Modification of Individual Sea Salt Particles

Kazuhiko Miura and Sayako Ueda

Department of Physics, Tokyo University of Science, 162-8601, Japan

Modification of sea salt particles by the chemical reaction with acid materials changes the optical properties and the humidity properties, especially cloud condensation nuclei (CCN) ability of sea salt. Effects of sea salt on sulfur cycle are accelerating not only the CCN ability, but also the removal of sulfur. To clear the effects of sea salt on sulfur cycle, we have studied on the modification of sea salt particles.

Aerosol particles were collected directly on a carbon-covered nitrocellulose grid by using an impactor for 10 min on board the research vessel. The electron micrograph was obtained using a scanning electron microscope. The elemental composition in individual particles larger than 0.1 μm in radius was analyzed with an energy dispersive X-ray spectrometer. Individual particles, which contained Na greater than 15%, were regarded as sea salt particles, which were classified into three groups according to the degree of the modification: strongly modified (Cl/Na < 0.5), weakly modified (0.5 < Cl/Na < 1) and non modified (Cl/Na > 1).

Main results are as follows: (1) Degree of modification of sea salt was strong under the following conditions: high nss-S concentration, high radon concentration, small size, weak wind speed, and high relative humidity. (2) Horizontal distribution of the modification showed that modified areas by maritime source spread over the north-central Pacific and southern ocean. (3) Vertical profile showed that sea salt particles collected by the kytoon were more modified than those on the deck because the degree of modification depends on the suspending period of sea salts.

Size and composition of atmospheric aerosol particles can be altered by in-cloud process with adsorption and drying of activated aerosol particles as CCN. To elucidate differences of aerosol particles before and after in-cloud process, we measured particle concentration and collected particles along the pass of Mt. Fuji, Japan (3776 m a.s.l.) four times during July and August 2011. The results of EDX analysis showed that most of particles (0.5–2 μm diameter) were sea salt, containing Na with some S and Cl both for samples above and below the clouds. The results suggest that sulfur components were absorbed or adsorbed onto sea salt particles after complete substitution of Cl.