This article exposes the development of a new hazard model for the city of Istanbul, Turkey. The model proposed mixes active faults and a background seismicity. The subject is pertinent and the overall article is well written and deserve to be published after some modifications are done: adding of a discussion about the slip-rate used in the model, the uncertainties and the output of the models, and improvement the figures.

Hereafter the list of issue concerning the article:

Main issues:

- The values of slip-rates used in this study are not referenced clearly enough and the uncertainties are not discussed enough.
  Here are a list of point concerning this issue:
  - "*slip rates should be participated* ». Comment: GPS does not provide slip rates for faults. Geodetic slip rates for major block-bounding structures are deduced from elastic block models. Suggestion: Geodetic slip rates deduced from elastic block models along the major block-bounding structures of the NAFZ. (McClusky et al. 2000; Meade et al., 2002; Reilinger et al., 2006). GPS data resolve left-lateral slip on the order of 25 mm/yr, with more than 80% being accommodated along the northern branch. Which is the reference providing this value of 80%.
  - "*slip rate of 19 mm/year is assigned to these segments of the northern strand and 6 mm/year is assigned to Geyve-Iznik Fault based on the values proposed by Stein et al. (1997) with slight modifications due to catalogue seismicity*." Why is there a need for modification of the slip-rate?
  - "*Since the contribution of Düzce Fault to the total slip is around 33% to 50% (Ayhan et al. 2001)*". What is the final contribution chosen here and why? Ayhan et al., 2001 states that analysis of GPS data suggest something different, that up to 10 mm/yr are accommodated on the Duzce-Karadere strand of the NAF [Ayhan et al., 1999].

    ➔ Suggestion: Please keep original reference when possible and explain how catalogue seismicity modifications led you to propose different slip rates for these two fault strands and could you please compare your slip rate estimates with more recent findings
    e.g. Ergintav, 2014 gives :
    - for the Cynarcik Basin fault PIF: 10-15 mm/yr **vs** the 19 mm/yr with no uncertainty used in this study;
    - for the Central Marmara region: < 2mm/yr **vs** the 19 mm/yr with no uncertainty used in this study.

    ➔ Suggestion: Table 1 please add original references used to estimate slip rates, add associated uncertainties and in the text justify your choice of slip rate with respect to the many alternative interpretations.

- The article targets to present "fully-documented and ready to use fault based SSC" (P1L18) which is a good way to share hazard model information. This approach deserves to be promoted in the seismic hazard community. Unfortunately, with this state of the paper, it is most possible to use the results for a reader in order to run a hazard calculation. The geometry of the faults and the background earthquake rates are provided in the supplements but the earthquake rate on faults is absent. Authors should provide these rates for the full logic tree described in this study. Furthermore, the authors should acknowledge the limitation of their

model and the uncertainties that remained unexplored in their logic tree (fault segmentation, fault geometries, slip-rate, scaling law used …) for future user to be able to use their work and run a complete and critical hazard assessment for the city of Istanbul.

- A logic tree is presented, with the exploration of several branches (b values, Mmax) but the results of the logic tree and the influence of each parameters is not exposed. A Discussion part should be added to the article in order to discuss the hazard model, to compare how it perform against the data (modeled seismic rate vs earthquake catalogue), discuss the issue of double counting, and to compare against the other seismic hazard model discussed in the intro. The limits of the models need to be clearly discussed as well. For example, the model allows multi-fault ruptures but the boundary of each system is based on the past earthquake rupture (Parson 2004) and the possibility of an earthquake passing from one system to another is not discussed.

- The issue of Mmax in the background zone should be discussed in greater detail: please refer to the extensive literature, UCERF3 in particular, for a more up to date discussion on this issue.

General comment:

- Why use the term “planar seismic source” instead of “fault source”?

Specific comments:

(format : page-line)

1 Introduction

2-1 please define “*floating earthquake*”

2-2 “*Parsons (2004) noted that the10 May 1556 (Ms=7.1), 2 September 1754 (M = 7.0), and 10 July 1894 (M = 7.0) earthquakes were located in the Çınarcık basin or on mapped normal faults in the southern parts of Marmara Sea*”. Please change located with “were assigned location” as written by Parson 2014 “ *1556 Ms _ 7.1, 2 September 1754 M _ 7.0, and 10 July 1894 M _ 7.0 earthquakes….were assigned locations in the Cinarcik basin or southern Sea of Marmara on mapped normal faults*”

2-30 “*preferred*” should be changed to *chosen*

3-1,2 please give references to the fault maps and satellite images

3-23 by “*seismic energy*”, do you mean *moment budget*?

3-26 “*can be directly implemented*”, as said before, there is a need for more information in order for the reader to implement the hazard model presented in this study.

