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## Complex rupture dynamics of the 2020 Mw 6.8 Elazığ (Sivrice) earthquake, Turkey

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The 2020 Mw 6.8 Elazığ (Sivrice) earthquake occurred on the Pütürge segment of the East Anatolian Fault zone. This strike-slip segment is situated between strong earthquakes that happened 100–150 years ago, and, since that time, the segment remained with eight Mw5-6 events, but with no Mw 6+. We relocate the mainshock and aftershock sequence and infer basic characteristics of the event using the ISOLA multiple point source approach and backpropagation of S-waveforms from local strong-motion recordings. Together with clear secondary P wave onsets identified in the recordings, the results suggest complex rupture propagation with reversal of the rupture propagation. We apply a recently developed Bayesian dynamic source inversion with slip-weakening friction and spatially inhomogeneous stress and friction parameters to gain better insight into the rupture process. Using high-quality near field recordings in the low-frequency range (<0.3Hz), we obtain a complex dynamic rupture model explaining the weak rupture initiation followed by a cascade of at least three rupture episodes, including the rupture reversal. The dynamic model explains significant features of the recordings even in a broader frequency range interesting for seismic engineering applications (<2.5Hz), e.g., a directivity pulse associated with rupturing the event's strongest asperity with 4 m of slip and local stress drop of 40 MPa. We show that by reducing the initial stress in the top 10 km by 10%, the rupture fails to develop into the larger event, finishing as an Mw 5.8 earthquake. Considering the latter experiment corresponds to an earlier state of the fault in the seismic cycle, we hypothesize that the interseismic M5+ events on the Pütürge segment were undeveloped rudiments of potentially large events. Thus, the fault seems to have been ready for the Mw6.8 earthquake only by the time of the earthquake occurrence in 2020. This suggests that at the time of the Elazığ earthquake initiation, the final Mw6.8 magnitude was not determined, making it a treacherous case for early warning systems.