Impact of Potential Future Climate Change on Regional Ozone and Fine Particulate Matter Levels in the United States

(A Joint Research Project between Georgia Tech, NESCAUM, and Massachusetts Institute of Technology)

Contribution of air pollution precursors to regional ozone and $PM_{2.5}$ formation and effectiveness of currently planned control strategies are investigated considering potential future climate changes over the North America. The changes in semi-normalized first-order sensitivities of ozone and $PM_{2.5}$ formation to their precursors (e.g., NO_x, SO_2, NH_3 and VOCs) due to potential future climate change alone as well as the combined effects of climate change and projected emission controls are quantified using MM5, SMOKE and CMAQ with DDM-3D. Sensitivities of ozone and $PM_{2.5}$ formation to precursor emissions are found to be only slightly sensitive to potential changes in future climate. In many cases, absolute sensitivities (e.g., ppm/ton) to NO_x and SO_2 controls are predicted to be greater in the future due to both the lower emissions as well as likely changes in climate, suggesting that control strategies designed for reducing NO_x and SO_2 emissions based on current climatic conditions will continue to be effective for decreasing ground-level ozone and $PM_{2.5}$ concentrations under the impacts of potential future climate changes, possibility even more so than they are today. Contributions of biogenic VOC emissions to $PM_{2.5}$ formation are simulated to be more important in the future because of higher temperatures and higher biogenic emissions, while future emission reductions decrease the sensitivities of $PM_{2.5}$ to SO_2 and NO_x emissions.