

Formation of cloud nuclei by atmospheric cosmic rays

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Many observations have revealed that the global climate change correlates to the change in the solar activity. One example would be the relation between the Little Ice Age in 16th–17th centuries and the Maunder minimum of the solar activity. However, the mechanism of the correlation is not clear though several ideas have been proposed. The galactic cosmic rays and cloud nucleation hypothesis is one of them. The galactic cosmic rays, which are produced outside the heliosphere and propagate to the earth, produce nuclear reactions and make air showers when entering the atmosphere of the earth. The secondary cosmic ray particles in air showers then lose their energy by ionization interaction in the atmosphere to produce ions. These ions react through attachment to the molecules and clusters to create their ions, followed by formation of aerosol particles with larger size. Thus growing particles become condensed cloud nuclei and large-scale clouds, which affect the global climate. Increase in amount of low-level clouds contributes to lower the surface temperature and cool the climate. There began the attempts to clarify the mechanism of these phenomena not only in the natural sites but also by laboratory experiments. In this talk, the proposed processes of cloud nucleation initiated by atmospheric ions due to galactic cosmic rays will be reviewed and current status of several laboratory experiments will be introduced.