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Interactive comment on "Mid and late Holocene dust deposition in western Europe: the Misten peat bog (Hautes Fagnes – Belgium)" *by* M. Allan et al.

Anonymous Referee #3

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Review of "Mid and late Holocene dust deposition in Western Europe: the Misten peat bog (Hautes Fagnes - Belgium)" by Allan et al. submitted to Climate of the Past

General overview This paper aims to determine sources of dust trapped into the Belgian Misten peatbog for the 5300BC- 30 BC time slice. It also aims to link dust deposition to climate. This study is based on several set of data: 14C for chronology, trace elements, REE and Nd investigations for dust sources and other chemical approaches to precise interpretation. This multiproxy investigation is of good value. Nevertheless and in the present state the paper lacks of organization (amount of sentences in discussion should be moved to results even introduction. It also lacks of central theme and of general consideration on the different approaches dealing with advantage and

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limitations of all used proxy.

Other comments 1. Introduction: Please add a paragraph to state the preservation of the original REE and Nd message. How is dust trapped? how can you rule out any exchange with water? How can you rule out differntial preservation (differential affinity with some mineral surfaces or organic compounds). Page 2891, line 18 and following : you provide some references but it could be nice to find here a state-of-the-art description adapted to the peat specificities. Page 2892, line 20: dry river banks, dewatered sea coast are majors dust sources too, especially for your study area Page 2892, line 22: it also depends on vegetation at the source location that allows or not the dust emission. Vegetation at the dust deposition point is important to trap the dust. It is thus greatly dependent of precipitation Page 2892, last line: you seem to only consider long distance dust transport... what's about short distance dust transport? Page 2893, line 8 to 12: go behind the references and clearly tell readers what were major conclusions and how authors came to these.

2. Material and methods 2.1. Sampling and preparation p. 2894, Line 6: how do you deal for Ti measurement ? p.2894, line 14: what is at the origin of the hydrologic changes? 2.3 Chemical analyses P. 2894, line 25: discontinuous sampling of the paleoenvironmental signal... highly risky!! P. 2894, line 25: : how many grams? even approximatively? or at least what the sediment volume used for REE? p. 2895, line 4: how do you deal with matrix influence? your standards are vegetal thus quite different from mineral samples.

2.4. Testate amoebae please provide some ecological and physiological treats! p. 2896, L.11: did you count testate on every 1cm-slice sample? or only 6 slices of 20cm as evidenced by table 3?

2.5. Radiocarbon dating P. 2896, L. 19: are they all from high superior plants (see Hatté and Jull) did you rule out any "peat decomposition effect" on 14C ages? why/how? P.2896, last line: what did happen at 200 - 250 cm depth?

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3. Results 3.1. Density, ash content and humification P. 2987, L. 4: N is missing here p. 2987, L. 8: how can you get a negative value for R? both are increasing.

3.2 Elemental concentrations p. 2897, L. 18: would you have a problem with sample numbering for Lu that would explain the shift at 450cm? is it an artefact? p. 2897, L. 21: authors might want to provide R value.

3.3. Dust flux please provide some explanation of the very high discrepancy between all derived flux. It is higher than expected.

3.4. Chronology of peat accumulation P. 2898, L. 22: resolution is even less as you analyzed each four samples Such a way, you can miss some peaks or reversely, evidence some peaks that don't really exist.

4. Discussion 4.1. REE distribution pattern beginning: that's not discussion but results

4.2. Dust sources p. 2900, line 5: I'm not a specialist of REE but it appears strange to me to imagine "immobile REE" anywhere. there is water in peat, low pH and high redox strengh and complexing OM... p. 2900, line 19: volcanic? I'm not convinced at all. If volcanic is one of the mixture poles, what is the second one? You definitely face a shift, even towards less Yb depleted values or towards more La enriched value. Two explanations might be: your potential sources are not the good ones or your assumption of REE immobility in peat is false. where do Gallet's loess come from? what's about Belgian fluviatile sediment? what's about North Sea Nd? P. 2900, line 21: according to table 1, it is rather 4880 or 4900 BC p. 2900, line 25: such a notation does not suit to calibrated radiocarbon age. probability distribution around mean age is far from being Gaussian. calibrated ages should be presented as interval. [4757 BC - 4877 BC] & [4829 BC - 4979 BC], [3041 BC - 3316 BC] p. 2901, line 5: I'm not convinced that this can explain the shift towards higher La/Yb value.

4.3. Evolution of dust deposition during Mid and Late Holocene P. 2901, line 11: high sensitivity: by now, you still don"t show any proof of that. you only showed that dust

sources might have been diffferent in the past. p. 2901, line 12: "check" would better suit here rather than test p. 2901, line 21: TA, first occurence of this abbreviation. not useful at all: keep testate amoebae. p.2901, line 23: you're here in the discussion section. This kind of considerations should not be here but much earlier in the introduction ... and should also be greatly developed. p. 2902: could you provide a synthetic figure that gathers all important parameters: dust flux (only one), humification, Nd together with the temporal zones and some major literature data you use here. It would be much easier for reader to follow your mind instead of having to look at 3 different figures and in 5 papers. p. 2902, lines 11-12 & lines 18-19: this sentence should be combined with the previous one dealing with dust sources. In this part you intend do discuss climatic information provided by dust: climatic results should thus be the last point of each §. P. 2903: what does explain the timing lag between all records?

4.4 comparison of dust deposition records from pet bogs and ice cores Page 2904, line 13: what's about loess? please restrict your affirmatiion to interglacial only. furthermore this doesn't find its place in the discussion section and should be moved to introduction. page 2904, lines 19 and following: provide a figure that gather all records. It would be much easier for readers to follow your comparison and you won't have to do a boring description of Canadian results. page 2905, lines 1 and following: much too long. Your paper is on Belgian peat bog. a figure that gathers all records is definitively required. page 2905, lines 16-26: this §is the only one to remain in this section... but you should expand a bit more the comparison. Why cold event is recorded in both Belgian and Canadian records but not in the Swiss one... and so on. page 2905, line 27-30: I'm so sorry but I don't find this demonstration in the paper. Where did you show that Saharan dust played an essential role in dust loading over Europe?

Figures & Table Table 1: age can not be associated to negative value if result is provided in BC. it either negative in AD or positive in BC. Did "Bacon" provide this mean age? should be mentioned. what is this mean age? do you mean "most likely age" that does have a signification or the arithmetic average between min and max that does not

have any signification ?

Figure 5: add element from which you derived dust fluxes on the figure itself Figure 5: same remark for dates here too.

Figure 7: legends are much too small to be readable! enlarge policy.

Figure 8: greatly enlarge the legend! what is the gray and black for? what are the red dotted line and red plain line for? please correct the calendar age (no negative value) and keep the same policy as for y axis.

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