

| Comments | Response |
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| For sections | |
| 1. The abstract is a little bit cumbersome, consider deleting the second and third sentences. | We shall revise the abstract and replace the mentioned sentences. |
| 2. The second section might be merged into the first section, placed just before presenting the scientific questions and research objectives. | We prefer to keep the introduction section relatively short, to help highlight the research questions and objectives. The subsequent 'dating plaggen soils' section is longer and more detailed because it provides background needed for readers of different expertise (archeological and luminescence communities) to grasp the study and its technical aspects. |
| For figures | |
| 1. Figure 2 should be labeled with latitude and longitude. | We shall add the grids and coordinates to the figure. |
| 2. The title of Figure 3 (b)'s z-coordinate should be changed to "Dose recovery ratio". | We shall change the label of the z-coordinate as recommended. |
| 3. In the caption of Figure 4, it should be specified that the average value is calculated from how many results. | We shall add the number of grains / aliquots that have been used to obtain the values in the figure. |
| 4. In Figure 6c, it is mentioned in line 388 of the text that the OD results of the filtered feldspar and quartz are very similar. However, comparing Figure 5 and Figure 6c separately is not intuitive. It may be worth considering including the OD of quartz in Figure 6c for comparison. | We shall add the quartz OD values into Figure 6c as recommended. |
| 5. In Figure 7, what does each point represent? Are they the age results of each sample? More detailed explanations should be provided in the caption. | Figure 7 is intended to show the effects of the filtering methods by comparing the De obtained from each dataset. The points of Figure 7.a. represent the ratio of the samples, and the points of Figure 7.b. demonstrate the ratio / depth relationship. We shall add this information to the caption as suggested. |
| 6. Table 3 should include a depth column for easier comparison with the figures. | We shall add the depth column to Table 3. |
| For lines | |
| Line 17, "Recently, luminescence... have recently", one of the "recently" should be removed. | We shall remove the latter one. |
| Line 69, the second goal has not been introduced in the previous text. Why is it important to identify changes in disturbances? What is the significance? | The introduction of plaggen agriculture is one of the major aspects reflecting the increasing land-use intensity during the Medieval Ages in the northwestern Europe. We believe that demonstrating the changes in soil-mixing intensity using luminescence dating techniques can provide a basis for the quantitative estimation of the intensification of land-use by the adoption of plaggen agriculture. We will include this in the paragraph before the research goals while revising the introduction. |
| Line 110, "They conclude that-", who does the "They" refer to? | We shall revise the sentence to "The research by van Mourik et al. (2011) conclude that-", for clarification. |
| Line 240, the sample ID does not match that in the Table 1. | We will correct the sample number accordingly (NCL-1117023 -> NCL-1117123 / NCL-1117029 -> NCL-1117129). |
| Line 265, it is good to consider the influence of fading on the ratio. However, is the ratio of Pirir290 really applicable to Pirir175? Is it possible to obtain a reference value by fitting data from published measurements of IR50 and pirir175 results taken simultaneously? | We adopted this threshold following Buylaert et al. (2013), even though we are using different pIRIR signals than the original publication by those authors. We acknowledge that the 90% threshold is indeed arbitrary; we would expect the ratio to depend on the age of the samples and the fading rate of the signals used for the mineral extract that is measured. We like the suggestion that the threshold could be obtained from a fit between published IRSL50 and pIRIR175 data. |

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| | <p>However, given the dependency on sample age and provenance, we argue that a ratio based on published information would be equally arbitrary. Moreover, there is not a lot of published pIRIR175 data for well-bleached samples that would allow comparison of results at single-grain level.</p> |
| <p>Line 268, "To determine the ages of samples", what specific ages are being referred to? If it refers to the poorly-bleached sample, it is understandable to use MAM to determine the depositional age. However, since the filtered pIRIR ages are already from well-bleached grains, why not use CAM to derive the depositional age? Actually, in your context, it doesn't seem like MAM is being used to obtain the conventional "depositional age", correct? So, this should be explained in more detail.</p> | <p>You are definitely correct that the ages referred to here are not the "depositional age". The BsMAM ages rather reflect the latest temporal period that the grains have been surfaced by soil reworking process. We will take your comment into account and clarify this in the revision by adding a conceptual diagram of how bleaching works in soils under effects of bioturbation and agricultural activities. For using CAM, we agree that this would be effective for the samples collected from the plaggen deposits. For these samples, we would like to emphasize that BsMAM and CAM provide identical results provided that the correct σ_b is used (Chamberlain et al., 2018). However, for the samples collected from deeper horizons, which have been exposed to prolonged (i.e. less intensive) soil reworking processes, we believe the CAM is less likely to provide the depositional age as well. Also, the main focus of this research is centered on the soil mixing rather than deposition, therefore we mainly utilize BsMAM ages.</p> |
| <p>Line 291, why is the σ_b input for quartz determined as 0.15 ± 0.04?</p> | <p>We have applied BsMAM to the OD obtained from CAM results of quartz measurements, as introduced by Chamberlain et al. (2018). We shall add this information to the revised manuscript.</p> |
| <p>Line 373, why is it at most an overestimate of 30%? Isn't there unfiltered/filtered ratio over 1.5?</p> | <p>We intended to mention that the average of the overestimate was about 30%. We shall revise the sentence to make it clear.</p> |
| <p>Line 473, I now understand that the high proportion of poorly bleached grains in the plaggen layer can be attributed to intensive cultivation activities, as you have clearly explained. However, why can we infer that the sedimentation rate also increased during the same time?</p> | <p>We thought that the increase in sedimentation rate was visible in Figure 8, but it may not be as clear as we thought. We will provide additional information on the sedimentation rate calculated by depth / luminescence ages.</p> |
| <p>Line 488, I am not arguing against the idea of using MaxAM to estimate the depositional age. However, it should be noted that bioturbation not only introduces younger grains but can also bring older grains from lower layers. Therefore, the use of MaxAM cannot completely eliminate the influence of bioturbation.</p> | <p>We agree that bioturbation may indeed introduce older grains from deeper deposits. However, in this specific context this is less likely as evidence from the broader region suggests that there is quite a thick layer of coversand that was deposited in a short period of time. This implies that bioturbation mixes sediments of similar depositional age. Also, it should be kept in mind that bioturbation is performed by bioturbating agents (e.g. earthworms) and they need a life supporting soil-food-web that is not present in the underlying Cg horizon due i) ground-water fluctuation, ii) no humus accumulation in purified quartz sand. We will discuss and clarify in the revised manuscript.</p> |
| <p>Line 496, the expression of this age is somewhat confusing. I suppose it should be "900-1000 years ago"? The same issue applies to Line 503. Please check the consistency of age expression throughout the article, abstract, and discussion sections.</p> | <p>We agree that the expression of age can cause confusion and consistency is important. We will check the full manuscript on the consistency of age expressions.</p> |
| <p>Line 517, "The ratio of $De_{IRSL} \sim$" at single grain scale. As you have mentioned that the ratio has already been applied in single-aliquot.</p> | <p>We will add "at single-grain scale" as commented.</p> |

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| <p>Line 519, Single-grain feldspar pIRIR yields similar ages as single-aliquot quartz OSL ages when~.</p> | <p>We shall revise the sentence as advised.</p> |
| <p>Lastly, I am interested to know if the authors have checked the variations in the proportions of zero-age grains throughout the profile.</p> | <p>This dataset contained very few zero-age grains (within 1-sigma error), and these were only found in the topmost sample (NCL-1117134). These results suggest that modern mixing is restricted to the upper layer, and that samples were not contaminated with modern material during sampling or processing.</p> |