

Solid Earth Discuss., referee comment RC3  
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## Comment on se-2021-74

Gianluca Valensise (Referee)

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Referee comment on "The damaging character of shallow 20th century earthquakes in the Hainaut coal area (Belgium)" by Thierry Camelbeeck et al., Solid Earth Discuss., <https://doi.org/10.5194/se-2021-74-RC3>, 2021

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This review comes after two accurate anonymous reviews which already addressed most of the questions I intended to raise. I will recall briefly my main points.

The paper is important and timely, but it is indeed quite long. It looks more like a catalogue, or a technical report, rather than like a scientific paper that extracts something relevant from the data presented. I praise the reviewers' recommendation to move the description of individual events into the Supplementary Materials section, so that the reader is free to focus on the most relevant conclusions of the work. But I don't want the authors to get me wrong. I think their work is valuable for two independent reasons: for their effort to reorganize the historical seismicity data in a systematic and objective fashion, and for their attempt to use the new data to improve SHA estimates for Belgium. As a matter of fact, I would urge the authors to consider using the data presented in this work to turn the simple parametric catalogue they run on the ROB website into a fully analytical catalogue such as Italy's Catalogue of Strong Earthquakes (<http://storing.ingv.it/cfti/cfti5/#>). This would be the best way to make sure that their efforts at investigating old earthquakes live over time.

The paper is made even longer by the particular wording adopted by the authors. The English is generally good and correct and I have no complaints (although I also noticed a few cases where the authors use single words/expressions that do not really mean what they have in mind: perhaps they are "false friends"?). I am not a native English speaker myself, but I am convinced that adopting a lighter prose and getting rid of some unnecessary explanations might reduce the total length of the text by 10-20%, in addition to reorganizing the text as detailed above.

All in all, the paper is an important contribution both to the homogenization and reappraisal of historical seismicity data for Belgium and to the quantification of regional seismic hazard, and it certainly deserves to be published on Solid Earth. Nevertheless, I do agree with one of the reviewers who stated that the paper should discuss in better detail the SHA implications of the new findings. I will be more specific in the specific comments listed below.

### Specific comments

Line 24 - " Hence, because of their shallow sources, moderate SCR earthquakes with

magnitudes in the range of 4.0 to 6.0 are often more damaging in SCR than at plate boundaries". I don't share this view. In Italian volcanic areas such as Mt. Etna and the Ischia Island, which certainly do not lie within a SCR, M 4.0 earthquake are capable of causing substantial damage and casualties.

Line 163 - "However, as the earthquake occurred at midnight, there was no notice of the event outside a radius of 3 to 4 km from the barycentre of all macroseismic data points". I don't understand this. What difference does it make if the earthquake occurred at night or during the day? It was felt over a small area because it was shallow, regardless of the time of the day.

Line 168 - "Two months later, the earth shook again north of Charleroi, but more strongly with a  $M_W = 3.9$  event on 1 June at 22h51m... The epicentral area of the 1 June 1911 earthquake includes 170 the localities of Gosselies, Lambusart and Ransart where the tremors were violent enough to awaken most of the inhabitants, knocking down many chimneys and causing cracks...". The authors should compare this event and its effect with those of the 27 August 2017, Ischia earthquake, a  $M_w 3.9$ /  $M_d 4.0$  event located around 1 km depth.

Line 172 - "...the most affected locality was Ransart where more or less 50 chimneys collapsed and a parked train was thrown off the tracks... We assessed intensity to VI in Ransart ...". Are you extra sure of this statement? Seems to me that overturning a train would require accelerations that are incompatible with the size of this quake, even if it occurred at very shallow depth. And an intensity VI sounds very low for such a damage scenario.

Line 322 - "The last earthquake in the Hainaut coal area for which it was possible to provide a macroseismic map occurred near Carnières on 14 September 1982 at 19h24 ( $M_W = 3.4$ ; Fig. S28). Two earthquakes were also widely felt in the region of Charleroi on 4 and 9 August 1983...". It sounds like no more earthquakes occurred after 1983? Is that really so? The authors mention something about it in this very long paper, but this point should be made very clear if we are to discuss the crucial issue of the natural vs. induced/triggered origin of this seismicity.

Line 410 - " Figure 10 reports the influence of focal depth from 1.0 to 6.0 km on the intensity attenuation curves and its stronger effect on the attenuation function than the uncertainties on the attenuation parameters. This also suggests that earthquake focal depth can be evaluated with a good accuracy using IDPs and that the differences in attenuation observed between the different earthquakes in the modelling (Fig. 9a) would likely reflect the small differences in their respective focal depths." I totally agree with this statement based on the authors' own data and based on my own experience. It is a strong conclusion that should be elucidated more extensively in the discussion.

Line 416 - I believe that Fig. 10 should be 11.

Line 492 - " The most destructive events occurred during or at the end of the mining exploitation." Once again, this is a crucial observation concerning the natural vs. induced nature of local seismicity. As such it should be more emphasized.

Line 518 - " All these observations suggest that the contribution of the Hainaut coal area seismicity on current seismic hazard maps in Belgium and northern France (Fig. 1) could be overestimated inside but especially outside the basin and would need to be reevaluated." This is a strong conclusion, hence I recommend the authors to clarify what exactly causes this overestimation.

Line 614 - " Our analysis provides new perspectives for seismic hazard assessment in

Hainaut by three aspects. First, it demonstrates 615 the importance of developing a GMPE for the Hainaut area that is more in line with the observed rapid intensity decay with distance than the current existing European GMPEs". Right, but if the rapid attenuation is dominated by the shallow depth of the local seismicity, improving existing GMPEs should not be so important. The authors should clarify this point.