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Exploring Informational and Topological Properties of Seismic Point Processes

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Extended Abstract

Seismic sequences are temporal point processes marked by event magnitudes. Denoting the magnitude by M, its distribution, p(M), follows the well-known Gutenberg-Richter law, log10(p(M))=a−b(M−M0) [1], where b represents the relative proportion of small to large earthquakes, offering insights into the stress conditions of a seismic region, and M0 is the completeness magnitude, the smallest magnitude detectable by the seismic network [2]. Similarly, denoting the interevent interval (the time between two consecutive earthquakes) by T, its distribution, p(T), varies depending on the nature of the seismic process.

Similarly to continuous time series, temporal point processes can be transformed into network representations [3, 4]. Among these, the visibility graph [5] has gained significant popularity over the past decade due to its straightforward implementation and robust performance on both natural and synthetic datasets.

To analyze the networks generated by visibility graphs, researchers have applied information theory quantifiers, such as the Fisher Information Measure and Shannon entropy [6]. These measures have revealed intriguing relationships, for example, with the Hurst exponent, which characterizes the long-range correlation properties of a time series.

In this study, we investigate the informational and topological properties of visibility graph networks constructed from seismic point processes, generated by a few physics-based earthquake generation models that share the fundamental Gutenberg-Richter magnitude distribution. The results of this study can contribute to enhance our knowledge about the complex time dynamics of seismic sequences.

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