Source processes of the 2016 Kumamoto, Japan, earthquakes inferred from strong motion waveforms

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We estimated the source rupture processes for two large events of the 2016 Kumamoto earthquakes (the M7.3 event at 1:25 JST on April 16, 2016 and the M6.5 event at 21:26 JST on April 14, 2016) from strong motion waveforms using multiple-time-window linear waveform inversion (Kubo *et al.*, 2016). Based on the observations of surface ruptures, the spatial distribution of aftershocks, and the geodetic data, a realistic curved fault model was developed for the source-process analysis of the M7.3 event.

The source model obtained for the M7.3 event with a seismic moment of 5.5×10^{19} Nm (M_w 7.1) had two significant ruptures. One rupture propagated toward the northeastern shallow region at 4 s after rupture initiation, and continued with large slips to approximately 16 s. This rupture caused a large slip region with a peak slip of 3.8 m that was located 10–30 km northeast of the hypocenter and reached the caldera of Mt. Aso. The contribution of the large slip region to the seismic waveforms was large at many stations. Another rupture propagated toward the surface from the hypocenter at 2–6 s, and then propagated toward the northeast along the near surface at 6–10 s. This rupture largely contributed to the seismic waveforms at the stations south of the fault and close to the hypocenter.

The source model obtained for the M6.5 event with a seismic moment of 1.7×10^{18} Nm (M_w 6.1) had large slips in the region around the hypocenter and in the shallow region north-northeast of the hypocenter, both of which had a maximum slip of 0.7 m. The rupture of the M6.5 event propagated from the former region to the latter region at 1–6 s after rupture initiation, which is expected to have caused the strong ground motions due to the forward directivity effect at KMMH16 and surroundings.

References

Hisahiko Kubo H., W. Suzuki, S. Aoi, and H. Sekiguchi (2016), Source rupture processes of the 2016 Kumamoto, Japan, earthquakes estimated from strong-motion waveforms, *Earth Planets Space*, **68**, 161, doi:10.1186/s40623-016-0536-8.