4.152 Variabilities in CCN concentration and CCN activity related to SO2 emission reduction and new particle formation in Qingdao.

Early Career Scientist

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Abstract:

We measured concentrations of cloud condensation nuclei (CCN) and CCN activity at a suburb site of Qingdao in the North China during two heating periods from 6 November to 6 December 2013 and from 9 January to 24 February 2017, respectively. Concentrations of CN during the first heating period were $3.3\pm1.4\times10^{4}$ cm^{-3} (mean ± standard deviation), While in the second heating period, CCN concentrations were $1.7\pm0.8\times10^{4}cm^{-3}$. The concentrations of CN decreased by about 48% from the first heating period to the second heating period because of the lower SO_2concentration induced by the emission reduction.In first heating period, the peak particle diameter of aerosol particles was 86.6 nm, While in the second heating period, it was 138.9 nm. We speculate that this is the reason why haze events have occurred frequently in recent years. The adoption of sulfur dioxide emission reduction measures may affect the primary particulate matter emissions, particle size and chemical composition from the source; therefore, it will produce a climatic effect through the direct radiative forcing of a particulate matter and activation of the ability to cloud condensation nuclei. At present, the ammonia desulfurization and other wet desulfurization technologies in industrial desulfurization methods reduce SO_2, but liquid ammonia in ammonia desulfurization is volatile, part of the water vapor is taken away in other wet desulfurization processes, and sulfate is a hygroscopic property. The inorganic particulates increase the MMD of sulfur dioxide plumes and increase the peak aerosol particle size. According to the ternary nucleation mechanism of new particles, NH_3 and SO_2 are important precursors for the formation of new particles, and new particles are an important source of CCN. The growth of new particles will also increase the peak particle size of atmospheric aerosols.
Keywords: Cloud condensation nuclei; New particles formation; Particle number concentration