



EGUsphere, referee comment RC3
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Comment on egusphere-2022-603

Anonymous Referee #3

Referee comment on "Climatic control of the surface mass balance of the Patagonian Icefields" by Tomás Carrasco-Escaff et al., EGU sphere,
<https://doi.org/10.5194/egusphere-2022-603-RC3>, 2022

General comments

The study analyzes the control of the present-day climate on the surface mass balance of the Patagonian Icefields. The main goals of the study are clearly formulated, and the study is well structured and written over largest parts. In the Discussion section, a stronger comparison with and discussion of results of other SMB studies in the region could strengthen the findings. Overall, the study adds valuable knowledge to the understanding of the interaction between climate and glacier mass balance in the southern Andes. I have one major comment which needs addressing and revision before publishing the article, together with several minor comments.

Major comment

The main limitation of this study is the fact that there is no spatial analysis for the correlation of SMB with large-scale indices and climate. It is possible that e.g. SAM does have an important impact on the SMB of the southern SPI, however, not on the whole study site. Averaging over such a large area can cause different signals in different regions to equal out. The study site does stretch over a large latitudinal band, and we know from literature that the climate and glaciology of NPI and SPI can show different characteristics and patterns. This is taken into account by calibrating the SMB model for both icefields individually, but then ignored throughout the rest of the paper.

Overall, I think by the spatial averaging a lot of valuable information is lost. I advise to conduct a spatiotemporal analysis instead of averaging over the SPI and NPI in order to

gain information about the regional variability of climatic control on the SMB in Patagonia.

Minor comments

L1: "Northern and Southern Patagonian Icefields" should be "Northern and Southern Patagonian Icefield"

L56 & 76 & 482: "dryer" should be "drier"

L88: The word "scenario" is strongly associated with climate scenarios, I recommend to reformulate

L93: "assess" to "assesses"

L112-123: The paragraph about the study site is a bit short in my opinion. I would include some brief information about major differences between the two icefields (e.g., SPI many marine terminating glaciers; do we have substantial climatic differences between the two icefields?). A reference to Fig. 2a would make sense here.

L125-131: Which exact variables are taken from RecCMv4?

L133: Why are two different versions used for precipitation and temperature?

L132-140: Both datasets, RefCMv4 and CR2MET, are (at least partly) based on ERA-Interim. I miss a comparison with an independent dataset. What about weather station data, or an independent Reanalysis dataset?

L150: You used the abbreviation ERA-Interim before. Introduce it at the first mentioning, please.

L154: Dot is missing at the end of the sentence.

L158: This is not clear to me: "Lastly, we spatially unweighted averaged the meteorological forcing and the glaciological over the Patagonian Icefields..."

L164: The first "DEM" can be removed.

L183f.: This is not a downscaling of radiation, but simple interpolation.

L199: I would replace the 10800s in the equation by a variable representing the timestep

L201: These are not soil. Rather call it type of surface.

L208: Accurately, the end of summer season would be the 31 March.

L218: Please, use a consistent number of decimal places.

L221-223: The values for c_0 are very different between NPI and SPI. Why is this the case?

L227: See comment to L132-140.

L241 & Table1: I recommend using a different abbreviation for the time period here to avoid confusion, as T has been used for temperature before.

Table 1 and following tables: It is common to put the table captions above the respective table.

Table 2: The annual SMB and precipitation value does not exactly add up from winter and summer values. Rounding error?

L286-289: Only mention the significant correlations here: "Among the modeled meteorological variables, the annual SMB is found to have the largest correlation with the annual precipitation ($r = 0.69$), followed by annual insolation ($r = -0.44$) (see Table 3). The same order is also evident in winter. The correlation between the SMB and temperature is only significant in summer."

L332: The correlation seems to be highest especially over the SPI?

L346: "shows" to "show"

Fig. 6b: The grey and white shading is confusing at the first glance, as it seems like there would be two different variables in this plot like it is in panel d. Maybe you can give the shading the same color as the contours to make it clearer.

L368f.: Refer to Fig. 9a here first.

L392ff.: The low correlation with the ENSO and SAM could be due to the spatial averaging over the whole study site. Consider differentiating into regions.

L418-426: Discussion and comparison with other SMB studies in southern Patagonia would support your findings. Similar findings have been found before, e.g., at Grey and Tynall Glacier (Weidemann 2018, <https://doi.org/10.3389/feart.2018.00081>)

L473 & 490: "SBM" to "SMB"

L476-489: Every paragraph starts with "years of ... SMB are characterized by ...". Consider reformulating.