Fast sulfate production in Beijing haze associated with elevated HONO and N_2O

*Xinlei Ge[1], Junfeng Wang[1]

1. Nanjing University of Information Science and Technology

Severe events of wintertime particulate air pollution in Beijing (“winter haze”) are associated with high relative humidity (RH) and fast production of particulate sulfate from the oxidation of sulfur dioxide (SO_2) emitted by coal combustion. There has been considerable debate regarding the mechanism for SO_2 oxidation. Here we show from field observations that rapid conversion of SO_2 to sulfate in Beijing haze is associated with increases in nitrous oxide (N_2O) and nitrous acid (HONO), and decrease in nitrogen dioxide (NO_2). Sulfate shifts to larger particle sizes, indicative of fog/cloud processing. Fog/cloud readily forms under winter haze conditions, leading to high liquid water contents (LWCs) with high pH (> 5.5) from elevated ammonia. Such conditions enable fast aqueous-phase oxidation of SO_2 by NO_2, producing HONO which can in turn oxidize SO_2 to yield N_2O.This mechanism could provide a general explanation for particulate sulfate formation in winter haze.

Keywords: sulfate, PM2.5, aqueous phase

