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Growth of lithospheric-scale fault system in NE Tibet: numerical modeling constrained by high-resolution seismic reflection data

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The growth of lithospheric-scale fault system is strongly coupled with the deformation of continental lithosphere in Tibetan Plateau. Therefore, prediction of fault growth is important to understand the tectonic history of continental deformation with fault system. Recently, high-resolution seismic reflection profiling across the Kunlun fault in northeasten Tibet reveals several fault systems at the scale of lithosphere. A 2D mid-crustal strain-transfer model, which emphasized on the lateral heterogeneity of crust, was proposed to explain the seismic reflection profiling under the condition of compression. In order to understand the dynamic process of lithospheric deformation, an elastic-plastic constitutive relationship in finite element modeling is used to investigate the mechanism of the fault growth in the section under the condition of compression by allowing permanent strains to develop in response to the applied loads. The vertical and lateral heterogeneity of material, effect of plastic parameters and geometry of models from nature structure are all discussed in this study. The results compared with high-resolution seismic image show that well-designed geomechanical modeling can produce overall process of fault growth for both continuum without preexisting fault and discontinuous deformation with a peexisting fault. But the model of the Kunlun fault cutting down the Moho is not supported by the results compared with the seismic data.