Unspeciated organic emissions from combustion sources and their influence on the secondary organic aerosol budget in the United States

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Secondary organic aerosol (SOA) formed from the atmospheric oxidation of non-methane organic gases (NMOG) is a major contributor to atmospheric aerosol mass. About one-third of organic emissions from major combustion sources are not speciated. These emissions are misclassified in the current generation of emission inventories and chemical transport models, and because the unspeciated emissions characteristically produce more SOA per unit emission than the speciated NMOG, model SOA predictions are biased low. We present new source-specific SOA yield parameterizations, constrained by chamber experiments on real emissions, to correct this bias. Using the new yield parameterizations we calculate that NMOG emissions from the top six combustion sources form 0.74 Tg yr^{-1} of first-generation SOA in the US, 87% of which is from biomass burning and gasoline use. Three-quarters of this SOA comes from unspeciated organics, demonstrating that unspeciated emissions must be properly treated in chemical transport models for accurate SOA predictions.