

EXISTENCE OF FRACTAL BEHAVIOUR IN OZONE TIME SERIES

(Kewujudan Tingkah Laku Fraktal dalam Siri Masa Ozon)

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ABSTRACT

Fractal has received a wide attention and has been used in many areas such as meteorology, stock market and also in medical field. It can be viewed as an object which has similar appearance when viewed at different scales which are known as self-similar. Thus, the scale invariance and scaling properties of the time series may be explored using fractal techniques. The aim of this study is to investigate the presence of fractal behaviour in the ozone time series. The presence of fractal behaviour can lead to the possibility of implementing the fractal approach in order to examine the properties of a time series. In this study, the daily average of ozone concentration from six selected air monitoring stations with different types of backgrounds in Peninsular Malaysia are used. From the autocorrelation function (ACF) plot obtained for the six stations, the slow decay in ACF values indicates that self-similarity are present where it shows that the series is having the property of fractal behaviour. In this paper, the existence of fractal behaviour is investigated by using the power spectrum method and the empirical probability distribution function. The result shows that the daily average of ozone concentration exhibits fractal behaviour for all the six monitoring stations considered.

Keywords: self-similar; power spectrum; empirical probability distribution function

ABSTRAK

Fraktal telah mendapat perhatian yang meluas dan telah berkembang dalam pelbagai bidang seperti meteorologi, pasaran saham dan juga dalam bidang perubatan. Ia boleh dilihat sebagai suatu objek yang mempunyai penampilan yang sama apabila dilihat pada skala yang berbeza dan dikenali sebagai swasama. Oleh itu skala ketakvarianan dan sifat penskalaan bagi sesuatu siri masa boleh diterokai dengan menggunakan teknik fraktal. Tujuan kajian ini adalah untuk menyiasat kehadiran tingkah laku fraktal dalam siri masa ozon. Kehadiran tingkah laku fraktal ini membolehkan kemungkinan penggunaan pendekatan fraktal bagi mengkaji sifat-sifat siri masa. Dalam kajian ini, data purata kepekatan ozon harian bagi enam stesen pemantauan dengan latar belakang yang berbeza di Semenanjung Malaysia digunakan. Daripada plot fungsi autokorelasi (ACF) yang diperolehi untuk keenam-enam stesen, penyusutan yang sangat perlahan dalam nilai ACF menggambarkan kewujudan swasama yang mana ini memberikan petanda kehadiran tingkah laku fraktal dalam siri ini. Dalam makalah ini, kewujudan tingkah laku fraktal disiasat dengan menggunakan kaedah spektrum kuasa dan taburan kebarangkalian empirik. Keputusan menunjukkan bahawa purata kepekatan ozon harian mempamerkan kewujudan tingkah laku fraktal bagi semua stesen pemantauan yang digunakan.

Kata kunci: swasama; spektrum kuasa; taburan kebarangkalian empirik

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