Reply to RC2 and RC3 hess-2021-44

RC2: I am totally aware of the fact that long-term measured mass balance data is lacking for a lot of catchments you analyzed. Still, at least for areas with comparatively (spatially) very dense and rather long-term measured mass balance time-series like Switzerland or Austria(or maybe even southwestern Norway?!), I think it would be worth taking only mass balance data from glaciers with “comparable regional climate conditions” for analyses of your catchments (e.g. differentiate between catchments of the northern slopes of the alps, of the inner (high) alpine regions (there also between west and east), and of the southern slopes of the Alps), see for instance Huss, M., Dhulst, L., & Bauder, A. (2015). New long-term mass-balance series for the Swiss Alps. Journal of Glaciology, 61(227), 551-562; you will see that, at least for Switzerland, there are quite a few long-term mass balance time series that you could use... For Austrian measured mass balances, you could also contact the WGMS national correspondent Andrea Fischer, for Norway Liss Andreassen (NVE), for western Canada, I am sure Brian Menounos (University of Northern British Columbia) would be willing to help you out with further detailed information. Have also a closer look at the detailed database of measured mass balances worldwide provided through www.wgms.ch. As this is, in my opinion, an important part of your study, it would be worth spending some more time and effort here I think, always aiming at taking long-term measured mass balance data with a regional and climatic context regarding individual catchments you analyze. –And if you have more than one mass balance time series to compare with one individual catchment, take area-weighted values!

RC3 Addendum by reviewer 22.02.2021

Dear Marit and Co-authors, what I wanted to add here is that of course you will have to consider the glacier size class distribution of the catchments you analyze in order to choose which and how many long-term mass balance time series you take into account for your new calculations. Example: If you have mass balance data for a small glacier in one catchment you analyze, but the glacier size class distribution of the catchment is more “towards larger glaciers”, i.e. there are also larger glaciers in the catchment, then it would be wrong as well to only take mass balance data from this single small glacier situated in the catchment you analyze(as catchment-wide mass balances will be strongly influenced by larger glaciers)... So to add on my comment above here: I would just try to take as many long-term mass balance data as you have for glaciers in the same region and with more or less the same climatic conditions as for the catchments you analyze, and then take area-weighted values of these to compare them with C values of the catchment you analyze(or you use other proposed approaches to extrapolate measured mass balance data to specific regions or catchments, as for instance discussed in Huss, M. (2012). Extrapolating glacier mass balance to the mountain-range scale: the European Alps 1900–2100. The Cryosphere, 6(4), 713-727.). Kind regards and all the best, Mauro

>> We thank the reviewer for his clarification and suggestions regarding the mass balance analyses. In fact, we did use the WGMS database, all the observations that are in there were used.

Considering review 1 and review 2, we now have two options for the glacier mass balance analysis: we can follow reviewer #1, indicating that it is an important part of our study and we should use area-weighted mass balances time series, preferably subdividing the glacier mass balance observations and catchments into more climatically similar regions (e.g. northern and southern slopes of the Alps, west and east). Alternatively, we can follow reviewer #2 who suggested leaving this part of the study out because it is only a very minor part. We have a slight preference for leaving the glacier mass balance analysis out of the

study and plan to change the manuscript accordingly. We will await the editor's guidance to this and make a final decision then.