4.008 Characteristics and influencing factors of PM1 over Shanghai and its impact on visibility.

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Abstract:

The relative long-term continuous *in situ* measurements during Jan 1st, 2015 and Dec 31st, 2016 were employed to study the characteristics of submicron particles (PM_1) over Shanghai and investigate the influence of precursors and meteorological factors on PM_1 as well as the impact of PM_1 on visibility. A discretization method was introduced to emphasize the general regularity of PM_1 with related factors. The results show that Shanghai has a relatively high PM_1 level of ~28 μgm^{-3} annually and accounts for 69% of $PM_{2.5}$. PM_1 concentration shows obvious temporal variation in year, month, week, and day. In discretized approach, PM_1 has good linear relationship with its precursor gases and meteorological variables in most conditions. Its concentration can be highly determined by SO_2, NO_2, and NO (<34 ppb) with increasing rate of 3.37, 1.17, and 1.08 μgm^{-3} per ppb precursor, respectively. It was validated by the comparison of PM_1 change in day of week. PM_1 is negatively related with precipitation intensity, relative humidity (RH, >35%), and wind speed (>1.5ms^{-1}) with rate of -3.3, -0.27, and -5.9 μgm^{-3}, respectively. Effect of ozone on PM_1 is in two linear relationships inflected at ~30 ppb. For other factors or situation, their relationship is not linear due to the indirect influence on transportation, formation, or accumulation. PM_1 concentration has distinct impact on visibility and $PM_1/PM_{2.5}$ ratio is found to be a key indicator to represent the impact of particulate matter hygroscopicity on visibility. $PM_1/PM_{2.5}$ ratio has a good exponent relationship with RH, *$PM_1/PM_{2.5}$=0.76 [(1-RH)/(1-40%)]$^{0.11}$* with determination coefficient of 0.98. It well describes the impact of particulate matter and its hygroscopicity on visibility companying with $PM_{2.5}$ concentration.