

Weather Clim. Dynam. Discuss., referee comment RC2
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Comment on wcd-2022-50

Anonymous Referee #2

Referee comment on "Anomalous subtropical zonal winds drive decreases in southern Australian frontal rain" by Acacia S. Pepler and Irina Rudeva, Weather Clim. Dynam. Discuss., <https://doi.org/10.5194/wcd-2022-50-RC2>, 2022

Manuscript Review

Manuscript Title: Anomalous subtropical zonal winds drive decreases in southern Australian frontal rain

Authors: A. S. Pepler and I. Rudeva

Overview:

This study investigates the possible causes behind the decline in frontal rainfall in southeast Australia (SEA). It builds on previous regional studies that have highlighted that there is little evidence to suggest that frequency of fronts have not changed, yet there has still been a decline in rainfall. Using a wind-based front detection method, the authors investigate what frontal characteristics could be behind the decline in rainfall within SEA. The key result being that decline in rainfall in SEA is linked to a weakening and southward shift in the northern edge of the front. Although there are numerous complex factors that impact the northern extent of the fronts, the intensity and position of the subtropical ridge appears to play a key role.

Overall, the study contains interesting scientific results, has appeal to a wide audience and is well presented. Thus, it should be considered for publication after some revision.

Major Comments:

Perhaps one of the key findings here is that there is evidence that the northernmost latitude at which fronts extend into the region has shifted polewards (i.e. weaker zonal winds). However, it is not clear as to how this results in less rainfall. It is suggested that it could be measure of frontal intensity, but perhaps just some more discussion as to the why or how is needed. Could it be less moisture transported into the region or perhaps less moisture already in the region before the front passes through?

Minor Comments:

A domain map early on in the manuscript would help the reader understand the domain of the study. This could be used to showcase the domains described in lines 70-71. A satellite image of day used to describe the front detection method could be an example of a domain map.

Consistency between the use of 'Southern Hemisphere' (e.g. line 7 and line 24) and 'southern hemisphere' (e.g. line 18 and 21) throughout the manuscript.

Line 84 – Is there any evaluation on ERA5 precipitation data with that of stations in the region? Not necessary for this study, just out of general interest for the reader in terms of decline seen in ERA5 compared to that in the observations.

Line 92-100 – Consider linking each bullet point to the associated figure panel in Fig. 1.

Line 100 – Could you explain Point 4 in more detail. It is not clear as to why this has been done.

Line 149 – Colorbar needs a label and units

Line 160 – 32mm per season?

Line 171 – Typo - 'South African'

Line 186/187 – I can understand why this is done, but perhaps for consistency in the Phillips Criterion acronym (PC) can just be used as it has already been used earlier.

Line 190 – does this infer that wet fronts move more slowly through the region compared to dry fronts?

Line 201 – Should the label for the blue in Fig 3. a-f not be “wet” instead of $\text{Rain} \geq 0.1 \text{mm/hr}$? That would just keep it consistent with the text. You could also consider splitting Fig. 3 into two separate figures.

Line 201 – Could the font not be made larger in Fig. 3? The mean lines are also difficult to read in the figure.

Line 251 – Similar to an earlier comment. Can one infer that the speed at which a front

passes through a domain has a direct effect on the volume of rainfall produced?

Line 276 – are the results for this section any different if the winter is broken down into an early vs late winter?

Line 285 – Consider re-ordering the panels in Figure 5.

Line 325 – Is there any intraseasonal variation with the relationship between the different drivers and frontal frequency / rainfall? For example, does the IOD have a stronger relationship with frontal rainfall during the late winter months compared to the early winter months?

Line 339 – Typo - 'Pearson's

Line 340 – Typo - 'm/s'

Line 348 – Could this be linked to anomalous moisture transport from the tropical Indian Ocean? Or is the impact more of changes on the Hadley Circulation and a weaker / stronger STR?

Line 368 – Just a general comment, what role does topography and wind direction play?
Could this account for any minor differences between the two Australian domain?

Line 427 - 'South Africa'