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The aerosol optical properties and $PM_{2.5}$ components over the world's largest industrial zone in Tangshan, North China

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Abstract

To achieve an in-depth understanding of the aerosol optical properties in the highly-industrial region of Tangshan, we provided systematic aerosol optical properties analysis in this largest industrial zone for the first time. The aerosol optical datasets (2013.05-2015.04) and chemical component data of $PM_{2.5}$ (2014-2015) obtained from the Tangshan site of the campaign on atmospheric aerosol research (CARE-China) network were analyzed. The results showed that the Tangshan region was seriously affected by fine-mode industrial aerosols all year, which would promote the accumulation of pollutants and influence the atmospheric circulation through changing the vertical temperature gradient. The annual average aerosol optical depth (AOD) and Ångström exponent (α) were 0.80±0.26 and 1.05±0.10, respectively. The aerosol optical properties revealed significant seasonal characteristics. The maximum seasonal average AOD (1.03±0.62) and α (1.12±0.19) accompanied the highest seasonal secondary inorganic aerosol concentrations (SIA: $SO_4^{2-}, NO_3^-, NH_4^+$), 53.33 μg/m^3, occurred in summer, and this phenomenon was attributed to the photochemical reactions favored by the high temperature and humidity. During the spring, frequent dust events led to the maximum Ca^{2+} concentration of 6.57 μg/m^3 and the lowest