Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SSS26-P30 Room:Convention Hall Time:May 20 17:15-18:30

Investigation of NFRD effect on strong ground motion during the 2004 Rumoi earthquake (Mj 6.1) using the Hybrid method

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Rupture directivity effects cause spatial variations in strong ground motions amplitude near the fault. An inland crustal earthquake (Mj 6.1) occurred on December 14, 2004 in the northern part of Hokkaido, Japan (2004 Rumoi earthquake). Source mechanism is reverse fault type with low dip angle (Dip=25degree). A strong ground motions over 1000 cm/s2 and 70 cm/s were recorded at the nearest strong-motion station (HKD020) about 10 km from the hypocenter. Using EGF (Empirical Green's Function) method, Maeda and Sasatani (2009) concluded that the large strong ground motions at HKD020 are mainly affected by forward directivity effects and shallow asperity. Miyakoshi et al.(2010) also validated these effects using theoretical method.

In this study we investigate NFRD (Near Fault Rupture Directivity) effect on strong ground motion during the 2004 Rumoi earthquake using the Hybrid simulation, which is combined of 3D-FD and SGF (Stochastic Green's Function) method. We calculated seismograms near the fault area (20km x 20km) and made PGV distribution map. Strong ground motion over 70cm/s, which are affected by NFRD (Near Fault Rupture Directivity) effect, are appeared around the surface projection line of the upper edge of the rupture area. We tried to extract area of the NFRD effect on near-source strong ground motions using the criteria of Ohno et al. (1998). They showed that the predominant area of the NFRD effect for the reverse fault type is defined an area having size +-0.25L and centered on the projection of the upper edge of rupture, where L is length of the surface projection line. Additionally we tried to choose large PGV zone in the predominant area of the NFRD effect using PGV attenuation curve (Si and Midorikawa, 1999). We selected the large PGV zone that has PGV greater than average PGV +1 sigma. As a result, we successfully chose large PGV zone affected by the NFRD effect near the fault area.

Acknowledgements
We would like to sincerely thank NIED (K-NET, KiK-net, F-net) for providing the strong motion data. The hypocenter information was providing by JMA and moment tensor by F-net of NIED. This study was supported by Nuclear Safety Commission of Japan (NSC).

Keywords: 2004 Rumoi earthquake, strong ground motion, hybrid simulation, NFRD effect