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Modelling the Tropospheric Multiphase Chemistry of Biomass Burning Trace Compounds Using the Chemical Aqueous Phase Radical Mechanism (CAPRAM)

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Biomass burning (BB) is a significant contributor to air pollution on global, regional and local scale with impacts on air quality, public health and climate. Anhydrosugars (levoglucosan, mannosan and galactocan) and methoxyphenols (guaiacol, creosol, etc.) are important tracer compounds emitted through biomass burning. Once emitted, they can undergo complex multiphase chemistry in the atmosphere contributing to secondary organic aerosol formation. However, their chemical multiphase processing is not yet well understood and investigated by models. Therefore, the present study aimed at a better understanding of the multiphase chemistry of these BB trace species by means of detailed model studies with a new developed detailed chemical CAPRAM biomass burning module (CAPRAM-BB). This module was developed based on the kinetic data from the laser flash photolysis measurements in our lab at TROPOS and other literature studies. The developed CAPRAM-BB module includes 2991 reactions (thereof 9 phase transfers and 2982 aqueous-phase reactions). By coupling with the multiphase chemistry mechanism MCMv3.2/CAPRAM4.0 and the extended CAPRAM aromatics (CAPRAM-AM1.0) and halogen modules (CAPRAM-HM3.0), it is being applied for some residential wood burning cases in Europe and wildfire cases in the US. Our model results show that the BB chemistry could significantly affect the budgets of important atmospheric oxidants such as H_2O_2 and HONO, and contribute to the SOA formation especially the fraction of brown carbon and substituted organic acids.