Geochronology Discuss., referee comment RC1
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Comment on gchron-2021-38

Anonymous Referee #1

Referee comment on "Luminescence age calculation through Bayesian convolution of equivalent dose and dose-rate distributions: the D_e_D_r model" by Norbert Mercier et al., Geochronology Discuss., https://doi.org/10.5194/gchron-2021-38-RC1, 2022

General Comments

This paper introduces a method for calculating luminescence ages using a dose rate distribution in combination with an equivalent dose distribution. It is a fantastic new tool to have for luminescence dating and I am pleased to see that it is readily available for community use in the R Luminescence package. As advances in dose rate characterisation continue, dose rate distributions could become more common, and this method could indeed be part of a paradigm shift as suggested in the paper's discussion section.

Most of my comments are suggestions for very minor word changes either for grammatical reasons (I often tried to list these under the technical corrections but I'm sure I sometimes listed them under specific comments instead) or to improve clarity. One comment that is repeated at various places throughout the paper is that using the word 'sample' to refer to both a sediment sample for dating and a sample of numbers from a distribution can at times be confusing. Also that using 'De_Dr Age' instead of 'apparent age' would be more specific and help readers to know that the number being referred to was calculated using the De_Dr age calculation method introduced in this paper.

One of the tenets of the De_Dr method presented is the identification and removal of outliers based on the shape of the Dr distribution (once the internal overdispersion of the equivalent dose distribution has been incorporated), and a significant proportion of this paper focuses on testing the ability of the method to identify outliers introduced to simulated datasets. Whilst I think there is exciting potential for this De_Dr method to identify outliers in real datasets, in some ways it feels like introducing this concept already is skipping a step in the development of the De_Dr method, which first needs to test on real samples the assumptions often stated in this paper regarding whether the shape of equivalent dose distributions mirrors the shape of dose rate distributions. It is not yet known how well a dose recovery test overdispersion value fully characterises the natural internal overdispersion or whether that internal overdispersion is symmetrical. However,

these are questions to be addressed by experiments on real samples and what this paper introduces is a tool that can be used to address them, which is very exciting.

I find it curious that the De_Dr method does not expect uncertainties on individual dose rate values input for the dose rate distribution. I haven't personally used numerical sediment models for predicting dose-rates but based on analysing this paper I presume that they don't calculate such uncertainties. Even still I wonder if further advances in such models or in experimental dose rate distribution measurement techniques might lead to uncertainties being generated, but then given such circumstances, this De_Dr method could also be further developed to account for them.

Overall, I very much enjoyed reviewing this paper and I think it's ideas and (readily available!) method will stimulate further research and advance luminescence dating techniques. I'm happy to recommend it for publication following minor revisions.

Please also note the supplement to this comment:
https://gchron.copernicus.org/preprints/gchron-2021-38/gchron-2021-38-RC1-supplement.pdf