

Measurements of the properties of ions generated in ambient air

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Gaseous ions are ubiquitous in the lower atmosphere, mainly produced by galactic cosmic rays. Other ion sources such as radioactive decay, lightning, power transmission lines and combustion can enhance the ion concentration locally. Atmospheric ions are essentially important in Atmospheric Electricity because they provide electrical conductivity to the atmosphere.

Ions are involved in aerosol formation. Ions may grow sufficiently to become stable aerosol particles. Ion growth requires the presence of atmospheric trace gas molecules which have the ability to attach to ions. The ion growth speed which increases with the concentration of such trace gas molecules must be sufficiently large to allow ion growth within the relatively short ion lifetime. However such conditions are met only in certain atmospheric conditions. Whether ion induced aerosol formation makes a significant contribution to the atmospheric aerosol budget therefore remains an open question.

In addition, artificially produced ions have been reported to reduce the levels of particulates, air-borne microbes, odors and volatile organic compounds in indoor air. Because of these effects of ions, commercial electrical appliances with ionizers (mainly corona discharge type) are widely used in indoor environment. However, the detailed mechanisms by which the ions contribute to improving indoor air quality are not clearly understood.

To access the role of ions in atmospheric environment in more detail, obtaining information on ion properties such as composition and mobility (diameter) under variety conditions is important. In this paper, we present experimental results of measuring ions formed by corona discharge in ambient air using an ion mobility/mass spectrometer (IMS/MS).