4.078 Impacts of Emissions and Chemical Complexity on Global Simulations of Secondary Organic Aerosol.

Early Career Scientist

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Abstract:

Considering the importance of Secondary Organic Aerosol (SOA) to air quality and climate, the global budget remains uncertain with estimates of the global SOA source ranging several orders of magnitude. In addition to this, SOA schemes within global Chemical Transport Models (CTMs) significantly underestimate observed SOA. This is, in part, due to simplified SOA schemes and the absence of anthropogenic and biomass burning Volatile Organic Compound (VOC) emissions. We used the U.K Chemistry and Aerosol (UKCA) model to simulate SOA formation using the modal GLObal Model of Aerosol Processes (GLOMAP-mode) aerosol microphysics scheme. We assessed how emissions from various sources (biogenic, anthropogenic and biomass burning) and SOA schemes of varying chemical complexity (fixed-yield and 2-product) influence uncertainty in simulated SOA both regionally and globally. By comparing simulated SOA to Aerosol Mass Spectrometer (AMS) observations we were able to quantitatively evaluate model performance and constrain uncertainties in the simulated SOA budget. Initial results suggest uncertainty in the global SOA source is primarily due to which VOC species are included in the SOA scheme. We also find that combing the 2-product scheme with biogenic, anthropogenic and biomass burning VOC emissions the model skill at capturing the observed spatial pattern of SOA is enhanced. This suggests that both increased chemical complexity and more explicit representation of VOC chemistry within the SOA scheme are required for more accurate simulation of SOA. Significant differences in aerosol optical depth (AOD) and aerosol number concentration were also observed across these simulations, implying that uncertainties in SOA modelling has the potential to influence simulated climate. This work will be continued by considering uncertainties for future projections of SOA under climate change.