PLASTIC EVENTS IN SOFT-GLASSY MATERIALS FOLLOW EARTHQUAKE STATISTICS.

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Key words Earthquake statistics, earthquake catalogue, Lattice Bolzman approach, soft-glassy materials

It is commonly accepted that earthquakes are the result of some mechanical failure of earth materials. However, many details of the underlying physics, especially at the microscopic scale, are currently not understood. At the macroscopic scale, many aspects of earthquakes show a complex behaviour that can be addressed with tools of statistical physics. We propose a new approach for generating synthetic earthquake catalogues based on the physics of soft glasses. The continuum approach produces yield-stress materials based on Lattice-Boltzmann simulations [1]. We show that, if the material is stimulated below yield stress, plastic events occur, which have strong similarities with seismic events. Based on a suitable definition of displacement in the continuum, we show that the plastic events obey a Gutenberg-Richter law with exponents similar to those for real earthquakes. We further find that average acceleration, energy release, stress drop and recurrence times scale with the same exponent (Fig. 1). The approach is fully self-consistent and all quantities can be calculated at all scales without the need of ad hoc friction or statistical laws. We therefore suggest that our approach may lead to new insight into understanding of the physics connecting the micro and macro scale of earthquakes.

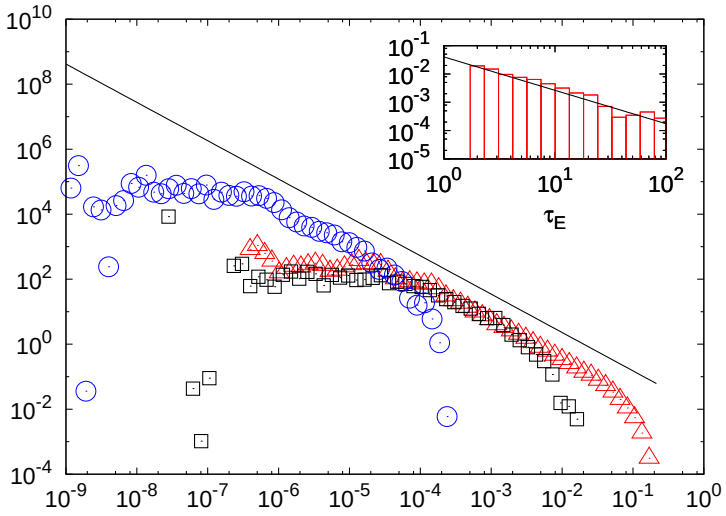

Figure 1. Probability density distribution for different quantities: red triangles correspond to the largest displacement in the medium, blue circles correspond to the average acceleration in the medium, black squares correspond to the energy release. In the insert we show the probability density function of the time between two consecutive events. The black line in the insert has the same slope as the black line in the main part of the figure.

References

[1] Benzi R., Sbragaglia M., Perlekar P., Bernaschi M., Succi S. and Toschi, F., *Direct evidence of plastic events and dynamic heterogeneities in soft-glasses*, Soft Matter, **10**, 4615-4624, (2014).