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# Fault interactions and synchronization: insight from the 1936-1997 NE Lut earthquake sequence

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## Abstract

The increasing number of observations indicates that large earthquakes occur in temporal cluster within fault system. The coseismic and postseismic stress transfers are thought to play an important role in the spatial occurrence of such seismic sequences. Indeed, many studies show the good correlation between positive Coulomb stress variation produced by moderate to large earthquakes and the localization of future earthquakes. However, most of the studied seismic sequence involves fault system having simple geometric configuration (i.e. collinear or parallel fault system). In this study, we focus on a sequence that occurred on a complex fault system (i.e. conjugate fault system), the 1939-1997 NE Lut earthquake sequence (NE Iran) that includes 3 Mw7+ and 8 Mw5.9+ earthquakes. The goals of the study is to assess (1) if stress transfers can explain the succession of earthquakes in the sequence and (2) if stress transfers can lead to the synchronization of the NE Lut faults over multiple seismic cycles. In a first part, using coseismic and postseismic Coulomb stress transfer modeling, we show that 7 out of 11 earthquakes of the NE Lut sequence are favored by the previous event, and that accurate modeling of the rupture geometry is crucial to robustly estimate the stress transfers. We also show that one of the major earthquakes of the sequence, the Mw 7.2 Zirkuh earthquake, has mainly been favored by the moderate earthquakes, and that postseismic stress transfers have not contributed significantly to the NE Lut sequence occurrence. In a second part, the simulation of multiple seismic cycles on the NE Lut fault system shows that stress transfers, in particular postseismic stress transfers due to viscoelastic relaxation, enhance the number of seismic sequences and synchronize the rupture of the faults, in particular for the three Mw7+ earthquakes. The simulations also suggest that the succession in which these Mw+7 earthquakes occurred during the 20th century NE Lut sequence is quite exceptional.

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