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Discussions

Interactive comment on "Biological proxies recorded in a Belukha ice core, Russian Altai" *by* T. Papina et al.

Anonymous Referee #1

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Overview

Papina et al. perform an analysis of biological parameters (pollen, cysts, diatoms) recorded in an ice core from the Russian Altai from 1964 – 2000. The data they present have continuous annual resolution, which is particularly valuable in examining the use of biological proxies in ice cores. The resolution and continuous record set the study apart from previous work in the same region, and the reader is left to assume that this is where the uniqueness and value of the research comes from, as the authors do not directly identify the importance of their research. The authors focus on connecting the various biological proxies to their sources by identifying the atmospheric circulation patterns that supplied the most precipitation based on correlating the occurrence of each proxy with the atmospheric circulation pattern providing the highest precipitation

during years of maximum and minimum concentration of a given biological proxy. They then correlate the counts of the proxy from each layer of the ice core with the total precipitation received from the relevant atmospheric circulation patterns. While the paper has potential, it is not ready for publication without serious revisions, mainly in these categories: 1. Clarification of the goal of the paper and its conclusions, 2. Clear discussion of the methods, 3. Streamlining of tables and overall writing and, 4. Meaningful discussion of the data in the context of other studies or theory relevant to biological proxies.

General comments:

1. A proxy, by definition, is some measurable characteristic that can stand in for an unmeasurable characteristic. The authors refer to the biological parameters that they measured in the Belukha ice core as "proxies", however, they never discuss what specifically they are proxies for. It is not clear whether the authors assume that the biomarkers in the ice core are proxies, or whether they are actually testing the idea that biological parameters can be proxies. This is a major deficiency in the framing of the story and should be clearly explained from the beginning of the paper. Further, if the former is true, then the authors need to be explicit with regards to what exactly their data are proxies for. Once this point is made clearly in the introduction, it should be carried through the entire paper, and discussed explicitly as part of the conclusions.

Overall, my best guess is that authors goal was to define the ECM, connect those patterns to the deposition of the biological "proxies", and then determine whether the sources indicated by their analyses match those linked to the previously analyzed chemical species in the ice core, which is a test of the potential utility of biological markers as proxies. This needs to be made clear, so I do not have to guess.

2. The paper lacks clear description of the methods. After some laboring through what methods they do describe, and through the references list, I think I determined that the ECM's were not determined by the authors of this study, but rather came from another

paper and were used to interpret biological data in this ice core. The authors should say this clearly, and discuss only the ECM's relevant to their story. The paper also lacks description of the statistics used to match the biological data with precipitation patterns. Correlation statistics are presented, but we have no idea how they were calculated (Pearson? Spearman? Were data transformed? etc.). It is also not clear what the ECM data that they used in the correlation even are – are they numbers? An index of some sort? The readers re left to simply trust the p-values that are given, but has no way to vet the data for themselves. All of the methods need to be described clearly.

3. There are far too many tables in this paper, and they are difficult to read. With a little thought, many of them could be either combined or deleted, and made more informative and useful. Some of the figures could be combined (i.e. figures 4 and 5 go together and could be joined into figure 4 a and b). The introduction to the paper is rambling and jumps between topics.

4. The paper lacks discussion. Jumping from Results to Conclusions is insufficient. The Introduction and Results should be streamlined in favor of including meaningful discussion of the data in the context of overall ideas about biological proxies.

Specific Comments:

Text P2590 L1: It is not clear to me, in this particular article, what these biological signatures are to be proxies for. The climatic data presented seems to be used to track the sources of the biological agents - so, the climatic data is already a given as far as I can tell. So, what is the biology a proxy for?

P2590 L17: Nice thesis statement. Direct and to the point.

P2590 L24: This statement begs the question, "Why do we need an additional tool? What is missing with the current tools?"

P2591 L1: I think there should be a citation, or some further discussion here, as I would

argue that deposition with precipitation should be higher than dry deposition, but not that there is no dry deposition of biological agents on glaciers. Can't things be attached to dust particles?

