Air Quality Modeling and Exposure Analysis for Environmental Justice Opportunities

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Issue: Protect Environmental Health

- Ambient air pollution harms human health
- Problems are best controlled at the source

- Prioritize emission reductions
- Environmental justice
Issue: environmental disparity

Marshall, 2008

Normalized Concentration

Ethnicity & household income category

-30% -10% 0% 10% 30%

Benzene Butadiene Chromium PM$_{2.5}$ Diesel PM$_{2.5}$ Ozone

Non-white; more than $50k$ Non-white; less than $50k$ White; more than $50k$ White; less than $50k$
Objective

Include environmental justice in air quality management

emissions $\rightarrow$ concentration $\rightarrow$ exposure $\rightarrow$ intake $\rightarrow$ dose $\rightarrow$ health effects
Case study location: South Coast
Methods – Ambient Concentration

• Ambient concentrations for one year (CAMx model)
  – 3-D Eulerian photochemical dispersion model
  – Emissions inventory from Multiple Air Toxics Exposure Study (MATES III) – year 2005
  – Fine particulate matter from diesel (DPM$_{2.5}$)
Ambient Concentrations

All Sources – 100%

Off-road – 40%

On-road – 36%

Ships – 19%

Trains – 3% (10x)

Stationary – 2% (10x)
South Coast demographics

High-SES Population, %
Incorporate community mobility
Environmental Goals

1. Impact
2. Efficiency
3. Environmental Equality
   • Gini Coefficient
4. Environmental Justice
   • High-SES (high-income whites) versus low-SES (low-income non-whites)
Acknowledgements

Marshall Research Group

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