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Interactive comment on "Dendrochronologically dated pine stumps document phase wise bog expansion at a northwest German site between c. 6700 BC and c. 3400 BC" *by* Inke Elisabeth Maike Achterberg et al.

Anonymous Referee #2

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Review of: Title: Dendrochronologically dated pine stumps document phase wise bog expansion at a northwest German site between c. 6700 BC and c. 3400 BC Author(s): Inke Elisabeth Maike Achterberg et al. MS No.: cp-2017-4 MS Type: Research article

This appears to be a well designed and well executed study that is of importance to a better understanding of long-term climate-hydrology-vegetation dynamics in peatlands. I think the study has the importance and quality to be published in Climate of the Past. Before publication, however, several questions have to be addressed and some changes in the text and figures are needed to improve the paper.

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Discussion paper

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I have three significant criticisms of the paper: 1. I think that one of the unique and important aspects of the paper is the usage of dated roots reaching different levels in the peat bog. The usage of horizontal versus vertical roots makes it possible to precisely date water table lowering in the peat bog. Moreover, the usage of dated vertical roots in combination with tree-ring width data provides a possibility to distinguish between water table rise and lowering, which both have the potential to cause radial tree-growth depressions. The information from the tree growth and the roots combined, however, should therefore be something that is used and displayed much stronger in the paper. The usage of the roots, and the associated information is for example not even mentioned in the abstract. 2. In general, the paper is well-written, though with some word choices and syntax that likely reflect English not being the authors' first language. I have therefore made some editorial suggestions along those lines. But, neither I have English as first language, I therefore suggest that the paper needs to be proofread by a native English speaker, preferably with knowledge in written scientific language, to improve the grammar and flow of the paper. I think this would improve the overall impression of the paper a lot. 3. In the end of the discussion (page 12, line 5-6), it's written that "In general, there is much agreement with other climate records, but also divergence. This is plausible, seeing that the mire development reflects climatic conditions on the one hand, but on the other hand represents a local signal." Does it mean that the data is okay when it correspond to other records, and that the local signal blurs the climatic influence when it doesn't fit other studies? If so, we don't learn much new things from the study. Moreover, if we don't have other records to compare to, what parts of your data series can we trust and what parts are just reflecting local mire development? I think that you need to explain during what conditions the new data presented is better than other records, and during what type of conditions there is a disadvantage compared to other records. Maybe the usage of roots and tree-ring data combined can make it possible to distinguish between different types of hydrological changes (wet-shifts and droughts) in a more accurate way than other studies. If so, there is great potential with the data, interpretations and the manuscript.

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ABSTRACT As already mentioned, the usage of the root depth and the associated information is absent in the abstract. This is something important and unique that should be stressed much more in the paper. The design of the abstract can also be improved if the results of the study are highlighted instead of a description of the methods. Page 1, line 11: In the third sentence, it's written that it's a "dated site chronology", but I suggest that it should be changed to "five dated site chronologies" as there are gaps between them. Page 1, line 14: change "larger period" to "longer period"

INTRODUCTION Page 2, line 2: Is it Pinus sylvestris or Pinus spp. ? Page 2, line 3: I suggest that "The expansion of the raised bog often killed trees" to "The expansion of raised bogs during moist periods often cause severe growth conditions for bog trees and consequently widespread dying-off phases.

Page 2, line 9: There is a review paper about bog trees that I suggest being mentioned here: Edvardsson, J., Stoffel, M., Corona, C., Bragazza, L., Leuschner, H.H., Charman, D.J., Helama, S. 2016. Subfossil peatland trees as proxies for palaeohydrology and climate reconstruction during the Holocene. Earth-Science Reviews 163, 118-140. The following study from Poland might also be relevant to mention: Krapiec, M., Margielewski, W., Korzen, K., Szychowska-Krapiec, E., Nalepka, D., & Lajczak, A. (2016). Late Holocene palaeoclimate variability: The significance of bog pine dendrochronology related to peat stratigraphy. The Puscizna Wielka raised bog case study (Orawa-Nowy Targ Basin, Polish Inner Carpathians). Quaternary Science Reviews, Volume 148, p. 192-208., 148, 192-208.

Moreover, I think that several results and studies presented in this review paper by Edvardsson et al. (2016) would be useful and improve the discussion when comparisons to other studies are made later in the manuscript (pages 9 to 11).

Page 2, line 13: The paper Edvardsson et al., 2011 was published 2012: Edvardsson, J., Leuschner, H.H., Linderson, H., Linderholm, H.W., Hammarlund, D. 2012. South

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Swedish bog pines as indicators of Mid-Holocene climate variability: Dendrochronologia 30, 93-103.

MATERIAL AND METHODS

Page 2, line 20-23: I think the first sentences in the section can be improved. Suggestion, “The Tote Moor mire complex is located north of lake Steinhuder Meer near Hanover. The undulating relief bellow the mire consist of sand, and is likely to have held several small ponds and isolated mires before the expanding mire complex connected them“. Use the word “sand” only if it’s “sand”, otherwise e.g. “minerogenic material”, “mineral soil”, or “glaciofluvial depiosits” might be better.

