Review of Loi et al.,

"*Revisiting Seismic Hazard Assessment for Peninsular Malaysia Using Deterministic and Probabilistic Approaches*",

NHESS-2018-51

I found this paper to be a thorough, thoughtful, comprehensive study of seismic hazard assessment in Peninsular Malaysia. The scientific merit of this paper is excellent, with many angles considered. The paper itself is very well-written and the work clearly and concisely explained, which is much appreciated from the perspective of a reviewer/reader. The paper is a synthesis of an impressive amount of work, one which seems it could even be presented in 2 – 3 papers instead of 1.

This manuscript will, I think, be an important contribution for both scientific literature, and hazard assessment in the region. I recommend that it be published with minor revisions. I do not have any major criticisms for the scientific contents of the paper. My main comments pertain mostly to some of the figures, and a few comments regarding the GMPE section of the paper, and this is the only reason I select minor revisions instead of technical corrections. Please find below my specific comments, as well as technical comments. Line reference as follows: P.#, L.#.

NHESS Review Criteria:

1) Scientific Significance: Excellent
2) Scientific Quality: Excellent
3) Presentation Quality: Text: Excellent Figures: Good (suggest a few changes below)

Specific Comments

1) P.6, L.1: You mention the local intraplate earthquakes and faults, and plot them on a couple figures. If possible, describe the type of faults these are (strike-slip, normal, thrust, etc.), as this is important for future studies to consider (with regards to directivity, hanging-wall effects, etc.), and I think also important for readers to understand if and how any of these effects have been considered in the GMPEs, later on in the manuscript.
2) P.12: I think it is important for readers to know a little more about the GMPEs, such as what are the basic components of the functional forms (i.e., are there hanging wall effects and other more detailed effects, or just magnitude/magnitude squared/geometric spreading/intrinsic attenuation terms?) What do the attenuation parameters look like, and how does that compare to attenuation in the region (if there are studies of Q here)? How is the site represented – is it basic NEHRP classes in all of these GMPEs? How do the models compare to each other? I don't think this has to be a long discussion, but as the rest of the paper is so comprehensive I don't think an extra paragraph or two here describing the ground-motion models could hurt, as they are a significant component of seismic hazard assessment.

3) P.13, L.19: I noticed in several places in the paper (including this line), the authors mention that they use "mean" values from the ground-motion models. Generally, ground-motion models predict median ground-motion – are the models you are using instead predicting the mean? If so, I encourage you to perhaps add some text in the discussion discussing the implications of this (i.e., it can sometimes inflate the hazard as opposed to using the median value).
4) Figure 1: I found this figure a little difficult to interpret. I appreciate that it is required to pack a lot of information into it, so I have a few suggestions that could include all this material, and make it a little easier to interpret:
    a. Make the coastlines thicker, and/or color the land/water separately
    b. Add some longitude/latitude tick marks and/or grid lines to the figure, to orient the reader and help them understand what the map projection is
    c. Perhaps add topography or bathymetry? (Though this could make it busier, and harder to read)
    d. Place a box around the approximate area/location of Figures 2,3,4 and 8,9,10, and 12 since I think they are slightly different from what I can tell
    e. Perhaps code the intraplate faults based on the type, and/or add direction of motion
    f. Place direction of motion on the SFZ
    g. Caption: Add a citation for the intraplate fault database.
5) Figure 2: A few comments -
    a. The label "Mantel" should be "Mantle"
    b. Add the direction of motion of the SFZ
    c. It is a little hard to see the Local Intraplate label on the top right – I would suggest adding this to the caption that is already on the bottom left, with "major seismic activities" and "subducting direction"
    d. Caption: Describe the diverging white arrows; I am assuming the numbers ("approx.. 10km", "> 2000km") are thicknesses, but I would suggest explicitly writing this in the caption; Add a citation for the intraplate faults, like Figure 1.
6) Figure 4: There are a few things that made this figure a little difficult for me to interpret, I have a few suggestions:
    a. Add some arrows indicating which boxes are Zone 1,2,3,4
    b. Perhaps reduce the opacity on the SSZ and SFZ zoned areas, as it is hard to see the background seismicity through them
    c. It is a little hard to see the text for Zones 5 – 7 in the SSZ, maybe make this text white, or put an opaque gray box behind all these zone texts?
    d. Not a major comment, small, but the last portion of the M in KM is cut off on the scale, bottom right
7) Figures 8 and 9: I have a few suggestions – most of them are in the interest of making the figures more similar to Figure 12, in the interest of being able to directly compare the results of the DHA vs. PSHA.
    a. Making the city labels a little larger, it is hard to see them
    b. Make the coastlines, geographic regions lines a little thicker, hard to see
    c. Make the fault labels a little larger

