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HETEROGENEOUS FOREST FIRE MODEL WITH ENLARGED NEIGHBOURHOODS AND FORBIDDEN SITES

Florentino Silva*[1,2],
Gustavo Camelo-Neto[1] and Sergio Coutinho[1]

[1]Federal University of Pernambuco (UFPE), Brazil

[2]International Centre for Theoretical Physics (ICTP), Brazil

fsilva@ictp.it (*corresponding author),
scoutinho@df.ufpe.br, gustavo.camelont@ufpe.br

The concept of self-organized criticality (SOC) is related to the ability of a dynamical system to evolve towards a critical phase spontaneously and which signature is the scale invariance of its observables. The forest fire model proposed by Drossel and Schawbl [1] in 1992, regards an homogeneous population of trees and its fire-size distributions suggest typical SOC behaviors. On literature it is reported that wildland fires whose frequency-area histograms are either power-law distributions or other heavy-tailed distributions. In 2011, Camelo-Neto and Coutinho [2] proposed a CA model in which two distinct populations of trees are considered: one consisting of trees with low flammability (with a parameter R of resistance to ignite) and the other composed by high flammability (susceptible trees).

The current work [3] is carried out using cellular automata models and some ingredients have been added either to amplify or restrict the fire spreading. On one hand, the number of neighbors interaction was increased allowing the fire front to reach further and, on the other hand, random forbidden site were added to the lattice which does not interact with the fire and are no allowed to sprout trees, in that way constraining the propagation. So far, results have showed that observable distributions present two distinct behaviours, qualitatively agreeing with the wildland fire reports. The next step is to understand which are the critical parameters to shift from on phase to the other and develop scalable algorithms that would reduce finite-size effects.

References

[1] Drossel, Barbara, and Franz Schwabl. (1992). *Self-organized critical forest-fire model*. Physical review letters 69.11 (1992): 1629.

[2] Camelo-Neto, Gustavo and Sergio Coutinho. (2011). *Forest-fire model with resistant trees*. Journal of Statistical Mechanics: Theory and Experiment 2011.06:P06018.

[3] Silva, Florentino (2016). *Forest Fire in Heterogeneous Environments: The Role of Enlarged Active Neighborhoods and Random Forbidden Sites*. Master thesis. Departament of Physics, UFPE, Brazil

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