Probabilistic Tsunami Hazard Assessment for Nankai Trough:Weight Ratio and Results of PTHA

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Earthquake Research Committee (ERC)/HERP (2020a) announced a probabilistic tsunami hazard assessment(PTHA) for the next Nankai earthquake based on the long-term evaluation reports for Nankai earthquake (ERC, 2013; ERC, 2020b). Although ERC (2020a) excluded possible maximum-sized ruptures over M9 on their PTHA, NIED conduct another PTHA for the next Nankai earthquake by adding earthquakes which have maximum-sized ruptures over M9 (Hirata et al., this meeting). In this presentation, we explain the setting of weight ratio on the two PTHAs and compare the results of the PTHAs.

ERC (2020a) constructed 79 earthquake source regions(ESR) by the combinations of 18 segments and a number of characterized earthquake fault models (CEFMs) for each ESR. As occurrence patterns for the next Nankai earthquake, they constructed 176 combos of ESRs and assigned weight ratio them. First, they divided the combos of ESRs into two groups; Group I had ESRs where the Tonankai and Nankai regions were ruptured individually (e.g.,1944 and 1946 sequence) and Group II had ESRs where both the Tonankai and Nankai regions were simultaneously ruptured (e.g.,1707 Hoei). The weight ratios for Group I vs Group II were assigned 2/3 vs 1/3 by taking account for occurrence pattern history. Next the combos of ESRs of Group I and II were addittionally devided into two groups; 2 segments of Tonankai region and 2 segments of Nankai regions ruptured simultaneously or individually where weight ratios were assigned 4/5 vs 1/5, respectively. The combos of ESRs were devided into two groups also about plate subduction direction; only ESRs with middle depth zone were ruptured or the others where weight ratios were assigned 4/5 vs 1/5, respectively.

The present study follows the methodology of ERC(2020a) principally, but newly adds (i) CEFMs in Group III that consists of maximum-sized ruptures over M9 and (ii) CEFMs with a super large slip(4 times amount of average slip) which is allowed to exist when earthquake ruptures reach the trough axis. Then we construct 83 ESRs and 180 combos of ESRs (Kito et al., this meeting) and conduct a PTHA with them. The weight ratios for Group III and GroupI&II are assigned 1/21 vs 20/21 based on the idea in “National Seismic Hazard Maps for Japan in 2014“(ERC,2014).

By adding earthquakes of maximum-sized ruptures and CEFMs with a super large slip, tsunami hazard curves exceed those of ERC(2020a) along coasts facing the Pacific between Kyushu and Boso Peninsula, especially for lower probability level. For example, the probabilistic coastal tsunami heights where exceedance probability in 30 years (P30) is equal to 3% are ~0.3m on average (~2.3m at maximum) larger than the PTHA of ERC(2020a), and those where P30 is equal to 0.3% are ~0.8m on average (~9.1m at maximum) larger. This suggests that when we want to know the tsunami risk of Nankai earthquake for frequency of once in a millennium or less, it is important to consider earthquakes of maximum-sized ruptures. However, the scientific evidence to the weight ratio to Group III vs Groups I &II is not so strong. We conduct a case study for weight ratio of Group III vs Groups I &II and show how the weight ratio affects PTHA largely.

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