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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Seismic hazards of the Iberian Peninsula – evaluation with kernel functions" *by* M. J. Crespo et al.

Anonymous Referee #1

Received and published: 30 September 2013

Dear Editor, I think the paper shows a very interesting and original research and it deserves to be published in NHESS after two major corrections and after being thoroughly review for a better English usage (particularly in Section 6 Results) and improvement of figs. 14 and 15 artwork.

The paper deals with the use of zoneless methods in seismic hazard assessment in the Iberian Peninsula, and it includes some strong statements when comparing to the more common in practice Cornell methodology. The method and data used in the research are fine. The paper is generally well written and clear, although I attached at the end a list of errata to be corrected by the authors. An important point here is that the title of section 6 Results, should be renamed 6 Results and Discussion in order to meet with scientific writing standards.

My concerns root primarily in a couple of statements showed in Section 6 Results and then repeated in Section 7 Conclusions. The authors must rewrite the statements:

When comparing to previous results in the Pyrenean and Alicante areas, the authors state: "This suggests that the zonation needed in order to capture correctly the seismic hazard requires very small zone dimensions, which cannot be characterised adequately with the seismic information available."

The use of "correctly" is wrong here, you are just comparing the results from two different approaches. What the authors may want to say here is that to have similar results (comparing zoneless and zoned methods) the zones should be smaller, and that may be problematic in some areas for deriving a reliable magnitude-frequency relationship.

And then: "This conclusion is also supported by the observation of recent seismicity around this area, specifically the recent Lorca earthquake (11 May 2011, Mw = 5.1, 1.5 km depth), one of the strongest in recent Spanish seismic history (maximum felt intensity of VII and a recorded PGA of 0.36 g a few kilometres from the epicentre) . . ."

The Lorca earthquake is known to have shown a very clear directivity effect: a conspicuous spike in a rather low amplitude accelerogram. Lorca is sited on the top of the causative Alhama fault. For this reason PGA of Lorca earthquake may not be the best parameter for comparing PGA from seismic hazard estimations that have not taken into account this effect. I think it is incorrect to use this example for supporting zoneless methods against zoned methods.

I further discuss these two points below, in the list of errata.

For some reason the paper turns from a good scientific work to a defense of zoneless methods. That is not the point. The zoneless methods are appreciated and actually used in seismic hazard mapping. They are not better than zoned methods, as zoned methods are not better than zoneless ones. Both are complementary, and this is known by the community as they are usually combined in logic tree schemes.

Then, later on, in section 7 Conclusions, it is said: “..this fact suggests that the zonation needed to capture seismic hazard in these areas requires very small zone dimensions which cannot be characterised adequately with the seismic information currently available. This conclusion is also supported by recent activity in the south-east of Spain”.

This paragraph should also be changed before admitting the paper for publication.

Please, find below a list of errata found during my reading of the paper. Some points for discussion are also shown:

Title: I SUGGEST TO CHANGE seismic hazardS FOR seismic hazard

Abstract: Please, refrain to use "law" when talking about ground motion prediction equatios, use relationship, equation, model,...

1.Introduction page 3764 line 21 NCSE-02 refers to the whole of Spain, including overseas territories. Please, change the phrase... "referring just to.."

page 3766 line 6 ADD the reference for the new seismic hazard maps of Spain, they are already published by IGN.

2.Methodology page 3766 line 18 Please, CHANGE "Later on, Woo .." FOR "Later on, Woo (1996a,b)...".

page 3769 line 18 CHANGE fortran FOR Fortran

3.Seismic Catalogue page 3771 line 23 It is said that the most ancient event with an assigned intensity dates back to 1948 WHICH I THINK MUST BE AN ERRATUM, I think the oldest event with intensity in the IGN catalogue is 1050 Orihuela (Alicante), or so.

page 3773 line 19 This is just my opinion, but I think your window parameters, particularly distance, are too wide. For example, a M 5 earthquake (like Lorca) will remove all the seismicity 40 km around the epicenter, which is nonsense because the dimensions of a M 5 rupture are in the order of 3 kmˆ2.

page 3774 line 9 cite the IGN reference, please, it has been already published.

4.Attenuation Model page 3776 line 13 I think Ambraseys et al (2005) does consider the magnitude dependence. You may be saying that you are not considering it in your calculations, for some reason. Rewrite the phrase to make it clear for the reader.

5.Seismic Activity rate page 3778 line 20 Please, avoid the term "law", CHANGE FOR relationship,..

page 3779 line 14 CHANGE in the past FOR previously

page 3781 line 8 CHANGE law FOR relationship

page 3781 line 9 DELETE this is OR REWRITE THE PHRASE

page 3781 line 16 CHANGE ORDER OF THE PHRASE, AFTER assumptions ADD will be based, like the ...

page 3781 line 19 CHOOSE “fig.” or “figure”, but use it consistently across the document.

6. Results –> CHANGE FOR Results and Discussion

page 3783 lines 5 to 12 Please REWRITE the following phrase:

"It is also around this return period that the contribution to the seismic activity rate arising from geological considerations may start being significant; note that the first event in the catalogue dates from the fourth century BC, and the first quantified event from the fifth century AD. The explicit inclusion of geological data in SHA affects two aspects: the location where the activity rate is modeled, which concentrates around specific geometrical features (faults); and the activity rate itself, which is enriched with geological information that the seismic catalogue does not reflect."

