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From normal state to magnetic storms in terms of fractal dynamics

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Major magnetospheric disturbances are undoubtedly among the most important phenomena in space physics and also a core subject of space weather. They are relatively rare events: as in the case of atmospheric storms, earthquakes, solar flares, etc., the occurrence of geomagnetic storms rapidly decreases as their magnitude grows. We show that distinctive alterations in scaling parameters of D_{st} index time series occur as a strong magnetic storm approaches. These alterations reveal a gradual reduction of complexity as the catastrophic event approaches. The increase of the susceptibility coupled with the transition from anti-persistent to persistent behavior may indicate that the onset of a severe magnetic storm is imminent. The preparation of a major magnetic storm could be studied in terms of “Intermittent Criticality”. The analysis also suggests that the continuous scale invariance is partially broken into a discrete scale invariance symmetry.