

EGU2020-21146

<https://doi.org/10.5194/egusphere-egu2020-21146>

EGU General Assembly 2020

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Within and Between-Events Variability of Strong-Velocity Pulses

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Ground motions with strong pulses often bring significant damage to structures. The period and the amplitude of the strong-velocity pulses are critical for structural engineering and seismic hazard assessment. The scaling of pulses periods with magnitudes and the within-event variability of pulses is however poorly understood. In this study, we analyze two moderate earthquakes, namely 2016 Meinong earthquake and 2018 Hualien earthquake, using Shahi and Baker's criteria (2014) to detect pulses. The observations in this study show that the amplitudes of the pulse decay with the distance from the source to the stations, and is also associated with the rupture direction from the asperity instead of the direction from the hypocenter. In addition, we further perform simulations using a simple FK method to clarify the causes of the variability of the pulse periods within and between events. We test the effect of faults dipping angles and the impacts of the asperity location and size. Through our simulations, we reveal that the amplitudes of the pulses in the shallow dipping fault are larger on the hanging wall than on the foot wall, and that the asperity properties has a large impact on the pulses periods and the amplitudes at the nearby stations. The results show that the asperity characteristics are critical for the occurrence of the strong-velocity pulses. The complete understanding of the kinematics of the rupture is then important for clarifying the effects of the strong-velocity pulses and improving ground-motions predictions.