Hybrid Source Apportionment of PM2.5 in a City of Northern China

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It is becoming increasingly clear that pollution of fine particles (PM2.5) in China is associated with anthropogenic emissions due to human activities. Source apportionment of PM2.5 plays a significant role in emission control. Although various methods have been developed for source apportionment study, each of them has shortcomings. In particular, local contribution and secondary formation were not well considered in receptor model method. This study established a hybrid source apportionment method, based on combination of a receptor model and a 3-D chemical transport model. Simulated source profile for secondary species are used to constrain the source apportionment result from receptor model. The hybrid method is applied in December 2015 in Handan, a city in Northern China. Sulfate, nitrate, ammonium, black carbon, organic matter and other fine particles are simulated, and totally 32 components are detected during the observation period. The observed PM2.5 is successfully apportioned to regional contributors and local source categories. According to the hybrid source apportionment results, during December 2015, 55% of PM2.5 in Handan is due to local sources, including coal combustion (38%), biofuel (21%), industry (16%), agriculture (10%), vehicle (9%) and dust (6%). This method also has capability to downscale the source contribution to each 12 km grid inside a city. Given potentially large changes of structure of energy, industry, transportation and land use in China in future years, more efforts are needed to clearly identify the latest major sources of PM2.5 and to update the control strategy timely.