d. Perhaps color the ocean like in Figure 12, for consistency?
e. Add gridlines on the plot, like in Figure 12

Technical Corrections

1) In abstract, P.1, L.14-15: Perhaps also give these PGA values in percent g? For example, "PGAs of 0.07 – 0.80 m/s2 (0.7 – 8.1 percent g)…"
2) P.2, L.28 – 29: "This method, nonetheless, is not free of criticism as studies have observed that PSHA is merely a numerical creation with a hazy mathematical concept and the use of it may lead to risky or overly conservative engineering design". Perhaps a bit nit-picky, but I feel this is a bit harsh on PSHA, and a subjective statement. The main criticism of PSHA is that it cannot be validated, and therefore I do not think its criticism can "observe" that it is numerical creation, or has a hazy mathematical concept… but perhaps these studies can "suggest" that is mathematical, and has challenges in validation due to lack of data. I still contend, however, that its mathematical concept is not hazy…probabilities are not hazy, they are used in major financial decisions every day and are at the root of most capitalistic endeavors, and those who apply these "hazy" mathematical concepts seem to profit from them…just as an example.
3) A purely stylistic suggestion, of course authors' choice: The introduction is very well laid out, and has a decent amount of background. My only suggestion would be to place the main study focus before the description of PSHA, i.e., put the material from P.2, L.31 through P.3, L.9 before the discussion of DHA vs. PSHA, which could then motivate this discussion.
4) P.5, L.17 – 18: "Lying dextral and parallel about 200km away from the trench to accommodate the oblique convergence along the plate margin is the Sumatran Fault Zone. This 1900 km long strike-slip fault…" I found myself a little confused about whether the fault was dextral in its motion, or if dextral referred to its position; perhaps change to: "lying east and parallel… This 1900km long dextral strike-slip…" ?
5) P.6, L.19: In the paragraph preceding this line, perhaps reference Figure 1 or 2, to indicate where the reader can find the local intraplate faults on a map.
6) P. 8, L.9: "within the same grid in the past.". I am assuming "in the past" refers to since 1797, as described on L.4 – if I am correct, perhaps add that in? "within the same grid since 1797"
7) P.11,L.8-9: I am assuming the b-value was computed on events with M> 4.0 (SFZ) and 5.0 (SSZ) because of the network's magnitude of completeness? It looks like on Figure 5, the event start to fall off here. If I am correct, perhaps state that here to clarify.
8) P.14, L.8: I suggest changing "local intraplate earthquakes" here to LI earthquakes, since you have an abbreviation for it.
9) Figure 3: I do not see any of the LI greater than M 3.0 events (pink dots) – should there be any?
10) Figure 6: In the caption, perhaps describe what the recorded data shown is from (dates, etc.); Add a goodness of fit of the GMPEs to the data, if you have them?
11) Figure 7: Is Beta-value (column heading) supposed to be b-value?

12) Figure 8: Caption – is “mean” GMPE supposed to be median here?
13) Figure 12: Add the study abbreviations (A06, A05, etc.) into the caption.
14) Table 1: Is PYSM_B9 the site located on a building, which you said was not included in the study? If so, perhaps add an asterisk in the table and caption to specify.