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Optical properties of aerosols in Titan's atmosphere: Large fluffy aggregates

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Abstract

In our previous paper [1] we performed a systematic analysis of the optical properties of tholin aggregates in Titan's atmosphere. We investigated aerosol particles formed by different aggregation mechanisms: Ballistic Particle–Cluster Aggregation (BPCA) and Diffusion Limited Aggregation (DLA) of spherical primary particles (monomers) were considered. The numerical code based on the superposition T-matrix method [2] has been used for numerical simulations of optical scattering. Due to computational restrictions of the code the biggest tested particle contained only 256 monomers. However, Tomasko, et al. [3] concluded from the observations that the number of monomers in the fluffy aggregates is roughly 3000 above an altitude of 80 km. This result has obtained based on extrapolation of scattering properties of small aggregates. We decided to extend our previous quantitative analysis to the range of larger aggregates and to verify previously obtained conclusions. To calculate the light scattering of such big nonspherical aggregates we used the DDSCAT code introduced in [4] and based on the Discrete Dipole Approximation (DDA) technique. The orientation averaged single-scattering phase function as well as the degree of linear polarization were calculated. Clusters with up to 2048 monomers were investigated in the optical wavelength range. We concluded that: a) aggregation mechanism play only a minor role, and it is sufficient to test only DLAs with different cluster parameters; b) the aggregate "fluffiness" can be qualitatively derived from polarization data; c) for a fixed number of monomers the scattering function of intensity is sensitive to the size parameter of the aggregates (e.g. to the effective cluster density); d) consequently characterization of aggregates by their number of monomers only is generally insufficient and more detail cluster descriptions are needed; e) even in the case when an aggregate is described more explicitly significant intensity variations can be observed over the whole range of scattering angles for "identical" model particles particularly for large fluffy aggregates and j) random generation averaging should be added to standard orientation averaging procedure.

References

[1] Skorov, Yu. et al. (2008) *PSS*, 56, 660-660.

[2] Mackowski, D. W., and Mishchenko, M. I., (1996) *J. Opt. Soc. Am. A*, 13, 2266-2278.

[3] Tomasko, M. et al. (2008) *PSS*, 56, 669-707.

[4] Draine, B.T., and Flatau, P.J. (1994) *J. Opt. Soc. Am. A*, 11, 1491-1499.