Reply Letter: Site characterization of Sikkim Himalaya using HVSR

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Editor

Comment 1: Please ensure that the English language in your manuscript is carefully checked for grammar, spelling, and syntax.

Reply: Thank you for the suggestion. We have thoroughly gone through the entire manuscript and have made sure the grammar, spelling and syntax is correct. Corrections have been made to this effect at the following line numbers in the marked-up pdf: Lines 9, 10, 11, 12, 14, 17, 21, 22, 24, 25, 26, 29, 30, 31, 32, 45, 46, 49, 57, 58, 59, 60, 62, 66, 78, 88, 117, 118, 120, 128, 147, 153, 154, 159, 165, 166, 171, 213, 226, 247, 248, 249, 256, and 309. Minor corrections have also been made in the caption of figures 1 and 6.

Reviewer A

Comment 1: Lines 112 to 113 (in the marked-up pdf) : Thank you for providing the rationale and references for selecting the 10-second window after the S-wave arrival. However, I find the end of the sentence still unclear, particularly the phrase "owing to the longer time windows." Could you please reword this part to make it easier for the reader to understand?

Reply: We would like to thank the reviewer for the previous comments which helped in improving the manuscript. As for the current comment regarding lines 112-113 (in the marked-up pdf), we have rephrased the concerned statement as follows (Lines 117-118 in the revised marked-up pdf):

Inclusion of signal after S-wave arrival and the corresponding longer time window ensures stability of HVSR curves (Field and Jacob, 1995; Bonilla et al., 1997). Use of longer time length for computation of stable HVSR curves complies with the recommended guidelines as well (Wathelet et al., 2020).

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Reviewer B

Comment 1: There remains some unevenness in the writing which should be improved by copyediting, in particular the abstract is not easy to read.

Reply: We would firstly like to thank the reviewer for the constructive comments which improved the manuscript greatly. We have checked for grammatical and typographical errors from our end as well and have made the necessary modifications. In particular, corrections have been made to this effect at the following line numbers in the marked-up pdf: Lines 9, 10, 11, 12, 14, 17, 21, 22, 24, 25, 26, 29, 30, 31, 32, 45, 46, 49, 57, 58, 59, 60, 62, 66, 78, 88, 117, 118, 120, 128, 147, 153, 154, 159, 165, 166, 171, 213, 226, 247, 248, 249, 256, and 309. Minor corrections have also been made in the caption of figures 1 and 6.

As for the Abstract, we have attempted to simplify it as follows:

Abstract: *The state of Sikkim in northeast India, located in the central segment of the Himalayan orogen, was plagued by the recent 2011 M_w6.9 earthquake. Study of local earthquakes recorded at the network of 27 broadband seismic stations in Sikkim Himalaya unveiled seismogenic zones extending down to lower crustal depths with a predominant strike-slip faulting mechanism. Persistent seismic activity in a region with a complex tectonic setting makes it imperative to study site characteristics crucial for determining the local site conditions. Here, we harness the noise and local earthquakes recorded at the Sikkim network to compute horizontal-to-vertical spectral ratio (HVSR) for site characterization. Comprehensively, local geology and topography are observed to incite distinctly intricate trends in the HVSR curves. The thick sedimentary deposit of the Himalayan foreland basin causes high amplification (∼7) at low resonant frequencies (<1 Hz). HVSR curves in the western section of Main Central Thrust Zone exhibit distinct double amplification peaks (∼2.5 at 1 Hz and 5 Hz) possibly due to the parallely dipping sheets of the duplex structure. Whereas, the eastern section of Main Central Thrust Zone exhibits a rather unclear trend owing to its proximity to the transitioning lithological unit. The central section prone to landslides has characteristic peaks at 2 Hz and 8 Hz, possibly indicating the contrasting composition of the sliding surfaces. Collective effects of towering topography and high wind speed are observed to result in anomalously high amplification (∼25) at low frequencies (<1 Hz) in north Sikkim. Directional amplification along discrete azimuth signifies the pronounced effect of topography and geometry of lithotectonic units in site response. In conclusion, locally varying site response with prevalent seismicity amplifies the seismic hazard risk potential of Sikkim Himalaya. In particular, central Sikkim is prone to high seismic hazard potential owing to severe seismic hazard level, higher landslide susceptibility, crustal seismicity and high peak amplification.*

References

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