

***Interactive comment on “Sub-decadal- to decadal-scale climate cyclicity during the Holsteinian interglacial (MIS 11) evidenced in annually laminated sediments” by A. Koutsodendris et al.***

**Anonymous Referee #2**

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Koutsodendris et al. discuss a varved lake sediment record from northern Germany covering 3200 years during MIS 11. The thickness records of the dark and light layers show periodicities that Koutsodendris et al. attribute to solar, ENSO and NAO cycles. They conclude that MIS 11 climate in central Europe is comparable to today's climate. I think Koutsodendris et al. present a very interesting study and I recommend publication after revisions that should clarify several open questions that I had after reading the manuscript.

I think it should be mentioned in the paper how the sediments were dated or how

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robustly they can be attributed to MIS 11.

The “dropstone-like sand grains additionally confirm the seasonal interpretation of the sub-layers”. I was wondering if these grains do not penetrate into the sediment and, therefore, cannot be used to confirm the seasonal interpretation. Figure 2f seems to suggest the same.

Interpolation of varve counting: Is this approach justified by a generally uniform sedimentation rate? Could it lead to biased results (e.g. generally harder to count when the layers are thinner)? Can the errors of the varve counting be estimated?

I agree with the previous reviewer that the approach to determine the thickness of the light and dark layers needs explanation. It seems pretty straightforward and clear for the winter to summer transition but how was the transition from light to dark determined? How was the light/dark layer thickness determined in the regions where the varves were hard to identify? Were these interpolated too?

Solar cycles: The 88-yr solar cycle seems to be present in the varve record but I was wondering why other well-known solar cycles are not visible. I guess one can only speculate about the reason but it should be mentioned that e.g. the 207 yr cycle is completely missing. In addition, it seems far-fetched to connect both the 25 and 11.5 yr cycle to the 22 and 11 yr cycle since the 11yr cycle is just the sunspot expression of the 22 yr magnetic cycle. This means that the Hale cycle has to be exactly the double length of the Schwabe cycle. Otherwise the cycles are most likely unrelated (and not the Hale and/or the Schwabe cycle).

In general, I think the cycle discussion is interesting but it seems that most of the identified cycles relate to climate patterns that are not so prominent in Central European climate at the moment. For example, is there a strong solar signal (e.g. 11 yrs cycle) in climate in Northern Germany during the last e.g. 100 years that could be the reason for the varve thickness variations during MIS-11. Similarly the QBO: Is a two years cycle present in modern instrumental data and could it explain variations in varve thickness?

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This discussion has to be extended if the authors want to argue that MIS-11 climate as seen from the varve thickness record is comparable to the Holocene climate.

Figure 8 (XRF data covering the OHO period) is not a good figure for showing that the OHO period was similar to other periods in element composition. It would need a figure that covers more than only the OHO period.

I cannot really follow the statement: "In contrast, when the cyclic signals are absent from all seasonal spectra, the external climate forcing controlling varve formation was altogether weakened and/or ceased completely" I think this could be one way to explain the data. However, it is at least as likely that the climate system (or the climate in Northern Germany) was not sensitive to e.g. solar forcing during these periods.

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