Earthquake probability forecast incorporating non-seismic data

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This study aims to develop statistical models for earthquake temporal occurrences based on both earthquake catalogs and other geophysical observations. As an example, the seismomagnetic signals at Kakioka (KAK) station are utilized to illustrate the modeling strategies, because previous studies suggest they might contain certain precursory information of local sizable earthquakes. Self-exciting, external-exciting, and combined models modified from Ogata’ s LIN-LIN algorithm have been applied to forecast the occurrences of M>4.05 earthquakes within 100 km from the KAK station. The self-exciting and external-exciting models perform significantly better than the Poisson Model, implying there are explanatory power in earthquake catalogs and magnetic anomalies, respectively. The combined model, which integrates information from catalogs and magnetic observations, is greatly superior to any of the other three models. Additional tests show that external exciting component derived from the magnetic data is not post-seismic in character, and is more likely to cooperate with large earthquakes. The combined model proposed in this study could also be useful to incorporate other non-catalog observations and may have potential value in improving Time-dependent hazard maps for operational forecasting.

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