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Simulating the Formation of Semivolatile Primary and Secondary Organic Aerosol in a Regional Chemical Transport Model

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Recent developments in our understanding of atmospheric organic particulate matter formation have been used to develop a state-of-the-art organic aerosol module for regional chemical transport models (CTMs). The module has been added to the regional CTM, PMCAMx, and has been evaluated against observations in the eastern US. The new module uses the volatility basis set framework to simulate primary organic aerosol (POA) partitioning between the gas and particulate phases and the gas-phase oxidation of the corresponding vapors. The formation and chemical aging of secondary organic aerosol (SOA) are modeled using the same volatility distribution approach. The module uses recent results from smog chamber studies for the formation of SOA from anthropogenic and biogenic hydrocarbons. Hourly organic aerosol predictions are evaluated using data from the Pittsburgh Air Quality Study (PAQS), while daily averaged predictions for July 2001 are compared to ambient measurements from the EPA Speciated Trends Network (STN) and the Interagency Monitoring of Protected Visual Environments (IMPROVE). The model reproduces both the absolute organic aerosol concentrations in urban and rural locations as well as the high degree of oxidation of these compounds. The chemical aging of anthropogenic SOA is consistent with the ambient organic aerosol concentration field and has a significant impact on the absolute ground-level concentrations of these compounds.