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Characteristics and variations of O_3-VOCs-NO_x sensitivity due to NO_x emission control in eastern China

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China has been suffering from increasing ozone (O_3) pollution even through nitrogen oxides undergoes a notable drop during past five years. Since that O_3 pollution has close but nonlinear relationships with NO_x and VOCs emission intensity, recent dramatic controls on NO_x emissions in China were expected to pose significant perturbations on the sensitivity of O_3 production. To shed more light on current situation of O_3 pollution and get in-depth understandings on how to scientifically control NO_x emissions and VOCs emissions spatially and temporally, we integrated continuous satellite retrievals, ground-based measurements together with modeling approaches in this study. Statistical data revealed that NO_x emissions decreased by $\sim$ 25% from 2012 to 2016, corresponding to a noticeable drop in tropospheric NO_2 column concentrations in eastern China ($\sim$ 30%). Based on multiple sensitivity simulations using a chemical transport model, we explored the characteristics and variations of O_3-NO_x-VOCs sensitivity with special focus on developed regions, such as Jing-Jin-Ji (JJJ), Yangtze River Delta region (YRD) and Pearl River Delta region (PRD) in eastern China. In spatial, all the regions demonstrated the change of the dominance of the VOCs sensitive regime to the mixed sensitive regime in O_3 formation, indicating the overall increasing sensitivity to NO_x. In temporal, a diurnal shift of O_3 sensitivity existed in all the 3 regions with VOCs sensitive regimes dominated in the morning shifting to mixed sensitive dominated regimes in the afternoon. Due to the transition in O_3-NO_x-VOCs sensitivity, the diurnal peak of net O_3 formation rate was $\sim$1-1.5h earlier in 2016 compared to 2012. Our O_3 isopleth studies suggested that the past control tendency would result eastern China in a wide mixed sensitive region with relatively high mixing ratios of O_3 and eastern China would suffer from deteriorating O_3 pollution at least in a short-term or even in a long-term if following the past control tendency. O_3 simulations with different reduction ratios of AVOCs/NO_x suggested that the VOCs-targeted control was more practical and feasible than the NO_x-targeted and was instructive for O_3 decrease in all the three regions. The study provides scientific supports for future emission control strategy in China.