

Problems on strong-motion evaluation based on the 2016 Kumamoto earthquake

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The 2016 Kumamoto earthquake sequence occurred on active faults where strong-motion evaluation was executed based on the long-term evaluation and strong-motion prediction method 'Recipe' by Headquarters for Earthquake Research Promotion (HERP). The magnitude of first large earthquake occurred on April 14 (M6.5) at a part of the Hinagu fault zone was smaller than that evaluated by HERP (about M6.8) before the earthquake. On the other hand, the largest earthquake occurred on April 16 (M7.3) at a part of the Futagawa fault zone was larger than that by HERP (about M7.0).

Here we examined whether strong-motion evaluation results based on the 'Recipe' could predict observations if the fault length on the ground surface, the fault area and the seismic moment of the target earthquake were evaluated appropriately before the earthquake. As a result, we found the following things.

- Distribution of calculated strong-motion parameter, such as peak velocity or JMA seismic intensity, was comparable with observed one if an appropriate seismic moment was given.
- However, The large amplitude of ground motion observed at sites very close to the source fault cannot simulate even if the appropriate seismic moment was given.
- The seismic moment of M7.3 event was underestimated if we use a mean value calculated from empirical relationships in the 'Recipe'.

Based on the above results, we suggest tentative plans to improve strong-motion evaluation method for earthquakes occurring on active faults as follows:

- 1) Modeling of uncertainties in magnitude for earthquakes occurring on active faults.
- 2) Revision of the 'Recipe' by adding procedures to set source parameters considering the uncertainties.
- 3) Modeling of earthquakes occurring on active faults whose magnitudes are smaller than 6.8.
- 4) Propose of scenario earthquake shaking maps considering the uncertainties.
- 5) Construction of strong-motion evaluation method for sites very close to source faults.

References

Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology (2016): Urgent local investigation report [May 13, 2016]: The surface rupture of fault from which emerged with the 2016 Kumamoto earthquake (fourth report), <https://www.gsj.jp/hazards/earthquake/kumamoto2016/kumamoto20160513-1.html> (in Japanese).