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Laboratory experiment with various radiation sources for verification of cloud condensation nucleation by 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 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, water vapor, ozone and sulfuric dioxide was introduced to a metallic chamber, where we irradiated UV light for solar irradiance and beta-rays or 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.

As a result, ions produced by the ionizing radiation and increased particle density were observed for beta rays.

Some results with the accelerator beam are the following.

Ion density in the chamber increased as the beam intensity and particle density increased with ion density.

Particle size distribution was measured and the peak particle size and the particle density became to larger with time after start irradiation, but the density stopped to increase or decreased after irradiation stopped although the peak size continued to increase.

It is shown that our system is ready for more detailed measurements.

Keywords: cosmic rays, cloud, cosmoclimatology, cloud condensation nuclei