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The Pollution Pattern of Ambient PM2.5 in Beijing based on one-year Measurement of PM2.5 and its Chemical Compositions

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Ambient PM2.5 pollution in China has caused concern worldwide due to its frequent outbreaks and unprecedentedly high concentrations. Beijing has experienced severe hazes for many years. Haze events occur in Beijing in periodic cycles of 4–7 days over four seasons, the necessity of episode-based analysis, rather than roughly averaging the whole data set, should be highlighted. Moreover, the evolution patterns of each pollution episode vary is characterized by a typical temperate continental monsoon climate with four distinctive seasons.
In this study, the typical evolution patterns of PM2.5 in each season were illustrated by episode-based analysis. A novel method was developed to elucidate the driving chemical species, the largest contributor to the incremental PM2.5 (ΔPM2.5). The results indicated that driving species throughout the year are nitrate-driven spring, sulfate-driven summer, nitrate-driven early fall, and organic matters (OM)-driven late fall and winter. It suggested that primary organic particles or volatile organic compounds emissions were dominant in the heating season due to residential heating, while NO_x and SO_2 emissions dominated in the other seasons. Besides, nitrate formation seemed more significant than sulfate formation during severe pollution episodes. It was also found that the pollution formation mechanism in the winter showed some unique features in comparison with the other seasons: aqueous reactions were more important in winter, while multiple pathways coexisted in the other seasons. This study provided a new perspective to understand the characteristics and mechanisms of aerosol pollution in Beijing. However, more accurate measurements are necessary for effective air pollution control that depends on the seasonal variation of fine particle formation in Beijing and the surrounding areas.