CCN size distribution measurement at Gosan, Jeju-island, Korea

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As described by the Köhler theory, cloud condensation nucleus (CCN) activity of an aerosol particle depends on its size and chemical composition. Therefore, size distributions of CCN activity (CCN/CN ratios) have been measured at laboratory. Nevertheless, these kinds of measurements have not been conducted for atmospheric aerosols.

The size distributions of CCN and CCN activity in polluted air exported from the Asian continental region are investigated in this study. The observation was conducted at Gosan, Jeju Island (Korea), during 18 March 2005 – 5 April 2005 as a part of the Atmospheric Brown Clouds (ABC) campaign. During the observation, number size distributions of aerosol particles and CCN were measured. Inorganic ions were measured by a particle-into-liquid sampler combined with ion chromatography (PILS-IC), water soluble organic carbon (WSOC) was measured using a PILS-WSOC, and the concentrations of organic carbon (OC) and elemental carbon (EC) were determined by a semi-continuous ECOC analyzer.

The CCN activation diameter was determined from the size distribution of CCN/CN ratio. The CCN activation diameter is defined as the minimum diameter required for an aerosol to act as a CCN at a certain supersaturation. The observed CCN activation diameters correlated well with the water-soluble fractions of aerosol compositions. This result indicates that the variation of the CCN activity is mainly controlled by the water-soluble fraction, rather than the change of water-soluble components. The observed activation diameters were compared with the predicted activation diameters. The predicted activation diameters were calculated from simultaneously measured chemical compositions by using the Köhler theory. The measured and predicted CCN activation diameter showed similar temporal variation, although the predicted activation diameter was always larger than the observation. There are two possible explanations for the causes of this discrepancy: one is the size dependence of aerosol chemical compositions, and the other is the decrease in the surface tension by water-soluble organic components.