

Changes in frequency ratio of inter-plate vs intra-plate earthquakes in the source area of the 2011 Tohoku earthquake

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In the current seismic hazard maps for Japan, contributions from earthquakes of non-specified fault parameters in the subduction area are considered either as interplate or intraplate earthquakes. Here, a ratio of the number of interplate earthquakes to the total number of quakes is used as a given parameter obtained from the frequency distribution of earthquakes in depth. In the present study, we attempt to employ focal mechanism solutions for estimating the ratio. As a case study, ratios are examined from 3663 mechanism solutions of earthquakes of magnitude 4.0 or greater occurring in the area of 36N-41N and 139E-144E, which covers the source area of the 2011 Tohoku earthquake (M9.0). First, we calculate the minimum 3-D rotation angle (Kagan angle) between the observed mechanism of an earthquake and expected one, which can be estimated on assumptions of configurations of plate interfaces and relative motions between the plates. Inter plate events are assigned, of which Kagan angles are less than a certain threshold level. We estimate a ratio at every 0.1 by 0.1 spacing grids. After operating smoothing method with ABIC, we obtain those ratios at every grids. The estimate is separated into that for the pre 2011 Tohoku earthquake period or for the post-earthquake period. As a result, we have found that, in general, ratios of the inter-plate earthquakes for the post-earthquake period are smaller than those for the pre-earthquake period. The ratios obtained in the present study are significantly smaller than the current ones.

Keywords: seismic hazard maps for Japan, Tohoku, interplate earthquake, Kagan angel, 2011 Tohoku earthquake