Investigating the Fractality and Stationarity Behavior of Global Temperature Anomaly Time Series

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Abstract:
The global climate has been changing rapidly in recent decades, with significant consequences for the environment and human societies. Understanding the long-term behavior and properties of climate data is crucial for predicting future changes and developing effective mitigation strategies. This study investigates the fractal and stationary properties of global temperature anomaly time series data from 1880 to 2022 using statistical techniques such as the Hurst exponent, rescaled range analysis, detrended fluctuation analysis, augmented Dicky Fuller test, and Kwiatkowski-Phillips-Schmidt-Shin test. The results of the analysis reveal that the global temperature anomaly time series exhibits fractal behavior with a Hurst exponent value of 0.6 during the last 42 years, indicating persistent long-term memory. Additionally, the data show nonstationarity with a significant increasing trend over the entire period of analysis. The authors found evidence of changes in the fractal properties of the data since 1980, possibly due to human-induced climate change. This study provides vital insights into the complexity of global temperature anomaly time series data and highlights the need for continuous tracking and evaluation of climate data to better understand and manage the issues of climate change. The findings have important implications for climate modeling and policy development, highlighting the need for continued efforts to mitigate climate change and its impacts.

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