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Interactive comment on "Probabilistic seismic hazard analysis using logic tree approach – Patna District (India)" *by* Panjamani Anbazhagan et al.

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Some comments and criticisms for an application of logic tree approach (Probabilistic seismic hazard analysis using logic tree approach-Patna District, India)

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Abstract

In the article of "Probabilistic seismic hazard analysis using logic tree approach-Patna District (India)" (Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-

2018-328) studied by Anbazhagan et al., a popular tool called the logic tree approach is employed for seismic hazard analysis of Patna District, India. Despite being an extensive study, it is observed that the logic tree application needs to be more informative about the weighting factors of terminal branches and selection of attenuation equations. This discussion mainly aims to present some comments and criticisms for some clarifications of the logic tree application.

Key words: Logic tree, weighting factors, seismic hazard analysis, attenuation equation.

Due to its capability of combination of multiple models alternatively, the logic tree approach employed in the article is of scientifically significance that practically offers a solution for the issues of the seismicity of the region (Patna District, India). However, the following technical points are the comments that could be queried for the application of logic tree approach in the study.

1) In the logic tree approach, the seismic hazard analysis is carried out by the combination of models and/or parameters constructed with each terminal branch regarding with weighting factors. However, for construction of logic tree branches with the weightings of models, it appears that the criteria are lack and/or not clear in the article. They are the questions that what are the experimenter's (authors') concerns (issues) in practice and what are the expert's recommendations about the seismicity of the region. As a consequence, without accounting the weighting factors realistically, it is not possible to obtain a realistic result of seismic hazard analysis using the logic tree (Gullu and Iyisan, 2016).

2) One of the power utilities of the logic tree comes from its relatively less effort compared to the conventional seismic hazard methodologies. It is important to note that using the logic tree with the judged weighting factor requires a calculation effort that dramatically increases with increased branches (Bommer et al., 2005; Sabetta et al., 2005). Thus, in order for preventing the troubles from the increased branches dur-

ing estimations, the branches with slight differences are strongly recommended to be avoided (Bommer et al., 2005). Hence, readers of the article should be informed whether the authors avoided from similar nodes in the logic tree branches. Again, this specifically requires presentation of selection criteria of weighting factors in detail.

3) Past works (Sabetta et al. 2005; Scherbaum and Kühn, 2011) indicate that selection of attenuation models (i.e., ground motion prediction equations) is much important for seismic hazard analysis using the logic tree approach. Moreover, their selection for the seismic hazard assessment has a greater impact than expert's judgments for the weightings of the logic tree branches. In order to provide a consistency within a probabilistic framework, it is proposed (Scherbaum and Kühn, 2011) that the weight factors in attenuation equations are assigned in a sequential manner (such that if the first equation of three selected gains a weight of 0.6, then the remaining equations as sum must be 0.4). Consequently, the study in the article requires being more informative about how the authors assigned the weights of their selected attenuation equations into account of logic tree frame.

4) In the article, the authors perform seismic hazard estimations by Frankel approach as well as the logic tree. The logic tree estimations should principally show the whole terminal branches (i.e., combinations of all possible models), not sub-branches. However, the study is not convincing that how the authors can compare the logic tree's responses with the ones of its sub-branch of Frankel approach. This makes confusing about the estimation by Frankel approach whether it is estimated using sub-branches of logic tress or using its relevant formula.

The clarifications of the concerns above would contribute to better understanding the ability of logic tree alternative to other methodologies.

References

Bommer, J.J., Scherbaum, F., Bungum, H., Cotton, F., Sabetta, F., and Abrahamson, N.A.: On the use of logic trees for ground-motion prediction equations in seismic haz-

ard analysis. Bulletin of the Seismological Society of America 95(2), 377–389, 2005. Gullu, H. and Iyisan, R.: A Seismic hazard study through the comparison of ground motion prediction equations using the weighting factor of logic tree. Journal of Earthquake Engineering 20(6), 861-884, 2016. Sabetta, F., Lucantoni, A., Bungum, H. and Bommer, J.J.: Sensitivity of PSHA results to ground-motion prediction relations and logic-tree weights. Soil Dynamics and Earthquake Engineering 25, 317-329, 2005. Scherbaum, F. and Kühn, N.: Logic tree branch weights and probabilities: summing up to one is not enough. Earthquake Spectra 27, 1237–1251, 2011.

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