M.S. Defense Announcement
Katelyn O'Dell
October 9, 2018 at 1:00pm

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Tuesday, October 9, 2018
1:00pm

Defense
ATS Large Classroom (101 ATS)

Post Defense Meeting
Riehl Conference Room (211 ACRC)

Committee:
Jeffrey Pierce (Advisor)
Emily Fischer
Bonne Ford
Sheryl Magzamen (Environmental and Radiological Health Sciences)

Estimating spatiotemporal trends in wildfire smoke concentrations in the western United States

The United States (US) has seen significant improvements in seasonal air quality over the past several decades. However, particulate air quality in summer over the majority of the western US has seen little improvement in recent decades. Particulate matter with diameters < 2.5 microns ($PM_{2.5}$) is a large component of ambient air quality that is associated with negative health effects and visibility degradation. Wildfires are a major summer source of $PM_{2.5}$ in the western US. While anthropogenic-related sources of $PM_{2.5}$ have decreased across the US, wildfires have increased in both frequency and burn area since the 1980s. It is currently uncertain 1) how this increase in wildfires has impacted seasonal air quality trends and 2) how the health effects of wildfire-emitted $PM_{2.5}$ may differ from anthropogenic-sourced $PM_{2.5}$. We do not directly address the latter uncertainty, but rather focus on improving smoke-exposure estimates which are a critical, yet challenging, component to understanding the health effects of wildfire-emitted $PM_{2.5}$.

We use a combination of satellite estimates, surface observations, and chemical transport models to distinguish wildfire smoke $PM_{2.5}$ from non-wildfire-smoke $PM_{2.5}$ during summer in the US. We update the record of seasonal trends in $PM_{2.5}$ observed at surface monitors to the most recent decade and provide the first estimates of trends in wildfire smoke-specific $PM_{2.5}$. We find continued decreases in total-$PM_{2.5}$ in most seasons and regions of the US. In summer in heavily fire-impacted regions of the western US we find non-decreasing total-$PM_{2.5}$ while wildfire smoke-specific $PM_{2.5}$ has increased and non-wildfire-smoke $PM_{2.5}$ has decreased.

We expand the application of blended smoke exposure models, which use multiple data sources as input variables (e.g. satellite-derived aerosol optical depth, chemical transport models, etc.), to the full western US. These models have previously only been applied on an individual state basis. We also incorporate a novel dataset into the model, Facebook posts, which have been shown to correlate well with surface $PM_{2.5}$ concentrations during the western US wildfire season. We find the blended smoke exposure model performs well across the western US (R^2 = 0.66). However, the Facebook dataset is well correlated with interpolated surface monitors (another input variable) and thus does not significantly improve the blended smoke-exposure estimates.