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3D Dynamic Earthquake Fracture Simulations Considering the Nonplanar Fault Geometry and Heterogeneous Stress States in the Sea of Marmara

The main objective the study is to determine 3D dynamic earthquake rupture scenarios in the Sea of Marmara, considering non-planar fault geometry and heterogeneous stress structures, since the Marmara region is prone to a large earthquake (M>7.0) with its >15 million inhabitants in İstanbul. We adapt creeping and locked parts of the segments of the Main Marmara Fault (MMF) via results of recent repeating earthquake and seismicity studies. We constrain initial shear and normal stresses through recent interseismic strain rates and regional stress orientations. Additionally, previous rupture extensions are estimated from the investigations related to historical data and turbidity records. Due the requirement of high computational demand, the most accurate and largest mesh size (200m) and the time step (0.01s) values are verified for planar (simple) and non-planar (complex) test geometries. Tetragonal mesh is used in order to increase the sensitivity of the rupture propagation within the generated fault geometry. As a result of this study, we obtain realistic 3D dynamic earthquake rupture scenarios for the non-planar and heterogeneous fault structure of the Marmara Sea. Hence, we consider under what conditions whole of the unruptured segments of the Main Marmara Fault can rupture and which scenarios are more realistic.

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