Verification of Seismic Gap by means of physical and statistical models

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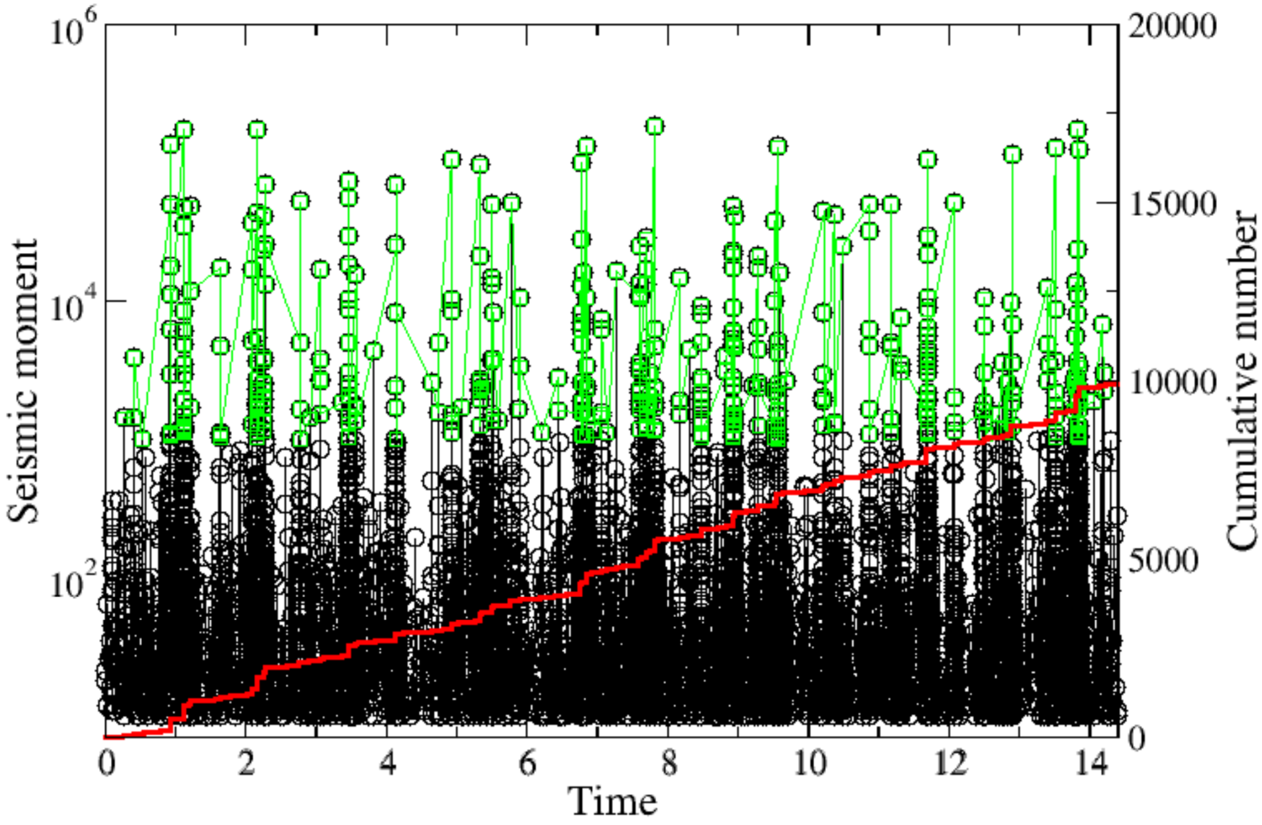
Spring-block models are a striking example of how implementing the right physical laws in a model, even with few parameters, it is possible to reproduce the statistical features of earthquakes. In fact, in recent years, the introduction of an additional parameter that regulates the elastic rebound after a large earthquake has also allowed the optimal description of the statistical laws of aftershocks. In the seismological community, the estimate of the occurrence probability of the next big shock on the basis of the time delay from the last earthquake still represents a big challenge. In fact, the real catalogs still contain few seismic events, therefore appears difficult to test the so called "Seismic Gap Hypotesis" in a statistically relevant way with current historical data. Instead, extensive numerical simulations can be obtained with up-to-date realistic spring-block model and allow us to test the Gap Hypothesis. Our numerical results support recent findings which have shown that important insights can be obtained from the spatial organization of aftershocks and its relationship to the mainshock slip profile. In particular, we show that large earthquakes do not regularly repeat in time, but it is possible to achieve insights on the time until the next big shock from the percentage of aftershocks occurring inside the mainshock slip contour. Finally, it is possible to describe the physical model numerical catalogs with other statistical-based models by means of Likelihood Maximization procedure. The results of the optimization for the Stress Release, Triggering and Self Exciting Long Term Correcting models confirm that in addition to the triggering process, the charge and discharge of stress due to the succession of events also plays an important role in seismic prediction.


Seismic moment
10^6
10^4
10^2
Cumulative number
20000
15000
10000
5000
0
0
2
4
6
8
10
12
14
Time