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CSEP-Japan: Testing earthquake forecasts based on seismicity data

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The current Japanese "Observation and Research Program for Prediction of Earthquakes and Volcanic Eruptions (2009-2013)" started this year. One part of the newly-introduced activities is to construct forecast systems of earthquake occurrence for Japan. This activity aims to quantitatively forecast time, place, and magnitude of future earthquakes in and around Japan. Our approach is based on a rigorous test of earthquake forecasts based on seismicity data. We follow three steps: (1) developing the Testing Center, a framework that quantifies the performance of registered earthquake forecast methods; (2) conducting comparative testing experiments within this framework to determine the registered forecast model's accuracy; and (3) aiming at the creation and buildup of sophisticated forecast models, based on results obtained from multiple experiments. To smoothly start this new research program, the Earthquake Research Institute (ERI) joined the global "Collaboratory for the Study of Earthquake Predictability" (CSEP) and started the implementation of the Japanese Testing Center, the nickname "CSEP-Japan". Also, to share and utilize the up-to-date knowledge of earthquake forecasting and hazards, we collaborate with a team of researchers in the framework of the "Special Project for Earthquake Disaster Mitigation in Tokyo Metropolitan Area". ERI started on 1 September 2008 a prototype experiment for evaluating a set of three one-year forecast models. We then formally started the prospective experiment on 1 November 2009. 91 earthquake forecast models were registered and the models are separated into four testing classes (1 day, 3 months, 1 year, and 3 years) and three testing regions that cover Japan, the Japan's mainland, and Kanto. We evaluate the performance of the models in the official suite of tests used by the CSEP. The forecasts for the 1- and 3-year classes are tested against observed data of magnitudes M from 5.0 to 9.0 while the 1-day and 3-month classes include $4.0 \leq M \leq 9.0$. Here, we provide an overview of the CSEP-Japan and show that the rigorous testing approach is becoming a good baseline for model development in order to move toward constructing earthquake forecast systems for Japan.

Keywords: earthquake, forecast, test, seismicity, collaboration, Japan