Improving wildfire smoke forecasts through the implementation of a canopy model parameterization

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Forecasting smoke impacts from wildfires on air quality remains challenging. Wildland fires dynamically interact with the atmosphere, which can impact fire behavior, pyroconvection, and smoke dispersion. For understory fires, the fire propagation is driven by winds attenuated by the forest canopy. However, most numerical weather prediction models providing meteorological forcing for fire models do not account for sub canopy winds, which are responsible for driving surface fire growth. For cases where no canopy model is used, fire growth within forest canopies tends to be overpredicted by fire prediction models. For this study, a canopy model parameterization was implemented within a coupled fire–atmosphere model (WRF-SFIRE) to forecast fire growth and smoke transport for a prescribe burn in Florida, along with large wildfire located in central Utah during September 2018. Integrating a canopy parameterization within our fire spread model ultimately resulted in fire growth rates, plume rises, and smoke simulations that more closely aligned with observations. This could have significant implications for air quality forecasting in Utah, especially during the wildfire season.