Three-dimensional earthquake forecasting model for the Kanto district: Progress reports of prospective tests for 3-month forecasting

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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. Because seismicity in this area ranges from 0 to 80 km in depth due to subducting Philippine-Sea and Pacific plates, we need to study the effect of earthquake depth distribution. We constructed a prototype of 3D earthquake forecasting model (3D-RI 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. Parameters of the 3D-RI model were optimized for past seismicity of the area by retrospective tests. Next, the model also was applied to prospective test which was already implemented with 3 rounds for the 3-month forecasting class. Forecasting period in the 1st round was started from 1 February in 2015. Expectations of the models were calculated using past events at the following time periods: Period 1) From 1 January 1998 to 1 January 2011: before the 2011 Tohoku earthquake, Period 2) From 1 January 1998 to a day before the forecasting period: before and after the 2011 Tohoku earthquake, and Period 3) From 1 January 2012 to a day before the forecasting period: after the 2011 Tohoku earthquake. These models were evaluated by a statistical method based on the Collaboratory for the Study of Earthquake Predictability (CSEP) experiments. Number of earthquakes during all of the rounds were observed within the average ±2σof that before the 2011 Tohoku earthquake. Also, observed earthquakes located around off Choshi at the depth of 10 –50 km due to aftershocks of the Tohoku earthquake. Results of the evaluations for the all rounds are summarized as follows; the 3D-RI model based on the Period 1) underestimated number of earthquakes and also showed the lowest log-likelihoods in the space test in all models because the model could not consider seismicity of the aftershocks. This result suggests that the data from Period 1) is insufficient to predict the current seismicity. The model based on the data of Period 2) showed the best forecasts for number of earthquakes and spatial distributions. The model based on the Period 3) failed to the number test of the CSEP tests due to overestimations. After these experiments, we tried to reconsider number of earthquakes using the Omori-Utsu law and the 3D-RI model based on novel periods from 1 January 2013 to a day before the forecasting period to improve forecasting performance retrospectively. Both estimations showed the better prediction than that of the 3D-RI models based on Period 2) .

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