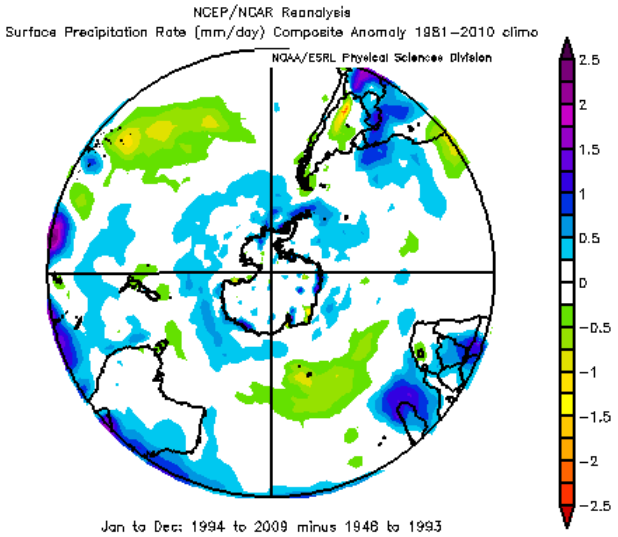
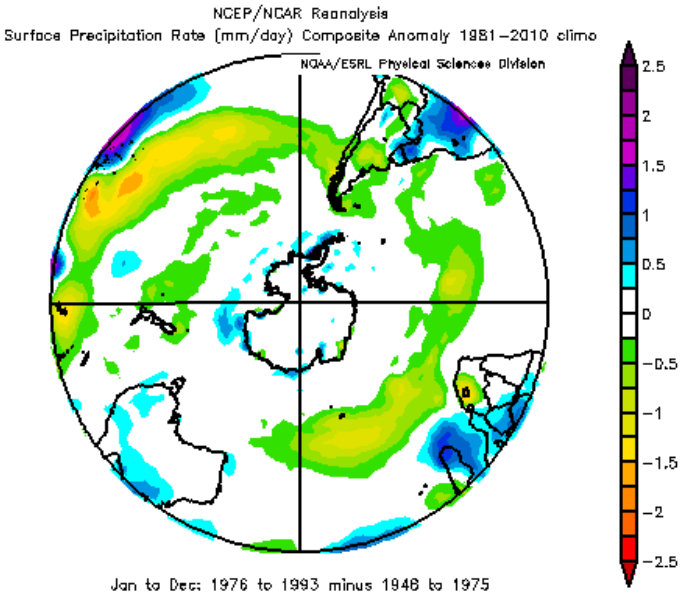
We would like to thank Dr Scanlon for her positive review and suggestions for improvement of the paper "Links between the Big Dry in Australia and hemispheric multi-decadal climate variability – implications for water resource management" by Verdon-Kidd et al. Details of how we have addressed Dr Scanlon's comments are included below:

1. "The global distribution of precipitable water changes (Fig 2a and Fig 3a) was used to show the precipitation trends across the Southern Hemisphere, and the station-based rainfall observations (Fig 2b and Fig 3b) were shown to support the argument. However, precipitable water is not precipitation, and hence the precipitable water trend would be greatly different from precipitation trend. This would make readers wonder if the precipitable water in this paper is not the same as its common definition. If so, it would be helpful to make it clear; if not, it would be better to use gridded precipitation data (e.g. NOAA CPC data) to show the precipitation trends over the Southern Hemisphere."

Authors' response: Until recently, global gridded precipitation data sets only covered the period 1979 onwards (the satellite era), therefore not of sufficient length to be used in our analysis. This includes the NOAA CPC data suggested by the author. As such, the authors used the NCEP/NCAR precipitable water data (which covers the period 1948 onwards) to investigate the spatial extent of the drying trends, while groundtruthing the relationships observed with gauged rainfall data. However, a recent extension of the global precipitation data set within the NCEP/NCAR Reanalysis project has resulted in a longer data set (1948 onwards) suitable for our analysis that was not available when this research was originally conducted. The precipitable water plots in Figures 2a and 3a will therefore be replaced by plots of precipitation rate to avoid confusing the two variables, using the NCEP/NCAR reanalysis precipitation rate data. Importantly, the trends observed in the precipitable water and precipitation rate plots are consistent. See new precipitation figures below:



Updated Fig 2a



Updated Fig 3a

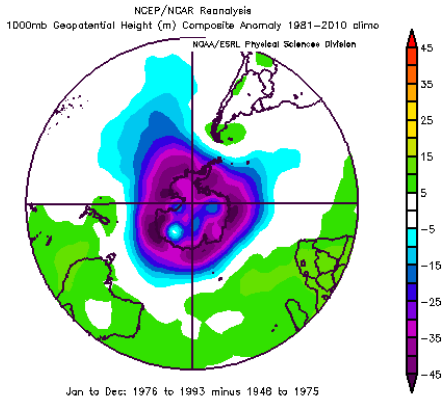
2. "Fig 2a and fig 3a show the global distribution of reanalysis data, but the paper only focuses on the trends in rainfall across Southern Hemisphere. It seems it is not necessary to show the pattern over the northern hemisphere without any discussion."

