

## Source model of the 2007 Niigata-ken Chuetsu-oki earthquake using empirical Green's function(SE-dip model)

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The 2007 Niigata-ken Chuetsu-Oki earthquake ( $M_w=6.6$ ) occurred on July 16, 2007, northwest-off Kashiwazaki, Niigata Prefecture, Japan. Strong ground motions with seismic intensity (JMA) of 6-upper struck Kashiwazaki and Kariwa. The peak horizontal ground accelerations of the strong ground motions follow the empirical relations in Japan, for example, Si and Midorikawa (1999). However, the strong ground motions in the site of the Kashiwazaki-Kariwa Nuclear Power Plant located about 10 km away from the source fault had very large accelerations, 1,223 gal on surface and 680 gals at the basements of the reactors locating five stories below the ground, which are more than those expected from the empirical relations. We estimated a source model of the 2007 Niigata-ken Chuetsu-Oki earthquake using the empirical Green's function method.

The strike and dip of the source fault are estimated from the aftershock distribution determined by ERI of University of Tokyo. The observed records close to the mainshock had two or three distinctive pulses. We estimated the locations of asperities using time differences between those pulses. We found that three asperities are located south-west and south of the hypocenter. In this study, we called those asperities to be ASP1, ASP2 and ASP3.

We chose appropriate records of aftershocks as the empirical Green's function, taking into account locations and fault mechanisms of the aftershocks. As a result, we adopted the record of Aftershock 1 on July 16 at 21:08 for ASP 1 and ASP2, and Aftershock 2 on August 4 at 0:16 for ASP3.

We obtained the best-fit model by forward modeling to minimize the residuals between the observed and synthesized. The areas of three asperities were about  $30 \text{ km}^2$  and stress drop were 20 - 24 MPa. The relationship between the combined areas of those asperities and total seismic moment follow the empirical one so far reported, which means that the stress parameters of the asperities are almost standard.

We calculated the S-wave radiation pattern from ASP3 to Kashiwazaki-Kariwa to examine why so large ground motions struck there during the mainshock. We found that the Kashiwazaki-Kariwa site is located in the direction of an anti-node direction of S waves generated from ASP3.