Increasing wildfire emissions worsen air quality of U.S. megacities by the 2050s

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Wildfire emissions can adversely affect air quality locally and downwind. Here, we apply combined chemistry transport modeling (CTM) and multiple observational datasets to quantify the impact of North American wildfire emissions on the air quality of U.S. megacities. First, we analyze records of fire reports over U.S. and Canada and ground measurements of PM2.5 concentrations at 1775 U.S. sites. Composite analyses show distinct responses of surface PM2.5 concentrations to wildfire episodes (area burned at >90^{th} percentile). Western and central cities are mostly influenced by fire events in the western U.S. In contrast, northeastern cities are easily affected by the long-range transport of pollution emitted by Canadian wildfires. Then, we perform sensitivity experiments with the GEOS-Chem CTM and calculate changes in surface PM2.5 concentrations at U.S. megacities with at least half million population. Simulations show that present-day wildfires enhance summer mean PM2.5 concentrations by > 0.5 μg m^{-3} at Chicago, Detroit, San Jose, San Francisco, Seattle, and Portland, the first two of which are influenced by Canadian fire emissions. By the midcentury, fire-induced summer PM2.5 enhancement is as high as 1-3 μg m^{-3} at these megacities, following the largely increased area burned in a warmer climate. The worse air quality due to wildfire emissions pose an emerging threat to the public health in U.S. megacities.

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