An Investigation of Anthropogenic Influences on Fluxes of Organic Nitrates from a Temperate Deciduous Forest in East Tennessee

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Forests are a dominant source of biogenic volatile organic compound (BVOC) emissions into the earth's atmosphere and play an important role in ozone photochemistry and the formation of secondary organic aerosol (SOA). To arrive at a better scientific understanding of the complex chemical and physical processes of forest-atmosphere exchange and provide a platform for robust analysis of field measurements of these processes, a process-level, one-dimensional, multiphase model of the atmospheric chemistry and physics of forest canopies is being developed. The initial gas-phase version of the model, the Atmospheric Chemistry and Canopy Exchange Simulation System (ACCESS) currently includes processes accounting for the emission of biogenic volatile organic compounds (BVOCs) from the canopy, turbulent vertical transport within and above the canopy and throughout the height of the planetary boundary layer, near explicit chemical reactions, mixing with the background atmosphere and bi-directional exchange between the atmosphere and the canopy and the forest floor.
The Walker Branch Watershed (WBW) is a dedicated ecosystem research area on the U. S. Department of Energy's Oak Ridge Reservation in east Tennessee. A flux tower located within the watershed (35°57′30″N, 84°17′15″W; 365 m above mean sea level) and 10 km southwest of Oak Ridge, Tennessee, served as a focal point for BVOC chemical flux measurements from the forest canopy in 1999. At the time of the measurements, the forest stand was approximately 50 years old, the overstory canopy height was 26 m, and the whole canopy leaf area index was 6.0 m2 leaf/m2 ground area. In this presentation, the ACCESS model will be briefly described and results from its application to the WBW forest canopy will be presented, emphasizing fluxes of organic nitrates produced from the interaction of emitted BVOCs and nearby anthropogenic sources of nitrogen oxides (NOx). Results from sensitivity studies will be presented to demonstrate the role of anthropogenic influences on organic nitrate fluxes from a temperate deciduous forest canopy.

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