

Reviews Actionable Items

Martin Hinz

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Reviewer A

- ☐ It probably should be noted that McLaughlin 2019 undertook a similar simulation experiment with the Contreras and Meadows black death case study, using KDEs of radiocarbon (with a 94% detection rate). The influence of sample size and the risk of false positives were not however addressed, so this new paper can be seen as significant progress
- ☐ An useful analytical step not undertaken in the current paper (but was one of the issues discussed by Contreras and Meadows) would be the transposition of the black death signal to a different region of time, to check that the signal detection results are robust against artifacts in the calibration curve
- ☐ Writing is excellent; there are a couple of typos L239-240 ‘It have to be noted’ and L255 ‘ab auctoritate’.
- ☐ The author should probably comment on Edinborough et al 2017 PNAS hypothesis test for short term events in archaeological radiocarbon

Reviewer D

Review of “Sensitivity of Radiocarbon Sum Calibration” by Hinz

- ☐ They are limited in that only one, fairly short time-scale is explored. The author might comment on the applicability of this to, for example, detecting a population crash in the late Neolithic.
- ☐ My fundamental issue with this paper is that it does not recognise that estimating the detection rate is fundamentally estimating a probability from a binomial count. Lines 151-153 indicate rather vaguely that 200 batches of 200 simulations were performed; I only understood this by looking at the code. In Table 1 the standard deviation, inner quartiles and 95% quantiles are simply dependent on the size of the batches (200) and underlying true detection rate. The standard deviation of a binomial estimate expressed as percentage is $100 \cdot \sqrt{pq/(n+1)}$. For $n=200$ and values of p from 61.1% to 72.8%, the sd ranges 3.44% to 3.14%, very close to what is reported empirically, especially as the latter will also include some noise as it is simulated. 200 batches of 200 simulations doesn’t tell us anything more than 40000 simulations on their own. For a given scenario, columns 4-6 of Table 1 will vary with batch size in a way that is predictable once the success rate is known. With $n=40000$ the s.d. is about 0.23% to 0.24% here. For the later simulations with $n=100$, the s.d. will not be more than 5%. Consequently parts of the discussion (lines 273-4, 276-7) and presentation (sizes of boxes and whiskers in Fig.6, scatter of points in Fig.7) are not relevant as these are simply functions of the chosen batch size. With se of the estimate at 0.2% only the first decimal place should be reported in all the estimated percentages, or third decimal place if using proportions. Table 1 uses percentages but Tables 2 and 3 use proportions – this should be made consistent and proportions would be better.
- ☐ Lines 345 and 346: this is not ‘significance’ (which is either there or not) but a p-value from which we decide on significance.

Other comments

- ☐ Lines 148-154: what are scenarios in the plural here? The start of the paragraph says it is using the single scenario of Contreras & Meadows.
 - Thank you for pointing this out! The different scenarios refer to different data densities, while the general scenario (the Black Plague) remains unchanged. I clarified that in the text.
- ☐ Lines 200-203: it would be useful to have these date ranges marked on Figures 4 and 5.
- ☐ Lines 204-205: ‘It was then tested whether this minimum was at least 10% below the mean of the 100 years preceding and following the event with a lag of 50 years’ I don’t understand what this means. Is it that, for example, if the minimum is at 1400 it is compared to the means of 1250-1350 and 1450-1550?
- ☐ Line 280 seems to be in error stating ‘detection chance seems to be relatively independent of the sample size’, as line 291-3 states ‘Up to a sample size of about 300 ... the detection rate improves and then remains in a plateau’ and this is clear in Fig.7
- ☐ In figures 6 and 7 why is there switch to 100 simulation rather than the 200 of Table 1?
- ☐ The code at lines 323-342 is not necessary in the main text and could go in an appendix
- ☐ Line 394: 68.88% is not justified and no one is interested in knowing the success rate to this precision. 69% will do.

Minor corrections

- ☐ Figure 1 contains a typographic error: ‘certanity’ should be ‘certainty’
- ☐ Line 364: replace ‘resp.’ with ‘and’
- ☐ Table 4: what is the heading ‘0.7780607003145’?
- ☐ Line 379: ‘The table 4 or Fig. 10’ should be ‘Table 4 and Fig. 10’
- ☐ Line 448: ‘assesement’ should be ‘assessment’