

Impact of Mobile Source Emissions on Air Quality

EPA Presentation to MSTRS

May 31, 2017



Why did EPA do this work?

- Periodically assess mobile source contributions to ambient concentrations of pollutants
 - Contribution of mobile source $PM_{2.5}$ precursors to ambient $PM_{2.5}$ concentrations
 - Contribution of mobile source NO_x and VOC to ambient ozone concentrations
- Can provide useful information to help guide future assessments and control needs

Modeling Methodology

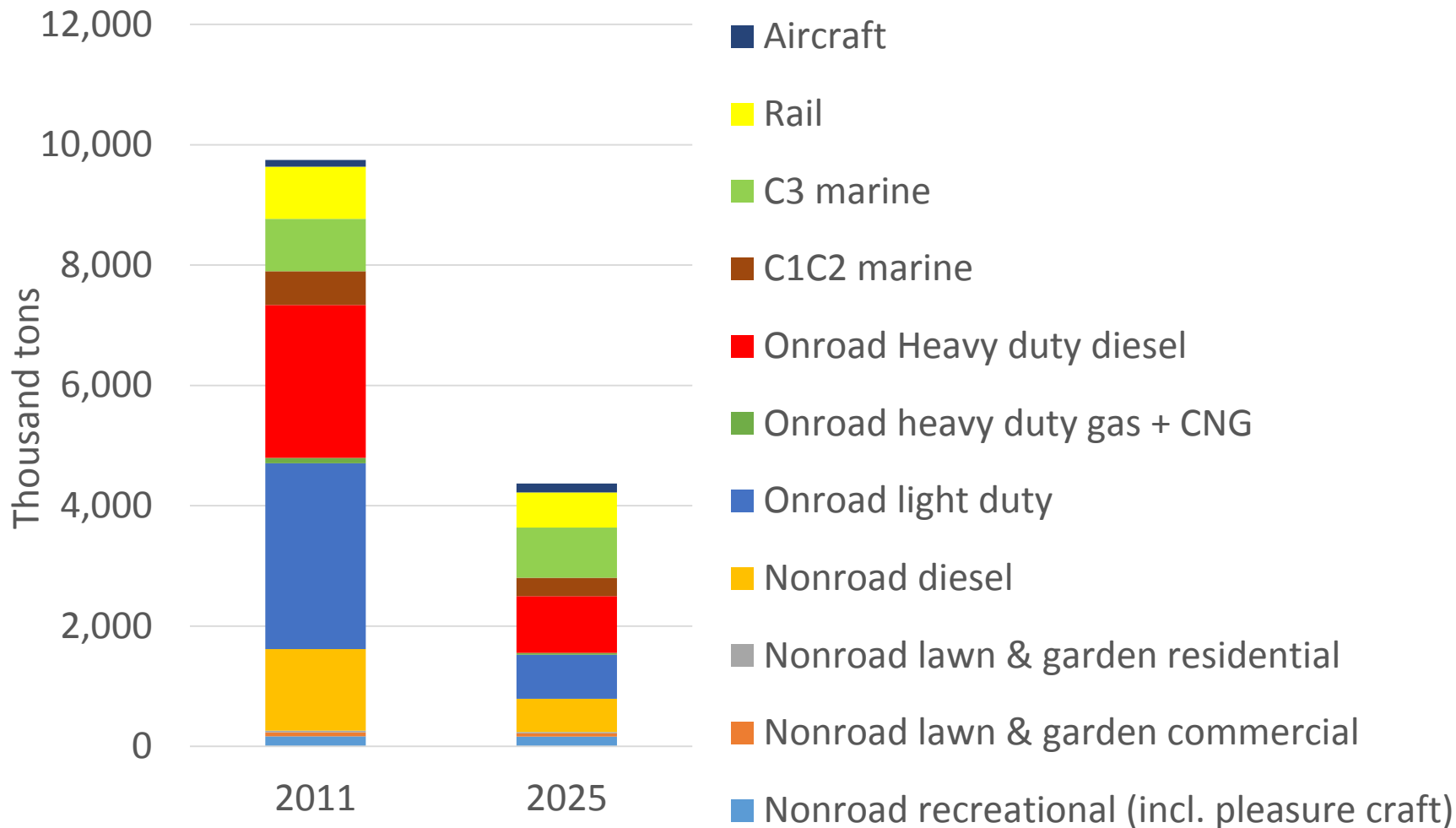
- 2011 v6.2 emissions modeling platform
 - MOVES 2014
 - NONROAD 2008
- CAMx photochemical model
 - 2011 and 2025
 - 48 state domain
- Source Apportionment Technology for Particulate Matter (PSAT) and ozone (OSAT)
 - PSAT includes contribution from NO_x to PM_{2.5} nitrate ion, SO₂ to PM_{2.5} sulfate ion, NH₃ to PM_{2.5} ammonium ion, primary EC, primary OC, other primary PM_{2.5}
 - OSAT includes contribution from NO_x and VOC to ozone
- 17 mobile source sectors
 - Merged into 11 mobile source categories

Caveats / Limitations for Modeling Projections

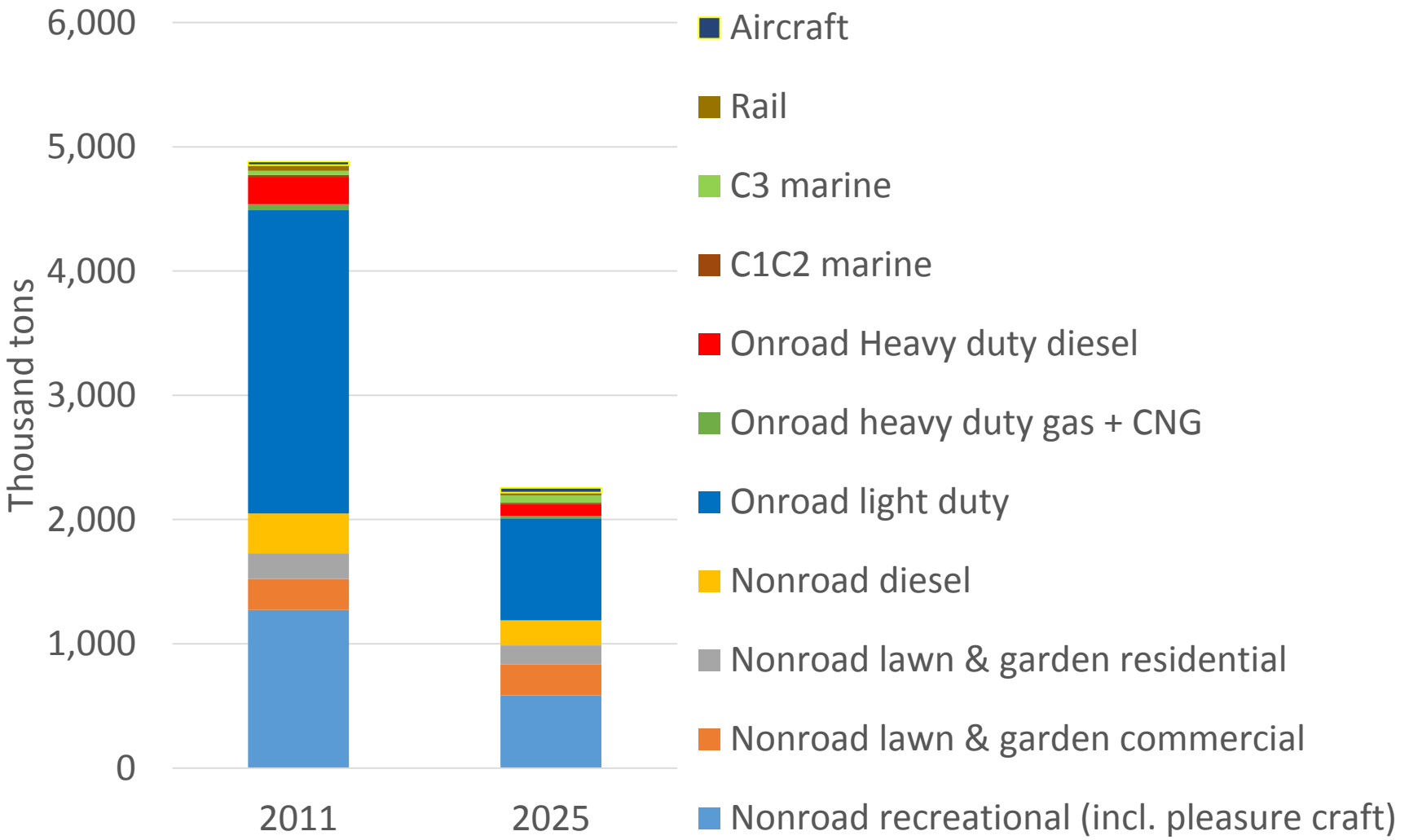
- Inventory is a snapshot in time, constantly being updated to reflect the latest science and data
- Nonroad inventory (including rail and marine) is less certain than onroad inventory
 - Emission factors, population, activity, and allocation (temporal and spatial) are being updated
- Meteorology inputs are only one year - 2011

