

Reply to reviewers' comments on "History of desert dust deposition recorded in the Elbrus ice core"

We would like to thank both reviewers for their comments that helped us to improve and clarify the manuscript.

Accumulation rates over past 260 years archived in Elbrus ice core, Caucasus

Mikhalenko and others.

The authors present an important new paleo reconstruction of precipitation, seasonally resolved, from the 182 m long Mt. Elbrus ice core. They apply sensible ice flow corrections to the data prior to interpretation, to allow for layer thinning, and show the regional extent of correlation between the ice core data and meteorological stations. They also demonstrate that precipitation in the region is linked to Atlantic variability, and show that the paleo reanalysis EK400v2 shows a likely unphysical disagreement with the ice core accumulation data prior to 1850, in contrast to good correlation from 1850 to present. This should caution future users of the paleo reanalysis to view the 1750-1850 period of this product with healthy skepticism.

The paper is generally well organized and composed, although it is significantly under-referenced in many sections which is its primary weakness at present draft. The authors make many statements which need to be referenced against the relevant supporting literature. I will note some specific instances, but not all. The manuscript does need to be edited for grammar.

We appreciate the reviewer's insightful feedback and have taken it into account during the revision process. We acknowledge that we inadvertently omitted several references in the manuscript. As per the suggestions provided by Reviewer 1, we have thoroughly revised and rewritten various sections of the manuscript, addressing the specific points raised.

L46: this paragraph should refer to the literature of published ice core accumulation records.

We have considered your comment regarding the absence of references in this introductory paragraph. In the subsequent paragraph, where we list the limitations and reasons that constrain accumulation reconstructions, we do cite various relevant studies to provide a more comprehensive overview.

L50: what errors are the authors referring to? They seem to be thinking of a particular result here but do not give a reference

Taken into account. We cite Pascal Bohleber's work here and references within since this paper investigated effects of snow scouring on isotopic records.

Bohleber, P., Wagenbach, D., Schöner, W. and Böhm, R.: To what extent do water isotope records from low accumulation Alpine ice cores reproduce instrumental temperature series?, Tellus, Ser. B Chem. Phys. Meteorol., 65(1), 1–17, doi:10.3402/tellusb.v65i0.20148, 2013.

L58 “compared” to other

Done.

L74: how long was the 2020 core?

Done, information added.

Section 2.2.1: generally the author’s presentation of dating and uncertainty is good, but the uncertainty of the record should be extended to graphical presentation of the data (shading, error bars, etc.).

Taken into account, we added another paragraph considering the uncertainty. Figure 4 was updated.

The uncertainty range for the reconstructed accumulation values is determined by multiple factors. Dating uncertainty varies with time, providing a precision of ± 1 year for the 2009-1912 CE period, ± 2 years for the period 1912-1825 CE, and decreasing to ± 4 years for the period 1825-1750 CE. Additionally, the uncertainty linked to the upstream effect correction is challenging to estimate precisely, depending on factors such as initial spatial accumulation distribution uncertainty, assumptions regarding its temporal persistence, and uncertainty in back trajectory modeling. To address potential errors, we estimated the uncertainty of the applied linear regression. Furthermore, for winter accumulation, the uncertainty increases due to lower sampling resolution. In particular, we added an uncertainty of 30% for winter accumulation values prior to 1865 CE, where the sampling resolution was insufficient, potentially leading to an underestimation of accumulation values.

L271: Appreciate that the authors clearly state limitations of the data and define boundaries for interpretation

Noted.

L284: reference?

Reference added.

L359: CAPE corrections for seasonality are really well done and much needed. This is great.

We appreciate reviewers comment.

L384: Statement on snow deposition isn’t supported by data or reference.

Taken into account. Removed.

L395: Section on occlusion unsupported by data or reference

Reference added.

L405: make sure acronyms are written out initially and defined.

Done. East Atlantic/Western Russia teleconnection pattern added.

695 Data availability statement isn't justified and currently doesn't align with CP policies which encourage archiving of data in agreement with FAIR principles. Authors must justify why data are only available on request, which often very much restricts access to datasets.

We decided to publish accumulation reconstruction data in the supplementary.

Finally, I do apologize for the lateness of this review and hope it hasn't unduly impacted the authors.