Page 2, line 29: It should be “0.01 mm” with a dot, not comma.

Page 2, line 30: It should be “TSAPWin” (TSAP with capital letters).

Page 3, line 4: In situ is sometimes written in italics and sometimes not. I should be consistent according to the guidelines of Climate of the Past.

Page 3, line 6: I think “About 96 trees have possibly been moved. . ..” reads better.”

Page 3, line 6: What is “in situ s.s. finds”?

RESULTS

Page 3, line 25: How many pine stumps does “many pine stumps” represent?

Page 5, line 20: I think that “first” and “second” group would read better. For example, “ the first type of root system (type 1) spreads horizontally without any downward pointing roots. The central root at these trees has either died off at a length of about 10 cm or less, or is not traceable at all. The second type of root systems (type 2), however, displays downward growing roots, most often with a pronounced central root that has grown vertically downwards”. Maybe “vertical” and “horizontal roots” are better than “flat” and “downward roots”.

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Page 5, line 25: Maybe “mineral soil” is better and more accurate to use than “sand”.

DISCUSSION Page 6, line 4: “at the raised bog margin”

Page 6, line 10: “peat stratigraphical” (two words)

Page 6, line 15: “display phases of. . .” or “displays a phase of. . .” and “This display phases of” or “This displays a phase of. . .”

Page 6, line 18-19: The end of the sentence is a bit strange and hard to follow.

Page 6, line 24: “A second type of root system”. . ., maybe it would be good to name the two types of root systems to “type 1 (horizontal) and type 2 (vertical)”. I think it would be easier to follow the discussion if the first type always is horizontal and the second type always is vertical (downward) root systems. Moreover, “to speak of” doesn’t read very well, maybe “horizontal root systems without any pronounced vertical root are more common at this site.

Page 6, line 25: Maybe “rising water table” is better that “higher water table”.

Page 7, line 1-2: Maybe “These are interpreted as moist phases associated with raised bog expansion” is better.

Page 7, line 10-14. One aspect that could be important to regarding the tree colonization is that the colonization itself might generate positive feedback effect, which allows for further trees to establish. Evapotranspiration can generate dryer peat surface conditions, which favours further establishment of trees. This is something, which has been discussed in e.g. “Limpens, Juul, et al. 2014. How does tree density affect water loss of peatlands? A mesocosm experiment. PloS one 9.3 (experiment on tree saplings)”, ”Edvardsson, et al. 2015. Increased tree establishment in Lithuanian peat bogsâĂŤInsights from field and remotely sensed approaches." Science of the Total Environment 505, 113-120” (study on living peatland trees), and ”Moir, A. K., et al. 2010. Dendrochronological evidence for a lower water-table on peatland around 3200-3000 BC from subfossil pine in northern Scotland. The Holocene 20.6, 931-942 (subfossil

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trees)". I think that the influence of the trees themself should be mentioned in this section.

Page 7, line 13: I think "Tree colonization events (germination phases) that took place simultaneously in several different peat bogs sometimes coincide with. . ." reads better.

Page 8, line 2: TOMO_south, sometimes in italics sometimes not.

Page 8, line 7-9: Changes in the preservation conditions is also important to mention. There might, for example, have been trees growing at the mineral soil for thousands of years, but only the trees growing at the site during the expansion of the peat bog have been preserved in the moist and anaerobic conditions the water saturated zone in the bog offering have been preserved.

Page 9, line 5-7: Is there a possibility that the second, third etc. phases of tree establishment, when trees are establishing on top of root/stump layers is not as good indicators of climate/hydrology changes as the first layer? The older generations of trees will generate more stable conditions for the following generations to establish on. This could be good to expand to some extent.

Page 9, line 10: Is the brown moss is deposit directly on the mineral soil? If so, was there no lake stage in this part of the mire? Or is there a hiatus?

Page 9, line 28: Maybe "conditions unfavourable for moss growth" is better than "bog growth"

Page 10: The same information is more or less written twice in line 1-7 and line 15-20.

Page 10, line 25: What does the predating of the 8.2k event indicate? Are the trees so sensitive that they die before the actual climate change?

Page 10, line 32: I think that "The onset of the event is contemporaneous to. . ." is better than "Its beginning is. . .".

Page 11, line 18: I suggest, "The third phase of high water levels described by Magny

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et al. (2004) does not. . .”

Page 11, line 25: “in” instead of “i n”.

Page 12, line 1-4: Isn’t the study by Dreslerova (2012) based on 14C-dated results? If so, these results might not pre-date the die-off phases, it might be within the error-bars.

FIGURES

Figure 1. I think that the figure would be improved significantly if there is a “1b” figure to the left showing a close up of the peat bog with areas with and without tree stumps, the location of the adjacent lake, the maximum extent of the lake etc.

Figure 11. I think that it would be good if germination and dying-off phases were highlighted somehow, e.g. with lines or arrows.

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