Mobile Source Inventory Inputs

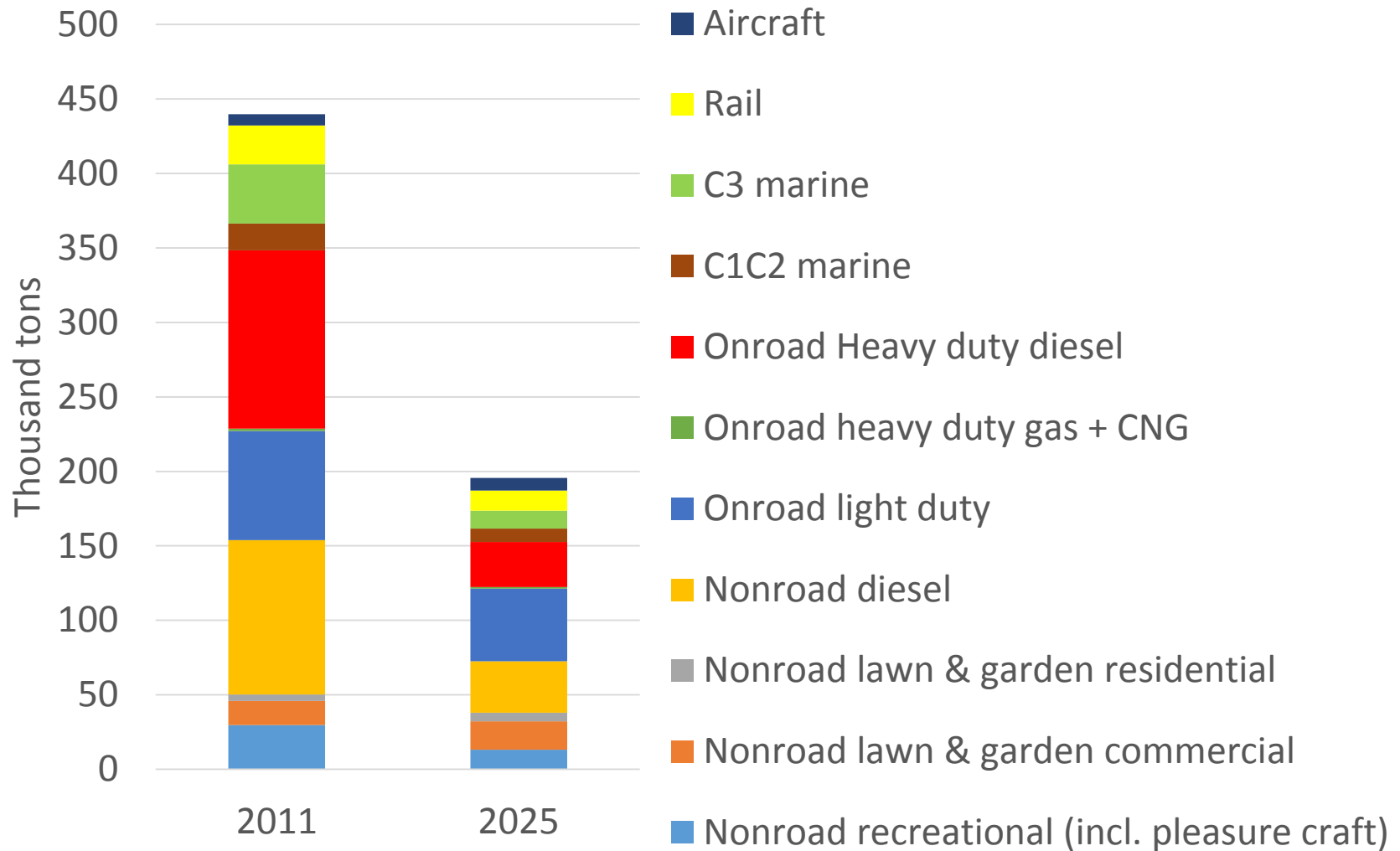
Nitrogen Oxide (NO_x) Emissions from 11 Mobile Source Categories



Volatile Organic Compound (VOC) Emissions from 11 Mobile Source Categories



Fine Particulate Matter (PM_{2.5}) Emissions from 11 Mobile Source Categories

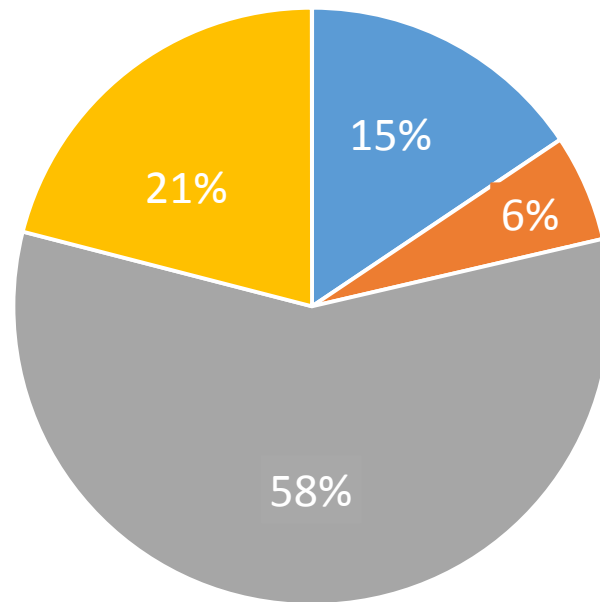




Air Quality Model Outputs



Presented in the following slides from 3 perspectives:

