



Recent advances in understanding secondary organic aerosols: implications for global climate forcing

Manish Shrivastava and the Manish Shrivastava Team

Pacific Northwest National Laboratory, Atmospheric Chemistry and Meteorology, Richland, United States
(manishkumar.shrivastava@pnl.gov)

Anthropogenic emissions and land-use changes have modified atmospheric aerosol concentrations and size distributions over time. Understanding pre-industrial conditions and changes in organic aerosol due to anthropogenic activities is important because these features 1) influence estimates of aerosol radiative forcing and 2) can confound estimates of the historical response of climate to increases in greenhouse gases (e.g. the 'climate sensitivity'). Secondary organic aerosol (SOA), formed in the atmosphere by oxidation of organic gases, often represents a major fraction of global submicron-sized atmospheric organic aerosol. Over the past decade, significant advances in understanding SOA properties and formation mechanisms have occurred through measurements, yet current climate models typically do not comprehensively include all important processes.

This presentation is based on a US Department of Energy Atmospheric Systems Research sponsored workshop, which highlighted key SOA processes overlooked in climate models that could greatly affect climate forcing estimates. We will highlight the importance of processes that influence the growth of SOA particles to sizes relevant for clouds and radiative forcing, including: formation of extremely low-volatility organics in the gas-phase; isoprene epoxydiols (IEPOX) multi-phase chemistry; particle-phase oligomerization; and physical properties such as viscosity. We also highlight some of the recently discovered important processes that involve interactions between natural biogenic emissions and anthropogenic emissions such as effects of sulfur and NO_x emissions on SOA.

We will present examples of integrated model-measurement studies that relate the observed evolution of organic aerosol mass and number with knowledge of particle properties such as volatility and viscosity. We will also highlight the importance of continuing efforts to rank the most influential SOA processes that affect climate forcing, but are often missing in climate models. Ultimately, gas- and particle-phase chemistry processes that capture the dynamic evolution of number and mass concentrations of SOA particles need to be accurately and efficiently represented in regional and global atmospheric chemistry-climate models.