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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cloud condensation nuclei activity at Jeju Island, Korea in spring 2005" *by* M. Kuwata et al.

M. Kuwata et al.

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We thank the referee for the useful comments and positive remarks. Our responses to the comments are described follows.

Comment:P15806 L9: Inclusion of standard deviation with the averages would be useful here.

Reply: We add the values to the revised manuscript.

Comment: P15806 L20: A line commenting on how this study compares to similar CCN studies elsewhere in the world might be useful for reference and to put this work in perspective.

Reply: We thank the reviewer for acknowledging the importance of the study. However, it may be too bold to make a general conclusion from one case study. In addition, we

want the abstract to be as concise as possible. Thus, we would not like to add a general comment here.

Comment: P15807 L25-29: This information seems better suited for the abstract?

Reply: This sentence describes the importance of CCN studies in the Asian region. We would like the abstract to contain only the essence of the study; thus, we feel that the information is too much to be included in the abstract.

Comment: P15808 L22: Kelvin effect is due to particle size which is a much more important component of the first term than is surface tension. This sentence implies that the Kelvin effect is a surface tension effect which it is not.

Reply: We agree that the Kelvin effect is more sensitive to diameter than surface tension. However, the cause of the Kelvin effect is the Laplace pressure, originating from the existence of surface tension. Thus, we can refer to surface tension as the origin of the Kelvin effect.

Comment: P15809 L15: Was RH $<$5% measured or estimated? Was it steady over the experiments even as the silica gel (was it silica gel?) became saturated with water vapor? From the reviewers experience, flowrate would need to be very low and silica gel constantly regenerated for two TSI 3062s to get RH $<$5%. This issue of metastable solution droplets vs. dry particles could have a large effect on CCN activity and other calculations such as particle mass and density. Perhaps the authors could include some commentary regarding this point.

Reply: We checked the value of RH at our laboratory in Tokyo using humid air generated by an atomizer. The humid air was passed through the diffusion dryers, and we measured the RH at the downstream of the dryers. The measured RH was less than 5% at the time. However, the RH sensor was not installed in the observation system. Silica gel was replaced periodically during the observations (1 time in 10 days). We checked D50 just before and after the changing of the silica gel, and no signifi-

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cant/systematic differences were observed. This indicates the validity of our particle drying method. These points are described clearly in the revised manuscript.

Comment: P15812 L21-22: The comment that ;The slower increase rate indicates the coexistence of different types of aerosol particles” is not necessarily true. Even laboratory studies of single-component inorganic and organic compounds show this rate change. While composition may be part of it, simple DMA size-distribution broadening is the primary reason for this phenomenon.

Reply: In the case of (NH4)2SO4 (activated at 125 nm), the width of the activation curve was about 30 nm. D50 on March 28 (22:00-22:30) was 156 nm (25% larger than that of (NH4)2SO4). If the slower increasing rate were due solely to the broader window in the DMA transfer function, it should be activated in 38 nm. However, the spectrum is much broader than this value (at least 70 nm was required for the activation). Thus, we still regard that the slower increasing as mainly due to the mixing state of the particles. These points are clearly described in the revised manuscript.

Comment: P15813 L18: How do these counts compare to other CCN studies?

Reply: Yum et al. (2007) performed the comparison of CCN number concentration during the observation period and other observations. Thus, we did not describe this point in detail in the manuscript.

Comment: P15816 L5-7: The fact that experimental activations are similar to ammonium sulfate does not, by itself, indicate the particles were ammonium sulfate. It merely suggests that they behave similar to ammonium sulfate. Many large and complex mixtures of organics and inorganics existing in metastable liquid states could behave similar to ammonium sulfate even when containing no ammonium sulfate.

Reply: As "B" of most organic compounds are much smaller than that of inorganic compounds (ammonium sulfate, ammonium nitrate), it is not likely that a significant portion of organic compounds were included in the particles at the time. In addition,

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pure ammonium nitrate particles do not likely exist under the tropospheric conditions. Thus, we consider particles at the time were mainly composed of ammonium sulfate, although we cannot rule out the possibility that a small amount of organic compounds and ammonium nitrate were included in the particle. We modify the statement in the revised manuscript.

Comment: P15822 L3: Define "nss" before using it for the first time.

Reply: We define "nss" as "non-sea salt (nss)" in the revised manuscript.

Comment: P15826 L2-3: Again, it suggests they behave as ammonium sulfate but not necessarily that they ARE ammonium sulfate.

Reply: See the reply to the previous comment.

Comment: Figure 3: The caption indicates standard deviation is shown when it is not.

Reply: The gray area shows the standard deviation. This point is clarified in the revised manuscript.

Reference

Yum S. S., Roberts, G., Kim, J. H., Song, K., and Kim, D.: Submicron aerosol size distributions and cloud condensation nuclei concentrations measured at Gosan, Korea, during the Atmospheric Brown Clouds–East Asian Regional Experiment 2005, J. Geophys. Res., 112, D22S32, doi:10.1029/2006JD008212, 2007.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 15805, 2007.

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Interactive Comment