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The influence of biomass burning on the global distribution of selected non-methane organic compounds.

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Forests fires are a significant source of chemicals to the atmosphere including numerous non-methane organic compounds (NMHCs). We report airborne measurement of NMHCs, acetone and methanol from > 500 whole air samples collected over Eastern Canada, including interceptions of several different boreal biomass burning plumes. From these and concurrent measurements of carbon monoxide (CO) we derive fire emission ratios for 29 different organic species relative to the emission of CO. These range from 8.9 $\pm$ 3.2 ppt/ppb CO for methanol to 0.007 $\pm$ 0.004 ppt/ppb CO for cyclopentane. The ratios are in good to excellent agreement with literature values. Using the GEOS-Chem global 3-D chemical transport model (CTM) we show the influence of biomass burning on the global distributions of benzene, toluene, ethene and propene (species which are controlled for air quality purposes sometimes used as indicative tracers of anthropogenic activity). Using our observationally derived emission ratios and the GEOS-Chem CTM, we show that biomass burning can be the largest fractional contributor to observed benzene, toluene, ethene and propene levels in many global locations. The widespread biomass burning contribution to atmospheric benzene, a heavily regulated air pollutant, suggests that pragmatic approaches are needed when setting air quality targets as tailpipe and solvent emissions decline in developed countries. We subsequently determine the extent to which the 28 global-status World Meteorological Organisation – Global Atmosphere Watch stations worldwide are influenced by biomass burning sourced benzene, toluene, ethene and propene as compared to their exposure to anthropogenic emissions.