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Binary signal characteristics as a tool for the interpretation of the intermittent structure of rainfall in space and time

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Rainfall processes present a deeply irregular time and space evolution. When observing pluviometric time series, such behaviour emerges in the form of long no-rain (or low-rain) periods alternated with very intense and unstable intervals, resembling intermittency. An outline definition of intermittency can be given also in terms of probability of extreme events: for an intermittent signal the occurrence of high amplitude events is more probable than for a Gaussian process and the spectral density function moves from the typical structure of a red-noise (where low frequencies are the most represented) to that of a blue-noise (characterised by an increasing power law at high frequencies) while the influence of laminar periods decreases. In this work we focus on the connection between the information content of rainfall data and the binary structure (rain/no-rain) of the process in space and time, as a basis for the interpretation of intermittent structures. An approximate law relating cross-correlation and MI in the case of binary signals holds also in the case of rain/no rain series, allowing direct inter-comparison between linear and non-linear correlation levels, and the MI values estimated from binary data and the original records seem to be almost indistinguishable at fine aggregation scales in time. Therefore, we use such a preponderance of the "structure process" with respect to the "amplitude" at fine scales in order to investigate the global correlation structure of the rainfall process in time. Finally, we investigate the possibility to extend the quantification of the global correlation structure for the observed rain/no-rain process into the spatial domain.