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Investigating the relationship between earthquake occurrences and global temperature fluctuation patterns

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Abstract

Earthquakes have long been studied as a geological phenomenon, and the nature of their occurrences has been investigated by examining various geological events. Global temperature has been changing since the eighteenth century. A correlation between these two dynamics has been suggested but has not been experimentally verified. This unprecedented work aims to consider the magnitude of globally occurred earthquakes as a time series and analyse its nature using statistical signal processing tools. The trends in global temperature have also been analysed similarly. This was done by primarily classifying the time series as fractional Brownian motion or fractional Gaussian noise based on their power spectral density. The Hurst exponent for the time series was computed using four standard methods, which exhibit that

both dynamics are self-similar, anti-persistent, and fractional Brownian motion in nature. Continuous wavelet transform–based semblance analysis of both the signals clearly shows the co-relationship between the two dynamics. Finally, the Granger causality test has been implemented, which reveals that both dynamics are caused by one another, and one is predictable using the other's previous data.

Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Code availability

All code for data cleaning and analysis associated with the current submission is available from the corresponding author on reasonable request.

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Bikash Sadhukhan: Conceptualization, methodology, formal analysis, investigation, software, visualization, validation, writing—original draft preparation.

Somenath Mukherjee: Methodology, supervision, reviewing, and editing.

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Ethics declarations

Conflict of interest

The authors declare no conflict of interest.

Additional information

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