Biomass Burning contribution to surface PM$_{2.5}$

Fig. 1  Fraction of PM$_{2.5}$ attributable to wildfires by county during fire seasons (May-October) in the present day (2004–2009), on all days (left panel), and on the subset of days that had total PM$_{2.5} > 35$ µg/m$^3$ (The National Ambient Air Quality Standards (NAAQS) threshold; right panel).
Fig. 1  Fraction of PM$_{2.5}$ attributable to wildfires by county during fire seasons (May-October) in the present day (2004–2009), on all days (left panel), and on the subset of days that had total PM$_{2.5} > 35$ μg/m$^3$ (The National Ambient Air Quality Standards (NAAQS) threshold; right panel)
Associations between wildfire smoke exposure and respiratory morbidity in general, and specifically for exacerbations of asthma and COPD

Suggested associations between wildfire smoke exposure with respiratory infections and all-cause mortality

Potential impacts on birth outcomes
Biomass Burning contribution to surface PM$_{2.5}$

*Combined satellite observations and chemical-climate models*

Globally: **339,000** (260,000 – 600,000) deaths per year from exposure to landscape fire smoke

Johnston et al., *EHP*, 2012
Estimating emissions from open burning

\[ \text{Emission}_i = f(\text{ef}_i, \text{Biomass Burned}) \]

**Emission Factor**
- Vegetation
  - Type
  - Condition
- Fire
  - Intensity
  - Stage

**Biomass Burned**
- Vegetation
  - Type
  - Condition
  - Density
  - Loading
- Fire
  - Intensity
  - Duration
Estimating Emissions
EMISSIONS

Chemical Transport Models

AIR QUALITY
Feedbacks to regional meteorology and chemistry

High Resolution WRF-Chem with fire emissions

Simulate impact of fire emissions on boundary layer and chemistry

Jiang et al., ES&T, 2012
Feedbacks to regional meteorology and chemistry

Changes in PBL, surface air temperature, solar radiation

Feedback to chemistry

Changes in -15% to +60% in ozone concentrations

Jiang et al., ES&T, 2012
Vertical Distribution of Emissions *Important*

- Preliminary simulations of the Williams Flats fire during FIREX-AQ
  - August 2019 over WA
- Comparing CO measurements from DC-8 to the model outputs
Preliminary results with plume rise parameterization improves model performance.
Biomass-burning smoke heights over the Amazon observed from space
Laura Gonzalez-Alonso et al., 2019

https://acp.copernicus.org/articles/19/1685/2019/
Prediction of AQ and Health impacts from wildfires

• Vertical Distribution of Plumes
  • Improve model predictions
  • Better interpret satellite observations