

Multifractal behaviour of ionospheric Total Electron Content (TEC) time series

Kamlesh Pathak*, Hemali Tanna,

Department of Applied Physics, S. V. National Institute and Technology, Ichchhanath, Surat- 395007,
Gujarat, India

*drkamleshpathak@gmail.com

The earth's ionosphere is well recognized as a dynamical system and non-linearly coupled with the magnetosphere above and natural atmosphere below. The shape and time variability of the ionosphere indeed shows chaos, pattern formation, random behavior and self-organization. With an aim to understand the underlying dynamics of the inhomogeneous/complex behavior of ionosphere over an Indian low latitude region, the present paper studies the fractal properties of ionospheric Total electron content (TEC) time series through the Multifractal Detrended Fluctuation Analysis (MF-DFA) and Rescaled range analysis (R/S) methods. The MF-DFA is used to identify the scaling and non-linear properties of the ionospheric time-series data of two different in nature. The obtained results show the existence of multifractal behaviour in low latitude ionosphere which is affected by the input drivers (i.e. solar parameters, complex interaction between enhanced eastward electric field and magnetic field etc.). The comparison of the MF-DFA results of original data to those of shuffled and surrogate series shows that the multifractal nature of considered time-series is almost due to long-range correlations. Subsequently, the Hurst exponents derived from the R/S also suggesting the presence of long range correlation. The presented results in this work may be of assistance for future modelling and simulation studies.