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Winter Haze in Beijing driven by fast Photochemical Smog Reactions

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Heavy haze conditions were frequently presented in the air-sheds of Beijing and surrounding areas, especially during winter time. To explore the trace gas oxidation and the subsequent formation of aerosols, comprehensive field campaigns were performed at both urban and regional sites in winter Beijing. Serious haze pollution processes were often observed with the fast increase of inorganic salt (especially nitrate) and these pollutions were always associated with enhanced humidity and the concentrations of PAN which is normally a marker of gas phase oxidations from NO_x and VOCs. Moreover, based on the direct measurements of OH, NO_2, VOCs, N_2O_5, particle concentrations/distributions/chemical compositions, and meteorological parameters, the gas phase oxidation rates that leads to the formation of nitrate and secondary organic aerosols were estimated. These determined formation rates were clearly enhanced by several folds during pollution episodes compared to that of the clean air masses. Analysis result showed that the gas phase formation potential of nitrate and secondary organic aerosols were capable to explain the observed concentrations of nitrate and SOA and associated with fast ozone production rates. Controlling factors of the gas phase formation potential of secondary aerosols and ozone are discussed in the framework of the empirical kinetic modeling approach.