- Pie charts of contribution from mobile sources
- Bar charts of contribution by mobile source sectors
- Maps of contribution by mobile source sector

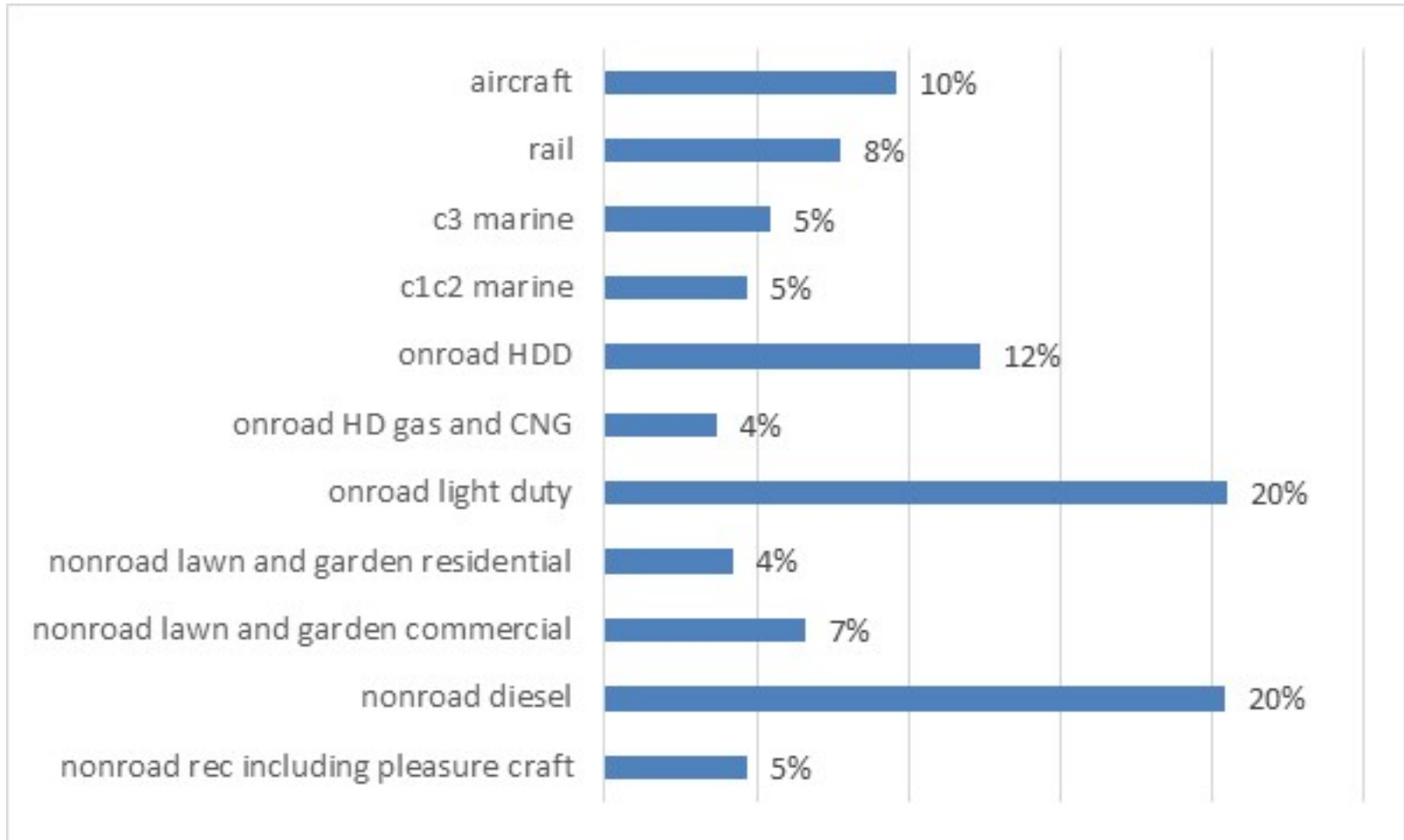
Contribution to PM_{2.5} Concentration in 2025



