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On the agreement between small-world-like OFC model and real earthquakes

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Despite all the existing knowledge about the production of seismic waves through slips on faults, much remains to be discovered regarding the dynamics responsible for these slips. Aiming to contribute to the understanding of earthquake dynamics, in this paper we implemented simulations of the model developed by Olami, Feder and Christensen (OFC model), which incorporate characteristics of self-organized criticality (SOC) and has played an important role in the phenomenological study of earthquakes, because it displays a phenomenology similar to the one found in actual earthquakes. We applied the OFC model for two different topologies: Regular and "small-World", where in the latter the links are randomly rewired with probability *p*. In both topologies, we have studied the distribution of time intervals between consecutive earthquakes and the border effects present in each one. In addition, we also have characterized the influence that the probability *p* produces in certain characteristics of the lattice and in the intensity of border effects. Furthermore, in order to contribute the understanding of long-distance relations between seismic activities, we have built complex networks of successive epicenters from synthetic catalogs produced with the OFC model, using both regular and small-World topologies. In our results, distributions arise belonging to a family of non-traditional distributions functions, which agrees with previous studies using data from actual earthquakes. Our results reinforce the idea that the Earth is in a critical self-organized state and furthermore point towards temporal and spatial correlations between earthquakes in different places.

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The influence of UV radiation on exoplanets' habitability

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High level of stellar UV radiation on a planet's surface may prevent planet's habitability and limit the width of the habitability zone (HZ). Hence, we wish to estimate the UV Index as a function of the stellar parameters for Earth-like planets within the HZ of main sequence stars. The stellar radiation that impinges the surface is calculated by a 1-dimensional radiative transfer model which couples the photo-chemical reactions in the atmosphere. The calculations show that the oxygen and ozone molecules provide a sufficient protection from the stellar radiation, even for hot host stars, as the UV Index can reach a maximal value of 21 units (about twice higher than on Earth). Furthermore, the UV Index is highest on planets which orbit stars with an effective temperature of about 9,000 K, and is lower for hotter and colder stars.

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