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Study of Optical Properties on Fractal Aggregation Using the GMM Method by Different Cluster Parameters

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Anthropogenic pollutants or smoke from biomass burning contribute significantly to global particle aggregation emissions, yet their aggregate formation and resulting ensemble optical properties are poorly understood and parameterized in climate models. Particle aggregation refers to formation of clusters in a colloidal suspension. In clustering algorithms, many parameters, such as fractal dimension, number of monomers, radius of monomer, and refractive index real part and image part, will alter the geometries and characteristics of the fractal aggregation and change ensemble optical properties further. The cluster–cluster aggregation algorithm (CCA) is used to specify the geometries of soot and haze particles. In addition, the Generalized Multi-particle Mie (GMM) method is utilized to compute the Mie solution from a single particle to the multi particle case. This computer code for the calculation of the scattering by an aggregate of spheres in a fixed orientation and the experimental data have been made publicly available. This study for the model inputs of optical determination of the monomer radius, the number of monomers per cluster, and the fractal dimension is presented. The main aim in this study is to analyze and contrast several parameters of cluster aggregation aforementioned which demonstrate significant differences of optical properties using the GMM method finally.

Keywords: optical properties, fractal aggregation, GMM, CCA