 Boundary Conditions
 Biogenics, Dust, Ag

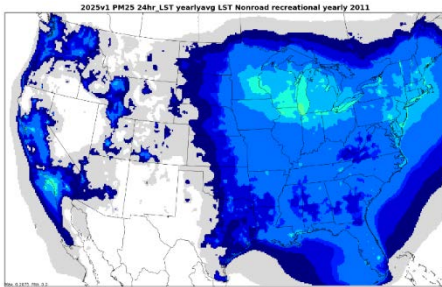
 Mobile sources
 Point, Nonpoint, Fires

Breakdown of Mobile Source Contributions to PM_{2.5} Concentration in 2025

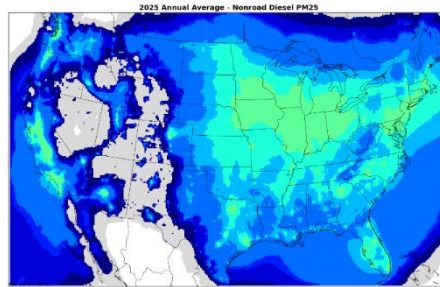


Mobile Source Contributions to Ambient PM_{2.5} in 2025

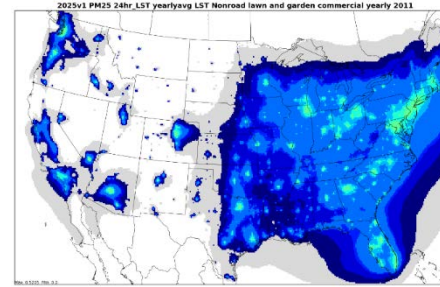
Nonroad Recreational



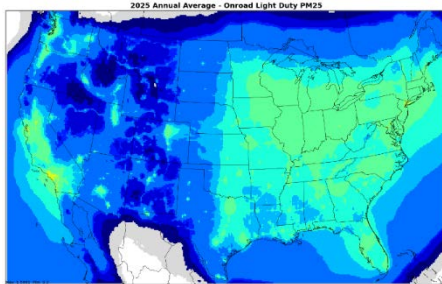
Nonroad Diesel



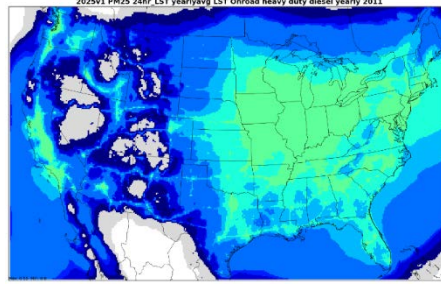
Lawn & Garden Comm



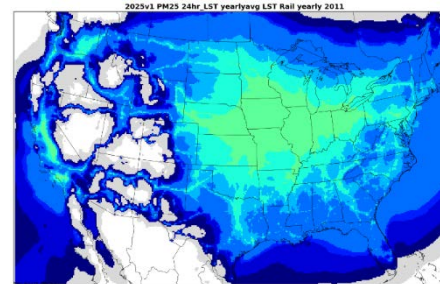
Onroad Light-Duty



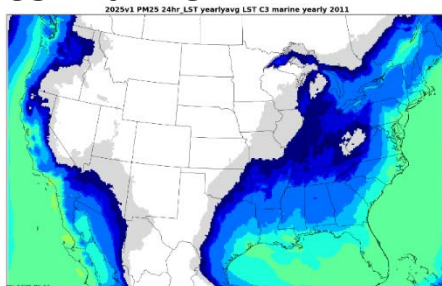
Heavy-Duty Diesel



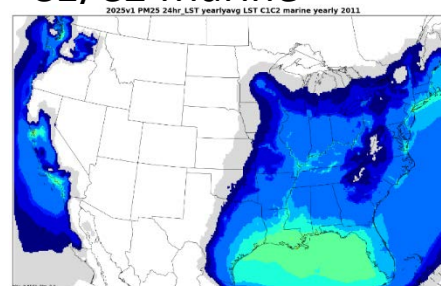
Rail



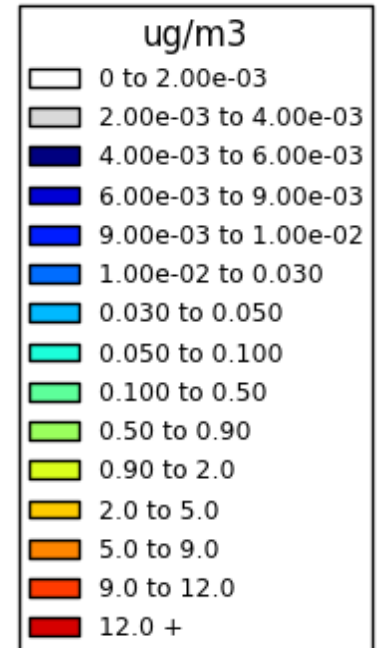
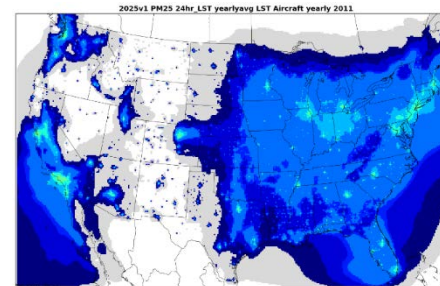
C3 Marine



C1/C2 Marine

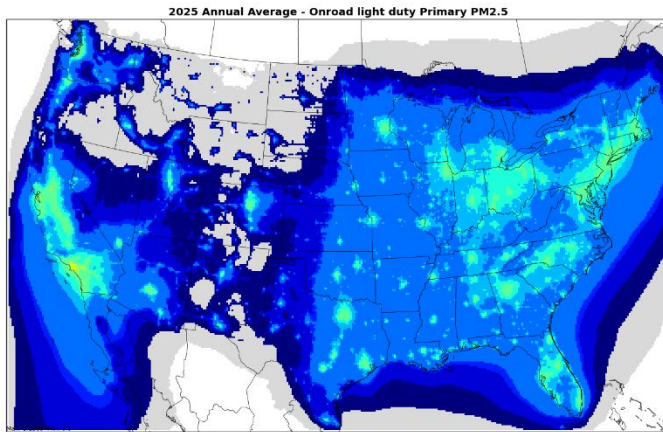


Aircraft LTO

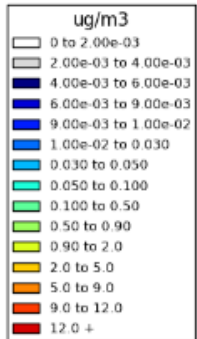
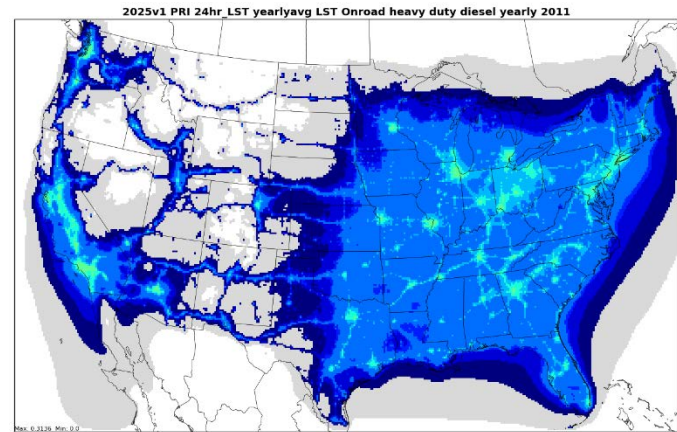


Mobile Source Contributions to Ambient PM_{2.5}: primary (top) and secondary (bottom)

