

Variation of CCN activity during two types of new particle formation events in the North China Plain

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Atmospheric new particle formation (NPF) is frequently observed in a variety of environments around the world (Kulmala *et al.*, 2004), which is found to be an important source of cloud condensation nuclei (CCN). However, the contribution of NPF on the CCN budget spans a large uncertainty range (Kerminen *et al.*, 2012).

To study the variation of particle CCN activity during NPF events, size-resolved activation ratio (AR), particle hygroscopic growth factor, particle number size distribution, as well as chemical composition were measured at a rural station in the North China Plain. Size-resolved AR was measured with a DMA-CCN counter at 5 supersaturations from 0.07% to 0.80% with time resolution of 1 h.

During 20-day measurement, 5 NPF events with clear subsequent growth were observed. These events can be classified as two types in which sulfate and organic matters (OM) is respectively responsible for the growth of the newly formed particles. Large difference is found between the size-resolved AR during the two types of NPF events, as shown in fig. 1. In the sulfate-dominant case, due to the high hygroscopicity of sulfate, the size-resolved AR shows a much lower D₅₀ than the campaign average; while in the OM-dominant case, a higher D₅₀ is found. CCN number concentration (N_{CCN}) during the NPF events was calculated based on the particle number size distribution measured in parallel. Due to the high CCN activity in sulfate-dominant case, using the campaign average size-resolved AR causes an underestimation of 25% in N_{CCN} for supersaturation of 0.80%.

Therefore, when evaluating the enhancement of N_{CCN} during NPF events in the NCP, both the evolution of particle number size distribution and the variation of particle CCN activity should be taken into account. Using an average size-resolved AR might induce large biases in the predicted N_{CCN} during NPF events.

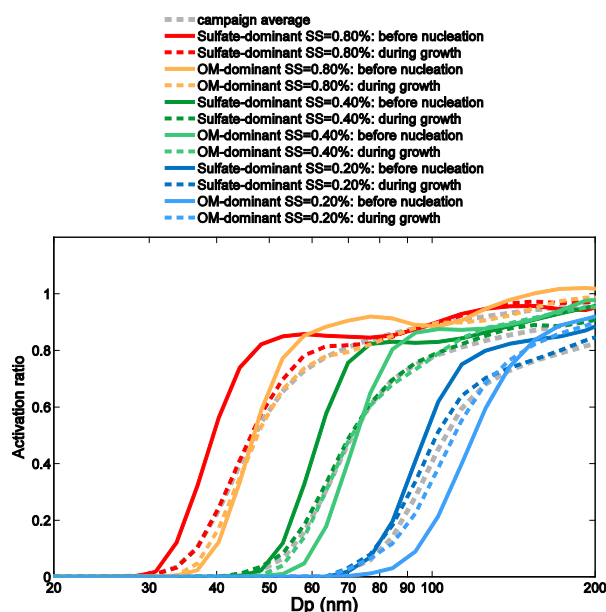


Figure 1. Size-resolved activation ratio before nucleation and during the growth in sulfate-dominant case and OM-dominant case.

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