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Impacts of Gas-phase Chemical Mechanisms on Modeled Responses of Ozone and Fine Particulate Matter to Emission Changes

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Two air pollutants of most concern are ozone and fine particulate matter (i.e. PM2.5; particulate matter with an aerodynamic diameter less than 2.5 μm) due to their adverse human health effects. Gas-phase chemical mechanisms are one of the important components in regional air quality models and applied to describe the formation of air pollutants such as ozone and secondary PM2.5. Modeled responses of air pollutant concentrations to precursor emission changes (i.e. sensitivities) provide useful information for developing air pollution mitigation strategies and are expected to be affected by gas-phase chemical mechanisms chosen for air quality simulations. The goal of this study is to investigate impacts of gas-phase chemical mechanisms on modeled responses of ozone and PM2.5 concentrations to emission reductions over the eastern United States. We used the U.S. Environmental Protection Agency's regional air quality model, Community Multiscale Air Quality Model (CMAQ) version 4.7.1, to simulate three-dimensional gridded concentrations of ambient ozone, PM2.5 and other air pollutants during three summer months (June, July and August) in 2007. A uniform grid of 12 by 12 km horizontal cells with 34 vertical layers was employed in the air quality simulations. Two gas-phase chemical mechanisms (CB-05; Carbon Bond Mechanism, version V and SAPRC-99; Statewide Air Pollution Research Center, version 99) were used in the regional air quality simulations.

The preliminary results show that modeled responses of peak ozone levels to emission changes could be affected by the gas-phase chemical mechanism chosen in air quality modeling. The effects of gas-phase chemical mechanisms on modeled responses of PM2.5 to emission changes are small. Final results of this modeling study and related discussion will be presented at the conference.