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► **To cite this version:**

Hideo Aochi, Virginie Durand, John Douglas. Influence of super-shear on simulated near-source ground motion from the 1999 Izmit earthquake. Japan Geoscience Union Meeting 2011, May 2011, Makuhari, Chiba, Japan. <hal-00588717>

HAL Id: hal-00588717

<https://hal-brgm.archives-ouvertes.fr/hal-00588717>

Submitted on 26 Apr 2011

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Influence of super-shear on simulated near-source ground motion from the 1999 Izmit earthquake

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We numerically simulate seismic wave propagation from the 1999 Mw7.4 Izmit, Turkey, earthquake, using a 3D finite difference method based on published finite source models obtained by waveform inversions. This earthquake has been reported, based on observations at the near-fault station SKR, as an example of super-shear rupture propagation towards the east. Although the modeled ground motion does show a characteristic Mach wave from the fault plane, it is difficult to identify any particular effects in terms of peak ground velocity, an important parameter in earthquake engineering. This is because the fault spatial heterogeneity is strong enough to mask the properties of super-shear rupture, which has been reported through several numerical simulations mostly based on homogeneous fault conditions. This study demonstrates the importance of studying ground motions for known earthquakes through numerical simulations based on finite-fault source models.

Keywords: ground motion, super-shear rupture, Izmit earthquake, finite source models, finite difference simulation