The Cryosphere Discussions

The Cryosphere Discuss., referee comment RC3
https://doi.org/10.5194/tc-2021-241-RC3, 2021

Comment on tc-2021-241

Anonymous Referee #2

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-RC3, 2021

Review to Serandrei-Barbero et al. (2021): "Effects of climate change on the valley glaciers of the Italian Alps" submitted to The Cryosphere.

The authors present a study of the future glacier length evolution of the Italian valley glaciers feeding a simple glacier model with future climate projections taken from the EURO-CORDEX initiative for RCP4.5 and RCP8.5 scenarios. The main result of the study is that until the end of the century the Italian valley glaciers (representing roughly 26% of the total Italian glacier area) will preserve about 50% of their length of 2017 and thus, their retreat will be slower than other glaciers in the Alps.

Overall, I rate this manuscript not ready for publication and due to the sum of inconsistencies I even suggest a rejection. My main points of concern are:

Missing scientific rigor: The introduction (L21) starts with a misconception. Glacier fluctuations are not a result of air temperature and precipitation variability, they are a result of complex climate-glacier interactions. We just prefer to make glacier fluctuations a proxy of air temperature and precipitation, because we usually have long-term observations of or established scaling functions for them. Hence, simple glacier models were established for conceptual understanding. However, we must be careful when interpreting (putative) results of (highly) parametrized processes or inverting them. Fig. 4 is an example of such a putative result. The correlation between the slope and the climate sensitivity is not a result of the study, it is a result of the model design. Because the simplified model defines the climate sensitivity as a function of the slope (Oerlemans, 2001), we detect it as correlation in the data. Cause and effect must not be interchanged. Additionally, the chosen method seems not to be state of the art anymore. Meanwhile ice thickness estimates are available (Farinotti et al., 2017) opening the path to models deriving glacier volume changes (e.g. Maussion et al., 2019), having a higher significance than glacier length changes.

Missing model calibration: A previous study of the same authors (Zecchetto et al., 2017) calibrated an existing method of glacier length change modelling (Oerlemans, 2005) on smaller glaciers in the Italian Alps for air temperature reconstructions. Now, the author team applies the same method without further amendments on the larger Italian valley glaciers. While the model is calibrated on shorter and steeper glaciers, it is applied on longer and flatter glaciers, although the authors would have all the data to calibrate the model on the valley glaciers, too. The missing model calibration might explain the low climate sensitivities and short response times compared to the original model publication (Oerlemans, 2005) and definitely impacts the results of the study and the conclusions the authors draw.

Missing error estimation: Because the model is not calibrated, there is no model error reported. The uncertainties given in Fig. 8 are induced by the different CORDEX ensemble members, but not by the model. Robust scientific results rely on a rigorous error estimation, would have helped to phrase a stronger discussion section.

References

Farinotti, D., Brinkerhoff, D. J., Clarke, G. K. C., Fürst, J. J., Frey, H., Gantayat, P., Gillet-Chaulet, F., Girard, C., Huss, M., Leclercq, P. W., Linsbauer, A., Machguth, H., Martin, C., Maussion, F., Morlighem, M., Mosbeux, C., Pandit, A., Portmann, A., Rabatel, A., Ramsankaran, R., Reerink, T. J., Sanchez, O., Stentoft, P. A., Singh Kumari, S., van Pelt, W. J. J., Anderson, B., Benham, T., Binder, D., Dowdeswell, J. A., Fischer, A., Helfricht, K., Kutuzov, S., Lavrentiev, I., McNabb, R., Gudmundsson, G. H., Li, H. and Andreassen, L. M.: How accurate are estimates of glacier ice thickness? Results from ITMIX, the Ice Thickness Models Intercomparison eXperiment, The Cryosphere, 11(2), 949–970, doi:10.5194/tc-11-949-2017, 2017.

Maussion, F., Butenko, A., Champollion, N., Dusch, M., Eis, J., Fourteau, K., Gregor, P., Jarosch, A. H., Landmann, J., Oesterle, F., Recinos, B., Rothenpieler, T., Vlug, A., Wild, C. T. and Marzeion, B.: The Open Global Glacier Model (OGGM) v1.1, Geoscientific Model Development, 12(3), 909–931, doi:10.5194/gmd-12-909-2019, 2019.

Oerlemans, J.: Glaciers and Climate Change, A.A Balkema, Lisse., 2001.

Oerlemans, J.: Extracting a climate signal from 169 glacier records., Science, 308(5722), 675–677, doi:10.1126/science.1107046, 2005.

Zecchetto, S., Serandrei-Barbero, R. and Donnici, S.: Temperature reconstruction from the length fluctuations of small glaciers in the eastern Alps (northeastern Italy), Climate Dynamics, 49(1–2), 363–374, doi:10.1007/s00382-016-3347-5, 2017.