

Source-based dynamic control strategies of ozone in different functional areas in Shanghai, China

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Abstract: In recent years, ambient ozone (O_3) level has been in an increasing trend and become one of the major pollutants during summertime in the megacities of China. Peak O_3 levels were far higher than the national standards during pollution episodes. Such an O_3 elevation might be caused by the unbalanced reductions of its precursors, VOCs and NO_x . Scientific evidence-based control strategies are needed to alleviate peak O_3 level and to bring it into attainment. Empirical kinetic modeling approach (EKMA) was generally applied to describe the response of ozone formation to changes in VOCs and NO_x . However, previous studies have shown O_3 short-term despiking and long-term attainment cannot be reached by a single set of control measures in some areas of China.

In this study, we propose to develop dynamic precursor control strategies during O_3 episodes so as to both minimize the NO_x -disbenefit in the short term and reach O_3 attainment in the long term in Shanghai, the largest metropolis of China. By utilizing the localized CMAQ modeling system with the most up-to-date emission inventories of pollutants, we depicted the representative EKMA curves and further explored relationships between ozone production and the mixing ratios (or emission rates) of VOCs and NO_x in different functional areas of Shanghai. Targeting on pollution sources, the effects of a set of pollution control strategies on the changes of ambient O_3 were examined. Optimal control strategies made up by step-wise control measures were selected to minimize both “ NO_x -disbenefit” and the time in reaching attainment. The philosophy of selecting the ‘steps’ and the ‘turning points’ so as to are discussed, and the regional heterogeneity of the optimal control strategies were investigated.

Key words: Ozone pollution, EKMA, NO_x -disbenefit, ozone attainment, Shanghai