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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Contrasting seismic risk for Santiago, Chile, from near-field and distant earthquake sources" *by* Ekbal Hussain et al.

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An important topic was analyzed in this work and can be a significant scientific contribution. Some comments are explained here, with the aim of improve the analysis and discussions of this work.

Major comments:

1. Lateral (N-S direction) continuity of the SRF

An important discussion has been obviated: the lateral-continuity (in a N-S direction) of the vertical offset of the fault, and which implications have in the fault rupture length. For example, (c) and (d) profile in Figure 4 do not have a defined offset to argue the fault presence. Additionally, differences in the offset ranging between 119 m and 5 m,

imply an unclear variability of the fault scarp. Does these offset represent the same geological process? Specifically, these offset also varies in the short-distance, for example varies between 30 and 2 meters in profiles (n) and (o) separated by only $\sim$ 1 km; or varies between 119 and 36 meters for profiles (h) and (i) separated only $\sim$1km. Thus, any obviously lateral-continuity is observed.

Then, (1.1) which criteria define a continuously fault? and (1.2) which criteria define a fault offset?

Additionally, Figure 4 does not have a descriptive caption to understand which represent the different colors of the lines (red, green and blue). (1.3) Please improve the caption of this figure.

(1.4) In the same Figure 4; Why red and green lines have different length including different number of points to make the linear regression? i.e. in profile (e), and (i) the green line starts in 0 distance, but in other profiles arbitrarily start at different distance.

(1.5) If one of the main goals of this work is define the fault trace: please discuss (1) lateral continuity, (2) the meaning of the fault surface expression and (3) comparison with the inferred sub-surface fault.

2. Peak Ground acceleration results

The PGA values are extremely important for this work, and must be presented, analyzed and discussed in the main manuscript. Please discuss the result of the PGA-values and presented it in the main manuscript.

From these results, arise the following questions:

(2.1) Why the PGA results of the SRF (upper panels in Figure S5) concentrated the higher values in a E-W elongated shape?

(2.2) Please use the same PGA-scale for all the earthquakes scenarios (Figure S5), to allow the comparison between them.

(2.3) Please add the USGS PGA map of the Mw=8.8 Maule earthquake.

3. Applications of the fragility curve

Fragility curve of Villar-Vega et al. (2017) may not represent the appropriate function for the earthquake scenarios of this work. First, Villar-Vega et al. calculated its fragility curves with 300 seismic records mainly composed by subduction earthquakes. Local crustal earthquakes mean a different frequency range, time of expose and spectral response. Thus, crustal events need an unique and independent analysis to created fragility curves. Additionally, differences between Chilean, Argentinean, Ecuadorian, Colombian, and Peruvian seismic regulations for building need careful attention. "Despite the usefulness of these models, it is important to acknowledge their limitations and range of applicability. These fragility functions do not capture the specific features of the building stock at the local level. For the assessment of earthquake losses at a local scale, models derived using a more detailed methodology and considering the local characteristics of the building stock should be considered." (Villar-Vega et al. 2017).

(3.1) Please discuss the applicability of the fragility curve to the Santiago building stock.

(3.2) Note that in supplementary figure S6. Fragility curve are referenced to Villar-Vega 2014.

(3.3) How to explain losses and fatalities for earthquakes scenarios, if the Bessason et al. (2012) vulnerability curve only expose losses with PGA up to 1 g; and according to yours models the major PGA values are 0.8 g (Figure S5)?

(3.4) Why do you present a MMI curve (Naguit et al. 2017) if your results are explained in terms of the PGA values?

(3.5) How can you explain that the mean building collapse expected for the Mw=8.8 earthquake according to your results, it is overestimated 200% above of the observed damage?

(3.6) Can you compare the results of the Maule, 2010 earthquake in terms of the

fatalities?

4. Conclusions and uncertain of this work

Section 5.4 discuss the limitations and uncertain of this work. However, these discussions are not explicit in the abstract and conclusion sections. To provide the limitation of this work, please add these uncertain at least in the conclusion section.

Minor comments:

Page 5 Paragraph between line 13 and 20: The 1647 earthquake can be attributed to several sources, one of them is the splay fault beneath Santiago; but there are other options; (1) intraplate earthquake as the 1939 Chillan Earthquake; taking into account the $\sim$200 second of duration (ref libro); (2) another crustal fault next to Santiago, for example the West Andean Thrust faults (Armijo et al. 2010) or other fault describe by other authors (e.g. Farias et al. 2010). Further efforts must be done to state this paragraph, and any of these possibilities can be obviated and not mentioned.

Page 9 line 12: "for the commune of Las Condes"

Page 11 Line 10: the reference is Vargas et al. 2018, not Easton et al. 2018.

Page 12: Line 12: Please add "According our models, it is clear that there is a trade-off"

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