

Reply to Reviewer #1

We would like to thank Pierre Francus for the constructive feedback and ideas to improve VARDA in future versions. We copied all comments below, numbered them in order of appearance (RC1-1 to RC1-11 plus specific comments) and provide a detailed response accordingly. We hope to have addressed all concerns and improved the manuscript according to the suggestions.

Arne Ramisch (on behalf of all authors)

General comments:

RC1 - 1. Years are expressed as “yr” in the database but as “a” in the tables of the paper. I do not want to enter into the debate of “yr” versus “a” (see for instance Christie-Blick 2012), but I much prefer “a” (for “annum”), and I think it would be a lot more pertinent for a database reporting dates and not durations. Nevertheless, I think that the paper and the database should use the same abbreviation.

Authors response: The reviewer is right in pointing out the discrepancy between labels of years in the manuscript and database. We have changed the label to “a” in the database according to the reviewers’ suggestion. We additionally changed labels in the manuscript to avoid confusion.

RC1 - 2. It is not clear how varve depths are reported. In table 7, a required information is the "Composite Depth" as well as the "Section depth". But what is the “depth” of each varve? This should be specified. There was a long discussion about that topic within the PAGES community (see Khider et al. 2019). In the case of varved records that are established from composite profiles, it is critical, in my view, to report the upper and the lower depths of each varve. This information is indeed needed when making the link between two sections that are used to build up a composite profile.

Authors response: In the previous version of the manuscript, varve depth in VARDA were reported as varve bottom depth. However, the reviewer is right in pointing out the ongoing debate and advantages of reporting upper and lower varve depths. We therefore adapted the upper and lower varve depth suggested by the reviewer as required information and updated all respective datasets as well table 7.

RC1 - 3. I also think that the distinction between “core section” and “sediment profile” should be clearer. I suggest to systematically write “sediment composite profile”.

Authors response: We agree with the reviewer, that there needs to be a clear distinction between the terms “sediment profile” and “core section”. We have adopted the suggestion by changing “sediment profile” to “sediment composite profile” throughout the manuscript to avoid confusion. Additionally, we removed all mentions of “core section” and changed “sediment profile depth” to “composite depth”.

RC1 - 4. Finally, it would be nice having some information about how and how frequently the data included in the database will be updated. Moreover, I suggest authors to outline how VARDA will be maintained in the long term. Is there some commitment from GFZ about this, or another strategy exists?

Authors response: Currently, VARDA is securely funded through the PalMod project until 2022 and hopefully until 2025 if the third project phase will be implemented as well. Long-term maintenance is

envisaged at GFZ and negotiations with the GFZ directory board about commitments are presently ongoing.

SUGGESTIONS FOR UPCOMING VERSIONS

RC1 - 5. Information about the quality of varve counts should be included in upcoming versions. It was already discussed in Ojala et al (2012) by the varve working Group of PAGES. Among others, the following informations were called for: the number of persons counting varves, the number of varve counts, the quality of varve preservation, the media on which the counting were performed (and its resolution), evidences that laminations are annual, . . .

Authors response: We agree with the reviewer that the quality of varve counts is an essential information. As a first step the information on method of varve counting and evidence for annual nature of laminations will be provided as part of the meta information in the upcoming version. This will be followed by standardized meta-information as suggested by Ojala et al. (2012). In addition, we already collected varve quality data for those records for which these data are provided. However, as these data are largely subjective, we refrained from including quality assessments on a varve-by-varve base in the first version of the database. Presently, we are discussing an appropriate way of providing these data in the next update.

RC1 - 6. There is a nice table for radiocarbon information. Would it be possible to include a 210-Pb and 137-Cs table as well?

Authors response: We already collected 210-Pb and 137-Cs data for several sediment composite profiles and intend to add the information as meta information to a chronology. However, this step will require expert knowledge and a common standardization scheme and is therefore postponed for forthcoming updates.

RC1 - 7. Create an interface to allow potential contributors to submit new or updated records. Of course, there should be a control by a database manager, but this can help to expand this database.

