Quantifying the Wildfire Contribution to Polycyclic Aromatic Hydrocarbon Exposure and Health Effects

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Abstract

As wildfire pollution becomes a growing concern, improved understanding of the chemistry and health effects of wildfire sourced toxic air pollution will become increasingly important. Traditionally, health effects caused by wildfires are assessed based on PM mass, ignoring the detailed chemical composition of wildfire PM. Evidence suggests that wildfire PM could be more toxic than PM from other sources. Our research focuses on one of the important toxic components of wildfire PM: polycyclic aromatic hydrocarbons (PAHs), which exists in both gas and particle phases. Due to the scarcity of PAH measurements, many quantifications of PAH health effects are based on the use of total PM as a proxy. This work aims to answer two key questions related to wildfire sourced PAHs 1) How do wildfires affect PAH concentrations, chemistry, and health effects? And 2) Is PM a sufficient proxy for capturing global PAH health effects? We model PAH and PM concentrations from wildfires using a global 3-D chemical transport model, GEOS-Chem. Results show that wildfires have opposing effects on PAH concentrations by increasing both PAH emissions and PAH oxidants. Wildfires also shift the partitioning of PAHs toward the particle phase. In evaluating the use of PM as a proxy for the study of PAHs, it was found that these methods poorly constrain PAH degradation products and the behavior of individual PAHs, which are important for studying health effects and source attribution. Regional chemistry and impacts are evaluated using the 2017 wildfires in Portugal as a case study.

Early Career Scientist

YES, I am an early career scientist.

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