Simultaneous estimation of the dip angles and slip distribution on the two active faults of the 2016 Kumamoto earthquak

*深畑 幸俊[1]、橋本 学[1]
*Yukitoshi Fukahata[1], Manabu Hashimoto[1]

1. 京都大学防災研究所
1. Disaster Prevention Research Institute, Kyoto University

At the 2016 Kumamoto earthquake, surface ruptures were observed not only along the Futagawa fault, where main ruptures occurred, but also along the Hinagu fault. To estimate the slip distribution on these faults, we extend a method of non-linear inversion analysis (Fukahata and Wright 2008) to a two-faults system. With the method of Fukahata and Wright (2008) we can simultaneously determine the optimal dip angle of a fault and the slip distribution on it, based on Akaike's Bayesian Information Criterion (ABIC) by regarding the dip angle as an hyperparameter. By inverting the InSAR data with the developed method, we obtain the dip angles of the Futagawa and Hinagu faults as 61º ±6º and 74º ±12º, respectively. The slip on the Futagawa fault is mainly strike slip. The largest slip on it is over 5 m around the center of the model fault (130.9º in longitude) with a significant normal slip component. The slip on the Futagawa fault quickly decreases to zero beyond the intersection with the Hinagu fault. On the other hand, the slip has a local peak just inside Aso caldera, which would be a cause of severe damage in this area. A relatively larger reverse fault slip component on a deeper part around the intersection with Aso caldera suggests that something complicated happened there. The slip on the Hinagu fault is almost a pure strike slip with a peak of about 2.4 m. The developed method is useful in clarifying the slip distribution, when a complicated rupture like the Kumamoto earthquake happens in a remote area.

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