Randomly oriented fractal-like clusters as a model of smoke particles: implementation into GRASP algorithm and tests on AERONET measurements

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The estimate of the impact of aerosols on Earth climate and atmospheric processes relies on accurate modeling of their interactions with radiation. Usually, the models of homogenous particles are used for these purposes. Meanwhile, number of measurements clearly show inhomogeneous structure of different aerosol species. In particular, smoke particles are complex structures of carbon-containing particles and, as shown in a large number of papers, can be modeled as fractal-like clusters (aggregates) of carbonaceous monomers [1-2]. The optical properties of such clusters are very different from the optical properties of homogeneous spherical particles or particles of other simple shapes which are usually used to retrieve smoke properties. The involvement of the fractal-like clusters in the analysis of smoke observations can provide additional information. In particular, it can reproduce the spectral dependence of the linear depolarization ratio, provide information about of the morphological properties and improve retrieval of the optical properties of complex smoke particles.

The prototyped database of the optical characteristics of fractal-like aggregates was created and implemented into GRASP algorithm [3]. It was used to invert AERONET measurements of biomass burning events including the cases when the depolarization ratio was measured with the LILAS lidar [4]. The results of the retrieval of the smoke properties using the fractal-like model and homogeneous particles model are compared. The effect of the cluster model on retrieved characteristics is discussed.

References

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