

Clim. Past Discuss., referee comment RC2
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Comment on cp-2021-110

Kurt Nicolussi (Referee)

Referee comment on "Glacier response to Holocene warmth inferred from in situ ^{10}Be and ^{14}C bedrock analyses in Steingletscher's forefield (central Swiss Alps)" by Irene Schimmelpfennig et al., Clim. Past Discuss., <https://doi.org/10.5194/cp-2021-110-RC2>, 2021

This paper is an interesting and well written contribution to the topic of Holocene glacier evolution in the Alps. It is based on a so far rarely used approach to the analysis of Alpine glacier evolution and phases after the end of the Late Glacial. The study thus complements the usually temporally fragmentary evidence for Holocene glacier retreat phases in the Alps based on the analysis of wood and peat material. The approach as well as the analysis and modelling steps are presented in detail and - for me as a non-cosmogenic isotope researcher - largely comprehensibly, the discussion should undergo minor changes. Overall, the study is very well suited for publication in Climate of the Past.

Specific and minor points

Lines 336-338: It remains unclear why the two samples 16-10 and 16-12, analysed for both ^{10}Be and ^{14}C content, should have had the same exposure history and why the results were - therefore - averaged, as they come from clearly different positions in terms of sampling elevation. One site may have been covered by ice during glacier advances in the early to mid-Holocene, but the other may not have been reached, which could be one explanation for the different results. The inferred longer exposure time of sample 16-12, which was taken at a more elevated position, also points to such a scenario. A more complex consideration seems to make more sense here.

Line 385 It not clear to me why the find of a wood fragment points to a warmer climate. If it is about the inferred position of the tree line, which in turn is interpreted climatically, this would make sense.

Lines 394-417 These lines discuss the time span in which the Steingletscher was smaller than its 2000 CE extent, i.e. that the Chüebergli riegel was not ice-covered. ("... indicate that the glacier was smaller than its 2000 CE extent for a total of ~ 7.4 kyr during the Holocene"). Wouldn't it be also possible that - since a certain ice thickness (>70 m, lines 231-233) is required in each case to prevent ^{14}C production - there were also less intense advances, that resulted in only minor ice overburden, but which clearly exceeded the 2000 CE extent? This would better explain the long exposure duration determined for sample 16-12 against the background of the state of knowledge on Holocene glacier evolution.

Line 476: The statement "HTM might have been $\sim 1-3^\circ\text{C}$ warmer than modern times" is quite strong, however, it needs a more specific temporal reference than "modern times" because of the currently fast changing climate conditions.

Lines 495-496 I agree that there is a lot of evidence for glacier advances and LIA-like extents between ca. 3.6 and 2.6 ka, but on the other hand, there is evidence for the glaciers Mer de Glace and Aletsch that they had a maximum extent as around 2000 CE at ca. 3 ka (see, e.g., Le Roy et al. 2015) - this should be added into this discussion.