

Modeling the Temporal and Size-Distributions of Diesel Particulate Matter

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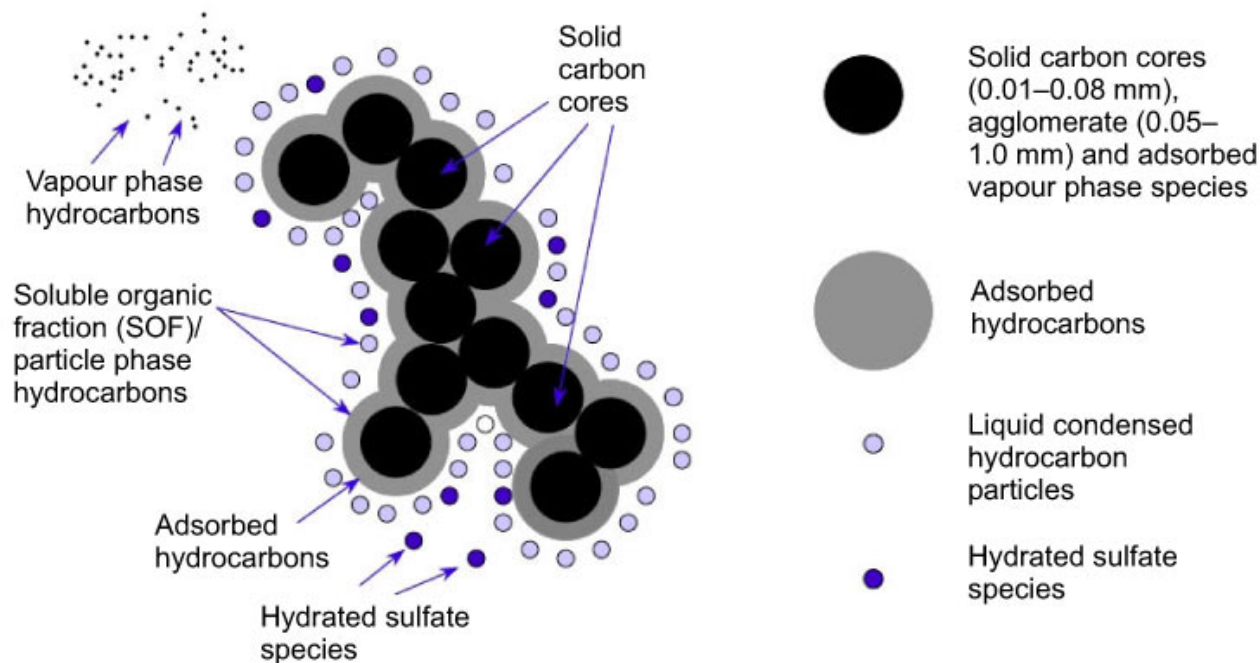
PhD Candidate

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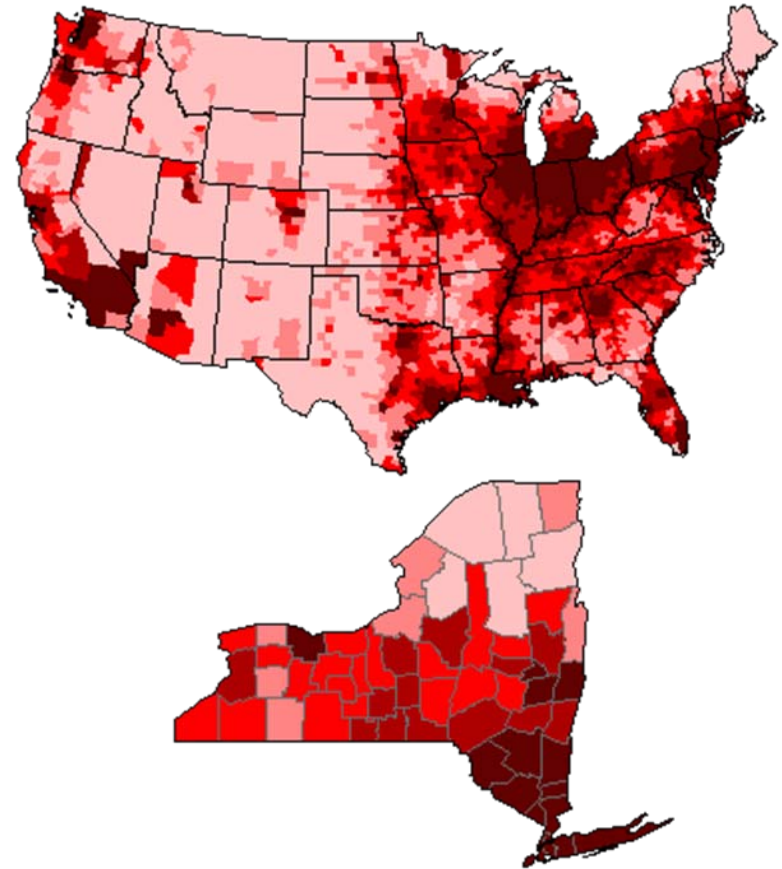
Particulate Matter (PM)

