

## SCALING AND PERSISTENCE OF OZONE CONCENTRATIONS IN KLANG VALLEY, MALAYSIA

(Penskalaan dan Keberterusan Aras Kepekatan Ozon di Lembah Klang, Malaysia)

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### ABSTRACT

The aim of this paper is to describe the characteristics of ozone concentration based on the value of Hurst coefficient. The Hurst coefficient, denoted as  $H$ , is used to explain the long-term degree of persistency in ozone concentration in Malaysia. This paper investigates the scaling properties and persistency of ozone concentrations at six selected air quality monitoring stations in Klang Valley, Malaysia. Daily mean for the hourly data of ozone concentration from 1998-2006 is considered in this study. In describing the statistical properties, several related statistics are identified and the autocorrelation functions of the observed data were plotted. The anomaly method is used to deseasonalise the seasonal variation and the natural non-stationary of the data. Next, the persistency of ozone concentration is determined by using the scaling analysis, namely Dispersional Ratio Method. This method considers two dispersion measures, that is the range and variance. The result shows that there are two different scaling regions, separated by a critical time scale,  $n_c$  which is approximately 90 days. For shorter time scale ( $n < n_c$ ), the ozone concentration persists and the concentration is high on higher time scale ( $n > n_c$ ) where the  $H$  values are between  $0.5 < H < 1$  at all monitoring stations. These findings provide information on scaling behaviour and persistence in ozone concentration in the ambient air of Klang Valley, Malaysia.

*Keywords:* dispersional ratio; Hurst coefficient; ozone; persistence; scaling

### ABSTRAK

Tujuan makalah ini adalah untuk menggambarkan ciri-ciri kepekatan ozon berdasarkan nilai pekali Hurst. Pekali Hurst, yang ditandai dengan  $H$ , digunakan untuk menerangkan tahap keberterusan jangka panjang dalam kepekatan ozon di Malaysia. Sifat-sifat penskalaan dan keberterusan kepekatan ozon dikaji di enam stesen pemantauan kualiti udara yang dipilih di Lembah Klang, Malaysia. Data purata harian per jam kepekatan ozon dalam tempoh 1998-2006 digunakan dalam kajian ini. Bagi menggambarkan ciri-ciri statistik, beberapa nilai statistik yang berkaitan dikenal pasti dan fungsi autokorelasi cerapan diplotkan. Kaedah anomali telah digunakan bagi menangani variasi bermusim dan ketakpegunan semula jadi yang terdapat di dalam data. Seterusnya, keberterusan kepekatan ozon ditentukan dengan menggunakan analisis penskalaan nisbah yang dinamai Kaedah Penyerakan Nisbah. Kaedah ini mempertimbangkan dua ukuran serakan, iaitu julat dan varians. Hasil kajian menunjukkan bahawa terdapat dua rantau skala yang berbeza dipisahkan oleh skala masa kritikal,  $n_c$  yang didapati tempohnya adalah hampir 90 hari. Bagi skala masa yang singkat ( $n < n_c$ ), aras kepekatan ozon adalah berterusan dan keberterusan adalah tinggi pada skala masa yang lebih panjang ( $n > n_c$ ) dengan nilai-nilai Hurst,  $H$  berada dalam selang  $0.5 < H < 1$  bagi semua stesen pemantauan. Kajian ini memberikan maklumat mengenai tingkah laku penskalaan dan keberterusan aras kepekatan ozon dalam udara persekitaran di Lembah Klang, Malaysia.

*Kata kunci:* nisbah penyerakan; pekali Hurst; ozon; keberterusan; penskalaan

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