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Information entropy and fractal dimension analysis of the NE-Italy and W-Slovenia seismicity

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We investigated the seismicity dynamics by analysing the normalized Shannon entropy and the fractal dimension of eight temporal seismic series, preceding and following moderate earthquake sequences in NE-Italy and W-Slovenia. We recognized three phases in the temporal seismic series. The period before the mainshock is characterized by oscillations of the Shannon entropy around a nearly constant level and by slight fluctuations of the fractal dimension of the spatial distribution. The phase of mainshock and aftershock sequence corresponds to a significant decrease of the Shannon entropy and, in most cases, of the fractal dimension. After the sequences, the seismicity evolves again to a nearly constant trend of the Shannon entropy and fluctuations of the fractal dimension.

We interpreted the trend of the normalized Shannon entropy, and of the fractal dimension as due to spatial and temporal fluctuations of the strain energy resulted from the coupling between the tectonic stress field and the mechanical heterogeneities of the crust. From a thermodynamic point of view, the system, characterized by general disorder and high uncertainty, tends temporarily to move towards higher order during local clusters.