

Determination of long- and short-period pulse sources of the 2011 Tohoku earthquake using the subduction zone structure

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The Tohoku earthquake on 11 March 2011 is a megathrust event on the subducting plate boundary. Several pulses can be seen in the strong motion records of this earthquake. It is important to determinate their sources using the subduction zone structure.

In our previous study, strong motion records by K-NET and KiK-net were used and integrated to long-period (10 ~ 100 s) and short-period (0.01 ~ 10 s) velocity waveforms using causal filtering, and we identified three main long- and short-period pulses, respectively. We located the pulse sources using arrival times of their initial motions. In our analysis, we used the 3-D velocity structure of the JIVSM model (Koketsu *et al.*, 2008). The pulse sources were located by using a nonlinear, probabilistic earthquake location method called NonLinLoc (Lomax *et al.*, 2000), in which a solution is represented by probabilistic density function and includes location uncertainties. The result showed that the long-period pulse sources were consistent with the results of the strong motion inversions by Koketsu *et al.* (2011) and Yokota *et al.* (2011), and that short-period pulse sources were consistent with strong motion generation areas by the empirical Green's function method (e.g., Asano and Iwata, 2012). Long- and short-period pulse sources were located to the up-dip and down-dip regions, respectively.

In this study, we picked the arrival times of the maximum amplitude of the second long-period pulse using a zero-phase filter, and located its source by the same method. Combined with the result of the initial motions, this study indicates that the slip related to the second long-period pulse occurred somewhat in the east of the epicenter about 56 s after from the origin time and expanded not seaward but landward. We plan to perform the same analysis of earthquakes of various magnitudes in the mainshock source region in order to check the validity of our analysis, and make detailed discussions.

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