



Revisiting the dry depositional sink of oxidized organic vapors to vegetation

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Large quantities of volatile organic compounds (VOC) enter the atmosphere. The annual production of VOC (600–2000 TgC/a) likely exceeds that of methane and CO (~500 TgC/a each). Together these gases fuel tropospheric chemistry. Oxidation of VOC leads to the formation of aerosol (Hallquist et al., 2009) via complex organic chemistry (e.g. Atkinson and Arey, 2003; Paulot et al., 2009) in the gas and aerosol phase thereby modulating the oxidation capacity of the atmosphere (Lelieveld et al., 2008). Currently one of the biggest uncertainties in constraining budgets of VOC is the amount of dry and wet deposition to vegetation, which acts as a major source and sink for organic trace gases on a global scale. This has consequences for constraining secondary species produced in the gas phase, which will either oxidize to CO and CO₂, condense on or form organic aerosol (OA) and be rained out, or directly deposit to the surface via dry and wet deposition. Two recent bottom-up assessments of the tropospheric OA budget (Hallquist et al., 2009, Goldstein and Galbally, 2007) were based on varying assumptions for wet and dry deposition of organic vapors (e.g. 130–200 TgC/a vs 800 TgC/a) and consequently derived significantly different global production rates for secondary organic aerosol (SOA). We present a synthesis of ecosystem scale flux measurements showing that the removal of oxygenated VOC (OVOC) via dry deposition is significantly larger than currently assumed for deciduous ecosystems. Laboratory experiments indicate that exposure to ozone, MVK or mechanical wounding can enhance the uptake of OVOCs. Since the general route of atmospheric photo-oxidation of VOCs goes through the formation of carbonyls and hydroxycarbonyls these findings have consequences for understanding the atmospheric evolution of organic carbon. A revised VOC uptake scheme was incorporated into a chemistry-transport model to investigate the impact on a global scale.

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