Accounting for the Impact of Climate Change on Regional and Urban Ozone in South and Central Texas

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As per the recent Intergovernmental Panel on Climate Change (IPCC) report, the projected average increase in surface air temperature over the northern hemisphere under various climate change scenarios ranged from 1.8 – 4 ^{0}C. Formation of ozone over urban atmospheres is temperature dependent and thus any further increase in atmospheric temperature will have a direct impact on the ambient ozone concentrations. Recently, US Environmental Protection Agency has proposed to revise the National Ambient Air Quality Standards (NAAQS) for ozone to 0.06 – 0.07 ppm. The attainment of the standards will be dependent on aggressive emissions control in urban areas of the nation. However, the efficacies of these control strategies will be confounded by potential warming of the atmosphere. Thus, it is critical to study the impact of the proposed ozone standard revision on the air quality over various urban areas under various atmospheric warming scenarios. The primary thrust of this study was to evaluate (1) the impact of the recently proposed 8-hour ozone standards, (2) the impact of changes in temperature on ozone concentrations, and (3) the spatial and temporal changes in the 8-hour ozone levels for different temperature change scenarios. The South Texas region, currently in attainment of the existing 8-hour standard and also designated as a near non-attainment area, was considered for this study. The impact analysis of the proposed ozone standard revision was conducted using photochemical modeling platforms for two high ozone episodes, Sept 16-19, 1999 and Sept 11-14, 2002 that affected the South Texas region. The meteorology was simulated using the meteorological model, MM5, for various scenarios with regional temperature increases ranging from 1 to 4^{0}C as stated in the IPCC analysis. Preliminary results for the 2002 high ozone episode with temperature increases from 1 to 4^{0}C showed a maximum increase of 2 - 8 ppb in the predicted 8-hour ozone concentrations. The results from this study will provide decision making guidance policy planners to identify and develop robust long term control measures for reducing ozone that also accounts for changed climate conditions.

Keywords: Climate change, Ozone, Photochemical modeling, and Urban airshed.