

Reviewer 1

The paper is consistent with the title and the declared objectives. Nevertheless, improvements could be made to increase the study understanding, through a deeper illustration of the methodology in some parts.

In the revised version of the manuscript, additional details about the risk assessment methodology will be added to facilitate and increase the understanding of the study.

The text has too many references to other papers (often the ones in the same special issue), reducing a lot the descriptions of the different steps in the present one. In many cases the references are related to important parts of the methodology, this makes less fluent the reading and sometimes it reduces the reading comprehension. Obviously, in a single paper it's not possible to describe all the details of a complex study, but adding the essential aspects will improve it.

Now that all the papers regarding risk assessment for this special issue have been submitted, we have been able to review the main aspect of this comment and make sure that all the relevant details about the methodology are included in the revised version of the manuscript.

In the following some specific comments highlighting minor typos and integrating the general observations written before:

- Lines 85-90: it is better to remove these results from the introduction.
 - We have removed this paragraph that included the results of the study from the introduction.
- Lines 103-4: there is an error in the paragraph interruption.
 - In the revised version of the manuscript, we have amended this layout error.
- Line 121: change 2090 with 2080 as reported in the other paragraphs of the paper.
 - This correction has been made in the revised version of the manuscript.
- Line 123: change module with model.
 - This change has been implemented in the revised version of the manuscript.

- Lines 120-135: the descriptions of the exposure models are too short. It's clear that the complete description is in other papers of the special issue, but, as example, a table with the different classes, or a resumed description, could help the comprehension of this step of your methodology, in this paper. The same for paragraph 3.1. Moreover, in the paper there isn't a short description of the different "SSP" or a related reference
- Lines 110-118: something more has to be added about the hazard assessment
 - In the revised version of the manuscript, we have added more details about the earthquake hazard model developed in the framework of this project.
- In paragraph 3.1 the sentence "The functions collected were then harmonized and processed" doesn't permit to understand the procedure to obtain the curves
 - In the revised version of the manuscript, a more complete description of the followed procedure to obtain the earthquake vulnerability functions has been included.
- In paragraph 3.2 it's not very clear the calibration process, after the comparison of the "real" and calculated data
 - In the revised version of the manuscript, a more complete description of the followed procedure to calibrate the earthquake vulnerability functions, based on the comparison between the modelled and the reported losses, has been included.
- Line 307: change Figure 2 with Figure 3
 - This typo has been corrected in the revised version of the manuscript.
- Line 379: change "he" with "the"
 - This typo has been corrected in the revised version of the manuscript.

Reviewer 2

The paper describes results of regional probabilistic loss assessment for five countries in central Asia. It describes a case-study for the application of event-based seismic loss assessment at the regional level. One issue with the paper is the possibility to re-produce the results. Therefore, the method, the data used, and the validation should be described in sufficient details for others to be able to follow/reproduce. For instance, the paper does not offer much insight about how the stochastic catalogue is generated, how the vulnerability functions are developed, the characteristics of the exposure model, and how the projection into 2080 is developed (some socioeconomic pathways are mentioned, and the reader is referred to another work). Moreover, very little is shown in the paper by way of validation –mentioned also by the authors. In most cases, the authors refer to other works for details/validation. This approach reduces the autonomy of the paper and makes it harder to read and to follow.

We thank the reviewer for the comprehensive revision of our manuscript. We would like to note that this manuscript is part of a Special Issue on which different papers, that have to do with the development of one or more components to carry out the fully probabilistic and event-based risk assessment for earthquakes (this paper) and floods (the one by Coccia et al.), have been submitted. This paper presents the risk assessment methodology and what outputs of each component have been used. To avoid repetitions, we have preferred to cite and indicate where the readers can find additional and complete details regarding the development of each component (e.g., PSHA, exposure model, etc.).

In the revised version we will provide more details about the validation and calibration procedure, as well as take care of the specific comments made by the Reviewer which we agree allow improving the original manuscript.

