

Experimental Evidence for the role of Ions in Atmospheric Particle Nucleation

J. O. P. Pedersen (1), H. Svensmark (1), N. D. Marsh (1), M. B. Enghoff (1), U. I. Uggerhøj (1,2)

(1) Center for Sun-Climate Research, Danish National Space Center, Copenhagen, Denmark,

(2) Also at Institute of Physics and Astronomy, University of Aarhus, Denmark.

(jopp@spacecenter.dk)

Recent studies have shown that the Earth's cloud cover is strongly correlated with the galactic cosmic ray flux. While this correlation is indicative of a possible physical connection, there is until now no confirmation that a physical mechanism exists. An experiment has therefore been set up in order to investigate the underlying microphysical processes. Since any physical mechanism linking cosmic rays to clouds and climate is currently speculative, there have been various suggestions of the role atmospheric ions may play. These involve any one of a number of processes from the nucleation of aerosols up to the collection processes of cloud droplets.

Experimental studies of aerosol nucleation in air, containing trace amounts of ozone, sulfur dioxide, and water vapor at concentrations relevant for the Earth's lower atmosphere are reported. The results suggest that the production rate of critical clusters is sensitive to ionization and indicate that ions act as a catalyst in the initial chemical reactions leading to a significant production rate of stable sulfuric acid clusters. It is suggested that this nucleation process is a fundamental source of new aerosols in the Earth's atmosphere, and could be the physical link between cosmic ray ionization, cloud cover, and climate previously reported.