

Response to reviewer 2

We thank the reviewer for their constructive comments and suggestions. We recognise that the interpretation is not fully explored in this publication. This is because the guidelines for a data description paper state that extensive interpretations of data remain outside the scope of this data journal. Therefore, we have focused on presenting the data to accompany the database and recognise the contributions of all co-authors who submitted previously unpublished data.

General comment

Thomas et al present a unique data base of previously published and unpublished sodium [Na+] and sulphate [SO42-] records from all over Antarctica, collected within the CLIVASH2k project. The records span several 100 years back to 2000 years. Age scales were made consistent where possible and age transfer functions are provided. A data validation is provided and recommendations with respect to uncertainty. In a second step, a comparison to the climatological parameter sea ice condition, wind and geopotential height is conducted to serve as a first level filter for the data base. To this end the correlation of each record to the climatological parameter is evaluated.

The authors present the data set along with a careful description of uncertainty and potential usage. The provided data base presents a well needed contribution to data coverage related to Antarctic climate. The only weakness of the paper is the attempted interpretation, i.e. the presentation of the correlation analysis of single records.

Line 147ff: It would be beneficial to have the records published with both –age and depth. Having access to the original record over depths allows re-using the record and comparing it to new/upcoming records in the future.

Most of the data does contain a depth scale, and it is our intention to include all files in LiPD format alongside the current database. However, not all the data (especially some of the historical records) contains a depth scale at this stage. Or not all authors were prepared to submit the records together. Therefore, we will work on this for future versions. However, while this step is ongoing, we felt it was important to make the data available to support existing community activities.

Line 156: how are these cores dated/synchronized with the others?

This sentence has been updated and a reference added for the DT401 age-scale.

“Plateau Remote and DT401, both very low accumulation sites in the interior of east Antarctica, have been dated using [SO42-] (Ren et al., 2010), however, the reference horizons differ from WD2014 age-scale prior to 1000 AD and cannot be confidently synchronized.”

In line 265ff (chapter 3.1.1) the correlation of single records with the three climatic parameter sea ice concentration, wind and geopotential height is used for validation. It has been shown for stable water isotope records from Antarctic ice cores, that single records contain little climatic information on annual time scales, i.e. that it takes several cores to increase the meaningful time period to interpret (Münch and Laepple, 2018). The authors recommend to average over several cores earlier in the text (line229) but interpret their single records with respect to climatic parameter. Assuming that sodium is deposited with the snow (like stable water isotopes) these findings (and the approaches to solve the issue) could be considered similar – i.e. that it makes sense to look and larger time scales than annual for records from the East Antarctic Plateau.

While we do agree with this to some extent, many in the community would argue that single ice cores do contain meaningful climatic information. It is not always possible, and not always necessary, to combine data to extract a statistically significant relationship with a climate variable. However, we recognise that for stable water isotopes, and especially records in low accumulation sites, combining records is an advantage.

The guidelines for a data descriptor state that extensive interpretations are outside of the scope of the journal. However, we have included this initial interpretation step because we felt it would be beneficial to future users. We agree that more in-depth analysis and interpretation, including combining record, is required and this is the basis for future publications.

Line 277: It is not explained well, why the correlation analysis includes wind/ geopotential height. What do you expect and why? Is your expectation the same everywhere in Antarctica?

In the introduction we reviewed the importance of meteorological conditions in driving chemical deposition in Antarctic. Referencing sites where sodium has been used as a tracer for marine-air mass incursions and atmospheric circulation. For this reason, we have included both winds and geopotential height in our first-pass filter.

We have expanded the paragraph in section 3.1.1 to explain this.

“Based on the published literature (section 1) the deposition of $[Na^+]$ and $[SO_4^{2-}]$ has been linked to changes in sea ice, winds, and atmospheric circulation. Thus, these parameters have been chosen for the initial evaluation step.”

Line 288ff: The authors write, that an “interpretation team” is evaluating the results. The objective of this approach is to provide a first level filter for the database. It implies, that the expert’s opinion is counted very high, whereas the statistical evidence is not relevant. On what basis did the experts decide? Has there been an objective measure? Is this finding reproducible by others? Maybe it is possible to mention some of the measures taken by the interpretation team here.

We wanted to avoid over-interpreting the data, but it is important that we don’t encourage inappropriate statistical interpretation to impact how the data is used. The use of the interpretation team is to sense check the statistical relationships, not suggest the statistics is irrelevant.

We have tried to demonstrate this in figure 2, by displaying an example of a statistically significant correlation which can not be corroborated with known transport mechanisms. In the chosen example there is a statistically significant correlation with sea ice on the opposite site of the continent to the ice core. While this might be indicating a teleconnection, the direct link between this region and the

chosen ice core site was considered unlikely. We are not suggesting that all users have to follow this method, but we felt it might be useful for those who are less familiar with the data.

We don't have an objective measure of how our decisions are made, but this was the focus of many lengthy discussions. The varying atmospheric processes influencing sites across Antarctica made applying a fixed set of criteria (e.g., distance from source) very difficult. Instead, we have applied a qualitative measure to help guide users, whilst not limiting the future use of the data.

We do identify this method as a potential limitation in section 5.2. Here we identify that 8% of the records were classified as uncertain.

Line 308ff: In previous studies it is shown, that climatic fields inherit patterns and correlations which lead to $p > 0.05$ probabilities by chance (see Livezey, R. E., & Chen, W. Y., 1983). The presented results have to be taken with care – i.e. to be redone accordingly and/or require a more in-depth discussion.

Thank you for the reference. Yes, we agree on this and have therefore been cautious not to assume that a statistical correlation proves a climatic connection. We have added an additional sentence in section 4 to strengthen our rationale for using the interpretation team.

“Indeed, studies have shown that climatic fields inherit patterns and correlations which can result in statistically significant correlations by chance (Livezey and Chen, 1983).”

Overall, the interpretation is the weakest part. Maybe it makes more sense to work on the interpretation in more detail in an extra paper and leave it out here.

We agree that the interpretation is not as extensive as we would expect from a scientific article, however, this was submitted as a data descriptor. And under the journal guidance interpretation cannot be an extensive part of the paper. The scientific interpretation of this data will be presented in more detail in future publications.

References:

Münch, T. and Laepple, T.: What climate signal is contained in decadal- to centennial-scale isotope variations from Antarctic ice cores?, *Clim. Past*, 14, 2053–2070, <https://doi.org/10.5194/cp-14-2053-2018>, 2018.

Livezey, R. E., & Chen, W. Y. (1983). Statistical Field Significance and its Determination by Monte Carlo Techniques. *Monthly Weather Review*, 111(1), 46–59. [https://doi.org/10.1175/1520-0493\(1983\)111<0046:SFAID>2.0.CO;2](https://doi.org/10.1175/1520-0493(1983)111<0046:SFAID>2.0.CO;2)