COMMENT: I agree with your statement but I think it needs to be rewritten as a general reader would ask him/herself: On what grounds are you basing this statement? To

support your statement you should consider these ideas: - that the slow convergence between Iberia and African plates determine that active faults in Spain are also slow and so morphogenic earthquakes (M>6) associated to them have recurrence periods of the order of few thousand years, which is longer than the length of the seismic catalogue, so it is important to enrich the catalogue with potential large (M>6) earthquakes that some of this faults could produce in the future. -Considering the frequency of these earthquakes, their impact in hazard assessment starts for return periods of the order of 1000 yrs and becomes dominant for return periods the same order more or less to the recurrence period, as it has been shown (as far as I know the only work in the region that specifically studies the contribution of active faults in probabilistic calculations is for the Murcia Region in García-Mayordomo et al., 2007). -It is important to consider that when faults control seismic hazard, this is in the vicinity of the fault itself. -The above is all based in the characteristic earthquake model, another discussion would be if a Gutenberg-Richter model is used for modeling faults. In the phrase ". . ..concentrates around specific geometrical features..." ADD (faults)

Page 3784 CHANGE the title of section 6.4 FOR Comparison with previous studies and seismic codes

Page 3784 line 12 I suggest to CHANGE really corresponds to... FOR corresponds, in fact, to...

page 3784 line 15 CORRECT above results; I SUGGEST the results OR the results shown above

page 3784 line 18 CHANGE rock for rock sites OR rock conditions.

page 3784 line 19 ADD , AFTER For Granada. REWRITE the difference in soil types (It does not sound good English), I SUGGEST this difference may result from the consideration of different soil types

page 3784 line 24 CHANGE the present results FOR our results OR the results pre-

sented here

page 3784 line 26 CHANGE than reported FOR than the one reported

page 3784 line 27 CHANGE but which is FOR but that is

page 3785 line 5 Please, refrain of using "correctly". Calculating seismic hazard is always an estimation, regarding the method used. What is correct or incorrect in a seismic hazard calculation may be performing of the calculations; the results are always estimations that you may believe it or not. You may wanted to say in the text that the "zonation needed to mimic zoneless results would require smaller zones, which cannot. . ..".

page 3785 line 25 CHANGE zoneless FOR zoned

page 3785 line 26 CHANGE assigned FOR estimated

page 3785 line 14 "Events such as the Lorca one were not expected from hazard evaluations based on zoneless (zoned) methods. . .." I do not agree with your statement here. In Gaspar-Escribano et al., 2008 you can see that the controlling earthquake for a 475 yr RP in Lorca area is a Mw 5.0, which it is very similar to M 5.2 of Lorca. A different question is the estimated PGA related to that event. Not just what the GMPE predicts, as well as specific soil and near-source effects (Lorca was on top of the Alhama fault responsible of the earthquake). It has been shown in different works that PGA in Lorca was originated by a directivity effect. Please, rewrite your statement accordingly. There are so many variables involved in ground motion shaking (uncertainties) that should prevent to make statements like that one of your paper. Zoneless methods perform well and are an excellent approximation to assess seismic hazard when combined with zoned methods, but they are not the final-solution.

7.Summary and conclusions

page 3788 line 16 CHANGE catalogue has had to FOR catalogue had to

page 3788 line 9 I do not agree with "...this fact suggests that the zonation needed to capture seismic hazard in these areas requires very small zone dimensions which cannot be characterised adequately with the seismic information currently available. This conclusion is also supported by recent activity in the south-east of Spain."

As commented before, you should say the zonation needed to get similar results to the zoneless method implies the use of smaller zones, which are difficult, sometimes, for obtaining a good G-R relation. Additionally, I do not think that this has nothing to do with the Lorca earthquake..

8.References Add the IGN reference and check for missing references

TABLES Table 1 CHANGE on land AND at sea FOR onshore AND offshore RESPECTIVELY

Table 2 CHANGE Reference years FOR Reference years of catalogue completeness

FIGURES Fig. 2 Put epicentral in capital letter: Epicentral and write Peak Ground Acceleracion. Otherwise use abbreviatures in both axis, PGA and Repi.

Fig. 3 Y-axis should read "Spectral Acceleration" AND X-axis should read "Period". If you prefer the abbreviatures then use SA and T, consistently.

Fig.4 Move the legend inside the graph to avoid wasting space. X-axis, CHANGE magnitude FOR Magnitude

Fig.5 Footnote: This is not clear for the reader, which are the low seismicity areas, indicate; and what do you mean with higher values? in relative or absolute sense? "... the higher values....similar size."

Fig.6 Footnote, CHANGE will be FOR is

Fig.7 Titles in x and y axis should start with capital letter. CORRECT km 2 for kmˆ2. Footnote, REWRITE straight line (sounds too coloquial)

Fig.8 Footnote, CHANGE would be FOR is

Fig.9 Please, try a larger font size for the isolines labels. Footnote, AFTER 475 yr ADD return period.

Fig.10 Please, try a larger font size for the isolines labels. Footnote, AFTER 2475 yr ADD return period.

Fig.11 Please, try a larger font size for the isolines labels. Footnote, AFTER 475 yr ADD return period.

Fig.12 Please, try a larger font size for the isolines labels. Footnote, AFTER 2475 yr ADD return period.

Figs. 14 and 15: The art work is not good. Improve the quality of the image or change the graph lines and marks for better resolution. Y-axis should read "Spectral Acceleration" AND X-axis should read "Period". If you prefer the abbreviatures then use SA and T, consistently.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 3763, 2013.