Regional contribution to PM_1 pollution during winter haze in Yangtze River Delta, China

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In recent years, heavy particulate pollution events frequently occurred in East China, mainly due to the synergy effects of local and regional influence. Therefore, understanding the contribution of anthropogenic pollutants emitted by local and regional sources is of great importance for making air pollution control policy, especially for megacities in China.

Industries, power plants, traffic and biomass burning (BB) are the main sources for primary pollutants, including particle and trace gases. Those primary pollutants can be formed into secondary species, such as sulfate, nitrate, and secondary organic aerosol (SOA), via chemical and/or physical processes in the atmosphere. Compared to primary species, secondary components generally can be transported over a longer distance in the atmosphere, and then show the characteristics of regional pollution.

To quantify regional sources contributing to submicron aerosol (PM1) pollution in haze episodes, an on-line measurement combining two modeling methods, i.e., positive matrix factorization (PMF) and backward Lagrangian particle dispersion modeling (LPDM), was conducted for the period of December 2013 in urban Nanjing, a city located in western part of Yangtze River Delta (YRD) region of China. Several multi-day haze episodes were observed during this month. Long-range transport from the southwestern YRD region of biomass burning emissions largely contributed to PM1 pollution with more than 25% of total organics mass in a lasting-heavy haze.

The LPDM analysis indicates that regional transport is a main source contributing to secondary low-volatility production. The high potential source regions of secondary low-volatility production are mainly located in regions to the northeast of the city. High aerosol pollution was mainly contributed by regional transport associated with northeastern air masses, on average accounting for 46 % of total NR-PM1 with sulfate and aged low-volatility organics being the largest fractions (> 65 %).

Large potential source areas for the regional secondary low-volatility aerosols were from northeast of Nanjing. Based on a typical case, the regional transport is a serious pollution source leading to air pollution of urban areas.

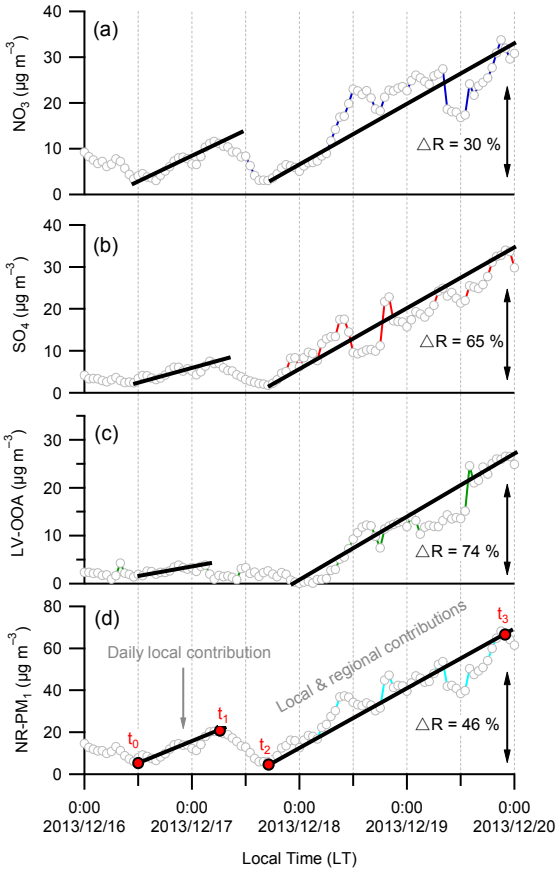

Figure 1. Case study for estimation of the regional contributions during the P3 period: (a) NO3, (b) SO4, (c) LV-OOA, and (d) NR-PM1. ΔR refers to the contribution from regional transport.

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