"Cosmic Rays-Cloud-Climate Conudrum: Can lon-Aerosol Near-Cloud Mechanism Explain the Observed Correlation?" by Prof. S.N. Tripathi, IIT Kanpur

Abstract

Analysis of modern satellite cloud observations has shown that, from 1983 to 1994, the fraction of low-altitude clouds in the Earth's atmosphere varies in a markedly similar way to changes measured in cosmic rays. The strength of the sun, which has varied in the past, on many different timescales, modifies the intensity of cosmic rays arriving at Earth inversely. In the lower troposphere, the ions formed due to cosmic ray ionization, coagulate and form become electrically charged clusters of particles, and recent theory shows that these clusters can continue to grow sufficiently large to permit formation of cloud droplets. An alternative, or indeed complementary, explanation is based on the electrical effects on clouds resulting from these ions: if charged by ions, aerosol particles are more readily attracted to water drops than are neutral particles, which could cause the drops to freeze. Changes in cloud radiative properties resulting from these microphysical processes, would have an effect on the Earth's climate. This integrated proposal seeks, for the first time, to quantify how the cosmic ray changes couple through aerosol and cloud microphysics into radiative changes in cloud properties. A coupled ion-aerosol-cloud global electrical model with state-of-the-art treatment of aerosol particle-cloud droplet collision will be developed and employed for quantifying the effect of cosmic ray modulations on contact ice nucleation (one of the potential pathways through which charging can impact cloud microphysics).