

## Three-dimensional earthquake forecasting model for the Kanto district:Results of retrospective and prospective tests

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We constructed a 3-dimensional (3D) earthquake forecasting model for the Kanto district in Japan under the Special Project for Reducing Vulnerability for Urban Mega Earthquake Disasters. This is based on the Collaboratory for the Study of Earthquake Predictability (CSEP) experiments. Because seismicity in this area ranges from shallower part to a depth of 80 km due to subducting Philippine-Sea and Pacific plates, we needed to study the effect of earthquake depth distribution. We constructed a prototype of 3D earthquake forecasting model for the area based on the Relative Intensity (RI) model (Nanjo, 2011) [EPS, 63 (3) 261-274] which forecasts earthquake probabilities using historical data. Therefore, we analyzed completeness magnitude ( $M_c$ ) of Japan Meteorological Agency (JMA) catalog by the Maximum curvature method (Wiemer and Wyss, 2000) [BSSA, 90 (4) 859-869]. The results showed that  $M_c$  has been temporally-stable having values less than  $M_c 2$  since 1980s. Then, we performed retrospective tests using JMA catalog from 1 January 1998 to 1 February 2011 to examine spatial resolution of 3D forecasting area for Kanto region. Results showed that the best spatial resolution is 0.05 x 0.05 degrees for horizontal grid and 5 km for depth. It is confirmed that scores in 3D-RI models are better than that in 2D-RI models. The RI models also applied for prospective forecasting test from 1 February 2015. Forecasting period in the 1st round of the test was 3 months from 1 February to 1 May 2015 for magnitudes  $\geq 4.0$ . RI models calculated expectations using past events at the following time periods: 1) From 1 January 1998 to 1 January 2011: unified JMA earthquake catalog before The 2011 Tohoku earthquake, 2) From 1 January 1998 to 1 August 2014: JMA unified earthquake catalog, and 3) From 1 January 1998 to 1 January 2015: Preliminary and unified JMA earthquake catalog. The performance of the RI models will be evaluated using the observations in the future. In this paper, we present the results of retrospective test by comparing the scores from 2D-RI models and 3D-RI models, and prospective test for the 1st round using preliminary JMA catalog. The authors thank JMA for the earthquake catalog. This work is sponsored by the Special Project for Reducing Vulnerability for Urban Mega Earthquake Disasters from Ministry of Education, Culture, Sports and Technology of Japan (MEXT).

Keywords: Three-dimensional forecasting model, Kanto district, Retrospective forecasting, Prospective forecasting, Collaboratory for the Study of Earthquake Predictability