A. Grezio

Thank you for your time and the remarks on the paper. We acknowledge that your comments significantly improve the original manuscript. Below we provide response to your points with more detail.

GENERAL COMMENTS:

The paper "Approach for combining faults and area sources in seismic hazard assessment: Application in southeastern Spain, by Alicia RivasMedina et al." can add interesting discussions points on the seismic hazard issues because of the hybrid source model. However, major changes are required to improve the paper. The background knowledge of the application area (Southeastern Spain) is poorly described and the choice of Mmaxc should be discussed more deeply.

SPECIFIC COMMENTS:

Abstract - Lines 9-11 page 1: Instead of " . . .model composed by faults as independent entities and zones (containing the residual seismicity). The seismic potential of both types of sources is derived from different data: for the zones, the recurrence model is estimated from the seismic catalog. For fault sources, it is inferred from kinematic parameters derived from paleoseismicty and GNSS measurements" a suggested re-writing could be (in the list put first fault and then zones): ". . . model composed by faults as independent entities and zones (containing the residual seismicity). The seismic potential of both types of sources is derived from different data: for the fault sources it is inferred from kinematic parameters derived from paleoseismicty and GNSS measurements, and for the zones the recurrence model is estimated from the seismic catalog".

The text has been modified

Lines 15-17 pag 1: The concept of the Max Magnitude in the abstract (stated by the following words "This is derived from a completeness analysis and can be lower than the Mmax generated by the faults, taking into account that their the recurrence period can be higher than the observation period of the catalog") starts a discussion but it is not fully developed, it is just mentioned here and needs to be better explained in the "Discussion and Conclusions" section or when the results are presented. This part in the abstract should be removed and/or re-written.

This is removed from the abstract and the text changed

Line 19 page 1: It is required an explanation of ". . .a seismic hazard model using the traditional zone". Is there any reference of this model? What do the authors mean by the word "traditional"? This part should be re-written.

1 Introduction - There are NO REFERENCES in the Introduction. This is an anomalous way of presenting a scientific paper in a peer review journal because the paper gives a narrow view of the subject. Please add appropriated references in the text. The Introduction looks more a discussion to motivate the paper than a wide presentation of the seismic hazard problem in the application region. Also, there is no mention of the previous seismic studies carried out in Southeastern Spain. Line 27 page 1: References are required near the words ". . . in the last years, as more studies".

References have been included

Line 28 page 1: Please write the acronimo as "GNSS (Global Navigation Satellite System)".

It has been added to the text

Line 2 page 2: Please add reference after " In most practical cases".

References have been included

Line 3 page 2: Please add reference after “Other approaches”.

References have been included

Line 22 page 2: Please add reference after “ Some authors ”.

References have been included

Lines 28-32 page 1: The sentences “The approach presented in this paper, as all probabilistic seismic hazard models, face the challenging question of estimating the expected ground motions with the basis of a short period of observations of earthquake occurrences and limited geological data (with significant uncertainty) to construct recurrence models. The purpose of this work is not to solve this challenge, but rather, to propose a model that contains different types of seismic sources (faults and zones) and distributes the seismic potential appropriately, avoiding double-counting and considering periods of completeness.” present the purpose of this study in a superficial way. Those lines should be re-written. If you want to start a probabilistic hazard assessment, firstly you consider the potential Max magnitudes generated by the faults, and then you associate a low probability of earthquake occurrence with them on the basis of your study and considering the relative uncertainties. Certainly you don’t exclude those max magnitudes just because of the completeness of the catalogue. A probabilistic hazard assessment should overcome those limitations. Again the choice of the Mmaxc should be properly explained, doubts on that should be solved and motivated by the authors in the paper. This part should be re-considered for the discussion in the last section.

We agree on that hose limitations are inherent to the probabilistic method. With this paragraph, we just wanted to clarify that we do not try to solve them, but only to take them into account in the proposed approach.

The maximum magnitudes associated to each fault are calculated, and their occurrence rates are estimated using a GR recurrence model. This model, considering Mmax of faults, is included in seismic hazard calculations. The MmaxC value is only considered for the distribution of seismic potential, but not for the input recurrence model incorporated in the hazard model.

2 Source hybrid approach (zones & faults) for hazard estimation - This section is presented in a schematic way, but should be completed with the description of the "Classical Method" which is also used in comparison with the Hybrid Model.

We consider that it is better to focus the paper in the specific features of the proposed approach. The manuscript is structured accordingly focusing on the description of the source hybrid approach. However, we include the reference to the classical method included in this study: IGN-UPM Working Group (2013).

Lines 10-16 page 3 : The definitions should be clearer, in particular CP(m) and PC(m) need a longer explanation.

The text has been modified

Line 20 page 4: Please write GR after Gutenberg-Richter and may be write a reference for that (Gutenberg and Richter 1944 or 1954).

The text is modified

Line 22 page 4: In Eq 4 it should be written what “d” and “beta” are.

The text is modified

Line 18 page 5: The authors state “ Considering that the fault may generate events with magnitudes larger than MMaxC , the corresponding distribution of seismic potential in the interval (MMaxC , MMax ] is calculated by extrapolation of the recurrence model with the last b-value adjusted”. This concept should be further discussed to overcome the limitations raised by the choice of the Mmaxc.

This issue is included in the Discussion

3 Application of the approach in southeast Spain - It is not clear how the results in the application region were computed with the Classical Method.

Line 14 pag 7: Please explain what QAFI database is and/or write references for that.

A reference to QAFI is included, as well as an annex with fault information

Line 9 page 8: The “Classical Method” should be better explained, it is just mentioned for the Fig 6.

Details on how seismic sources are used in the CM can be found in IGN-UPM Working Group (2013) (reference included in the paper) We have not provided further details on this paper because it is not the objective of this paper.

4 Discussion and conclusions - The discussion of the results and the conclusions should be include the point raised previously.

Line 6 page10: Please add references for 2009 L’Aquila and 2011 Lorca events.

References are included

References - They are a poorly and unsatisfactory list of the other paper on this subject. The References are simply the ones used to carried out the computation.

New references are included

FIGURES - Figure 2: more explanations are needed in the caption, in particular about “AR”.

The figure is explained with more detail

TECHNICAL CORRECTIONS:

Line 17 page 1: delete “the” before “recurrence”.

The text is modified

Line 10 page: difficult to read. Instead of the sentence “using the records which origin time and magnitude are contained in the period for which the catalog can be consid ered complete” a suggested change could be: “using the records with origin time and magnitude contained in the period for which the catalog can be considered complete”.

The text is modified

Line 27 page 8: This part on region 30 should be immediately after “return periods”, to complete the part on hazard map.

The text is modified

Line 31 page 8: the sentence with “The hazard curves” should start a new paragraph, on the hazard curves.

The text is changed