- Diesel particulate matter
 - Complex mixture of organic and inorganic compounds
 - Both solid and liquid phase



PM Health Effects

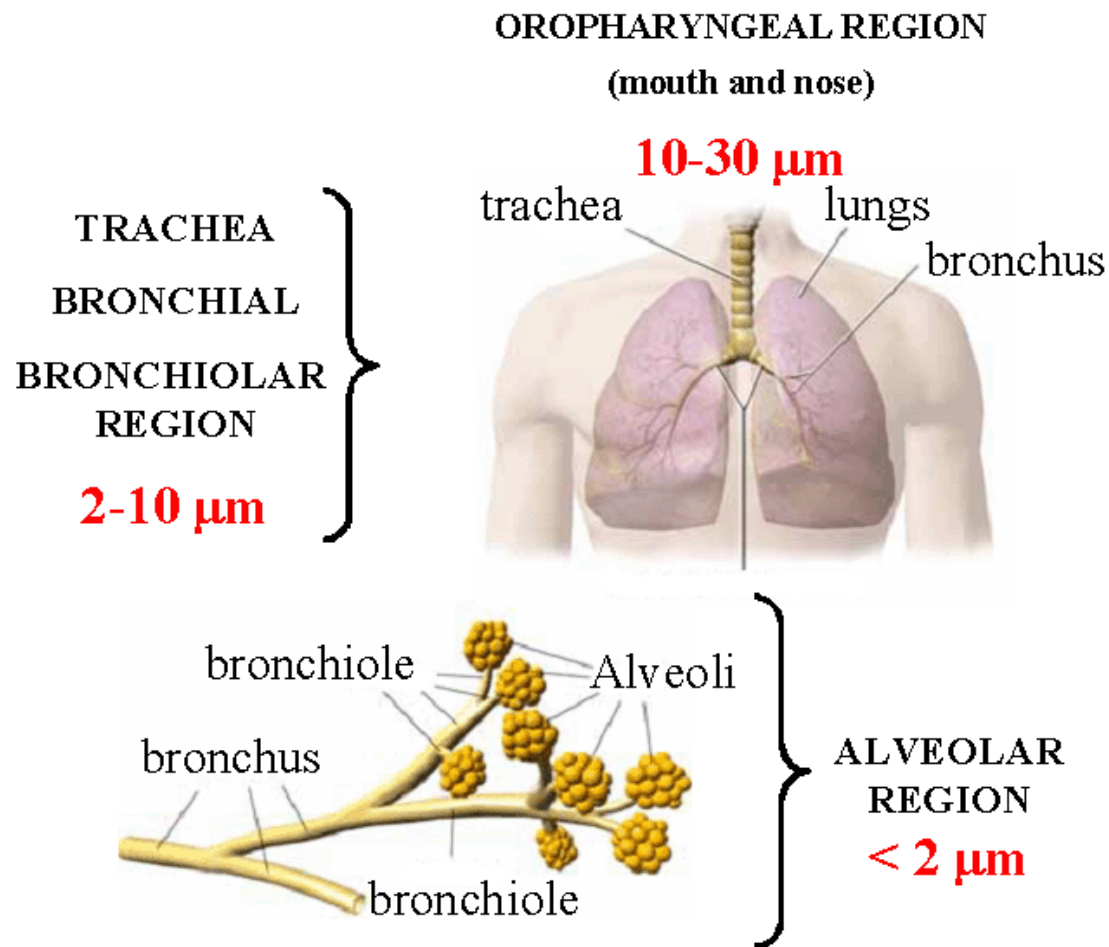
- NYS and NYC ranked highest in the nation in terms of health impacts from diesel fine particles (*Clean Air Task Force*)
- Due to less PM pollution, US urban dwellers live 5 months longer in 2000 compared to 1980 (*Pope et al. 2009*)



