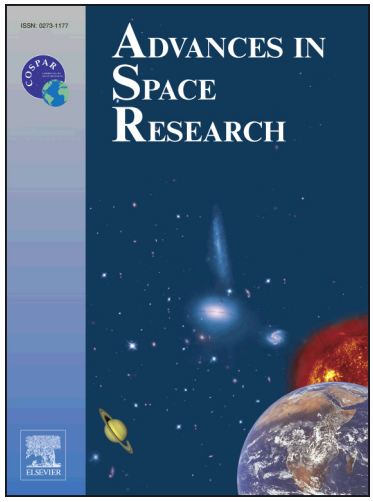

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Multifractal characteristics of magnetospheric dynamics and their relationship with sunspot cycle

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Abstract

Multifractal analysis deals with a process whose power-law scaling behavior is a nonlinear function of statistical moments having a spectrum of scaling exponents. In contrast, monofractal process has a scaling behavior which is a linear function of moments with a single scaling exponent. In this study, multifractal analysis of complex magnetosphere using box-counting approach has been considered for a better understanding of intermittent and persistent features, focusing on the auroral electrojet index (AE), SYM-H and Dst indices. For the analysis, 1-min AE, SYM-H and Dst indices are taken during the interval 1985-2007. We compare the sunspot cycle dependence of self-similarity and multifractality of magnetospheric proxies such as AE, SYM-H and Dst indices, using both monofractal and multifractal paradigms. The results indicate that monofractal features of AE, SYM-H and Dst indices are solar activity dependent. But, while analyzing the multifractal features, multifractal spectrum of AE index is less dependent on solar activity when compared with that of SYM-H and Dst indices. This implies that, other than solar wind forcing, certain complex phenomena of internal origin also modify the dynamics of geomagnetic fluctuations in the high-latitude auroral region.

Keywords: Multifractality; Magnetosphere; Sunspot cycle

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