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The effects of tectonic loading and earthquake triggering on the 2008 Wenchuan earthquake by a new finite element model

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The 2008 Wenchuan earthquake with the magnitude of Ms 8.0 occurring on the Longmenshan fault in Sichuan Province of China was unexpected to geoscientists because both the seismicity and slip rate of the fault in historical records are much lower than those of other faults in the region around it. Therefore it was considered safe for large earthquake occurrence. In this study we try to probe the effects of tectonic loading and large earthquake triggering on the Wenchuan earthquake occurrence in the region during the past 222 years by a new finite element model with heterogeneous materials and initial stress field. In the model, firstly, we build up an initial strain and stress fields which was constrained by geological survey and GPS data on the faults, secondly, we simulate the occurrence of each large earthquake in the region, which caused by the fault softening and stress field driving.

The results show that the most triggering effect on the Wenchuan earthquake in seven historical large earthquakes is the 1933 Diexi earthquake with magnitude of 7.5. The effect of the tectonic loading on the seismic risk of the Longmenshan fault is greater than that of the historical earthquake triggering.

Keywords: Wenchuan earthquake, tectonic loading, earthquake triggering, seismic risk