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Closure study on concentration of cloud condensation nuclei at the summit of Mt. Fuji

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1. Introduction

According to the report on radiative forcing of IPCC (2007), the impact of aerosol on cloud and the corresponding feedbacks of cloud are currently considered as the largest uncertainty in climate system. Therefore, it is necessary to measure cloud condensation nuclei (CCN) in various areas. In recent studies, the parameterization of contributing to CCN activity, such size and chemical composition or hygroscopicity of aerosol particles, is often carried out for applying Global Climate Model. In this study, we measured CCN number concentration at the summit of Mt. Fuji and carried out CCN closure study. CCN closure study is referred to compare calculation of CCN number concentration (Nccn_cal) from these parameters with direct measurement (Nccn) by k-Kohler theory (Petters and Kreidenweis, 2007) to investigate most contributing to CCN activity. Ultimately, our purpose is to find parameters or models which can estimate CCN concentration without actually measuring that.

The summit of Mt. Fuji (3776m a.s.l.) is almost located in free troposphere and affected little local pollution. Therefore it is expected to be measured background atmosphere and long-range transport of pollutant from the Continent. The example of CCN observation in free troposphere is a few, so CCN observation at the summit of Mt. Fuji is invaluable.

2. Method

This observation is done at the Mt. Fuji Weather Station from 14 July 2011 to 25 Aug. 2011. We used SMPS (Scanning Mobility Particle Sizer ; TSI Inc., Model 3936N75), OPC (Optical Particle Counter ; RION Inc., KR12A) and CCNC (Cloud Condensation Nuclei Counter ; DMT Inc., CCN-100) as measuring instrument. We continuously measured dry particle number concentration and size distribution through diffusion dryer by SMPS and OPC, and CCN concentration with six different supersaturation (SS) conditions (SS=0.10, 0.19, 0.27, 0.36, 0.44, 0.52%) by CCNC.

3. Results and Discussion

Nccn_cal was calculated in two ways and compared with Nccn measured by CCNC. One method is to utilize averaged particle size distribution and real-time measurement of hygroscopicity (k) or chemical composition (Method 1), the other is to utilize real-time particle size distribution and averaged k (0.13 at 0.1% and 0.28 at 0.52% ; Method 2). As a result, the relative deviation (=|Nccn_cal-Nccn|/Nccn) between Nccn and Nccn_cal in Method1 was larger than that in Method2. Therefore, it can be seen that the particle size distribution affect CCN activity more than particle hygroscopicity at the summit of Mt. Fuji.

During this measurement period 2011, CCN concentration when the summit of Mt. Fuji was located in free troposphere (FT) is about twice larger than that in the time of others. This result is opposite to that of observations at Jungefraujoch (Juranyi et al., 2010). Also, geometric mean diameter in FT was larger, and continental air exceeded in this time. Consequently, particles were grown by long-range transport from the Continent, and CCN concentration increased because CCN activity is more affected by the particle size distribution than the particle chemical composition.

We will consider whether CCN concentration at the summit of Mt. Fuji is estimated as well as other regions by k-Kohler theory and how much contribution to CCN concentration particle chemical composition has even though the particle size distribution mainly affects CCN activity.

References

IPCC, Cambridge University Press, Cambridge, 153?154 and 171?172, 2007.
Petters, M. D. and Kreidenweis, Atmos. Chem. Phys., 7, 1961-1971, 2007
Juranyi,Z. et al., Atmos. Chem. Phys., 10, 7891-7906, 2010.

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Keywords: cloud condensation nuclei, CCN, Mt. Fuji, free troposphere, closure study, k-Kohler theory