DOES A DAMAGED FAULT ZONE MITIGATE THE NEAR-FIELD IMPACT OF SUPERSHEAR EARTHQUAKES? - APPLICATION TO THE 2018 MAGNITUDE 7.5 PALU EARTHQUAKE

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The 2018 Mw 7.5 Palu, Indonesia earthquake ruptured 150 km of a strike-slip fault and struck the city of Palu severely. Its impact was amplified by triggering of catastrophic landslides in the proximity of the fault and submarine landslides in the Palu Bay that likely contributed to the devastating tsunamis. Back-projection imaging revealed that the rupture speed rapidly reached a steady state with a sustained velocity of about 4.1 km/s, exceeding the S-wave velocity, V_S . Conventionally supershear ruptures propagate stably at speeds between Eshelby's speed ($\sqrt{2}V_S$) and the P-wave velocity V_P ; the observed speed lies in an unstable regime. Such a low rupture speed was interpreted possibly by the presence of a low-velocity damaged fault zone (LVFZ). In this study, first, we analyse the effect of a LVFZ on rupture development, accounting for the effects of seismogenic width and initial conditions. Furthermore, we investigate the effects of rupture speed and the LVFZ on near-field ground motions. The preliminary results confirm the possibility of an early and steady supershear rupture at the observed velocity due to the LVFZ, and a slower rupture speed results in attenuation of ground motion and thus a reduced landslide risk. Moreover, the LVFZ leads to amplification of near-field ground motion, particularly on the frequency band of 1 - 2 Hz, compared to a homogeneous fault medium with the same rupture speed. Our findings support the significance of rupture and fault zone properties (such as rupture velocity and LVFZ) on near-field ground motion and related landslide triggering.