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Microphysical modeling of tholin haze in the Titan atmosphere

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A self-consistent 1D microphysical model of Titan tholin haze, involving settling, eddy mixing, charging and Brownian coagulation, has been developed for the purpose of explaining data retrieved by various instruments during the descent of Huygens probe. The model simulates both size distribution and structural distribution of tholin particles, i.e. the combined distribution in cluster size and size of components forming a cluster. Simultaneously, charge distribution is being simulated. Model results are compared with DISR observations in order to determine key processes of haze formation. Simulations show that charge acquired by tholin particles during electron and ion collisions, as well as by UV-stimulated photoemission, plays a key role in control of particle sizes. The break of density and particle sizes below 80 km observed by DISR spectral radiometer could be explained by the lack of mixing across a thin layer characterized by high static stability, where both vertical and horizontal air motion is suppressed. The observed flattening and shift of the linear polarization curve implies the increase of the effective monomer size, which may reflect the processes of capillary condensation of minor organic constituents and even nitrogen within the nanopores of fractal aggregates.

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