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Climate of the Past Discussions

Interactive comment on "Multivariate statistic and time series analyses of grain-size data in Quaternary sediments of Lake El'gygytgyn, NE Russia" *by* A. Francke et al.

Anonymous Referee #1

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The findings of the paper are based on a tremendous data base, comprising grain-size data from more than 1000 samples, which have been treated by time-consuming laboratory routines. My suggestion is that the authors should try to find proxy data from the element-scanning procedure, which possibly also indicate simple changes between coarser and finer-grained sediments. Maybe Zr/Ti or Sr/Rb ratios and should use a reduced sample set for ground truthing of grain-size signals. Anyway, this hard analytical work has provided a unique data set to explain glacial-interglacial variability at Lake El'gygytgyn through the late Neogene to Pleistocene at high temporal resolution. The conclusions on the modes and frequencies of local glacial-interglacial cycles and differences to global signals, influenced by ice-sheet fluctuations and insolation forcing

with all the linear and non-linear responses, are clearly demonstrated. In parts of the article, the sedimentary processes could be better explained. The paper can be published after some revison, as it is elaborated and fits the scope of the journal. In the following, I focus on some specific items:

Multivariate statistics: The authors use the traditional statistical Folk-and-Ward parameters for the description of grain-size distributions (mean, mode, sorting etc.). As this approach is only reasonable for monomodal size distribution, multivariate statistics has been applied, in particular principal component analysis. I miss some explanation, why this approach has been chosen, because the state-of-the-art approach is end-member modelling, which decomposes grain-size populations that can be interpreted in terms of sedimentary transport processes (see for instance: Weltje, J., Prins, M.A., 2007: Genetically meaningful decomposition of grain-size distributions. Sedimentary Geology 202, 409–424). This approach has been widely used in the last years and adopted by other researchers. Nonetheless, I see that another statistic method would not change the basic outcome that interglacial sediments include more coarser grains than glacial sediments.

Page 220, lines 17-18: Please explain what you mean with permafrost and modelling processes.

Page 222, lines 11-12: You possibly mean "local insolation pattern inferred from the calculation of orbital configurations according to Laskar (or rephrase otherwise).

Page 224, line 15: What is meant with “artificially“?

Page 226, lines 8-10: Phrasing should be clearer.

Page 226, lines 17-19: This “gold washer“ process needs further explanation, without reading the cited paper. Has it to do with seiches? Can surface-induced currents be transmitted to the profundal basin?

Page 226, Line 25: Please explain more clearly!

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Page 227, lines1-4: Also this part is difficult to understand. How is aeolian material supplied to the lake, directly through the water column in summer, or is it stored at the winter-ice surface and thaws out during ice melt? Considering this process, a seasonally persistent ice cover during glacial stages should provide a high amount of aeolian material to the lake floor, once it melts the first time through climate amelioration.

Page 227, lines20-25: Here is the answer to my last comment question. We learned that glacial stages are characterized by fine-grained sediment, but here the process of soft-clast-formation is mentioned, which should produce coarse particles. Please also explain better, why the formation of marginal moats has impact on particle fluxes in the deep basin (the reader wants to know it, without searching the cited papers).

Page 228, lines13-15: The PCA is only another tool to demonstrate the prominent coarse-fine cycles, you can also recognize in the raw data. Climate does not trigger grain-size variations. The grain-size signal reflects the dominance of distinct sedimentary transport processes controlled by climatic influences on the depositional environment. The relationship seems to be very direct, of course.

Frequencies: It turns out that the precessional cycle is a prominent feature at “Gygy“ and overprints the global glacial-interglacial pattern. This 23-kyr-periodicity often is reported for the low latitudes, where it can obscure the 40- and 100-kyr cycles. Maybe there is some kind of low-to-high-latitude teleconnection. A good candidate could be the prevailing mode of Pacific Decadal Oscillation in the North Pacific, which somehow is dictated by ENSO (only an idea).

Fig. 3: Please show examples from all the three different facis units. As more than 1000 grain-size samples have been measured, it would be good to show more overlying curves for the respective lithological units or at least an envelope of standard deviation.

Does the paper address relevant scientific questions within the scope of CP? Yes Does the paper present novel concepts, ideas, tools, or data? Yes Are substantial conclusions reached? Yes Are the scientific methods and assumptions valid and clearly out-

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lined? Yes Are the results sufficient to support the interpretations and conclusions? Yes Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes Does the title clearly reflect the contents of the paper? Yes Does the abstract provide a concise and complete summary? Yes Is the overall presentation well structured and clear? Yes Is the language fluent and precise? Mostly Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? See comments Are the number and quality of references appropriate? Yes

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Interactive comment on Clim. Past Discuss., 9, 217, 2013.