P2591 L4: This seems to be the main point of the paper, but it is kind of buried here and unclear. "Insight" is not a specific enough term.

P2591 L6: What do you mean by "typical"?

P2591 L22-23: "proxy records of biological species for the Altai region and northern Eurasia as a whole" – this statement seems to be just thrown in here, as nothing in the preceding sentences prepares the reader for this idea. A clearer connection needs to be made here.

P 2592 L4 to end of paragraph: This sentence is very confusing. If understanding the atmospheric patterns is important, what are the biological markers proxies for? What is the interpretation?

P2592 L12: Describes the results from another study, where the biological record actually was used as a proxy for something. Similar interpretation is totally lacking in the current manuscript.

P2592 L20: The description of the circulaton mechanisms and the precipitation is out of place here. It should be described clearly in the Methods, as it is difficult to determine exactly how the circulation patterns responsible for highest precipitation were identified.

P2592 L24-25: The section ends with the statement that the analysis of the results allowed the authors to identify the main sources of the biological signatures deposited on the glacier, but does not tell the reader WHY they were identifying the sources. What is the goal here? This would be a great time to make that clear.

P2594 L7: State what types of spores were being looked at. Bacteria also form spores, and this is an important distinction, which is not made clearly until later in the paper.

P2594 L9: Decontamination procedures should be described clearly, or at least cited.

P2594 L25: Describe "standard hydrobiological methods".

P2595 L4: So, what was on the filter was resuspended in Milli Q water? It is not clear to me how the samples were processed.

P2595 L5: What is "Nazhotta"?

P2595 L21: Write "it is", not "it's".

P2596 L1: Write "cyclones coming from the South (the Mediterranean, Black, and Aral Seas).

P2596 L6-16: This is just Table 1, rewritten. Text should not merely re-state the tables.

P2596 L18: I do not understand this sentence. Does it mean that the classification system was used from 1899 to 2000? Or that the data were from 1899-2000? Please clarify.

P2596 L21: Delete "most".

P2597 L3: "contributed" instead of "contribute"

P2597 L6-10: Again, it is not clear how exactly the circulation patterns with high precipitation were determined.

P2597 L12: No need to repeat "1964-2000" again.

P2597 L24: "low biodiversity", not "weak biodiversity".

P2597 L28: I'm not sure how you can say that they were "most often preserved". This implies equal rates of deposition, but differential rates of preservation, which I do not think is what you mean. Maybe you could say "were most frequently observed".

P2598 L7: Write "that live", not "living", as they were not living there when you found them.

P2598 L13: Instead of "and different species of", write "and species-specific".

P2598 L15: "periods" not "period".

P2598 L27: I am not sure what the addition is for. Was the precip for each of the four ECM added together to be used in the correlation? It would seem that different diatoms could be related to different ECM, so it would make more sense to analyze each ECM individually. Either way, this math should be clarified.

P2600 L10: Why are algal cysts and fern and lichen spores combined in one category? Also, I think that the term "inferior plant" is somewhat outdated.

P2600 L11-17: Needs rewording and proper punctuation. Additionally, the contention that "smooth" algae are more common in eutrophic water and shallow pools needs a citation. Finally, this information needs to be tied to information on local water sources in order for it to be relevant.

P2601 L5: Underlying surface of what?

P2601 L11: "In the period of dominant zonal circulation (1981-2001)" is not needed in this sentence.

P2602 L4: Again, there is no indication as to why we need this additional signal, or what environmental changes it might tell us about. After reading the paper, it seems that the authors needed a lot of pre-existing environmental data to make their conclusions, so it is not clear to me what environmental changes the data might serve as record of.

P2602 L21: "ECM" was already defined, and does not need to be defined again here.

P2603 L4: As a closing statement, this sentence is very weak. It leaves the reader still not knowing what the point of the paper was, and reads more like good, supporting data that should have been integrated earlier in the story.