2 Fault Models, Rupture Systems, and Partitioning of Slip Rate

The faults in the southern part of the Marmara Region are not included in the model. The background seismicity will in a way fix this problem latter on. In any case, the fact that only the Northern faults are taken into account should be clearly stated in the beginning of this part.

3-29 “previous large magnitude earthquakes” Parson 2004 needs to be cited here.

4-10 “…..its motion must be controlled by the motion of the Izmit Segment.” What do you mean? Please justify and provide references.

4-29 The Geyve-Iznik fault is cited and a slip-rate is attributed but this fault is not kept in the final model. This fact should be clearly pointed in the text.

4-32 Here the author that the segment 1 of the Duzce fault is connected with the Izmit system. However, they cannot rupture together. Why so?

6-4 “*that act*” replaced by “*that can act*”

6-14 “*hence the most imminent seismic hazard to Istanbul and other cities*” this is true but since this paper is presenting a Poissonian model and not a time-dependent model, it is out of the scope of this study.

4 Magnitude Recurrence Models – Seismic Moments

What is the slip-rate chosen for a rupture scenario when faults don’t have the same slip-rate (for example, S 2_2 and S 2_3 in S 2_2+2_3)

7-8 “*the catalog was assumed to be complete for 52 years for Mw ≤4.5 and Mw ≤5.0*” do you mean Mw >=4.5 or 5.0? Please be precise the on the completeness time for each magnitude range.

7-30 “Seismic sources generate varied sizes of earthquakes” change to “Seismic sources can generate various sizes of earthquakes”

8-6 “fault zones” do you mean individual faults? The GR distribution can work quite well for a fault zone if several faults are in this zone.

8-17 “*relative rates of small, moderate and large earthquakes*” The term MFD can be introduced here.

8-18 “*related to the rupture system*” As I understand, this MFD is attributed for each possible rupture of the model. A rupture system will be the sum of these MFD, something different from a Youngs and Coppersmith distribution.

9-5 Can “*magnitude PDF*” be replaced by MFD?

9-6 Why this choice of adding 0.25 and 0.5 to the Mmax define using Wells and Coppersmith 1994? Doesn’t make the new Mmax not fitting the scaling law? Why not explore the uncertainty given by Well and Coppersmith or another scaling law in order to grasp the epistemic uncertainty?

Equation (4) – what is value of μ used in this study and based on which data?

9-20 is the *moment-balancing* the same for all the branches of the logic tree? What is the branch presented in figure 4?

9-22 the “*best fit*” between the rate in the catalogue and the weighted average is defined in which way? It seems that the fit with the smaller magnitude is preferred according to fig 4 because of the large uncertainty on the rate of large magnitude earthquake. Why the authors didn’t choose to use an historical earthquake catalogue in order to improve the estimation of the rate of larger earthquakes?

9-29 higher weight is attributed to single rupture than to multiple fault rupture. What are the basis for this assumption since the distribution used (Youngs and Coppersmith) already predicts more small

magnitude earthquakes than large ones? Is this argument stronger than the fit to the data in the weight determination?

5 Background Zone – Smoothed Seismicity

10-4 define "*not associated*". What is the size of the buffer zone? And why? Please state whether the background zone and the fault sources should be superposed in the PSHA calculations. (Not clear in figure 5)

10-7 "*distinctive zones of seismicity are not observed*": what do you mean by this?

10-21 "*no active fault has been reported*". Faults in the vicinity of Istanbul have been described in other studies. See Diao et al 2016 (Secondary Fault Activity of the North Anatolian Fault near Avcilar, Southwest of Istanbul: Evidence from SAR Interferometry Observations).

Discussion part is missing

6 Conclusion

10-30 "*previous SSC models*": a comparison on the modelled rate will improve the quality of the article.

11-12 "*can be directly implemented*" I agree that sharing a properly documented hazard model is a goal that more PSHA study should aim too. For this paper, information is still needed in order to accomplish that goal.

11-18 this interesting comparison with other model could be done in the discussion part in greater depth.

References

please have a look at the format for this journal. I think the "&…" is not accepted and doi should be provided when available.

Figures

Figure 1

A color code for each rupture system could be used. The full name of each rupture system should be indicated on the map to help the reader. What is the number between brackets?

Figure 4

Lines and Points are too thick and make the figure difficult to read. Please indicate which branch of the logic tree is exposed here (Mmax, b value). What do the blue and purple colors correspond too? This figure deserve to be explain more clearly. Please unify the style of the four figures.

Figure 5

Please complete the legend: scale of the color scale, red dots.

Choose better color code for the faults and add the names. (Linked with the rupture system for example)

Tables

Table 3

"*Logic tree for style of faulting*". This is not a logic tree since the style of faulting is not an epistemic but an aleatory uncertainty. I needs to be specified that the table refers to the background zone.

Table 4

The rupture scenario is not an epistemic uncertainty but an aleatory one.