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Simulations of aerosols and their effects on photolysis and ozone formation in Mexico City

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Atmospheric aerosols, formed from natural and anthropogenic sources, are believed to be associated with adverse human effects at high levels in polluted urban areas. They also play a key role in climate through direct and indirect effects. Therefore, accurate simulations of aerosol composition and distribution in the atmospheric models are important in evaluating their impact on environment and climate. In the present study, a flexible gas phase chemical module with SAPRC mechanism and the CMAQ/models3 aerosol module developed by EPA have been implemented into the WRF-CHEM model. Additionally, to further improve the aerosol, especially the secondary organic aerosol (SOA) simulations, an advanced SOA module [Tsimpidi et al., 2009] has been incorporated into the WRF-CHEM model. The new SOA module is based on the volatility basis-set approach in which both primary and secondary organic components are assumed to be semivolatile and photochemically reactive [Lane et al., 2008]. Gas phase species and aerosol simulation results are compared with the available measurements obtained during the MILAGRO 2006 campaign. When the advanced SOA mechanism is employed, the SOA simulations are significantly improved. Furthermore, the aerosol impacts on the photochemistry in Mexico City have been evaluated using the FTUV [Tie et al., 2005]. Aerosol optical properties are calculated using the Mie theory and compared with available observations in Mexico City [Paredes-Miranda et al., 2008]. Aerosols, principally black carbon, reduce the photolysis frequencies of J[O3(1D)] and J[NO2] in the planetary boundary layer and hence decrease the ground-level ozone concentration. Our study demonstrates that the impact of aerosols on photochemistry is significant in polluted urban atmosphere.

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