Authors response: The interface to upload is under construction. We are developing a user management system to assign editorial rights to users which will enable them to update meta information and upload new records. This will be included in the next major update of the database and presented in forthcoming publication on VARDA.

RC1 - 8. It would be nice to have an entry for IGSN numbers (see <http://www.geosamples.org/igsabout>)?

Authors response: We thank the reviewer for this advice and must admit that this is not yet on the priority list. However, we agree that this information would be nice to have and will include this in an upcoming version of VARDA.

RC1 - 9. Include marine varved records.

Authors response: We are currently working on an integration of marine records into the database in collaboration with our project partners from MARUM. Since this effort has just started, we don't have a specific timeframe for this update, yet (see also comment 3 to Reviewer #2).

RC1 - 10. I'm not sure this is possible, but it would be nice including the lake Suigetsu record as another landmark record such as the NGRIP record.

Authors response: We are currently developing a data visualization tool for VARDA and will follow this suggestion and include the varved parts of the Suigetsu record as a lake landmark record.

RC1 - 11. Make the database codes available to allow researchers that are building new varve records to immediately and locally collect their data in a format that will be easily sent to VARDA once the publication is accepted and the data transferred to data repositories.

Authors response: A publication of the VARDA source code is in preparation. Furthermore, an import tool for users to directly upload data to VARDA is in development and will be included into the next major update (see also comment on RC1-7). We have included this information into the *6. conclusion and future developments* section.

Specific comments:

RC1 - Line 1: This can be done on all time scales, and it is even more pertinent for the last 2ka.

Authors response: We have removed the reference to the last glacial cycle to acknowledge climate simulation on all temporal scales.

RC1 - Line 26: What do you mean here? They are key sites?

Authors response: We used the term node as defined in the framework of graph theory. We changed “node” to “data” to avoid potential confusion.

RC1 - Line 30: Not only

Authors response: We changed the passage to “understand past climates, especially of the last glacial cycle”

RC1 - Line 31: contrasted?

Authors response: We have changed the phrasing according to the reviewers suggestion.

RC1 - Line 65: change “Lac D'Annecy” to “Lac d'Annecy”

Authors response: We changed the name of the lake (both, within the manuscript in line 65 / Table 8 and the database) according to the reviewers suggestion.

RC1 - Line 66-67: How this point is determined for a large lake? Is it similar to the coordinate of the location of the core?

Authors response: The geographical location of the lake is independent of the core location, since a single lake can include a multitude of core locations. The lake location roughly refers to the lake center. We have included this information into the revised version of the manuscript.

RC1 - Line 73-74: It is not clear if it is the depth in the sediment or something else.

Authors response: We changed this passage to clarify, that this relates to the total sediment composite profile length characterized by an upper and lower depth.

RC1 - Line 94: I think this would be more clear if this was called "sediment composite profile".

Authors response: See RC 1-3

RC1 - Line 116: I suggest that you assign predefined values to these strings to avoid confusion.

Authors response: We will incorporate this suggestion into the import tool we are currently developing and which will be included into the next major update.

RC1 - Line 119-120: Then this should not be a required information, but rather an additional

Authors response: We agree with the reviewer and changed uncertainty estimates from required to additional in line 120 and table 5.

RC1 - Line 149: In table 7, a required information is the "Composite Depth" and there is also the "Section depth". But what is the depth of the varve? This should be specified. There was a long discussion about that within the PAGES community (see Khider et al 2019 PaCTS 1.0: A Crowdsourced Reporting Standard for Paleoclimate Data. *Paleoceanogr. Paleoclimatol.*, 34 (10) : 1570-1596.

Authors response: See RC1-2

RC1 - Line 184: What do you mean?

Authors response: We have removed this sentence in the revised version of the manuscript to avoid confusion.

RC1 – Tab. 8: I suggest repeating the header of Table 8 on each page and add some separators or shading to better distinguish between records.

Authors response: We added a header to table 8 on each page and shaded every second row to improve readability.