4.230 A case study of spring haze in Beijing: characteristics, formation and regional transportation.

Presenting Author:

Fengkui Duan, School of Environment, State Environmental Protection Key Laboratory of Sources and Control of Air Pollution Complex, Tsinghua University, Beijing 100084, China, duanfk@tsinghua.edu.cn

Co-Authors:

Hui Li, School of Environment, State Environmental Protection Key Laboratory of Sources and Control of Air Pollution Complex, Tsinghua University, Beijing 100084, China

Yongliang Ma, School of Environment, State Environmental Protection Key Laboratory of Sources and Control of Air Pollution Complex, Tsinghua University, Beijing 100084, China

Kebin He, School of Environment, State Environmental Protection Key Laboratory of Sources and Control of Air Pollution Complex, Tsinghua University, Beijing 100084, China

Tao Ma, School of Environment, State Environmental Protection Key Laboratory of Sources and Control of Air Pollution Complex, Tsinghua University, Beijing 100084, China

Shuo Yang, School of Environment, State Environmental Protection Key Laboratory of Sources and Control of Air Pollution Complex, Tsinghua University, Beijing 100084, China

Tao Huang, Kimoto Electric Co. Ltd, Funahashi-Cho, Tennouji-Ku Osaka 543-0024, Japan

Takashi Kimoto, Kimoto Electric Co. Ltd, Funahashi-Cho, Tennouji-Ku Osaka 543-0024, Japan

Abstract:

Continuous haze monitoring was conducted from 3 April to 8 April, 2017 in Beijing, China to develop a more detailed understanding of spring haze characteristics. The $PM_{2.5}$ concentration ranged from 6.3 to 164.6 μg m^{-3} with an average of 63.8 μg m^{-3}. Nitrate was the most abundant species, accounting for 36.4% of $PM_{2.5}$, followed by organic carbon (21.5%), NH_4^+ (19.3%), SO_4^{2-} (18.8%), and elemental carbon (4.1%), indicating the key role of nitrate in this haze event. Species contribution varied based on the phase of the haze event. For example, sulfate concentration was high during the haze formation phase, nitrate was high during the haze, and secondary organic carbon (SOC) had the highest contribution during the scavenging phase. The secondary transition of sulfate was influenced by SO_2, followed by relative humidity (RH) and O_x (O_3+NO_2). Nitrate formation occurred in two stages: through NO_2 oxidation, which was vulnerable to O_x; and by the partitioning of N (+5) which was susceptible to RH and temperature. SOC tended to form when O_x and RH were balanced. According to hourly species behavior, sulfate and nitrate were enriched during haze formation when the mixed layer height decreased. However, SOC accumulated prior to the haze event and during formation, which demonstrated the strong contribution of secondary inorganic aerosols, and the limiting contribution of SOC to this haze case. Investigating backward trajectories showed that high speed northwestern air masses following a straight path corresponded the clear air periods, while southwesterly air masses which traversed heavily polluted regions brought abundant pollutants to Beijing and stimulated the occurrence of haze pollution. Results indicate that the control of NO_2 needs to be addressed to ameliorate spring haze. Finally, the correlation between air mass trajectories and pollution conditions in Beijing reinforce the necessity of inter-region cooperation and control.