Review for the article titled as:

“Development of a country-wide seismic site-response zonation map for the Netherlands” by van Ginkel *et. al*.

This interesting paper attempts to assess site response for the Netherlands for a first identification of regions with increased seismic hazard potential. Ambient noise HVSR amplitude (A0), amplification factors (AF) and empirical transfer functions (ETF) were retrieved by means of data recorded by the seismic network (consisting of borehole and surface seismometers) of the Royal Netherlands Meteorological Institute (KNMI, 1993) across the Netherlands. S-wave velocity profile from a Seismic Cone Penetration Test (SCPT) available for some boreholes were also used together with detailed 3D geological subsurface models GeoTOP and NL3D. All these data were used to derive empirical relationships between measured amplification in the time and frequency domain, estimated amplification from the ambient noise field and the local lithostratigraphic conditions and a zonation map as well.

The results of this work is based on extensive geophysical and some seismological measurements. Though these techniques are widely used to address site effects, the attempt to provide a 3D model of the site through the obtained results is, to a certain degree, a novel approach and definitely adds extra value. This reviewer recognizes that the paper contains interesting results. The content of the article is also very relevant and in line with the focus of the special issue. The paper is generally well organized and well written. However, there is still scope for enhancing the writing quality. For example, the authors should avoid some repetitions.

The scope fits the subject “Natural Hazards and Earth System Sciences”. So, this reviewer believes that the paper should be considered for publishing and recommend minor revisions.

GENERAL COMMENTS & QUESTIONS

Line 171: At this depth, 95% of the Dutch subsurface is composed of these sediments ~~at this depth~~

Line 191: In this study we compute amplification factors (AF) in the time domain from the G-network earthquake recordings. We compute the AF for each borehole site by taking the ratio of the maximum amplitudes recorded at the surface and the 200 m deep seismometer.

Line 194: The amplitude at the surface was divided by a factor of 2 order to remove the effect of free surface amplification.

Line 196 – 199: We decided to adapt the frequency band and seismometer depth to obtain an AF that is more representative for use on a national scale than the AF used in the region of Groningen. Hence in this paper, the AF is calculated between the seismometers at surface and at 200 m depth, for a frequency band of 1-10 Hz. The AF is determined in the time domain and therewith it provides an average amplification over the applied frequency band.

Line 210: In this study we compute the ETF between the radial component of the seismometers at surface and at 200 m depth (ET F200).

Line 215: demonstrating that most amplification develops in the top 50 m of the sediment cover which is supported by

Commented [SU1]: We decided to adapt the frequency band and seismometer depth to obtain an AF that is more representative for use on a national scale than the AF used in the region of Groningen. From the G-network earthquake recordings, we compute the AF for each borehole site by taking the ratio of the maximum amplitudes recorded at the surface and the 200 m deep seismometer.

Commented [SU2]: Why a value of 2?

Commented [SU3]: in order

Commented [SU4]: The AF is calculated between the seismometers at surface and those at 200 m depth, for a frequency band of 1-10 Hz. It is determined in the time domain and therewith provides an average amplification over the applied frequency band.

Commented [SU5]: Delete “In this study”

Commented [SU6]: are developed

Line 245 - 246: Whereas the ETF peak amplitudes represent maximum amplification (at peak frequencies which vary from site to site), the empirical relationship between the HVSR A0 and AF is of most importance for the construction of the site-response map.

Commented [SU7]: Why?

Line 250: However, recent studies (Castellaro et al., 2008; Kokusho and Sato, 2008; Lee and Trifunac, 2010) have drawn attention to the fact that using only V s30 as proxy for site-response is inadequate,

Commented [SU8]: However, studies from Castellaro et al. (2008}; Kokusho and Sato (2008); Lee and Trifunac (2010) have drawn attention. Delete "recent" because these studies are older than those cited in the previous sentence.

Line 253: Hence, the shear-wave velocity ratio between the top and base layer is introduced as a proxy for site amplification by Joyner and Boore (1981) and further explored by Boore (2003)

Commented [SU9]: Delete "Hence" for the same reason as previously

Line 255: the AF is fitted, using A0 = x1 +x2e $x3^{Vs}$

Commented [SU10]: What are x1, x2, x3?

Line 260: Secondly, from the SCPT data we derive the depth and size of the velocity contrast (VC) by dividing the shear-wave velocity values for each 1 m interval by the maximum value over the full 30 m is taken as the VC-value.

Commented [SU11]: Something is missing

Line 265: On the other hand, the correlation between the AF and the VC is less, meaning this parameter is inferior to the AF.

Commented [SU12]: Do you mean that the influence of this parameter is the least?

Line 267: A large VC-value is leading to resonance in the near-surface, which is expressed in high amplitude peaks of the HVSR

Commented [SU13]: leads

Line 287: For the TERZ borehole the ETF is displaying similar curve characteristics as the HVSR estimations.

Commented [SU14]: displays

Line 291: The borehole ETFs confirm that most of the amplification develops in the top 50 m (Figure 5) of the sedimentary cover

Commented [SU15]: are developed

Line 292: The top 10 m (Figure 7)is

Commented [SU16]: (Figure 7) is

Line 306: The main reason of is that we

Commented [SU17]: Missing a word

Line 311: sites with bedrock at depths shallower than 100 m fall into Class V. For Class V, the resonance over the complete unconsolidated

Commented [SU18]: Avoid repetition. For example, "than 100 m fall into Class V for which the resonance over the complete unconsolidated"

Line 356: As a result, we present the national site-response zonation map (Figure 12), were each class characterises a certain level

Commented [SU19]: where

Line 361: Typically, at these places there is large model uncertainty. For example in north-east Noord-Holland

Commented [SU20]: uncertainty, for example

Line 367: the HVSR of the seismometers (e.g. ALK2, Figure 8) deficit any peak due to the absence of an velocity contrast

Commented [SU21]: a

Line 363: The geological model at these locations presents large portions of clayish sand, resulting in class category III, while the HVSR curves exhibit distinctive, high amplitude peaks, demonstrating local conditions related to class IV.

Commented [SU22]: According to you, what can explain such a discrepancy? What show for example the corresponding ETF?

Line 370: Most of the northern part of this region is Class II due Pleistocene sands

Commented [SU23]: due to Pleistocene

Line 394: the site-response map (Figure 12) exhibits an which is rather similar to the geological map (Figure 1).

Commented [SU24]: A word is missing