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Relationship between friction and earthquake statistics: evidences from experimental and numerical investigation and application to the earthcrust seismicity.

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The friction heterogeneity of faults is of major importance for understanding the physics of earthquakes and for improving hazard mitigation. Estimating the friction heterogeneity along seismically active faults would help us to estimate the distribution of weak portions and then the potential magnitude of future earthquakes. The seismological analysis usually performed by inverting the waveforms allows us to estimate the earthquake stress-drop or slip distribution along the fault.However, the absolute value of friction and its heterogeneity remains out of reach until today. The scaling invariance of earthquake statistics and of several fault properties, particularly the roughness and the gouge distribution, authorize us to use small scale experiments in the laboratory to investigate the relationship between friction and earthquake . Here we show a new experimentally established relationship between the absolute value of friction and the statistics of earthquakes (i.e. b-value of the Gutenberg-Richter Law). Numerical simulations of faulting avalanches, in which friction is controlled, allows us to reproduce such a relationship confirming the role of friction in earthquake statistics. Applying this relationship to natural faults permits to draw a map of the friction along seismically active faults and then to better estimate potential size of future earthquakes. The particular case of .supershear earthquake areas, are characterized by low friction value, providing a physical meaning for these anomalous earthquakes.