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Cloud condensation nuclei activity at Jeju Island, Korea in spring 2005

M. Kuwata[1], Y. Kondo[1], Y. Miyazaki[1,*], Y. Komazaki[1], J. H. Kim[2], S. S. Yum[2], H. Tanimoto[3], and H. Matsueda[4]

[1]Research Center for Advanced Science and Technology, the University of Tokyo, Tokyo, Japan

[2]Department of Atmospheric Science, Yonsei University, Seoul, Korea

[3]Atmospheric Environmental Division, National Institute for Environmental Studies, Tsukuba, Japan

[4]Geochemical Research Department, Meteorological Research Institute, Tsukuba, Japan

[*]now at: Institute of Low Temperature Science, Hokkaido University, Japan

Abstract. We measured the number concentrations of cloud condensation nuclei (CCN) and the size distributions of CCN/CN (CN: condensation nuclei) ratios at supersaturations (*SS*s) of 0.097, 0.27, 0.58, and 0.97% at Jeju Island, Korea during March-April 2005. We made simultaneous measurements of aerosol inorganic ions, water-soluble organic carbon (WSOC), organic carbon (OC), and elemental carbon (EC) in $PM_{2.5}$. The CCN/CN ratios increased with increasing particle diameter, and the diameter at CCN/CN=0.5 was defined as D_{50}. D_{50} represents the activation dry diameter of atmospheric particles. The average D_{50} at SS=0.097% and 0.97% was 136±17 nm and 31±3 nm, respectively. The temporal variation of D_{50} at SS=0.097% was correlated with the mass fraction of water-soluble components (inorganic ions + WSOC), indicating that the temporal variation of CCN activity was mainly controlled by changes in the water-soluble components fraction. The critical dry diameter (D_{crit}), which is the threshold dry diameter for CCN activation, was calculated from the observed aerosol chemical compositions by Köhler theory for comparison with D_{50}. The D_{50} at SS=0.097% was correlated (r^2=0.48) with calculated D_{crit}, although D_{crit} was larger than D_{50} by 20–29% on average. The systematic difference between D_{50} and D_{crit} could be caused by the size dependence of the aerosol chemical compositions or surface tension lowering caused by the mixing of water-soluble organic compounds. This difference corresponds to a 27±14% uncertainty in the CCN number concentration estimated from the observed particle number size distribution.

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