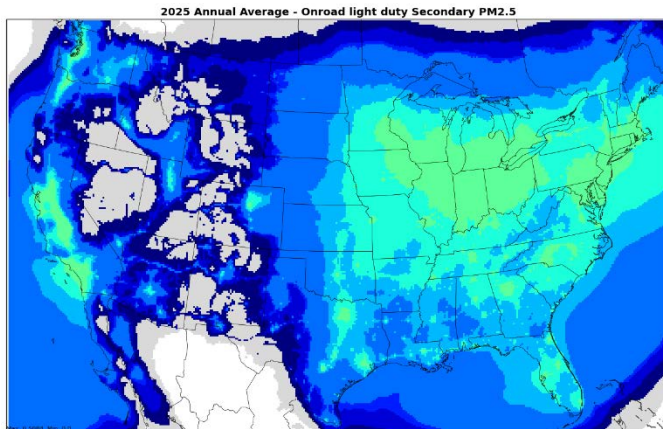
Onroad Light-duty: 2025 primary



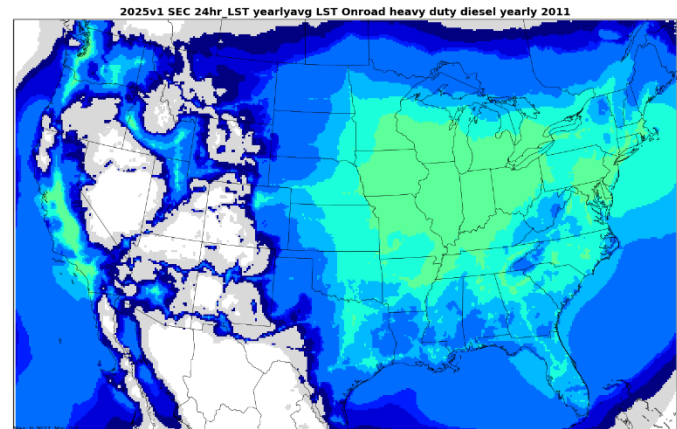
Onroad Heavy-duty Diesel: 2025 primary



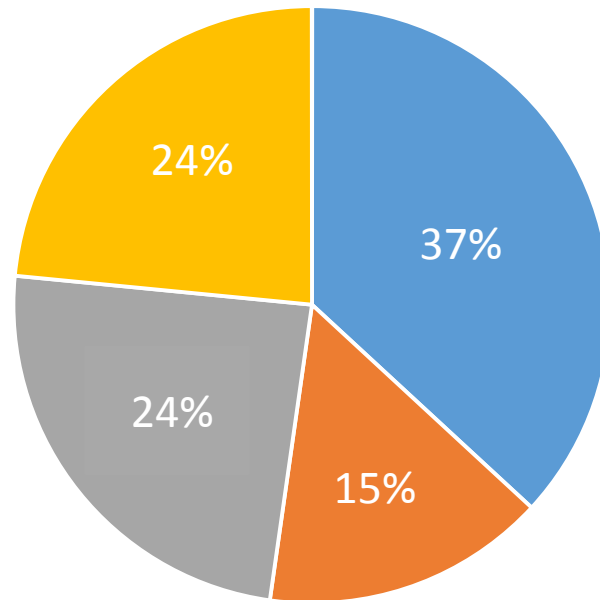
Onroad Light-duty: 2025 secondary







Onroad Heavy-duty Diesel : 2025 secondary



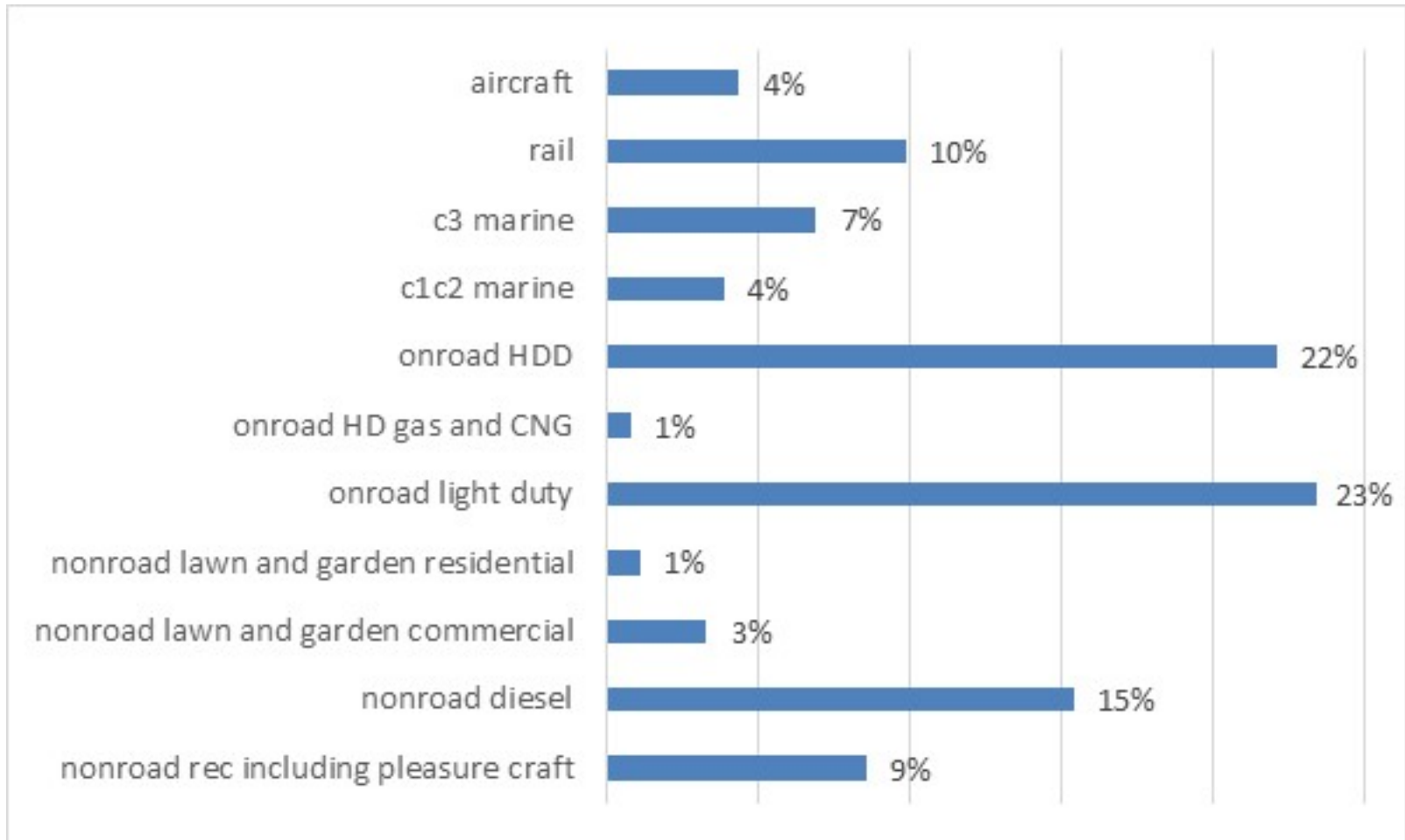
Contribution to Ozone Concentration in 2025



