

General comments

This manuscript presents a detailed analysis of glacier changes in Chile's La Laguna catchment based on multi-source remote sensing observations. Compared to previous studies quantifying regional glacier mass balance in the Andes of Chile, this study showed finer details of the rock glacier dynamics and temporal variations of glacier mass changes in a catchment of interest. The methods and results are clear, with quantifications compared with in-situ data and estimation from previous studies. The authors thoroughly discussed the implications of heterogeneous rock glacier changes and explained the glacier response to climatological context in a long-term time frame. This study contributes to a better understanding of the underlying dynamics of rock glaciers in contrast to the intensified thinning of the typical glaciers (clean-ice/debris-covered), and an in-depth discussion of the evolution of glacial behaviors and associated landforms under the scenario of climate change. In general, the reviewer suggests modifying a few points as specified below to improve the clarity and rigor of the argument, in addition to some minor mistakes/unclarities listed in the specific comments.

(1) Uncertainty of glacier mass balance

The authors followed a method similar to Falaschi et al. (2019b?) to quantify glacier elevation change and mass balance errors. However, it is unclear how to compute the error of penetration depth (E_r) in equation (4). The accounting of penetration error as an independent source may be questionable in equation (4). Given that the error of penetration depth affects the calculation of elevation changes which are then propagated to the error of mass changes, E_r is not independent from $E_{\Delta v}$ in this case.

(2) Comparison with the latest regional glacier mass balance estimation

The glacier mass change estimation in this study was compared to that of Braun et al., 2019 and Dussaillant et al., 2019, which used different sources of DEMs. A new global estimation of glacier mass balance (and elevation change maps) is published in Hugonnet et al. (2021). It is necessary to update the comparisons with this dataset to see whether the disagreement persists.

(3) Comparison with in-situ glacier mass balance

In line 350, the figure (Figure 8, comparison of glacier velocities) does not match the contents about comparing with in-situ glacier mass balance. Quantitative information from the field survey is therefore missing.

(4) Discussion on the elevation changes of rock glaciers in contrast to the thinning of Tapado Glacier

Rock glaciers seem to be in an overall equilibrium (Table 5) between 2012 and 2020 in contrast to the noticeable thinning of Tapado Glacier with debris-covered and clean-ice sections (Table 4). In addition to velocities and evident elevation changes on different parts of rock glaciers, any extended comments or discussions regarding the overall state of rock glaciers? I.e., is the equilibrium state indicative of the insensitive response of glaciers to climate forcing?

Specific comments

Line 95: Please simply describe the annual temperature level and precipitation amount in the study region in this paragraph.

Line 160: 'Third order polynomials were fitted to elevation biases...'. According to Figure 2, six-order polynomials was used for across-track correction?

Line 195: 'We opted to follow the same methods as Falaschi et al. (2019) who utilized...' The reference is unclear, Falaschi et al. (2019a) or Falaschi et al. (2019b)?

Line 251: When describing glacier area changes, keep the number (positive/negative) consistent to avoid confusion. The sentence can be revised to '...the glacier area decreased at a rate of $5910 \pm 1060 \text{ m}^2 \text{ a}^{-1}$ ($0.35 \pm 0.30 \% \text{ a}^{-1}$), which increased to $6818 \pm 24202 \text{ m}^2 \text{ a}^{-1}$ ($0.60 \pm 2.28 \% \text{ a}^{-1}$)...'.

Line 251 Page 12: ' $-5910 \pm 1060 \text{ m}^2 \text{ a}^{-1}$ ($-0.35 \pm 0.30 \% \text{ a}^{-1}$)', missing space between units ($\% \text{ a}^{-1}$). This kind of error is widely found throughout the manuscript (i.e., line 256, 315, 316). Do proofreading and correct the missing or surplus spaces.

Line 265: '()' missing references?

Line 278: '...between 2012 to 2015' revise to 'from 2012 to 2015'

Tables: The format of tables (number format, border lines, etc.) needs to be revised to improve the reading and be in line with the journal's requirements.

Table 5: The table is long, moving to the appendix or supplementary?

Figures:

Figure 1: It is not clear about the extent of debris-covered sections in (b). This information is necessary for a better interpretation of Figure 5. Try set the shade of rock glacier extent more contrasted in (a). The location of the (c) is not described in the figure caption. For a concise presentation, (b) and (c) can be aligned horizontally rather than vertically with (a). This organization also applies to Figure 3.

Figure 4: The legend covers up (blurs) part of the line drawings.

Figure 8: The figure does not match the contents discussed. It is about the validation of glacier velocities rather than glacier surface elevation changes from the field survey.

Figure 11: To improve visual geolocation, set the scale of the same place consistent across different panels (a, b, c).

References:

Hugonnet, R., McNabb, R., Berthier, E., Menounos, B., Nuth, C., Girod, L., Farinotti, D., Huss, M., Dussaillant, I., Brun, F., and Kääb, A.: Accelerated global glacier mass loss in the early twenty-first century, *Nature*, 592, 726–731, <https://doi.org/10.1038/s41586-021-03436-z>, 2021.