

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-241

Michael Kuhn (Referee)

Referee comment on "Effects of climate change on the valley glaciers of the Italian Alps"
by Rossana Serandrei-Barbero et al., The Cryosphere Discuss.,
<https://doi.org/10.5194/tc-2021-241-RC1>, 2021

Based on measurements from 1980 to 2017, this paper gives a survey of general properties of the largest Italian valley glaciers that obviously distinguish them from slope glaciers. Six Eurocordex climate projections are applied to these valley glaciers for the period 2018 to 2100. The analysis is based on annual length measurements and records of temperature and precipitation. The projection up to 2100 uses a model proposed by Oerlemans which has two characteristic parameters, climate sensitivity of glacier length (m K^{-1}) and response time, which are valid for length variations with a standard deviation much smaller than glacier length, which is true for the Italian valley glaciers.

Valuable results of this study are summarized in this manuscript on lines 324 to 329: "a) under the RCP8.5 scenario, the mean retreat velocity of the glaciers is similar to that of the period 1980 to 2017 obtained from the observed data; b) given the form of the model used, the main forcing is the air temperature variation, while total precipitation changes have a weak impact on the results; c) the impact of different climatological models on the simulated results is less than 10%; d) according to the model, under the RCP8.5 scenario the majority of the valley glaciers (about 80%) will resist the climate change experiencing retreats less than 50% of their 2017 length and thus probably maintaining their characteristics of valley glaciers."

There are two aspects that may be improved in the final publication: (1) changes of length are expressed in percent. In Table 1 a column of absolute length changes in m in addition to relative changes in % would help the readers to give weight to the results. (2) is the commitment of mass balance of the positive years before 1980 significant for the projections to 2018 - 2100? And one suggestion: (3) can you provide links to relevant glacier photographs?

I am confident that these three points can be accomplished without much effort.

A few clarifications or corrections are required as follows.

Line 54 such as their

57 other more sophisticated

72 in areas

78 that the model

Figure 1 explain the color code in the legend

Table 1 add delta length in meters

170 – 173 explain this in more detail

189 how was the slope defined, $(\text{top} - \text{end}) / \text{dh}$? was it area-weighted?

Figure 6 This is Fig. 5, apparently with the legend of Fig. 6 which is missing.

235 while their primary classification as valley vs. slope glaciers

255 the response times (equ. 3) Did Paul et al. 2004 use the same definition of response time?

316 glaciers seem able

317 present at the end of the 21st century

334 Although the effect of climate change indicates a severe ice mass decline for the
Alps

337 probably more resistant to climate change

375 glacier

406 Knoll before Kuhn

506 Check Figures 5 and 6, one of the two panels is missing.

With best wishes for the finalization of this manuscript, Michael Kuhn