 Boundary Conditions
 Biogenics, Dust, Ag

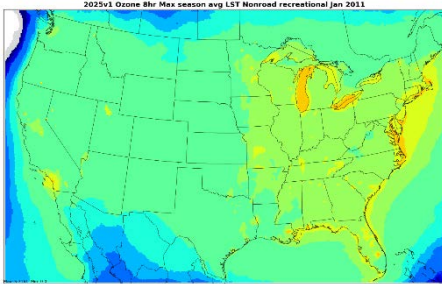
 Mobile sources
 Point, Nonpoint, Fires

Breakdown of Mobile Source Contributions to Ozone Concentration in 2025

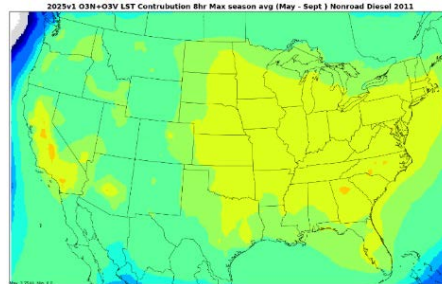


Mobile Source Contributions to Ambient Ozone in 2025

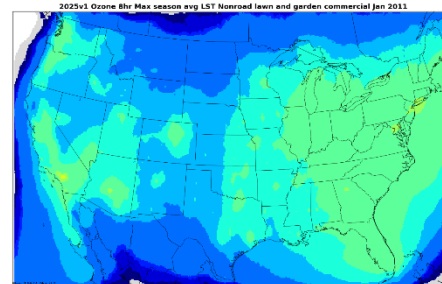
Nonroad Recreational



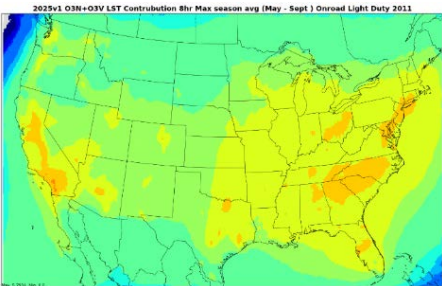
Nonroad Diesel



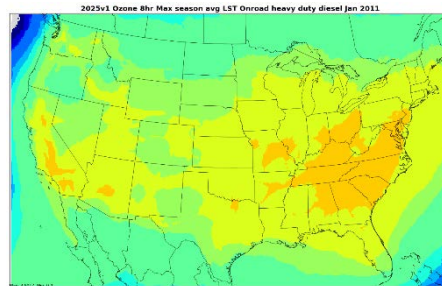
Lawn & Garden Comm



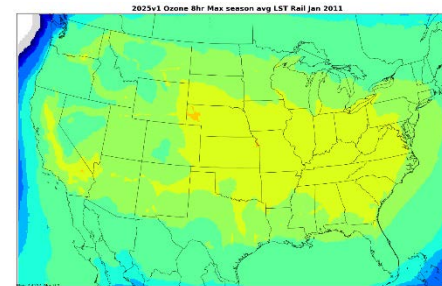
Onroad Light-Duty



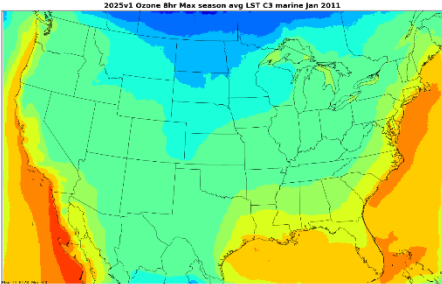
Heavy-Duty Diesel



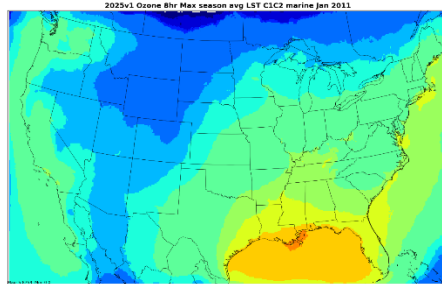
Rail



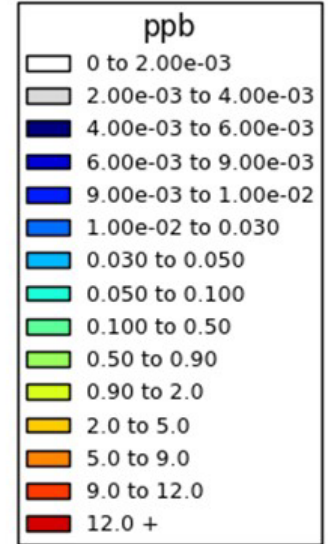
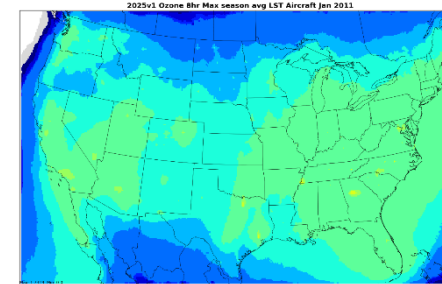
C3 Marine



C1/C2 Marine

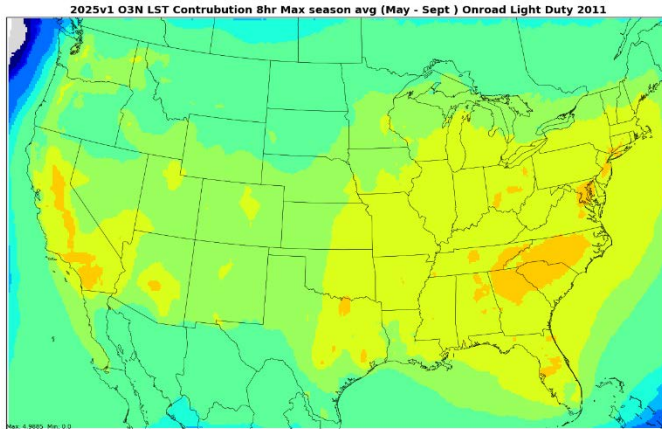


Aircraft LTO

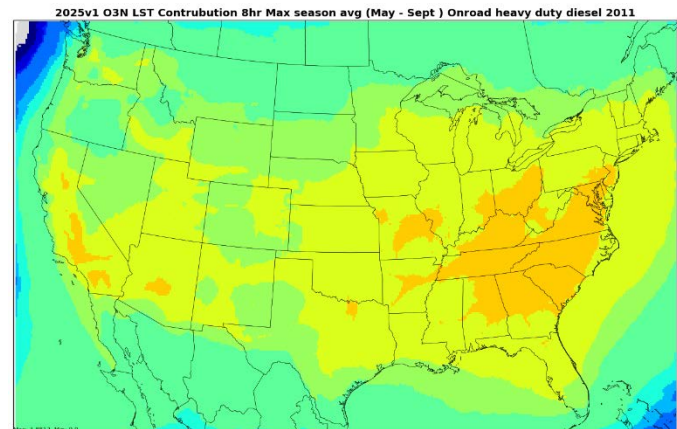


Mobile Source Contributions to Ambient Ozone: NO_x (top) and VOC (bottom)

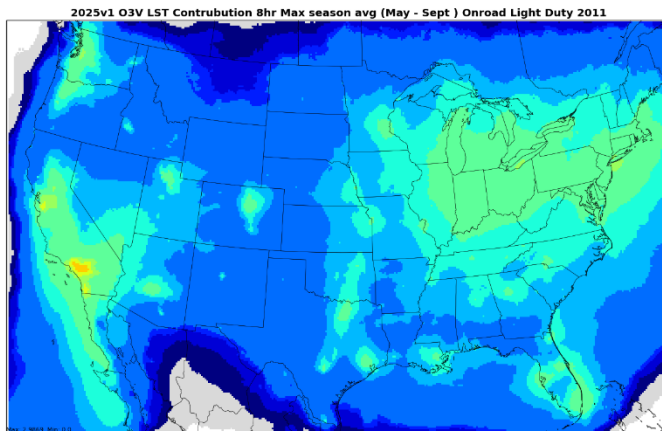
Onroad Light-duty: 2025 NO_x



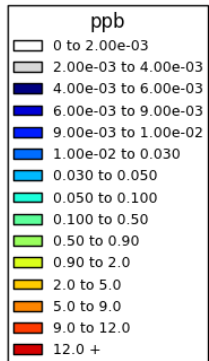
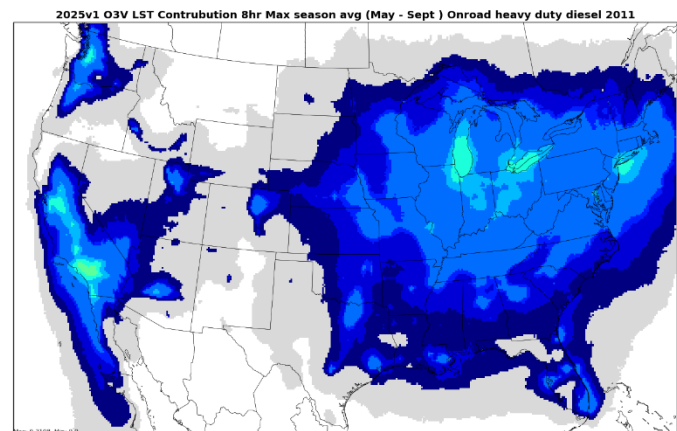
Onroad Heavy-duty Diesel: 2025 NO_x



