Characteristics of Source Parameter for Aftershocks of the 2016 Kumamoto Earthquake Estimated by the Coda Spectral Ratio Method

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After the 2016 Kumamoto Earthquake occurrence, a hypocenter distribution along the strike of the Hinagu Fault was found in the aftershock activity deeper than 13 km [Mitsuoka et al., 2019, SSJ fall meeting 2019]. The alignment of the hypocenter has not seen in the distribution before the Kumamoto earthquake. In addition, the activity is located above a low resistivity zone at depth of 18 km [Aizawa et al., 2019], suggesting that the cause of the special activity relates to the resistivity structure.

In order to understand the rupture characteristics of the events, it is essential parameters such as seismic moment (M_0), corner frequency (f_c) and stress drop ($\Delta\sigma$). We estimated M_0 and f_c for 17 aftershocks of the 2016 Kumamoto Earthquake by using a S-wave coda spectral ratio method developed by Somei et al. [2014] and calculated stress drop based on a circular crack model. Then we discussed the spatial variation in stress drops. We investigated the parameters at two groups that were divided the earthquakes into the northern group (11 events) and the southern group (6 events). The parameters for an event were obtained from a processing that we took the spectral ratio of the observed seismogram at a station between an event pair and then stacked among 13 stations to stabilize the ratio. Using the ratio with signal-noise ratio of 2 or more, we estimated seismic moment ratio to the largest event among event of a group and corner frequencies of event pairs by nonlinear least square method.

As the result, we could see the seismic moment and the corner frequency follow the relationship of $M_0 \propto f_c^{-3}$. By adopting seismic moment of the largest earthquake in a group from F-net catalog and assuming a circular clack fault model, we obtained the stress drop [Eshelby, 1957; Brune, 1970,1971]. Stress drops for all 17 events varied between 3.5 and 17 MPa. These were within the range of stress drop for inland earthquake in Japan [Somei et al., 2014]. On the other hand, comparing with similar magnitude earthquakes in Somei et al. [2014], we found stress drops in this study were larger than their results.

In the northern group, we found positive correlation between seismic moment and stress drop (correlation coefficient = 0.78). Geometric average of the stress drops in each group was 6.8 MPa in the northern group, and 12 MPa in the southern group. This is consistent with the previous study that suggest aftershocks in this area caused by shear stress of several MPa to several tens MPa [Mitsuoka et al., 2019, JpGU meeting 2019].

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