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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on “The slope seismic response monitoring of Wenchuan aftershocks in Qingchuan” *by* Y. H. Luo et al.

Anonymous Referee #2

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This paper studies the dynamic response of a small valley (about 1.5 km wide and 200 m deep) to 22 small and moderate earthquakes (M between 2.3 and 5.3) located at a distance varying between 3 to 46 km. Five seismological stations were installed at different elevations along the valley profile. Site effects were analyzed by comparing PGA and Arias intensity values at the different stations, considering one station as the reference, and by computing HVSR (Horizontal to Vertical spectral ratios) at all stations.

Although the subject could be of interest for the readers of NHESS, the paper suffers severe weaknesses and the main comments are listed as follows:

1. I do not see the scientific question that the authors wish to address. Their study comes after the 2008 Wenchuan earthquake that triggered tens of thousands landl-

sides. The authors claim that they want to the study the effect of geological conditions on slope seismic response and they installed five seismological stations on the two slopes and in the valley center. After the 1985 Michoacan earthquake, tens of papers have been written in international journals (BSSA, JoS, GJI, BEE. . .) on the site effects resulting from such 2D/3D valley-like structures, including detailed investigation of the structures, comparison between recorded ground motions and numerical simulations, and the effect of the source characteristics. What is new and innovative in this study?

2. The introduction does not present the state-of-the-art on dynamic response of slopes. The authors just quote about twenty relatively old papers on the subject without synthesizing current knowledge. Most recent and significant works on the dynamic response of slopes are not mentioned. This part has to be completely rewritten, considering recent and appropriate references. Numerous sentences are vague and general, and no clear scientific objective emerges from the introduction.

3. Although the authors want to understand the effects of local geological conditions on ground motions, the geology of the site is little known and poorly presented. According to the geological map (Figure 1), the stations were all installed on phyllites of Lower Silurian age (Sm), while the two hills are mainly made of limestone on the EW cross-section (Figure 3). In the same figure, a reverse fault (south branch of the QC-PW??) juxtaposes limestone and phyllite, but this fault is not drawn at this place on the geological map. There is a discrepancy between the geological map and cross-section. The thickness of the quaternary layers filling the valley is not given, which is of first importance for site effect evaluation, and no information is provided on the shear wave velocity values characterizing the different rock/soil layers. The cross-section shows a flat area at an elevation of about 960 m on both sides of the valley, which suggests the presence of a terrace level but this particularity in the topography is not described or discussed. This lack of information and the inconsistency in the presentation strongly weaken the paper.

4. The authors extracted three parameters from the signals for highlighting potential

site effects: PGA, Arias intensity and HVSR. The reasons for choosing these parameters are not explained. There is not a word about the main effects of geological conditions on earthquake ground motions (amplitude, duration, frequency) and about the relevant parameters for showing these effects. For comparing PGA and Ia values, the authors considered the Q3 station as a reference, which is a very questionable choice. The Q3 station is located close to a major fault and at the level of the alluvial plain. The ground motions at this station are without doubt affected by site effects. It is then not surprising that weak "amplification" values are obtained, even lower than 1. This point has to be more clearly stated and discussed. I would avoid the term "amplification" (and rather use ratio amplitude), which is normally related to the comparison with horizontal topography and rock conditions. Comparing with the records of a station installed on such rock conditions would strengthen the paper.

5. For investigating the spectral effects of the geological conditions, the authors choose to compute the Horizontal to Vertical spectral ratios (HVSR) on earthquake records at all stations. It is hard to understand why standard spectral ratios, using the same reference station as for PGA and Ia, are not calculated. In addition, the HV physical basis of the method and its actual relevancy for site effect estimates still remain a controversial subject but the authors seem to be unaware of it. Both recent experimental data (Haghshenas et al., 2008, Bull.Earht. Eng,6) and theoretical works (Kawase et al., 2011, BSSA, 5) suggest that the H/V peak amplitude derived from ambient noise or earthquake records is not directly correlated with the site amplification (although that some characteristics like the main site frequency could be retrieved).

6. This paper (Figures 6 to 8) shows a great variability of the relative response with the source, suggesting some potential effects of the source characteristics (depth, back-azimuth, magnitude. . .). These effects are not investigated.

7. Figures and figure captions are of poor quality and have all to be dramatically improved. A figure, along with its caption, has to be understandable alone. Most figures are not clear and cannot be read easily. In Figure 1, it is hard to distinguish the different

geological formations, the type of fault is not indicated, and populated areas should not drawn on a geological map. Figures 2 and 3 should be merged. The legend of Figure 3 is incomplete. The ground surface line should be thicker and the geological formation drawn in a clearer way (using symbols or collors), along with the alluvial deposits. Orientation has to be indicated in a standard way (E and W) and the figure must be consistent with Figure 1. Figure 4 has to be presented first, in order to give the location of the site. The upper left sub-figure is not readable. Scale has to be shown in all figures. The station number should be indicated on all sub-figures (instead of the elevation) and all subfigures have to be redrawn in order to show the axis labels in a correct way (vertical are compressed –horizontal are elongated). The amplitude scale should be normalized to highlight the difference in amplitude. P, S and surface waves should be shown. The graphs of Figures 6 to 8 should be labeled a), b), c). . .and presented in the caption, and the relevant information (station name) indicated in order to make a better link with the text. The so-called "amplification factor" in Figures 9 and 10 should have the same scale for comparison. Figure 11: all curves corresponding to the same station should be plotted on the same graph, in order to see if there is a general tendency related to the site and to identify particular responses.

8. The English is shaky and some parts are really difficult to understand. I suggest the authors to ask the assistance of an English speaking person.

In conclusions, this paper does not reach the standards of an international journal in both form and content. The scientific objective is vague and the data set is not appropriately exploited. My recommendation is to reject it in the present form.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 4135, 2014.