Onroad Light-duty: 2025 VOC



Onroad Heavy-duty Diesel : 2025 VOC



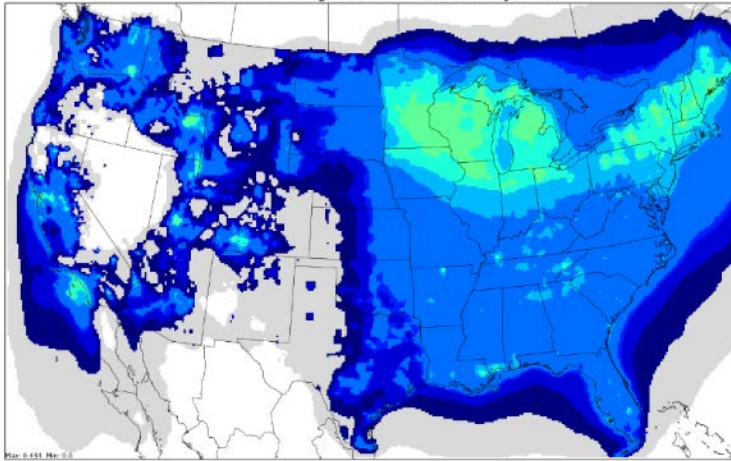
Example Application of Results

- Seasonal comparisons
- Trends over time, comparing 2011 to 2025

Seasonal Comparison: Nonroad Recreational

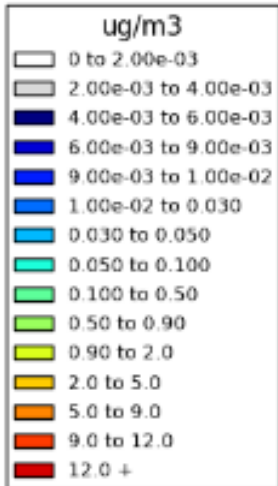
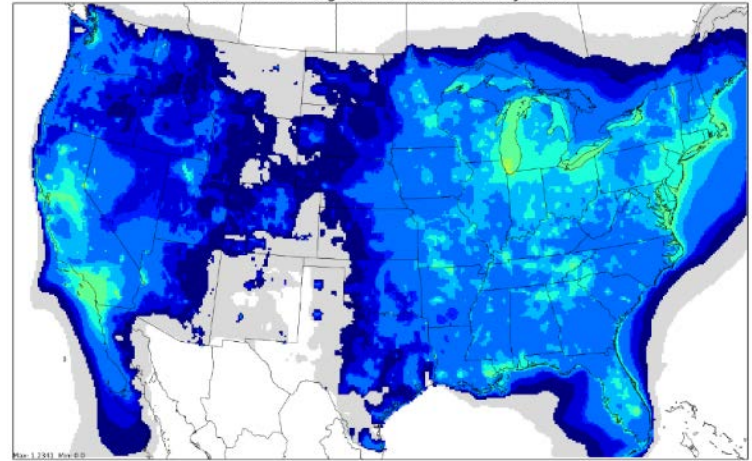
January 2011

2011v2 PRI 24-hr avg LST Nonroad recreational Jan 2011



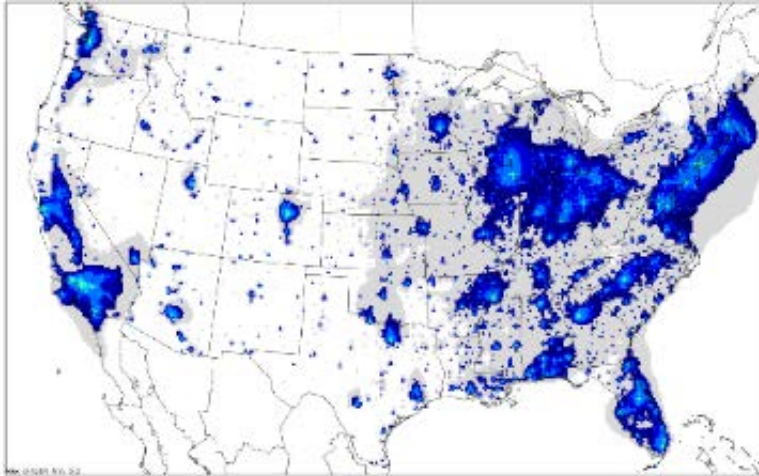
July 2011

2011v2 PRI 24-hr avg LST Nonroad recreational Jul 2011

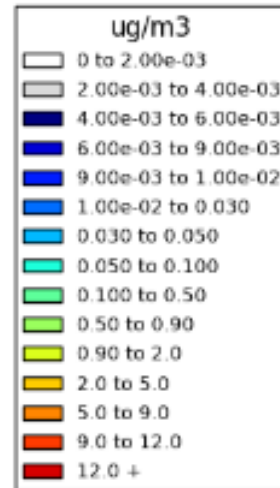
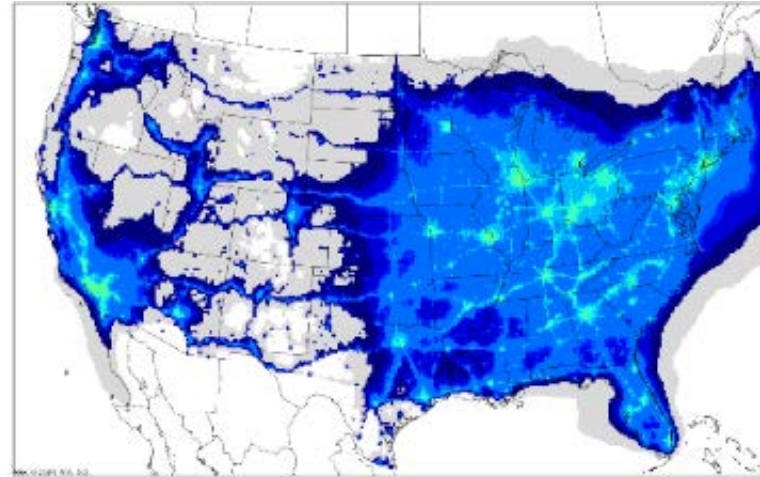
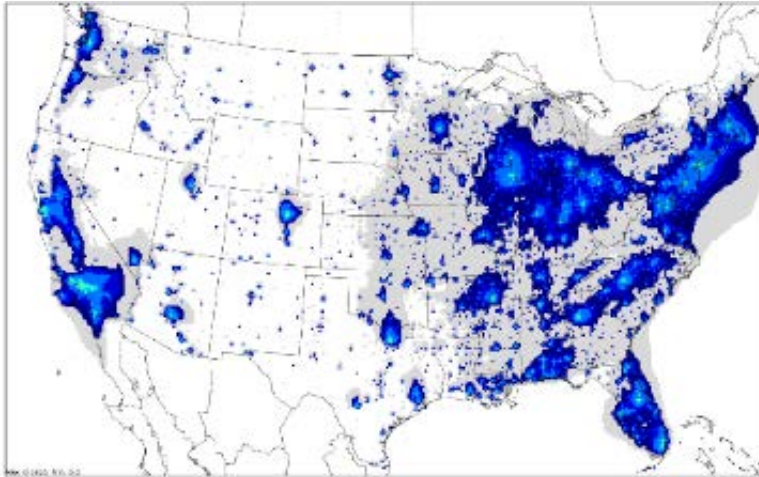
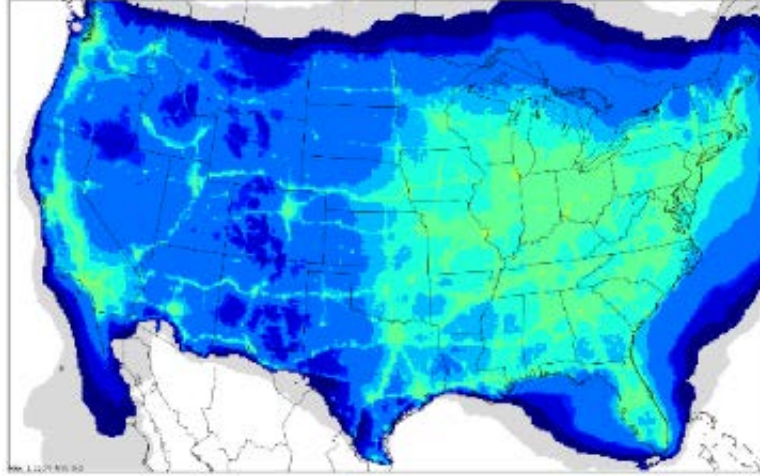


