

The verification experiment for aerosol nucleation focused on a kind of secondary cosmic rays

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It is considered that the solar activity may affect the global climate, but the correlation mechanism is still not understood. One of the possible mechanisms for the correlation is the cloud formation by the galactic cosmic rays, which are modulated by the variation of solar magnetic activity. This relation was clearly indicated by the good correlation observed for the galactic cosmic-ray intensity and the global low-cloud amount. This hypothesis includes the ion-induced nucleation model, in which new particles in the atmosphere are created efficiently through atmospheric ions produced by cosmic rays, and finally these particles grow up to the size of cloud condensation nuclei. In this study, a laboratory experiment for verification of the hypothesis has been conducted with a reaction chamber. A flow of clean air with water vapor, ozone and sulfuric dioxide was introduced to a metallic chamber, where we irradiated UV light for solar irradiance and accelerator beam for cosmic rays. The beam of the heavy ion accelerator HIMAC at National Institute of Radiological Sciences was used in the present experiment.

In this presentation, I will report the results of the proton and nitrogen ion irradiation experiments. These high-energy ions have different ionization loss. The ionization loss is an index representing the ability to ionize the air molecules, that is, a parameter that contributes to the atmospheric ion generation. Furthermore, the simulation shows that the proton and the neutron contained in the secondary cosmic rays, keep the variation of solar activity even on the ground surface. Neutrons in secondary cosmic rays may generate energetic heavy ions (nucleus) through nuclear collisions with atmospheric atoms. Then, these energetic ions produce ionization ions through electronic energy loss process. Since it is considered that the aerosol particle generation would be increased according to the amount of ions produced in the energy loss, the experiment was carried out by using these heavy ions.

We will present the experimental result and discuss the difference of aerosol nucleation efficiency between different kinds of secondary cosmic rays.