

Dear Prof. Cindy De Jonge,

On behalf of my co-authors, I am pleased to resubmit our revised manuscript “*Diatom shifts and limnological changes in a Siberian boreal lake: A multiproxy perspective on climate warming and anthropogenic air pollution*” for its publication as a research article in *Biogeosciences*.

We thank the reviewer, John Smol, for his second revision of our manuscript and sincerely appreciate his feedback. The comments have been addressed as outlined in our individual responses below. Many thanks to you for leading the communication throughout the review process and for editing this manuscript.

Best regards,

Amelie Stieg

Corresponding author

Review of the manuscript submitted to Biogeosciences by Amelie Stieg, Boris K. Biskaborn, Ulrike Herzschuh, Andreas Marent, Jens Strauss, Dorothee Wilhelms-Dick, Luidmila A. Pestryakova, and Hanno Meyer

Diatom shifts and limnological changes in a Siberian boreal lake: A multiproxy perspective on climate warming and anthropogenic air pollution

The authors have effectively responded to my comments. I only have a few remaining trivial suggestions.

Line 51 in abstract – instead of Despite, I would say Nonetheless,

ANSWER: done

Line 76 – maybe add For example, at start of that sentence on Lake Baikal

ANSWER: We agree with the suggestion to add "*for example*" and have also included a regional context to clarify the connection to Siberia:

‘Extensive research on lakes in North America and Europe (Smol et al., 2005; Smol and Douglas, 2007; Rühland et al., 2008; Kahlert et al., 2020) has shown that climate warming and human activities lead to significant ecological changes on remote high latitude ecosystems. In Siberia, for example, Lake Baikal, a thoroughly studied system, has experienced documented ecosystem changes driven by recent warming, including increased water temperatures and shorter ice-cover periods (Todd and Mackay, 2003; Mackay et al., 2006; Hampton et al., 2008; Moore et al., 2009; Hampton et al., 2014; Izmet'eva et al., 2016).’

Line 559 - move the “consistently” to line 560 -- just before “above the minimum”

ANSWER: done

Line 593 --- I think you need “and this” before “align” and change “align” to “aligns”

ANSWER: done

Line 644 – why would snow melt provide turbulence?

ANSWER: Thank you for this question. A previous study at Lake Khamra showed that the lake water is strongly influenced by isotopically light snowmelt water, as reflected in the

$\delta^{18}\text{O}_{\text{diatom}}$ record from the same sediment samples (Stieg et al., 2024b). In this generally snow-rich region, we assume that spring snowmelt inflow contributes not only to nutrient supply but also to water column mixing due to the temperature gradient between cold meltwater and the lake water. *Aulacoseira* benefits from a prolonged cold spring circulation and sufficient turbulence, which help resuspend resting cells, maintain them in the photic zone, and enhance nutrient availability. We acknowledge that other factors, such as wind-induced mixing or summer thermal stratification, also influence lake water mixing and, consequently, *Aulacoseira* abundance. We introduce this argument earlier in Section 4.1 as follows:

‘Furthermore, the snow-rich region and the associated inflow of cold snowmelt water (Stieg et al., 2024b) presumably lead to sufficient turbulence and nutrient upwelling in spring, promoting sustained circulation beneficial for A. subarctica (Horn et al., 2011). However, other factors, including atmospheric-surface temperature gradients and wind-induced mixing, are also likely relevant for sufficient lake overturn (Smol and Douglas, 2007; Winder and Sommer, 2012).’

In Section 4.2, we build on this introduction and focus on the possible relationship between *Aulacoseira* abundance and hydroclimate variability inferred from the $\delta^{18}\text{O}_{\text{diatom}}$ record and suggest a potential link between snowmelt water supply and *Aulacoseira* abundance at Lake Khamra.

Stieg, A., Biskaborn, B. K., Herzsuh, U., Strauss, J., Pestryakova, L., and Meyer, H.: Hydroclimatic anomalies detected by a sub-decadal diatom oxygen isotope record of the last 220 years from Lake Khamra, Siberia, *Clim. Past*, 20, 909-933, 10.5194/cp-20-909-2024, 2024b.

Line 785 – title – should have ca. or approximate sign before 1950 CE .. and in line 786 ... and just below with 1970 CE -- ok and elsewhere – please add approximate signs to all dates – you did before but seem to have stopped now.

ANSWER: We agree and have carefully reviewed the text, adding approximate signs where necessary.

Line 969 – need a comma before “and biomass burning”

ANSWER: done

Line 1048 - remove “Despite,” from start of sentence.

ANSWER: done