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Numerical simulation of the 1976 Ms7.8 Tangshan Earthquake

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An Ms 7.8 earthquake happened in Tangshan in 1976, causing more than 240000 people death and almost destroying the whole city. Numerous studies indicated that the surface rupture zone extends 8 to 11 km in the south of Tangshan City. The fault system is composed with more than ten NE-trending right-lateral strike-slip left-stepping echelon faults, with a general strike direction of N30°E.
However, recent scholars proposed that the surface ruptures appeared in a larger area. To simulate the rupture process closer to the real situation, the curvilinear grid finite difference method presented by Zhang et al. (2006, 2014) which can handle the free surface and the complex geometry were implemented to investigate the dynamic rupture and ground motion of Tangshan earthquake. With the data from field survey, seismic section, borehole and trenching results given by different studies, several fault geometry models were established. The intensity, the seismic waveform and the displacement resulted from the simulation of different models were compared with the observed data. The comparison of these models shows details of the rupture process of the Tangshan earthquake and implies super-shear may occur during the rupture, which is important for better understanding of this complicated rupture process and seismic hazard distributions of this earthquake.