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Discussions

Interactive comment on "Hydrochemical composition of thermokarst lake waters in the permafrost zone of western Siberia within the context of climate change" *by* R. M. Manasypov et al.

Anonymous Referee #1

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Hydrochemical composition of thermokarst lake waters in the permafrost zone of western Siberia within the context of climate change by R. M. Manasypov et al.

The paper is a very interesting and well-documented study of the hydrochemical composition of freshwater lakes in western Siberia. The paper comprises a valuable data set, is well written and includes a sound literature survey of existing pan Arctic hydrochemical lake studies. I strongly recommend its publication, but only after major issues have been addressed and the paper has been reworked significantly. Specifically, I have the following four major comments:

1. Overdrawn conclusions: In general, the authors should avoid drawing conclusions for which no sound analysis is provided in the paper. First, conclusions about climate change are drawn, but this is based on a set of spatially distributed measurements of hydrochemical data of two different regions from one or two years. Secondly, a large part of the interpretation and conclusion uses the conceptual idea of lake stages where "lake diameter" is used as a surrogate for "lake stages". However, these process studies of lake formation and succession are not provided in this paper" (direct parameter of "lake age" could have been dating the age of lake sediment or lake water). In summary, the authors can draw results and conclusions from hydrochemical differences of lakes of two regions (North/South) and differences within these regions.

2. Physical parameter: What is the rationale to use lake diameter as physical parameter in the statistical analysis together with lake chemistry data? The hydrochemistry of the lake water is a complex interplay of the lake catchment, processes occurring in the lake and the water budget of the lake (precipitation, evapotranspiration, runoff, groundwater). I recommend performing the statistical analysis using the lake volume (if data are available), or, alternatively, lake surface area. The paper should also provide much more detail on the difference between regions 1-3 in terms of permafrost distribution, geologic material, topography, climate and hydrology (precipitation, evapotranspiration and runoff). Furthermore, some additional specific properties might be of importance (for example, are/were some lakes connected to rivers?).

3. Latitudinal gradient: The paper uses data from three study regions, two in the south (2, 3: ∼ 65-66°) and one in the north (Gyda: ∼70°). Thus, conclusions should not be drawn about latitudinal gradients, but about two regions, as well as differences within these regions. In addition, the North (Gyda) region shows higher concentrated waters. By including results of both regions in one data plot (often logarithmic plots), much of the interesting information (for example differences within the region) is lost. The research question needs to be rephrased, and accordingly, the data set should be separately analyzed and presented in figures (North/South).

4. Generally, there are too many figures included in this paper. Please rework your figures and include only the ones that are essential for the conclusions of this paper.

Overall, the paper needs to be rewritten. The major conclusions with reference to lake formation and stage hypothesis, latitudinal gradient and climate change need to be removed. Instead, the focus should be on explaining the hydrochemical differences between the regions and within these regions using physical parameters (lake volume). Additional data (lake catchment, climate, etc) should aid in the interpretation of the hydrochemical data.

In the following, I provide some details of the required changes.

Page 5334

Abstract

Line 1-3: Remove link to thaw lake and pond formation and succession- data on this are not shown in this paper.

Line 9: Remove link to "lake development" - it is not discussed in this paper.

Line 12: Remove link to "dynamic succession"- it is not discussed in this paper.

Page 5336

Line 17: What do you mean with "surface peat dissolution"? Please clarify.

Study site and methods

Generally: there should be more information given on: depth and type of permafrost, parent geologic material, climate, water balance, etc.

Page 5337

Line 3: Simply state your first hypothesis as: Is there a latitude gradient….in thermokarst lakes (remove the link to the "stage of development").

Line 25: Remove the linkage to lake stages and used lake diameter as the physical parameter.

Page 5338

Water samples were collected during different years (2010/2011) and potentially different seasons by including the study of Shirokova et al. 2013. Please provide more details on the interannual and seasonal variability of the hydrochemistry of the thermokarst lakes, as well as the study by Shirokova (which years and season were the samples collected?). Furthermore, how is the hydrogeochemistry affected by different water balance years? Are the years 2010 to 2011 representative for the long term mean water budget?

Page 5339

Line12: Relative difference of < 30 % for B and P seems rather high; is this affecting the results and discussion?

Results

Page 5341

Line 12: Remove "variation of different stages of lake development.."

Line 20: Why should there be sub permafrost groundwater feeding into lakes in this continuous permafrost area? The studied lakes and ponds by Abnizova et al. 2012 have higher conductivities and are not connected to sub permafrost groundwater. The hypothesis of groundwater inflow is rather speculative, if you do not have data that indicate this (chemical, hydrogeologic). What other potential reasons could explain this interesting finding at your site?

Tables and figures

Tables 1, 2

Instead of "stages of evolution" and "arctic lake", the lakes should be categorized by their volume or area.

Figure captions

Please check the spelling of all figure captions, there are many typos (especially figure caption 2). Also, the figure captions need to completely describe the data sets, i.e. should describe the figures fully. Overall, the number of figures needs to be reduced.

Figure 1

The figure legend and caption are incomplete- where is study region Nr. 1? What do the grey dots (Dudinka etc) represent? What do the hatched backgrounds represent? Geographical coordinates are missing. These figures also demonstrate that detailed sampling was carried out in two major regions (North/South), rather than across a latitudinal gradient.

Figures 3-8

Please provide more information on the comparative studies that you include in your graphs (Abnizova, Shirokova, Pokrovsky, Boushard). Why are these studies shown as lines (and not as symbols)? Furthermore, some figures include the above mentioned comparative studies; others do not (for example Figure 7a). Please be consistent. Why are some of the symbols encircled (for example Figure 6A, 8A/B)?

Figure 9

I recommend removing this figure.

Figure 11

I do not understand the relevance of this figure. Why "two" types of lakes? I recommend removing it.

Figure 12

In contrast to the previous figures, these figures use lake diameter (not stages) as physical variable. The statistical information (differences between the regions) is lost by plotting the data on a latitudinal gradient figure. Furthermore, samples were collected not over the entire climate gradient, but detailed in two regions. The focus of this paper should thus concentrate to investigate the differences between these two major regions (North/South), as well within in the regions.

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Interactive comment on The Cryosphere Discuss., 7, 5333, 2013.