The analysis of statistical mechanical properties of earthquakes using simple models

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In recent years, there has been an increasing interest in analyzing the statistical mechanical properties of real earthquake data. It has already been shown, using the California earthquake catalogs, that (i) the distribution of waiting times between earthquakes obeys a simple unified scaling law which unifies the well-known Omori and Gutenberg-Richter laws of seismicity [1], (ii) the correlation between earthquake events exhibits aging phenomenon inside the Omori regime, whereas no aging is observed outside the Omori regime [2], and (iii) if the seismic data is mapped to a growing directed network, the period distribution in the network (which implies that after how many earthquakes an event returns to the initial location) obeys a power law [3]. In this work, these three observations coming directly from the analysis of real seismic data have been tested using two very simple toy models of earthquakes, namely, the coherent noise model [4] and Olami-Feder-Christensen model [5]. Moreover, the inequivalance of time and ensemble averages in these models is discussed using recent results of aging obtained for these models [6].

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[1] P. Bak, K. Christensen, L. Danon and T. Scanlon, Phys. Rev. Lett. 88 (2002) 178501.
[2] S. Abe and N. Suzuki, Physica A 332 (2004) 533.
[3] S. Abe and N. Suzuki, Eur. Phys. J. B 44 (2005) 115.
[4] M.E.J. Newman and K. Sneppen, Phys. Rev. E **54**, 6226 (1996).
[5] Z. Olami, H.J.S. Feder and K. Christensen, Phys. Rev. Lett. **68**, 1244 (1992).
[6] U. Tirnakli and S. Abe, Phys. Rev. E 70 (2004) 056120.