



Supplement of

Heterogeneous chemistry: a mechanism missing in current models to explain secondary inorganic aerosol formation during the January 2013 haze episode in North China

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Supplementary Information

Title: Enhancement of sulfate and nitrate by heterogeneous chemistry during the January 2013 haze episode in North China

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The Data for Model Performance Evaluation

National Climate Data Center (NCDC) contains measurement data of major meteorological parameters such as wind and temperature every 1 or 3 h. These data can be accessible via <ftp://ftp.ncdc.noaa.gov/pub/data/noaa/>. To evaluate the meteorological fields produced by Weather Research and Forecasting (WRF), five meteorological variables that influence the accuracy of air quality modeling are selected: temperature at 2 m (T2), RH at 2 m (RH2), wind speed at 10 m (WS10), wind direction at 10 m (WD10), and daily mean precipitation (Precip), as in previous studies (Zhang et al., 2006, 2011; Wang et al., 2010; Liu et al., 2010). T2 and RH2 are selected for evaluation because they have significant effects on rate constants of atmospheric chemistry. The accuracy of the modeled WS10 and WD10 are very important because the horizontal transport of pollutants is sensitive to wind and overestimated WS10 can cause underestimates in the concentrations of air pollutants in the source regions (Liu et al., 2010). The Precip is evaluated because it is the driving force for wet deposition of air pollutants and the precipitating clouds can enhance SO_4^{2-} formation via the aqueous-phase chemistry.

China National Environmental Monitoring Center (CNEMC) published hourly concentrations of SO_2 , NO_2 , CO, O_3 , $\text{PM}_{2.5}$, and PM_{10} from 496 national monitoring stations located in 74 major cities (about 20% of the total cities in China) since January 2013. The number of cities reporting these data has increased to 190 since January 2014. These data can be accessible via <http://113.108.142.147:20035/emcpublish/>. The O_3 data in the January 2013 has some mistakes because the values in one day are always the same. In this study, all the pollutants except O_3 are used to evaluate the CMAQ performance.

Tsinghua University site (THU) dataset contains hourly concentrations of major particulate species (SO_4^{2-} , NO_3^- , NH_4^+ , EC, and OC) measured during January 2013. The site ($40^\circ 0' 17''$ N, $116^\circ 19' 34''$ E) is located in the campus of Tsinghua

University, northwest of urban Beijing. The PM_{2.5} is measured by the PM-712 Monitor (Kimoto Electric Co., Ltd., 2012). Sulfate and nitrate in PM_{2.5} are measured using ACSA-08 Monitor (Kimoto et al., 2013). Ammonium is predicted on the basis of sulfate and nitrate concentrations. EC and OC are measured using the Sunset Model 4 semi-continuous OC/EC analyzer (Beaverton, Oregon, USA) with the NIOSH (National Institute for Occupational Safety and Health) temperature protocol.

Reference

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