Estimation of the source location of the 16-April-2016 Oita induced earthquake with array analysis

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At the 14 April 2016, the mainshock of the 2016 Kumamoto earthquakes (M_{JMA} 7.3) occurred in Kumamoto Prefecture. After about 32 seconds from the origin, the induced event took place in Yufu, Oita prefecture. Looking on the seismograms, high-frequency phase is found following the phase of the mainshock, and can be clearly seen in the stations near the hypocenter. JMA determined the hypocenter of induced event by mainly picking S-wave arrival. Since phases of this event were contaminated due to the mainshock, the number of picked P-wave arrival was only four stations. Yoshida (2016) and Miyazawa (2016) also determined the hypocenter by picking out P- and S-wave arrivals in stations near the hypocenter. Nakamura and Aoi (2017) estimated the hypocenter location by the back-projection method using an acceleration envelope. In this study, we determine the source location using a horizontal slowness and an azimuth estimated by semblance method as a kind of array analysis. This method is employed for S phases observed in surround of the source region and a distance from there. We used the seismograms observed in K-NET, KiK-net and F-net of NIED, and seismic intensity stations of JMA and Oita prefecture. We set 5 arrays constructed each 3 stations. In the result of hypocenter determination using the azimuth and the slowness estimated in each arrays, the source location is 33.277N, 131.420E, 10.7 km depth. Seen from the hypocenter determined by JMA, the position by this study is off from the east side. Calculating PGA and PGV in 5 stations near the source, OIT009 in K-NET has higher PGA than other stations and highest PGV, where high site-amplification is modeled in Yufu basin. Although site-amplification is lower than OIT009, Tsurumi intensity station in JMA has largest PGA. These features denote that the source location might be located in the position of eastern side of the JMA’ s location. Moreover we estimate moment magnitude using a flat level of S-wave displacement spectrum in 2 stations near the source. Modifying the site effect using observed spectrum in maximum aftershock (M_{JMA}5.4), we obtained M_w 5.5. Also, since the aftershocks did not hardly occur in surround the source location estimated by this study, we think that this area is the asperity of the induced event.
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Keywords: Oita induced earthquake, Semblance method, Array analysis