Diesel Soot Impacts Across U.S.

Source: <http://www.catf.us/projects/diesel/dieselhealth/>

Particle Size

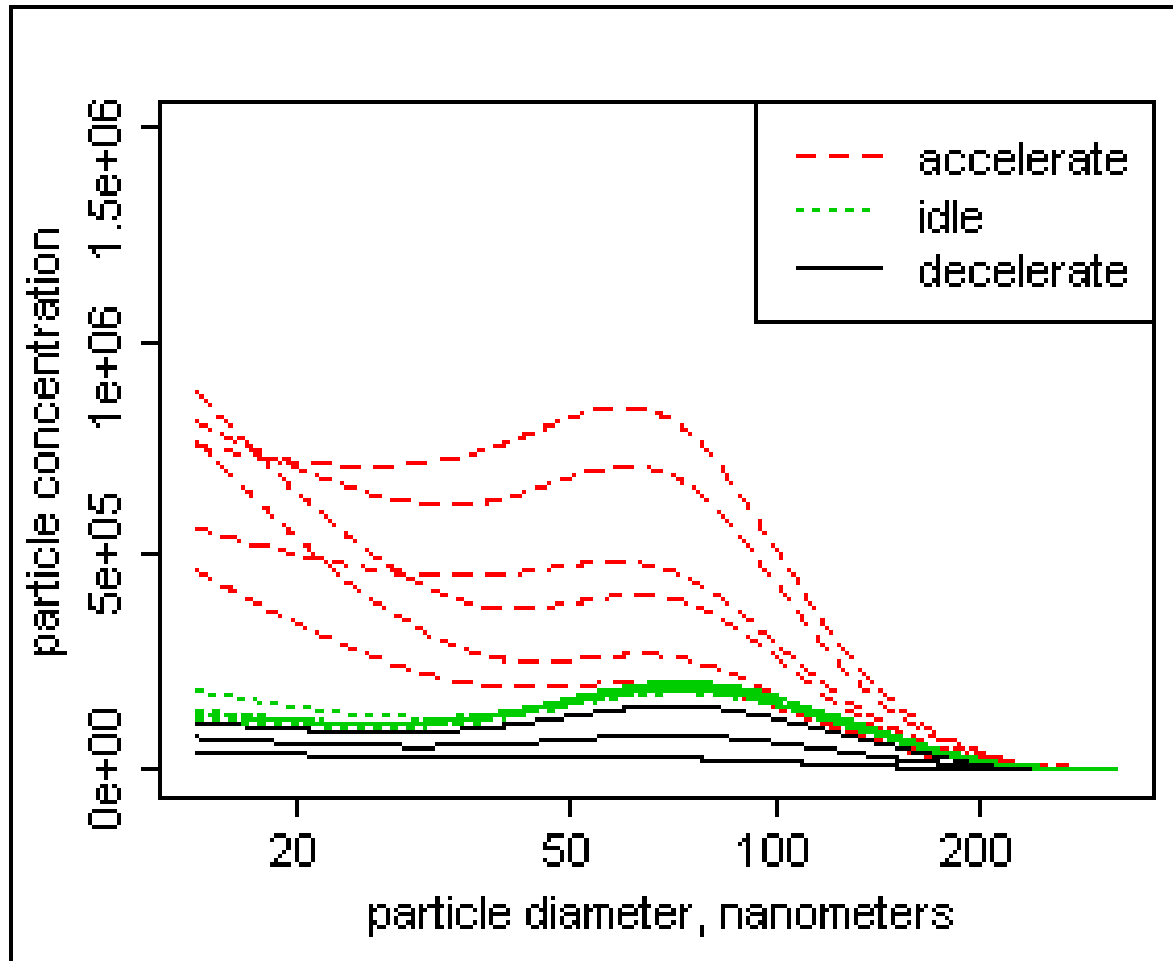




September 11th Research Project

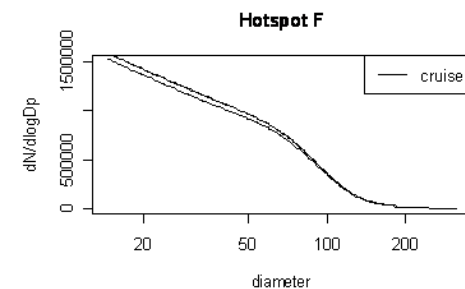
