On Application of Dynamic Rupture Simulations to Assess Possible Earthquake Source Parameters for Beppu-Haneyama Fault Zone, southwestern Japan

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For the strong ground motion prediction, increasing the physical constraints for source models is important to increase the predictability of the phenomena caused by possible future earthquakes. Currently standard approaches constrain the source models basically with the macroscopic characteristics of the slip-fault length scaling in a kinematic manner, where fault lengths, faulting styles and slip distributions are determined based on judgements of professionals. Relaying on such external information causes major difficulties of this approach since it contains large ambiguities due to observational limitations and, further, it is not necessarily physically based.
In this study we aim to utilize results of dynamic rupture simulations to provide the constraints of the source parameters targeting hypothetical future earthquakes generated along the Beppu-Haneyama fault zone (BHF), which exists as western continuation of the median tectonic line, southwestern Japan. The western part of BHF had been broken during the 2016 Kumamoto earthquake sequence. We constrained our dynamic model based on the regional stress field obtained basically by the seismological stress tensor inversions (Matsumoto et al., 2015) and newly modified fault geometry there, consisting of the three segments called the Funai-Asamigawa-Hotta (hereafter Funai), the Misa and the Hoyo channel from the west. The nonplanar geometry of these fault segments is treated by the spatio-temporal boundary integral equation method (ST-BIEM) with the fast domain partitioning method. The simulation results show, for example, the rake angles differ by up to approximately 30 degrees from the values assumed based on the recipe for kinematically predicting strong motion, namely 90 degrees for the Funai and Misa segments and the 180 degrees for the Hoyo channel segment. The dynamic rupture simulations may provide additional information for the strong ground motion prediction regarding the rupture/slip profiles, which are physical and natural outcome of the model.
This work is supported by the Comprehensive Research on the Beppu-Haneyama Fault Zone funded by the Ministry of Education, Culture, Sports, Science, and Technology (MEXT), Japan.

Keywords: Beppu-Haneyama fault zone, Dynamic earthquake rupture models, Boundary integral equation method

