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Influence of the precipitation data temporal scale when using the self-organized criticality theory to describe the rainfall process

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The precipitation can be described using the self-organized criticality (SOC) theory as it has been shown in several works. However, the temporal scale of the data used in those work varies from minutes to days. This fact raises the question about what is the most suitable kind of data to detect any evidence of SOC in the rainfall process for a place.

With the aim of answering that question, a SOC analysis was carried out using long term series of hourly and daily rainfall data recorded in different locations of Andalusia (Southern Spain) with a range of mean annual precipitation between 150 and 600 mm. Some places were under the influence of convective storms, while the frontal storms were dominant in others. The rest of locations had an intermediate situation.

The existence of power-law behaviors in the distributions of rain event sizes and durations as well as in the drought durations were found in all the cases. Similar exponents of the laws were fitted when hourly rainfall data were analyzed but they differed to those obtained when daily records were used. However, the ratio between the two scaling regimes detected for the distributions of rain event sizes was kept almost constant in the places clearly influenced by convective or frontal storms. On the contrary, that ratio varied when hourly or daily data were used in the analysis performed for locations where there was not a predominant kind of storm. This fact suggests that the application of the SOC theory for describing the rainfall process in such places is highly sensitive to the temporal scale of the data.