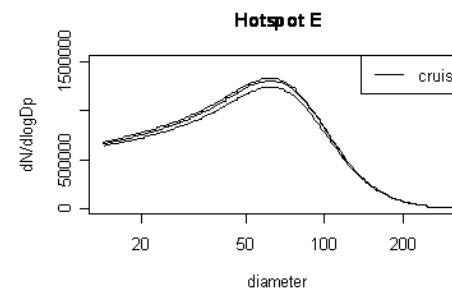
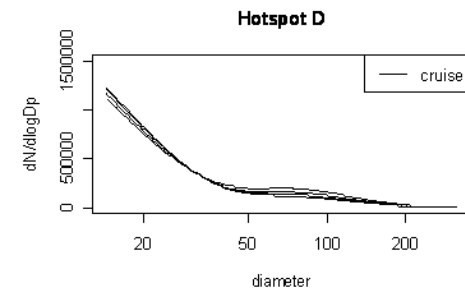
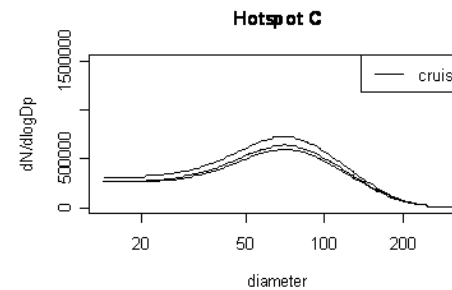
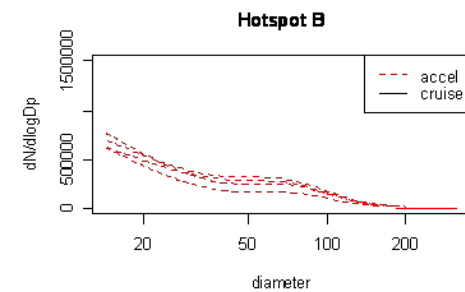
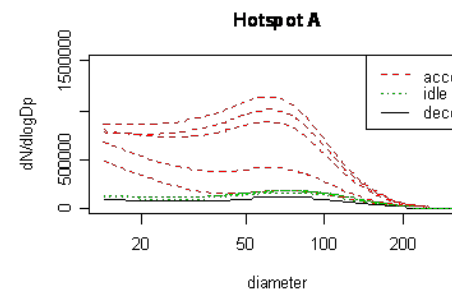
