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Comment on **essd-2021-12**

Anonymous Referee #1

Referee comment on "Large ensemble of downscaled historical daily snowfall from an earth system model to 5.5 km resolution over Dronning Maud Land, Antarctica" by Nicolas Ghilain et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2021-12-RC1>, 2021

Review of

Reconstruction of daily snowfall accumulation at 5.5 km resolution over Dronning Maud Land, Antarctica, from 1850 to 2014 using an analog-based downscaling technique

By Nicolas Ghilain

General

This is an interesting application that remaps coarse-resolution Antarctic accumulation fields from a GCM to high (5.5 km) resolution using two intermediate products, a coarse resolution re-analysis product (ERA-Interim/ERA5) and a high-resolution regional climate model (RACMO). There are three problems that I identified while reading the paper: the introductory sections are poorly written, the goal is not well-motivated, and most of the figures are of mediocre quality.

Major comments

Unfortunately, the introductory parts of the paper are not well written. Many formulations could be clearer and more concise. Sometimes not even the meaning of a sentence is clear, for example, the sentence starting at l. 19: "While the Greenland Ice sheet is eroding at an increasing speed both from the base and the surface, the Antarctic Ice Sheet is sometimes viewed as subject to a mitigation mechanism to the observed melting of the ice shelf through an increased coastal precipitation due to a higher atmospheric humidity." is really unclear. It is true that in a warmer atmosphere, snowfall over ice sheets is expected to increase, mitigating future mass loss. This is true for both Greenland and Antarctica, so why make the distinction? Solving this requires a thorough and critical

re-reading of the manuscript, maybe the co-authors can be of assistance here?

Please better motivate the goal of the study. The title suggests that 'real' snowfall amounts are reproduced, but these are merely time series with improved statistics that do not represent 'real' events, rather 'real' variability. So please clarify: what are these data derived for?

Please improve figure quality, below are some suggestions.

Fig. 1: what do the colours of the text boxes represent?

- Fig. 2: add elevation contours to map, what are axis units? To see the improvement, time series should also show the non-downscaled ERA-Interim time series. Increase font size, add units to colour bar, 'nbr months' is not really a clear axis label etc.

- Fig. 5: increase the font size, add a unit to the colour scale.

- Fig. 7b: unclear which colour represents which principal component

- Fig. 9: increase the font size, add a unit to the colour scale.

- Fig. 10: add colour scale.

- Fig. 11, 12, 13: consider removing.

Minor and textual comments

ERA-Interim is known to have a serious dry bias in the interior ice sheet (doi.org/10.1175/2011JCLI4074.1).

850 hPa values for humidity, temperature are used, but this pressure level intersects with the surface of the ice sheet. How was this dealt with?

Abstract: the first few sentences do not really belong in an abstract, but rather in the introduction.

l. 1: over -> of

l. 9: Dronning Maud -> Dronning Maud Land

l. 18: the global -> global

l. 31: reconstitutions?

l. 114: lead -> led

Table 1: please adjust the number of decimals of the coordinates