High resolution space-time models forecasting 3D seismicity beneath the Greater Tokyo Area

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We propose an extended 3D epidemic-type aftershock sequence (ETAS) models of longitude, latitude and depth for short-term forecasts beneath the Metropolitan area (south Kanto region), Japan; this model also takes account of the induced effects by the 2011 Tohoku-Oki earthquake of magnitude 9.0 (M9). Specifically, we use some location-dependent coefficients in the 3D space; which is called as a hierarchical model. Similarly, we consider 3D location-dependent b-value for the Gutenberg-Richter law. In such modeling, we use linear interpolation on each of the 3D Delaunay tetrahedra of the hypocenters to estimate high resolution images in zones where hypocenters are dense. Based on the hypocenter catalog for a century period, we solve the location dependent parameters including the background seismicity rates, the self-exciting (aftershock) productivity rates, and the M9 induced productivity rate. The optimally inverted 3D spatial images of such characteristic parameters represent quite informative seismicity patterns such as in shallow crust and on the surface of subducting plates. In particular, the location-dependent external triggering factor shows the zones where the induced effect took place intensely by the M9 earthquake beneath the region.

Keywords: Akaike Bayesian Information Criterion (ABIC), Earthquake forecast, Extended 3D hierarchical space-time ETAS model, Induced seismicity, Tohoku-Oki Earthquake of M9