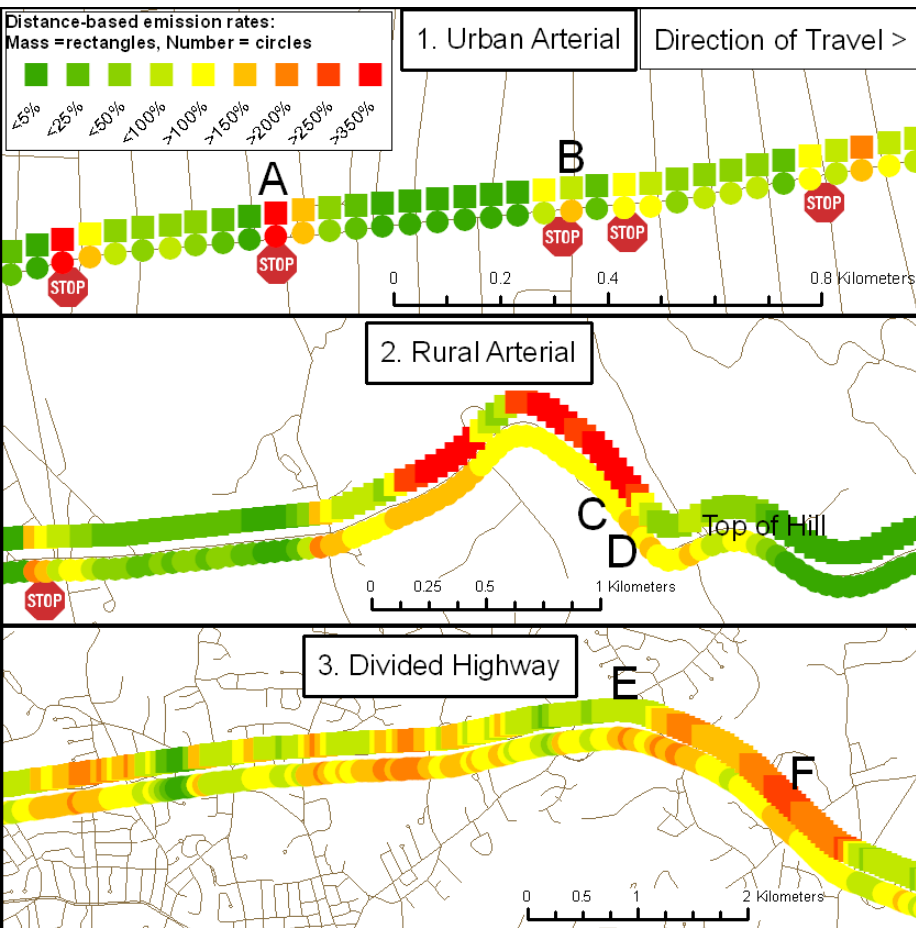
1. Evaluate vehicle emissions according to the particle size-distribution
2. Develop statistical models to understand factors that influence particle emissions

