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Characterization of aerosol composition and sources in a polluted city in Central China

Qingqing Wang[1], Yele Sun[1,2], Jie Li[1], Yong Chen[1], and Yanyu Li[1]
[1]Institute of Atmospheric Physics, Chinese Academy of Sciences , State Key Laboratory of Atmospheric Boundary Layer Physics and Atmospheric Chemistry, China (wangqingqing@mail.iap.ac.cn)
[2]Center for Excellence in Regional Atmospheric Environment, Institute of Urban Environment, Chinese Academy of Sciences

Air pollution problem in megacities in China has been significantly improved as annual average $PM_{2.5}$ in 2019 in Beijing was 42 μg/m^3. But is still a serious problem in many smaller cities. Sanmenxia is located in the Fen-Wei Plain, close to China's largest coal base. The annual average $PM_{2.5}$ of Sanmenxia decreased from 72 μg/m^3 in 2015 to 59 μg/m^3 in 2019. The highly concentrated industries, especially coal industries, heavy traffic, and the typical terrain that it locates nearby the gorge of the Yellow river, make Sanmenxia a highly polluted city. The highest average $PM_{2.5}$ was ~100 μg/m^3 in winter. Non-refractory PM_1 (NR-PM_1) species including organic aerosol (Org), sulfate (SO_4), nitrate (NO_3), ammonium (NH_4) and chloride (Chl) were measured at Sanmenxia Environmental Protection Bureau (34.794°N,111.171°E) by the ACSM at a time resolution of ~5 min from December 21, 2018 to January 21, 2019. High time resolution of online meteorological variables, as well as precursor gases, OC/EC, and trace elements were also collected at the site, aiming to characterize the pollution sources and evolution mechanisms of aerosol chemical composition. A long haze episode lasted for 16 days was observed with NR-PM_1 = 76±33 μg/m^3, $PM_{2.5}$ = 180±89 μg/m^3. During this episode, the primary species, nitrate accounted for 32% of NR-PM_1 due to high emission of NOx. Positive matrix factorization (PMF) analysis indicates that industrial emission, coal combustion, traffic emission, and secondary species (sulfate + nitrate + ammonium + secondary organic aerosol) were the major sources of pollution. The diurnal variations of pollutants in Sanmenxia were affected significantly by the vertical movement of air flows, but were not sensitive to the regional transport.