Fine and ultra fine particle in Beijing:Seasonal variation, secondary composition and regional pollution

Fine and ultra fine particle in Beijing: Seasonal variation, secondary composition and regional pollution

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Abstract

Beijing is a mega-city with 15 million populations. It is semi-humid climate with four distinctive seasons: short spring and autumn, and long summer and winter. In summer it is hot and humid with precipitation concentrated in July and August, but in winter it is cold and dry. Along with urbanization and rapid increase of vehicle number and energy consumption, the features of air pollution in Beijing are changing from typical coal-combustion pollution to multi-pollutions. A combination of primary emissions of pollutants and secondary photochemical pollution possibly occurred, leading to unique characteristics of air pollution in Beijing. The seasonal changes in both primary emissions of pollutants and climate features, like heating supply in winter, dust storm in spring, active photochemistry process in summer, and biomass burning more in late summer and fall, cause obvious seasonal variations of air pollution in Beijing. It is observed that seasonal variations of ambient temperature and relative humidity could affect photochemical activities in the atmosphere, leading to change the percentage of primary and secondary pollutants in the atmosphere.

Ambient SO_2 level decreases under pollution control by using low sulfur containing coal and clean energy, and SO_2 achieved attainment in 2004 for the first time. But ambient NOx level increase with the growth of vehicle emissions. PM2.5 has become the major fraction of PM_{10} ranged from 40% to 70%. The annual average concentrations of $PM_{2.5}$ in Beijing were reported to be above 100 μg m^{-3}, with organic material as the most abundant species with the fraction between 1/3 to 1/2.

Beijing has not solved primary air pollution caused by SO_2, NO and PM_{10}, fine particle and O_3 as secondary pollution has been severe, results in regional air pollution like regional haze episodes and elevated oxidant concentrations in the Beijing areas.