Particle Number Size-Distribution



Diameter of human hair = 70,000 nanometers

- How do particle emissions behave through a typical bus route?



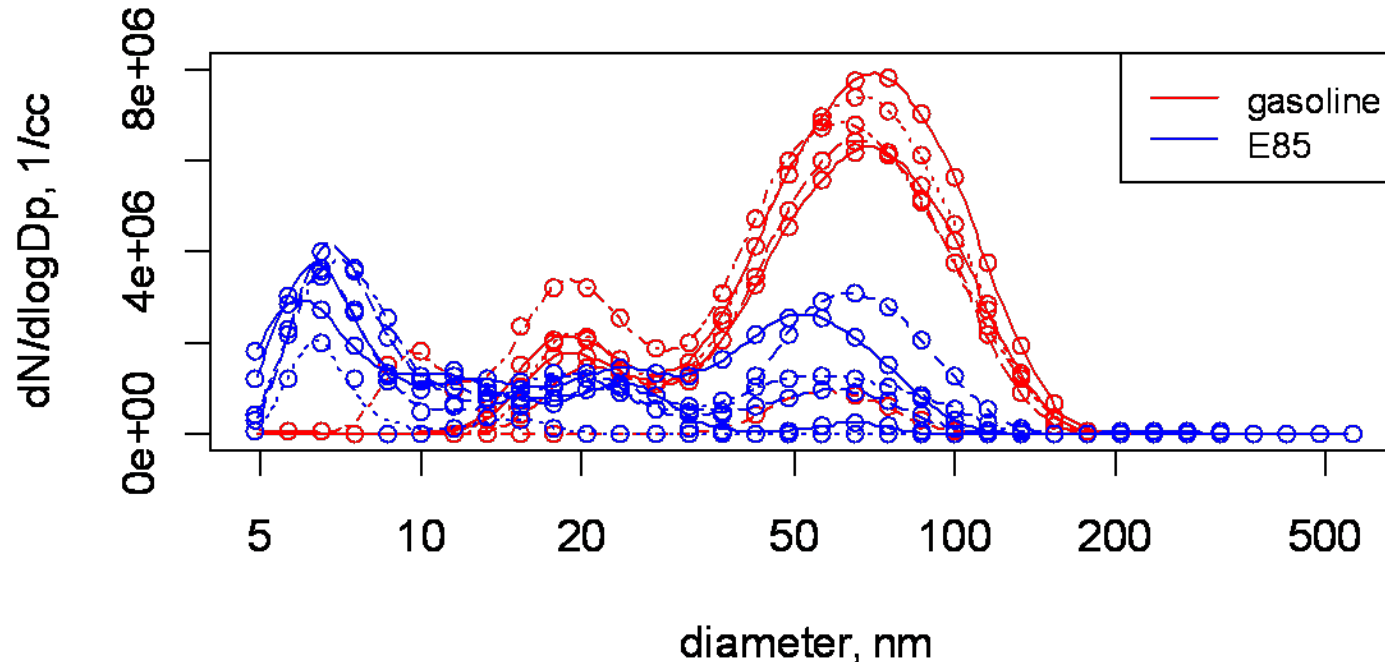
On-going Research

- Alternative fueled-vehicles
 - Gasoline vs. Ethanol (E85) blends
 - Biodiesel vs. Straight Vegetable Oil
- What is the effect of these fuels on particle size-distributions?



Fuel Effects on Particle-Size Distribution

- 2008 “Flex-Fuel” Chevy Impala
- E85 (Ethanol-gasoline fuel blend)



Modeling particle-size distributions

- What is the effect of engine load on emissions?

$$y_i(d) = \beta_o(d) + \beta_1(d)x_i + \varepsilon_i(d)$$

where:

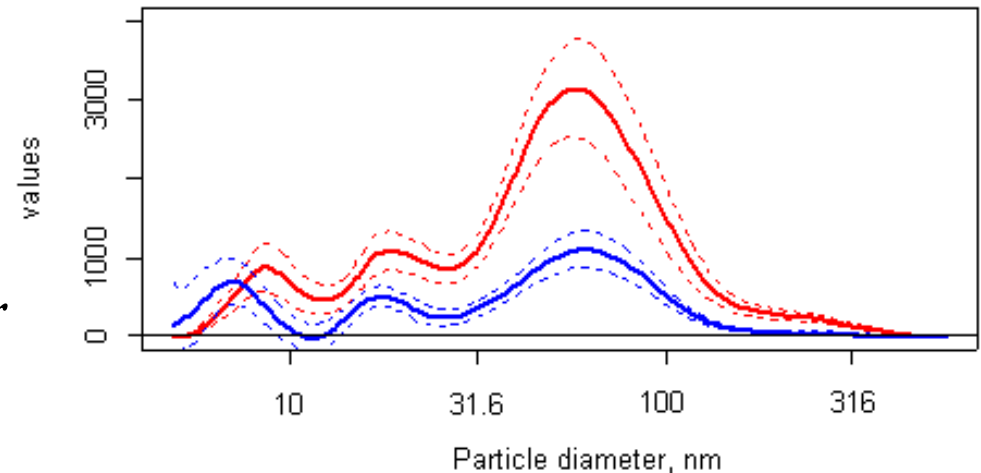
$y_i(d)$ = particle concentration

at time i ,

as a function of particle diameter

x_i = engine speed at time i

$\beta_1(d)$



- Gasoline - E85

Points to Remember

- Size of particles influences health effects
- Size of particles emissions
 - Operating mode
 - Fuel type
- Understanding the relationships can help improve policies and human health