MULTIFRACTAL AND CONTINUOUS WAVELET ANALYSIS OF GEOMAGNETIC ACTIVITY

N. ZAOURAR, S.A. Ouadfeul and M. Hamoudi

Laboratoire de Géophysique, FSTGAT, USTHB, BP32 USTHB, 16123 Bab-Ezzouar, Alger, Algérie

This work focuses on short term geomagnetic field activity considered as fractional Brownian motion signal and the development of new technique of investigation which takes into account its non stationary property in order to help detecting main events such as sudden storms (SSC)
In this study, we analyze the horizontal component of the magnetic field recorded by 4 InterMagnet observatories located at various latitudes, from high, close to auroral regions to low, close to equator. The analysis is performed using quiet and disturbed days 1 min-value sampling data during more than a decade, starting from 1996. The intrinsic properties of high-frequency signals and the related causative sources are explored thanks to 1-D Continuous Wavelet Transform and especially the Modulus Maxima lines (WTMM). The obtained results clearly show that the major magnetic singularities of the field, such as SSC are characterized by very low values of Holder exponents estimated at the local maxima of the Wavelet Transform. Generalized fractal dimension is then derived and used as a new powerful parameter describing the geomagnetic activity. We show that the main phases of an SSC are uniquely characterized. Holder coefficient could be a good candidate as an efficient key indicator of geomagnetic activity and singularity detection.

Geomagnetic activity, wavelet transform modulus maxima lines, Holder exponent, generalized fractal dimension

N. Zaourar, Departement de Géophysique, University of Sciences and Technology Houari Boumediene/FSTGAT, BP32 BAB-EZZOUAR, 16123, Algiers, Algeria