Probabilistic Hazard Assessment of Tsunami due to Large Earthquakes along the Nankai Trough

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Earthquake Research Committee, the Headquarter of Earthquake Research Promotion (ERC/HERP) has released "*Probabilistic Hazard Assessment of Tsunami due to Large Earthquakes along the Nankai Trough*" (hereinafter-called PHAT) on 24 January 2020. This is the first report on hazard assessment of tsunami by ERC, and is based on "*Long-term evaluation of the Nankai Trough earthquake (Second edition)*" (ERC/HERP, 2013; hereinafter-called LTE2) and "*Tsunami prediction method for earthquakes with characterizing source faults (Tsunami Recipe)*" (ERC/HERP, 2017). PHAT evaluates the distribution of exceedance probabilities that will cause the tsunami height on the coast to be 3 m or more, 5 m or more, and 10 m or more due to various major earthquakes along the Nankai Trough within next 30 years. This abstract introduces the outline of PHAT.

The tsunamis targeted by PHAT are large repeating earthquakes along Nankai Trough whose seismic magnitudes and occurrence intervals has been evaluated by LTE2 as M8 to M9 class, and from 100 to 200 years, respectively. However, the so-called "largest-class earthquake" of Nankai Trough defined by the Cabinet Office is excluded from the target. The future possibility of occurrence of the largest-class earthquake cannot be denied logicaly because, very limited information of evidence on past occurrence of such huge earthquake is found from any written historical records or at least 2000 years-long sediment records.

PHAT assumed 176 patterns with different combinations of extent of epicenter area as next large earthquake cycle along the Nankai Trough by considering the diversity of it. In addition, according to the Tsunami Recipe, two or more cases having different large slip regions were prepared for each pattern in order to consider heterogeneity with respect to of the fault slip. As a result, source fault models of 348,345 cases were selected, and the distribution of tsunami height corresponding to each case were calculated.

Each case was weighted according to its similarity to past major earthquake along the Nankai Trough. Using these weights, the tsunami height computation results were superimposed at each evaluation point located at approximately 50-meter intervals along the coastline within potentially affected area due to the large earthquake along Nankai Trough. From the hazard curves obtained in this way, the exceedance probabilities of tsunami exceeding 3m, 5m or 10m within next 30 years was calculated. The upper limit of the excess probability is 0.743, which is the probability of occurrence probability of large earthquake occurring within the next 30 years from 2020 along the Nankai Trough.

The distribution of excess probability values has been compiled as maps for whole area and tables for each municipality. Each evaluation point or municipality is classified into 3 categories (less than 6%, from 6% to 26%, and 26% or more) according to its exceedance probability.

The characteristics of the map of "exceedance probability that a tsunami height on the coast will be 3m or more due to large earthquakes along the Nankai Trough within next 30 years" are as follows:

- Evaluation points classified into 26% or more are found in wide area.

- The Izu Islands and Kyushu, which are slightly away from the tsunami source, has locally large probability.

In the map of that of 5m or more, wide area centered on the Pacific side from the Kyushu region to the Tokai region indicate 6% or more, and some regions near the epicenter indicate 26% or more. The map of that of above 10m, some coastline near potential source area indicate from 6% to 26%.

According to three maps, the probability at inner bays in rias coast facing an open sea and the straight-shaped coast, which are in general sensitive to a tsunami source, and tends to be higher than surrounding area.

Keywords: Nankai trough, probabilistic tsunami hazard assessment, exceedance probability, long-term evaluation, large earthquake