Authors' response: As suggested Figure 2a and 3a have been refined to only show the southern hemisphere precipitation trends (see revised plots plots above).

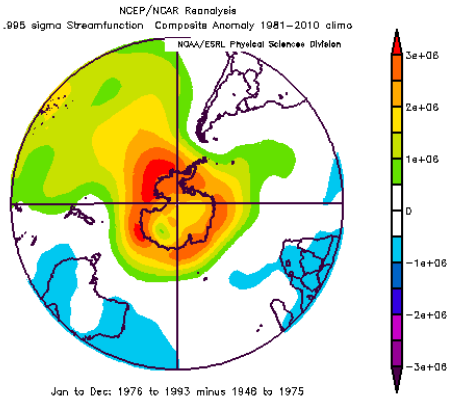
3. "It does not seem credible to conclude that weakened meridional winds and enhanced zonal winds since the mid-1970s would pull the storm tracks further north. Actually, it appears that the paper conveys a separation of large-scale circulation and synoptic-scale weather systems, which may not be the case. The changes in storm tracks can result in observed changes in meridional and zonal winds. The latter would not be understood to "pull" the storm track southward. It would be better to analyze the changes in stream function or geopotential height to see if there was a storm track migration across the southern hemisphere since the mid-1970s."

Authors' response: We agree that small-scale synoptic systems operate on the background of large-scale circulations. It was not our intention to suggest otherwise. This will be clarified in the revised paper. We acknowledge that the changes in meridional and zonal winds would be an 'effect' rather than a 'cause' of southward migration of storm tracks across the southern hemisphere. Therefore, as suggested by the reviewer we have analysed the geopotential height and streamfucntion data post 1975 (see two new figures below), which will be included in the revised paper. The geopotential height plot (a) clearly shows a reduction in geopotential height since the mid 1970s over Antarctica (indicating an increase in conditions conducive to storms) and a corresponding increase in geopotential height over Australia, southern Africa and New Zealand (associated with clear

weather). Similarly the plot of streamfuction shows an intensification of streamfunction over Antartica and the southern Oceans and a decrease over Australia and southern Africa, further evidence of a southward migration of storm tracks over this period.



a) Geopotential Height



b) Streamfunction

4. "It would help to spell out the variable shown in the figures 8 and 9: sea level pressure."

Authors' response: This will be corrected in the revised manuscript

5. "It is good to know the favorable synoptic patterns that account for wet autumns and winters during the mid-1980s to the early-1990s is SEA, but it seems that sea level pressure patterns (figures 8 and 9) can only reveal surface meteorological conditions. It is difficult to see any Subtropical Trough or Ridge that often refers to specific lower troposphere geopotential conditions and any monsoon depression from figures 8 and 9. It would be clearer to plot latitude and longitude on figures 8 and 9 and circle the troughs, ridges, and monsoon depressions discussed in the paper."

Authors' response: As suggested by Dr Scanlon, latitude and longitude will be included in revised figures 8 and 9 and the troughs, ridges and depressions will be indicated for a selection of representative types. This will aid in interpretation of the figures.

6. "It seems there is no evidence that has been suggested to show that the Hadley cell expansion has resulted in the rainfall belt shift across the middle latitude. The Hadley cell is a zonal-mean meridional circulation, and it seems there is no evidence to show that the Hadley cell expansion has significant impacts on zonal mean precipitation over middle latitudes. The rainfall climatology over middle latitudes is also affected by the presence of continents and oceans."

Authors' response: The potential impact of the Hadley cell expansion on rainfall in Australia has been analysed as part of the South Eastern Australia Climate Initiative (SEACI, see http://www.seaci.org/index.html). SEACI researchers have proposed that recent declining trends in rainfall across Southern Australia are associated with changes in the global atmospheric circulation via the expansion of the Hadley circulation (estimated at 50 km per decade) and associated increase in pressure in the sub-tropical ridge, resulting in mid-latitude storm tracks being 'pushed' further

south (see *CSIRO*, 2012). The SEACI researchers have recently (February 2014) published an article in the International Journal of Climatology on this concept (Whan K, Timbal B and Lindsay J. (2014) Linear and nonlinear statistical analysis of the impact of sub-tropical ridge intensity and position on south-east Australian rainfall. *International Journal of Climatology*. 34(2):326-342 DOI: 10.1002/joc.3689. ISSN: 0899-8418). This recent journal article will be referred to in discussions relating to the role of the sub tropical ridge and Hadley cell expansion on precipitation in SEA in the revised paper.