Probabilistic seismic hazard assessment of response spectra for whole Japan (part 2: Probabilistic seismic hazard assessment)

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The seismic intensity or peak velocity is used in the probabilistic national seismic hazard maps for Japan. However, seismic hazard assessment of response spectra is useful in seismic risk assessment and engineering field. In this study, we try to assess seismic hazard of the response spectra by using the seismic activity model in the national seismic hazard maps for Japan. In this paper, the seismic hazard assessment results of the response spectra are shown using the selected ground motion prediction equations (GMPEs) in the previous report.
Three GMPEs are used: Morikawa and Fujiwara (2013), Goda and Atkinson (2009), Zhao et al. (2016). When evaluating seismic hazards for Japan, it is difficult to evaluate only by one GMPE, so it is necessary to select multiple GMPEs as a branch of the logic tree.
Based on the hazard curve of the response value with respect to the natural period, a uniform hazard spectrum (UHS) is calculated by connecting response spectra that have the same excess probability for each natural period. We calculate UHS at 6 cities (Sapporo, Sendai, Tokyo, Nagoya, Osaka, Fukuoka) by using the seismic activity model in the national seismic hazard maps for Japan.
As an example of the result, we are shown uniform hazard spectra for 39%, 10%, 5%, and 2% probability of exceedance occurring within 50 years from the present for all seismic activity models in Sapporo and Tokyo using GMPE by Morikawa and Fujiwara (2013). In the uniform hazard spectra, we can confirm the difference between the seismic hazard level of Sapporo and Tokyo. Also, the degree of influence of the seismic category for each natural period for a 10% probability of exceedance occurring within 50 years from the present is shown. By using the seismic activity model in the national seismic hazard maps for Japan in this way, it becomes possible to grasp the difference of the seismic hazard in the region for each natural period. In addition, we assess seismic hazard of standard peak acceleration in the world.

Keywords: Seismic hazard assessment, Response spectra, Peak acceleration, Ground motion prediction equation

