be cited.

Cai, W., P. van Rensch, S. Borlace, and T. Cowan (2011), Does the Southern Annular Mode contribute to the persistence of the multidecade-long drought over southwest

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Western Australia?, *Geophys. Res. Lett.*, 38, L14712, doi:10.1029/2011GL047943.

Feng, J., J. Li, and Y. Li (2010), Is there a relationship between the SAM and southwest Western Australian winter rainfall?, *J. Clim.*, 23, 6082–6089.

Interactive comment on *Hydrol. Earth Syst. Sci. Discuss.*, 8, 7461, 2011.

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