

Interactive comment on “A Procedure to Select Earthquake Time Histories for Deterministic Seismic Hazard Analysis: Case Studies of Major Cities in Taiwan” by Duruo Huang and Wenqi Du

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The authors thank for the comment and discussion on the manuscript. Replies to the comment are provided as follows.

The discussion paper presents a general method to select ground motion time histories in Taiwan region. The findings and results presented through this study may have the potential to be of high impact for the study region. I have some comments provided as follows:

1. I recommend removing the term "site-specific" appears many times in the manuscript

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(e.g. Page 8, Line 201). The term implies consideration of local site conditions. However, for all cases the authors used a single ground motion prediction relationship. The term "site-specific" in Taiwan may include quite different geological conditions, such as, alluvium filled basin (Taipei and Ilan basin); thick Quaternary strata (Chianan Plain); relatively stiff soils in extended hilly areas (north western part of the Island). Moreover, the upper part of the deposits may be characterized by large spatial variations of thickness and geotechnical characteristics (e.g. Taipei basin). Thus, to my mind, it would be better to construct target response spectra using semi empirical approach, i.e. applying stochastic simulation based on spectral seismological models together with corresponding site amplifications.

Reply: The authors appreciate the comments. We refer time-history recommendations in this study as "tentative site-specific" because the site effect is not comprehensively characterized with a more detailed site response analysis, but with a soil-site ground motion prediction model. Therefore, the selected ground motion time-histories could be recommended for general earthquake analytical cases, where specific site investigations are not performed. Following this line, we should modify the Subtitle 4.2 in the manuscript to "Tentative site-specific time histories". Actually we have some contents in the manuscript clarifying "site-specific" ground motions provided in Lines 202-213, Page 8:

"This paper presents an option to select earthquake time histories from the reputable NGA database. But strictly speaking, those time history recommendations are not site-specific, because the site condition is not carefully taken into account with a comprehensive site investigations and site response analyses. In other words, the site-specific motions are those from seismic hazard analyses, to site response studies (e.g., Du and Pan, 2016). As a result, this study refers to those time-history recommendations as "tentative site-specific," because the site effect is not comprehensively characterized with a more detailed site response analysis, but with a soil-site ground motion prediction model. Therefore, the selected ground motion time-histories could be rec-

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ommended for general earthquake analytical cases, where specific site investigations are not performed. Since the recommended time-histories can reasonably reflect the local seismic hazards at these cities, they should be used as basic results and then be serviceable for common engineering practice.”

2. The strong motion duration, Arias intensity and other parameters are also important and should be considered in ground motion selecting for engineering practices in Taiwan. These criteria can be found in some standards. It is recommended to show these parameters in the selection process for the selected records.

Reply: Comments appreciated. The authors fully agree that spectral shape only provides a partial picture of real ground-motion characteristics and doesn't contain other important features such as Arias intensity, duration as well as ground-motion nonstationarity. These parameters have been found to be important in the analysis of certain types of structures and may be incorporated in ground-motion selection process if possible. Following this line, the author recently proposes a new technique to generate synthetic ground motions that not only match the target response spectrum, but also match target Arias intensity build-up and significant duration (Huang and Wang, 2017). On the other hand, this paper aims at presenting a detailed procedure in selecting ground-motion time histories from a reputable global database for major sites in Taiwan with the use of an interactive tool when comprehensive seismic hazard assessments and site investigations are yet available. Multiple-target ground motion selection is somewhat beyond the scope of the current study, and we can add discussion regarding this concern in the revised manuscript.

3. lines 214-235. The “Chi-Chi Earthquake’s motions are not selected” section is not relevant with this study and thus it should be removed. Besides, the “basin effect” paragraph is very confusing. In other words, it is not understandable how the basin effect in the calculation chain is introduced and how the geographical distribution of these basins is considered. Please clarify it.

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Reply: Comments appreciated. Regarding the basin effect of Taipei city, we follow several previous studies (Sokolov et al., 2000, 2009) on the topic to scale the target response spectra at a specific range of periods, with such a site effect properly considered. Following the suggestions, we upscale spectral accelerations at long period to incorporate the basin effect. Consequently, the time histories matching the up-scaled response spectrum are selected from the NGA database.

References:

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