

Interactive comment on “Glacier runoff variations since 1955 in the Maipo River Basin, semiarid Andes of central Chile” by Álvaro Ayala et al.

Anonymous Referee #2

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Review of “Glacier runoff variations since 1955 in the Maipo River Basin, semiarid Andes of central Chile” Authors: Álvaro Ayala, David Farías-Barahona, Matthias Huss, Francesca Pellicciotti, James McPhee, Daniel Farinotti. This article aims to quantify the evolution of the glaciers and the runoff since 1955 in an Andean Chilean catchment using the TOPKAPI-ETH hydro-glaciological model. This study is very interesting and could help for water management in this region. Nevertheless, some issues have to be resolved before publication in the TC journal (see below).

1 – I am not convinced by the long term simulations that use a ‘stationary climate’ during two decades. By nature, climate is non stationary and an important decadal variability is observed in this region for the different climate variables (for instance the precipitation). The simulations provided here can be a first approach but simulations

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based on future climate projections should be made. This is important if one consider that this kind of study is oriented to water ressource management (as state in various places in the article). 2 – The methodology to calculate volume and surface glacier variations in relation with the climate is confused. More details should be done (time step, kind of processes, basal sliding, etc. ...). 3 – Concerning the precipitation used in the model, a clear explanation on how the discrimination phase between solid and liquid is done is missing. I don’t understand why an additional meteorological station is used here. Only one station is not adequate to the size of the catchment. A correction is made on the raw precipitation but details should be given concernig the methodology used. Finally how does the model compute the sublimation ? 4 – For the snow cover evolution, no in-situ data is provided. Does such data exists ? If yes a comparison between the simulations of the snow cover with TOPKAPI and CAMEL-CL models should be made. Please give more details concerning the CAMEL-CL product (resolution, etc. ...). 5 – Recent studies underlined the importance of groundwater in mountainous catchments. Here in the model, it seems that no water flux into the ground exists. This can not be true. Subteranean water fluxes may have an importance for the future of water ressources. 6 - Please define ‘glacier runoff’. 7 - If the model is oriented to be used for water management (as stated in the lines 544-547), please give results for daily simulations. What is the agreement between the simulations and the observations at daily time-step ? 8 - I think that all the sections 6.3, should be moved at the beginning of the result section.

Specific comments : Abstract – line 14 : please precise the time step of the simulated runoff Abstract – line 20 : please precise the latitude range Abstract – Please precise if the glacier area’s changes are taking into account in the model Line 81 : “...estimate glacier changes...” – please precise if it is surface, volume or both ? Line 95 : “... , to which it provides most of the drinking water...” – please specify the percentage (give a quantity). Line 125 : If I understand well, the outlines taken in 1955 are used for the year 2000 ? If the answer is yes, it is certainly not true. Please add more details. Lines 191-194 : “...for the years 2004-2016 ...” – How do you do before 2004 ?

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Line 221 : The model is "physically-oriented", so how do you do with the land cover and land use changes over the last decades ? Please indicate clearly that in the article. If the changes are important, this should be taken into account in the model. Line 245 : "...but no area increases due to positive mass balance are prescribed." This is not a valid statement as it is possible to observe glacier's advances. So if the model is "physically-oriented" this should be changed. In all this part, the time-step should be precised. In the model, the selected calibration and validation periods are unclear. Furthermore, details should be given concerning the snowfall/rainfall discrimination (T° threshold ?). I don't understand why the ERA-interim and MERRA products are not tested in the model. Please explain why. Line 315 : What is the criterion "to fit the geodetic mass balances..." ? Line 366 – 367 : Please rewrite this sentence, unclear. Fig. 1 : please specify in the legend how the total ice volume is obtained Fig. 6 : you should add the uncertainty for each curve. Fig. 7 : Where is the subteranean part ? Please indicate the evolution of glacier volume and glacier area. Fig. 8 : In the figure 7, you indicate Rain = 3% and in the figure 8 you indicate Rain : 29+/-8 % , why ? Tab. 1 : Please indicate the tested ranges for each parameter and the references associated.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-233>, 2019.