The paper needs to specify the thematic datasets used, the sources of data, the resolutions, the spatial extent. This holds, especially, for the exposure datasets, the vulnerability models, seismic sources, the stochastic catalogues, the geological and geotechnical datasets, and the loss data from historical earthquakes. As a work showcasing the results of a regional risk assessment useful for decision making purposes, the results need more comprehensive validation (both at the local/global level). Have the authors thought of comparing with the results of the Global Earthquake Model, if available?

In the revised version of the manuscript, we will provide additional details about the spatial extend, resolution level, generation of the synthetic catalog.

Here are some more specific comments:

- Please describe what is mean by the "regionally-consistent" in the title?

- An explanation of what is meant by the expression regionally-consistent will be included in the revised version of the manuscript. In a nutshell, it refers to an homogeneous approach to carry out the earthquake risk assessment, on which the same resolution level, assumptions and source data were used.
- Introduction and abstract: please specify the spatial extent for the 2bn AAL estimate. Is it all the five countries?
 - In the revised version of the manuscript, the specification of the 2bn AAL estimate will be provided. As the reviewer points out, it refers to the combined AAL for the five countries that are part of the study.
- Introduction, Line 85: It is not clear whether this part is related to the results of this paper or past studies. If these are findings of this paper, please move to the conclusions.
 - The values shown starting in L85 are the results of this study. We will make it clearer in the revised version of the manuscript.
- Line 100: what is meant by a long-term relationship? Please describe.
 - A description and more complete explanation about the meaning of a long-term relationship when dealing with earthquake risk assessment will be included in the revised version of the manuscript.
- Figure 1: The quality of the figure should be improved; the plots are too small and the labels cannot be seen.
 - The size of the fonts of labels and captions in all figures will be revised.
- Line 120: 2090 or 2080?
 - This value should be 2080 as correctly pointed out by the reviewer. The typo will be corrected in the revised version of the manuscript.
- Equation 4: please use a different notation like ν or λ to indicate rate. $F(.)$ is the notation for a cumulative distribution function (CDF), therefore it represents a probability and not a rate.
 - We prefer to keep the original notation, noting that the full explanation of all variables shown in Eq. 4 are included in the text.
- Line 200: This is the epistemic uncertainty in the prediction of the IM for a given event. It is estimated through a logic tree approach. please fix the wording.
 - We are referring to two types of uncertainties and the way they can be dealt with in a probabilistic earthquake hazard risk assessment

framework. We believe the paragraph is correct and no modifications are needed.

- Figure 2: how these curves are derived? no explanation is provided. If they are derived based on literature, provide the statistics, the reference papers, information about the consequence model(s) used, information about the fragility curves, the number of damage states, etc.
 - The revised version of the manuscript will include additional details about the development (and calibration) of the earthquake vulnerability functions.
- Figure 3: how this calibration is done? It seems that in some cases the difference with observed values has even increased after the calibration. Please describe the rationale for this calibration briefly.
 - The revised version of the manuscript will include a more complete description of the vulnerability calibration procedure.
- Line 350: “However, the same additive property does not hold true for specific return period losses, meaning that the regional loss for a given return period is different (lower) than the sum of the individual losses for that same return period calculated for each country.” Why is lower? Please explain.
 - In the revised version of the manuscript, we will include more details about the risk metrics, to make it clear why the regional losses for a given return period is always lower than the sum of the individual country losses.
- Line 389: what is this shortlisting representing? how it done? what are the criteria?
 - Since an event-based earthquake risk assessment was carried out, there are more than one synthetic earthquake that cause similar losses to that one with a 100-year return period. To that subset of possible synthetic earthquakes is that the shortlist is referring to. In the revised version of the manuscript this will be explained in more detail.
- Table 7: If these scenarios represent a 100 year return period, say so specifically.
 - Yes, these scenarios are representative of a 100-year return period loss. In the revised version of the manuscript it will be made more explicit to avoid misunderstandings.
- Section 4.2: Scenario earthquake loss estimates. Perhaps, instead of calling them pseudo-deterministic, they could be referred to as

scenario-based loss assessment. Then the authors could explain that the method is not fully deterministic.

- Although we understand the suggestion of the reviewer, we prefer to maintain the original name for the analyses shown in Section 4.2, mainly to avoid misunderstandings with the event-based risk assessment methodology (which itself is fully probabilistic).