Natural Hazards and Earth System Sciences Discussions

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC1
https://doi.org/10.5194/nhess-2021-287-RC1, 2021

Comment on nhess-2021-287

Anonymous Referee #1

Referee comment on "Brief Communication: A case study of risk assessment for facilities associated with earthquake-induced liquefaction potential in Kimhae City, South Korea " by Sang-Soo Jeon et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2021-287-RC1, 2021

Review to:

Brief Communication: A case study of risk assessment for facilities associated with earthquake-induced liquefaction potential in Kimhae City, South Korea;

By: Sang-Soo Jeon, Daeyang Heo, Sang-Seung Lee

Jeon et al. evaluate severity of liquefaction in Kimhae, a city in Southern Korea, adjacent to the Nakdong river, due to a possible Mw = 5.0 and 6.5 earthquakes originated along the Yangsan Fault that crosses the city. They examine the Liquefaction Potential Index (LPI) calculated on the base on groundwater level and standard penetration tests from 274 locations in Kimhae City, and evaluate the hazard to various infrastructure facilities in the city.

This is an important investigation relevant to South Korea in general and particularly to Kimhae City. Nonetheless, in my opinion, the way the evaluation was conducted needs comprehensive revision and revaluation of the results and the conclusions.

My main comments are:

Terminology

The authors use various terms for the liquefaction potential in Kimhae City. For example, the title, heading 4.2, line 46 and elsewhere, speak about RISK; line 68 about "ground DAMAGE level"; line 52 about "estimate the HAZARDS induced by liquefaction"; line 75 about "levels of liquefaction SEVERITY".

There is a need to clarify what is the evaluation about, and follow the terminology used in this discipline.

Methodology

Some aspects of the methodology are not clear, for example:

- What were the criteria used for selecting the proper SPT data (Line 173) for LPI calculation;
- What are the "Preliminary estimation" in the Flowchart (figure 1), and the criteria for 'yes' or 'no' decision? Similar question refers also to the criteria used for FS in the same flowchart.
- There is a need to present the soil classification used for the analysis

Due to the poor resolution of map 4, it is not possible to identify the location of SPTs points and figure out the spread of SPT points across the city area. As far as I could see and understand, there are some areas with no data. The authors need to determine the threshold density of information relevant to the analysis, exclude no data areas from the analysis, and accordingly reexamine and modify the results presented and elaborated in Chapters 4 and 5 and in the relevant figures.

I wonder why there is no presentation and discussion on the geology of the region. There are methods and procedures for identifying zones of required investigation for liquefaction susceptibility by geological screening, and it is thus possible to complement the investigation in region with no or scarce LPI data.

It would be useful to present the geology of the region and see whether the LPI results agree with the geology, and thus extrapolate the understandings for areas with no LPI data.

PGA:

The first paragraph in section '3.2 Attenuation relationship of PGA' is confusing:

- The text is hard to follow because there are many repetitions;
- Lines 152-3 say that "Choi et al. (2005) was used in this study", while lines 159-160 state the opposite for distance shorter than 10 km, and Table 3 (line 169) base the estimation on Jo and Baag (2003).

Please rephrase and explain what were the attenuation relationships used in this study?

The text states: (lines 114-115): "the horizontally extended location from the centroid of Kimhae City to the closest fault is assumed to be the location of the epicenter". However, Figures 2a shows a line diagonal to the fault line rather than normal to it. The same should be applied for the 17 sub districts (Figure 2b).

Thus there is a need to correct the distances and recalculate the expected PGAs.

Risk level

It appears that most of the facilities are distributed where LPI = 0. Is it an artifact due to lack of LPI data? May be there should be a minimum distance from a given facility to the nearest LPI data in order to except or reject the results.

Alternatively, are there zones with no or little LPI data but with geological conditions that favor liquefaction hazard? How would you define the hazard in such areas?

Results and discussion

While defining areas with very low level of liquefaction severity in an urbanized area for an earthquake (Result 1) on the base of interpolation of LPI data but no geological screening, there should be a note that zones of significant PGA amplification, artificial landfill, leakage of water and sewage systems, etc., should be excluded and treated with care.

Result 4: the authors state that "Therefore, the construction of buildings in regions with high liquefaction severity should be avoided." This is a very strict conclusion that is not fully supported in this study. Such a recommendation should be taken by an engineer after geological screening, site specific investigation, and no way for a proper soil treatment.

Figures

There is a need to add location map of the study area and show where Kimhae City is in South Korea, the earthquake epicenters, faults and localities mentioned in the text.

The maps are hard to read (I could hardly see the location of the SPTs points and other information), mainly due to low resolution and scale. Please improve resolution of the maps, text on the maps (Figures 5ab), size of legend, explain what is shown at the background of the maps, and show the limits of the urban area at the background.

Technical comments

- Line 38, Should be: "… earthquakes (Mw = 6.2, 7.1) in 2010 and 2011, respectively."
- Line 175: "inside of the dotted line" – do you mean the doted red ellipse in Figure 4?
- Table 4 – please round the numbers where needed.
- Line 196- what does it mean "plat area"?
- Line 238, first sentence, seems to belong to the introduction?