

# Cascading Multi-Segment Faults Triggered by Supershear Rupture During the 2023 SouthEast Türkiye Earthquake Doublet: A Giant Jigsaw Puzzle Mobilized

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A devastating earthquake doublet occurred on 6 February 2023 with moment magnitudes of Mw 7.9 and Mw 7.7 along the East Anatolian Fault (EAF) and Sürgü-Çardak Fault (SCF), respectively. The 2023 earthquake sequence resulted in catastrophic human life and economic loss, and caused major impacts to infrastructure throughout south-east Türkiye and north-west Syria. The kinematics of ruptures for the doublet was complex involving multi-scale cascading rupture growth across the hybrid fault segments. We find that the first earthquake (Mw 7.9) nucleated on a previously unmapped fault, Nurdağı-Pazarcık segment, before transitioning to the EAF leading to supershear bilateral ruptures on the initial branch, Pazarcık and Erkenek segments and subshear rupture on the Amanos segment. The dynamic stress of the leading branch rupture impulsively triggered the EAF segments accelerating the following bilateral supershear rupture of the second earthquake (Mw 7.7) along the curved fragments of the SCF with dominant westward rupture directivity, and stopping instantly at geometric barriers at both ends of the fault. Hence, the geometry and pre-stress level of multiple segments heightened the diverse rupture characteristics of the 2023 south-east Türkiye earthquake doublet, contributing to the strong ground shaking and associated devastation and amplified the ground shaking intensity.

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## Promotional text

## Oral preference format

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