

Construction of a source model for the 2011 Tohoku, Japan, earthquake with special reference to strong motion pulses

NOZU, Atsushi^{1*}

¹Port and Airport Research Institute

The 2011 off the Pacific coast of Tohoku, Japan, earthquake is obviously the first M9 earthquake which was recorded by dense strong motion networks. The occurrence of the earthquake enabled us to analyze real strong ground motions due to a M9 earthquake for the first time in the history. Before the occurrence of the earthquake, the author proposed the following for the evaluation of strong ground motions due to a large subduction earthquake (Nozu, 2010):

- 1) To use a source model composed of asperities with relatively small size.
- 2) To calculate strong ground motions based site amplification and phase characteristics.

In the past study, the applicability of the above strategy was fully investigated for M8 class earthquakes. In the present study, to investigate the applicability of the strategy for a M9 earthquake, a source model with asperities was newly developed for the 2011 Tohoku earthquake. The constructed source model involves 9 asperities with relatively small size, located off-the-coast of Miyagi through off-the-coast of Ibaragi. The strong ground motions due to the earthquake were calculated based on site amplification and phase characteristics, using the constructed source model. The agreement between the observed and calculated ground motions was quite satisfactory, especially for velocity waveforms (0.2-2.0 Hz) including near-source pulses. The result definitely shows the applicability of the strategy for a M9 earthquake. The asperities with small size introduced in this study are equivalent to the concept of super asperity proposed by Matsushima and Kawase (2006), because the size of the rupture area used in this study is much smaller than the size of the asperities or SMGAs conventionally assumed for a huge subduction earthquake. More elaboration is required, however, in terms of terminology, because the concept of asperity itself is currently ambiguous.

Keywords: the 2011 off the Pacific coast of Tohoku earthquake, strong ground motion, strong motion pulse, source model, super asperity