Tables: There are far too many tables, and a lot of them can probably be consolidated, some maybe deleted. The descriptions for the tables should include a more explicit title

so that the reader can easily see where tables fit in to the text. For example, Table 3 is about diatoms, but you don't get to that until you are almost through the description. Similarly, Table 4 also goes with the diatom analysis, but there is no indication of that whatsoever in the title, which is exactly the same as that for Table 6, save the ECM numbers. It might be possible to combine the "amount of precipitation" tables into a single table and the "characteristics of atmospheric processes" into another table, instead of having so many small tables.

Table 1: Out of the 41 types of ECM listed here, only 9 are actually related to the biological parameters discussed later in the text (based on a count of the ECM that appear in later tables). Presenting all 41 of them is confusing, and makes this table too busy. I recommend focusing on only the ECM that are important later in the paper. Also, it looks like none of the Southern meridional ECM ended up explaining the biological parameters, so space is wasted here describing them, and in Figure 2 showing the example of 13(s).

I do not think that the atmospheric pressure, blocking processes, and cyclone outlets are information that are integrated into the paper. It seems more important to know things like the main months of precipitation here - information that clutters later tables, but would be useful here.

The table description should be able to stand alone, so I would define "ECM" here.

How the letters "a-d" correspond to blocking processes is not explained.

Brackets are [], while parentheses are ().

Table 2: This is a nice summary table. Instances of the word "some" should be changed to something more quantitative, as I do not know what "some" means. I believe you mean "cosmopolitan" rather than "cosmopolite". The word "spores" does not need to be capitalized, and this heading could be shortened "Cysts and spores" with a footnote describing them. Be consistent throughout the table – in the diatoms section, there is

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a small line between each species, but in the coniferous tree section, there is not.

Table 3: And all tables of this type – the Roman numerals for months are confusing and not particularly helpful in the table. Be consistent in naming columns in all of the tables. They should all read "minimal concentration" and "maximal concentration", not some abbreviated to max. and min. and some "maximal" and "absence". Also, standardize the font sizes. Put a line in between the sections for maximal and absence of diatoms, or a break in the line that is there, so that the separation is clear. As it is, I have to guess at whether 1984 goes with "maximal" or "absence". You do not need to list the name of the met station, as you already say it in the text and it is not necessary information for understanding the contents of the table. If you want to make it clear that it is met station data, you could put it in a footnote.

Table 4: What is "Zn"? What is "Trace"? What do you mean by "intensive" precipitation? Can you be more quantitative about this? Further, you probably do not need to dedicate a column in the table to this, as they are all "intensive". You could mention in the Table description that they are all periods of heavy precipitation instead. However, a description of the terminology is absolutely necessary, and should be at least in the Methods.

Table 6: Zn-Az should be defined. I was able to find Az in the text, but not Zn. They should both be defined in both places anyway.

Table 10: It is not clear to me why this and similar tables need to list the primary season. If this is needed, it should be made clearer in the text.

Figures: All labels written as units/l should be changed to superscript format.

Figure 1: All of the blues are too close in color, so we cannot tell lakes from glaciers.

Figure 2: There are far too many lines in this figure, rendering it nearly unreadable. Lightening the lat/long lines are removing some of them altogether would help. The figure is far too difficult to read and interpret as it is. Also, the final dynamic scheme is

not used in the paper (as far as I can tell), so why show it?

Figure 3: Label the months as months, instead of Roman numerals. The biological object labels are too close to each other. The units on the axis should be in parentheses.

Figure 4: The legend should clearly state what the arrows indicate. Change "diatoms are not identified" to "no diatoms observed". Figures that go together, such as 4 and 5, could be combined into a single, paneled figure.

Figure 5: The dynamic schemes should be described, not just depicted. Description belongs in the text, but possibly in the figure legend. I do not understand why you show the four "example" dynamic schemes in Figure 2, but then show different schemes of the same groups in the following figures. This is redundant, and I do not see why you cannot use the figures to serve both purposes at the same time.

Interactive comment on Clim. Past Discuss., 9, 2589, 2013.