Source process of the 2018 Hokkaido Eastern Iburi earthquake derived from strong motion data

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The 2018 Hokkaido Eastern Iburi earthquake (M_{jma} 6.7) struck southern Hokkaido, Japan on September 6, 2018 (JST). This earthquake caused strong ground motions over southern Hokkaido with a maximum seismic intensity of 7 on the JMA scale and a maximum PGA of over 1500 cm/s/s. In this study, we estimate the source process of this earthquake using strong motion waveforms.
For source-process analysis of this event, we develop a curved fault model based on the spatial distribution of aftershocks. This curved fault model consists of multiple planes, each with a width of 20 km, a common dip angle (65 degree), and a common top depth (approximately 22 km). The common dip angle refers to the moment tensor analysis of F-net. The strike angle of the planes smoothly changes along the strike direction: the strike angle is 15° at the north part, 340° at the central part, and 40° at the south part. The rupture starting point is set to the hypocenter determined by JMA. The curved fault model is divided into 15 subfaults along the strike direction and 10 subfaults along the dip direction.
We use velocity waveforms at 20 stations of K-NET and KiK-net, F-net of NIED. The waveforms are band-pass filtered between 0.05 and 0.5 Hz, resampled to 10 Hz, and windowed from 1 s before S-wave arrival for 25 s.
Green's functions are calculated with the discrete wavenumber method (Bouchon 1981) and the reflection/transmission matrix method (Kennett and Kerry 1979) assuming 1-D velocity structure models. The structure models are obtained for each station from the 3-D structure model (Fujiwara et al. 2009). Logging information is also used for the KiK-net station. To consider the rupture propagation effect, 25 point-sources are uniformly distributed over each subfault in the calculation of Green’s functions.
The multi-time-window linear waveform inversion method (Olson and Apsel 1982; Hartzell and Heaton 1983) is used in this study. The slip time history of each subfault is discretized using eight smoothed ramp functions (time windows) progressively delayed by 0.4 s and having a duration of 0.8 s each. The triggering velocity of first time window is set to 1.4 km/s to minimize the data-fit residual. Two orthogonal slips of each time window at each subfault are derived by minimizing the difference between the observed and synthetic waveforms using the non-negative least-squares scheme (Lawson and Hanson 1974). The slip angle is allowed to vary centered at 107°, which is the rake angle of the F-net analysis. In addition, we impose a spatiotemporal smoothing constraint on slips (Sekiguchi et al. 2000).
In the estimated source model, the large slips are found at approximately 30 km depth in the up-dip direction from the hypocenter. In the first 6 s, the rupture grows slowly around the hypocenter with small slips. Then, the rupture developed with the large moment release between 6 s and 12 s in the large slip area. The large slip area does not overlap with the active aftershock area

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