A Simple Fault Model to Calculate Strong Ground Motions Including Fling Steps for the Main Shock of the 2016 Kumamoto Earthquake

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A composite source model was developed to simulate strong ground motions during the main shock of the 2016 Kumamoto earthquakes which can consider both fling steps due to slips near the site and pulses from deeper asperities. The authors’ intention was to develop a simple source model which can be easily handled by engineers. To this end, a simple geodetic fault model by the Geospatial Information Authority of Japan (GSI), comprising of three faults with uniform slip, was used as a starting point and parameters related to the temporal evolution of the slip were added. The added parameters included the rupture starting point, rupture propagation pattern, rupture velocity and rise time. The resultant model was used as a background region, which was combined with asperities to form a composite source model. The ground motions from the background region were calculated by the discrete wavenumber method (Bouchon, 1981). The ground motions from the asperities were calculated by what we call “the corrected empirical Green’s function method” (Kowada et al., 1998; Nozu et al., 2009). The simulation results showed that the composite model can well reproduce near-source displacement and velocity waveforms including fling steps at KMMH16, KMM006, KMM005, Komori and Kawayo, although the model was relatively simple in a sense that the slip-velocity function and the rise time were uniform throughout the background region. A closer look at the results showed that the fling steps were slightly overestimated or underestimated depending on the site. It was obvious that if we had introduced more complicated slip models, the results would have been closer to the observations. However, from an engineering point of view, it was a meaningful result that such a simple source model could explain ground displacements with fling steps without significant discrepancy because, in a prediction problem, it is difficult to assign a detailed slip distribution. On the other hand, to represent pulses with approximate periods of 1 s, it was definitely necessary to consider asperities.

Keywords: crustal deformation, fling step, the 2016 Kumamoto earthquakes

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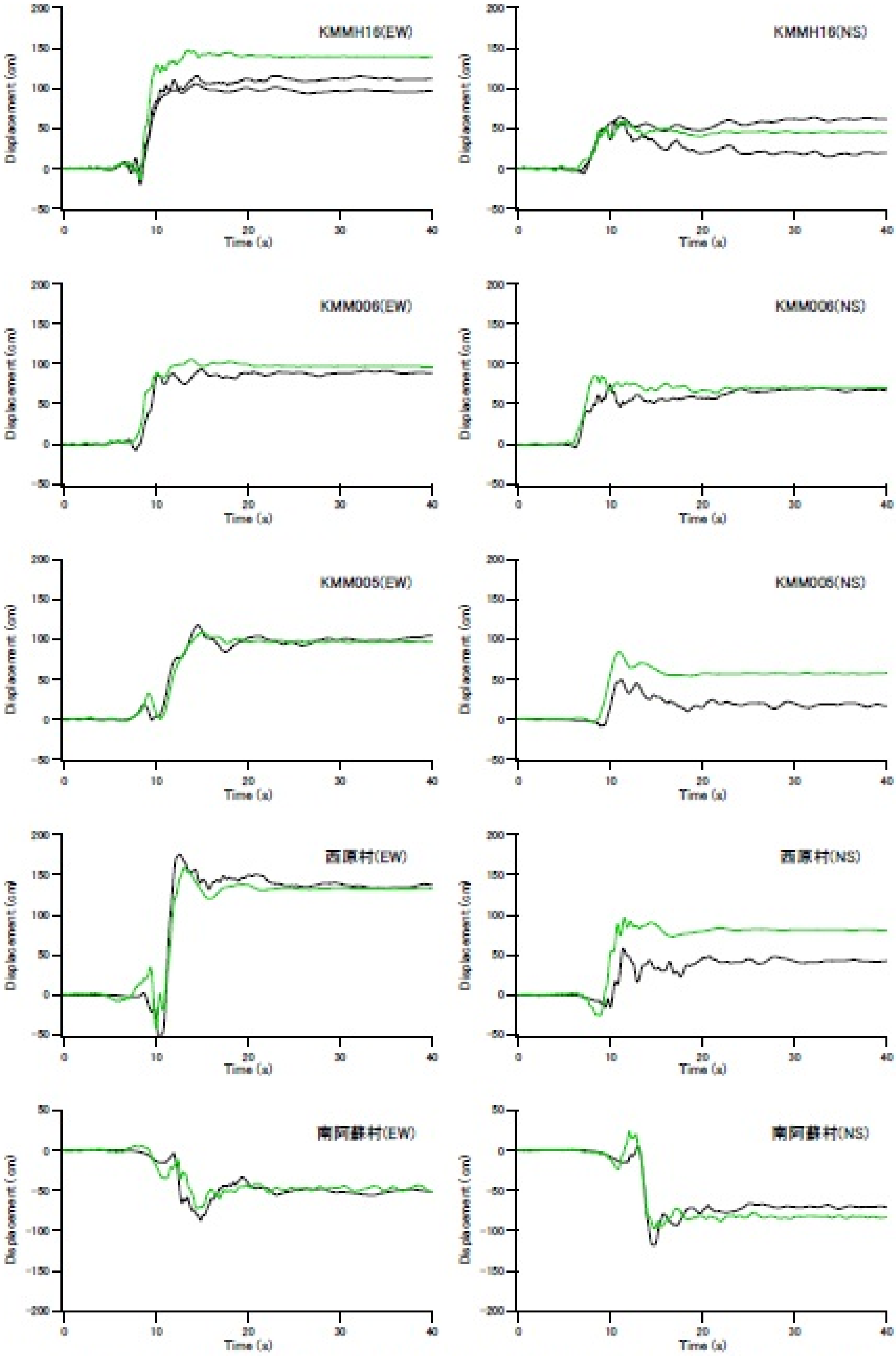

背景領域＋アスペリティを考慮した変位波形の計算結果（黒が観測，緑が計算）　（原点は気象庁の発震時刻）

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