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Gas — Particle Transformation Simulations in Titan's Atmosphere

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The gas-particle transformation in Titan's atmosphere is simulated by means of a coupled radiation transfer – photochemistry – microphysics model in one dimension proceeding in a self-consistent scheme. The atmospheric model extends from the surface up to the lower thermosphere and incorporates: high resolution radiation transfer codes for solar and thermal radiation, complete neutral species photochemical evolution and a detailed Eulerian description of the microphysical haze particle growth. Laboratory experiments for the haze formation pathways and previous theoretical studies on this subject, suggested that the chemical structure of the aerosols include polymers of acetylene, nitriles, benzene, polyaromatics and copolymers of the previous. The latest results from the Huygens probe's ACP instrument, have provided some insight into the subject with a clear indication of nitrogen incorporation in the aerosol's structure and a homogeneous composition between altitudes of 20 and 130km which suggests a common chemical source for the haze monomers situated at a higher altitude region. We validate different chemical pathways for the particles formation by comparison of the derived chemical composition, temperature structure and geometric albedo with the observed ones. According to our results, the vertical production profile for the haze monomers resulting from the suggested pathways, have a strong dependence on the reactions chosen: pure hydrocarbon polymers are mainly produced in the lower stratosphere while nitrile and PAH polymers contribute mainly at high altitudes. The resulting haze structures for the nitrile co-polymers provide the best results so far.