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Atmospheric processing of dust particles in a polluted urban area of northwestern China

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Dust particles strongly absorb solar radiation and thus have climate impacts on the Earth. In the polluted urban area, the interaction between dust particles and anthropogenic pollutants need to be studied to clarify their effects on environment and climate. A single particle aerosol mass spectrometer (SPAMS) was used to investigate both the atmospheric processing of dust particles during a non-duststorm period in the urban area of Xi'an (26/09/2013 to 13/10/2013). The detailed chemical composition of ambient dust particles was measured using single particle mass spectrometry. Moreover, the chemical composition profiles of background dust, road and construction dust, biomass burning ash, and loess dust were also analyzed using SPAMS as comparisons of ambient urban dust. During the non-duststorm period, the single particle chemical composition of urban dust particles was well correlated with these different kinds of particles and underwent extensive aging due to the uptake of acid gases, such as HCl, HNO_3, H2SO4, and organic acids. Dust particles (31.0% by number) contained 76.3% of the nitrate and 35.0% of the sulfate (molar ratios) during the observation. This study provides detailed information concerning the atmospheric processing of ambient dust in a polluted, mid-latitude urban region, and the results are useful for understanding the dust particle behaviors, impacts, and sources. Importantly, the control of ambient dust particles would affect the budgets of sulfur and nitrogen in aerosols from Northern China.