

The Cryosphere Discuss., referee comment RC4
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Comment on tc-2022-101

Anonymous Referee #3

Referee comment on "Climatology and surface impacts of atmospheric rivers on West Antarctica" by Michelle L. Maclennan et al., The Cryosphere Discuss.,
<https://doi.org/10.5194/tc-2022-101-RC4>, 2022

General comments

The manuscript by Maclennan et al. presents a study of atmospheric river events and their effects on the climatology and surface mass balance in West Antarctica. First, the MERRA-2 and ERA5 reanalysis products are used to quantify the frequency, trends, and large-scale effects of ARs on precipitation in the period 1980 to 2020. Then in-situ observations from weather stations at Thwaites Glacier are used to reconstruct accumulation and firn conditions during a series of AR events in 2020. Finally, the possible future effects of increasing AR intensity and frequency on surface conditions and surface mass balance in the areas are discussed.

The paper provides a good background of ARs in West Antarctica and their effects on surface mass balance, and the large-scale study is combined with the in-situ data into a very interesting discussion. The topic is timely and the paper is suitable for The Cryosphere.

The only minor issue is that the presentation of the work should more clearly state the goal of the investigations as well as summarize the findings more clearly. As I see it, the main strength and new contribution of this paper is that the authors combine the large-scale reanalysis products with detailed in-situ data. Thereby, they are able to qualify the discussion of the future impacts much more convincingly than from reanalysis products alone. This message should be communicated more clearly. The discussion section is strong, but I suggest that the Discussion and Conclusion section is divided into two, so there is a separate conclusion section in order to communicate the findings more clearly.

Detailed comments:

Page 1: the abstract is far too long. The length should be 250 words (see instruction in the TC). Remove sentences that are essential background or discussion.

Page 2-3: The introduction contains the motivation and background on ARs. However, the purpose of the study is not clearly stated. Rewrite the last paragraph to start with "In this study, we... This would also make it clear from the start how this paper differs from earlier studies by including the in-situ data, and why these data are included.

Page 2:, line 33: I don't think "TG" has been defined, please do so.

Page 4: AMIGOS – include a reference to define what AMIGOS is, it is not enough to include it in the title of section 2.1

Page 4, line 100: add "s" to sensor, and change "is" to "was".

Page 5: Perhaps explain a little more clearly why you focus on the precipitation and use the vIVT algorithm to detect the ARs. The precipitation effect is most important at present, but this could perhaps be made more clear here, or stated earlier in the motivation.

Page 7, figure 1: Indicate the 80degS latitude at the figure to the left. This would be helpful later in the discussion. What is the black outline in the middle figure?

Page 10, line 231: Please define "ASE".

Page 12, line 278: remove "and".

Page 12, line 280: The spatial resolution of the reanalysis product could both mean that it does not resolve variations within the grid cell, and also that some larger scale patterns are not resolved properly. It could be relevant to mention both.

Page 14, line 306: please correct the reference.

Page 14, line 312: Add the 80degS latitude to figure 1, see comment above.

Page 17: I miss a conclusion section to summarize the findings clearly and provide an outlook.