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Fractal Analysis of Aerosol Mass-Size Distribution

Behzad Ghanbarian-Alavijeh and Abdolmajid Liaghat
Dept. Irrigation and Reclamation Eng., University of Tehran, Karaj, Iran (ghanbarian@ut.ac.ir, +98 261 2241119)

Fractal geometry has been widely used in description of complicated natural phenomena. The objectives of this study were (i) to apply fractal scaling for aerosols mass-size distribution, (ii) to study one and two-domain fractal analyses of aerosols mass-size distribution and compare these two approaches. A total of 20 of different elements were considered in which Mg, Al, Ca, Si, K, and Fe were the main compositions of atmospheric aerosols over the Mount Yulongxue Region, 15 km north of Lijiang in China, and account for more than 82% of a total of 20 elements. For one-domain fractal analysis, fractal dimension changed from 2.213 for Fe to 2.874 for Zn, and was significantly correlated with the total mass of aerosols of size less than or equal to 0.25 μm (R2=0.98). The goodness of fit (R2) was in the range of 0.698 for Cu to 0.996 for Ca. Elements such as Mg and Ca showed one-fractal domain completely, whereas other elements indicated more than one fractal domain. For two-domain fractal analysis, D1 and D2 covered the small and large aerosol sizes, respectively. D1 changed from 1.093 for Mn to 2.748 for Zn, and D2 changed from 2.386 for Fe to 2.935 for Zn. The goodness of fit for two-domain fractal analysis was greater than 0.96. For all samples except Ca, D1 was less than D2, and for 16 elements, dc which was the cutoff of the whole domain was between 0 and 1 μm.

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