Primary PM_{2.5} Trends: 2011 (top) compared to 2025 (bottom)

Aircraft LTO (Jul)



Onroad HDD (Jul)



Wrap Up

Next Steps

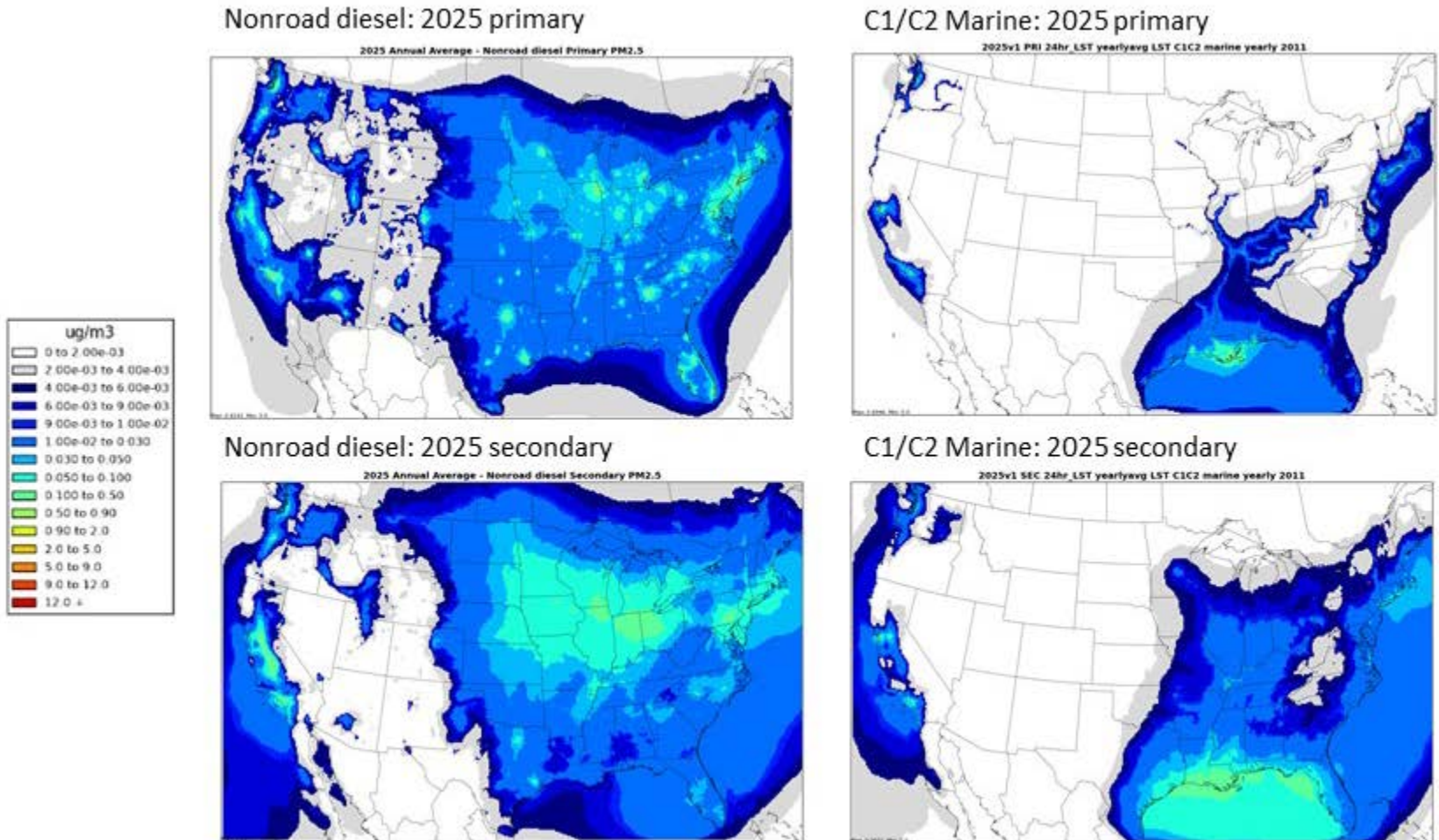
- Submit to peer reviewed journal this summer

Questions? Contact info for Molly Zawacki:

- zawacki.margaret@epa.gov
- 734-214-4472

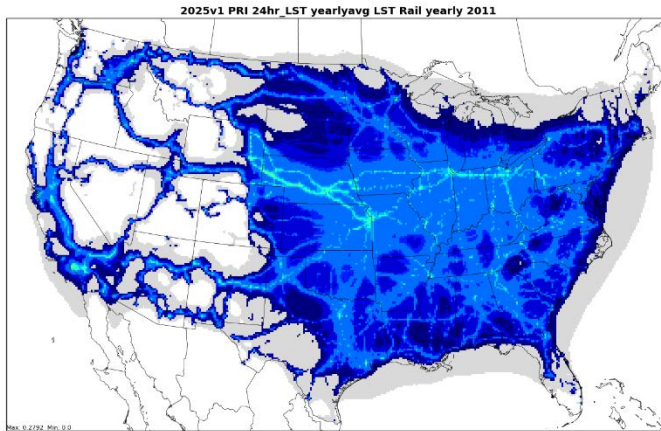
Appendix

Mobile Source Contributions to Ambient PM_{2.5}: primary (top) and secondary (bottom)

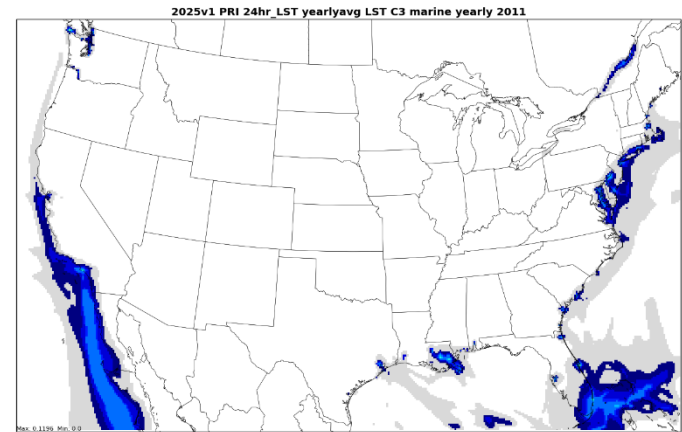


Mobile Source Contributions to Ambient PM_{2.5}: primary (top) and secondary (bottom)

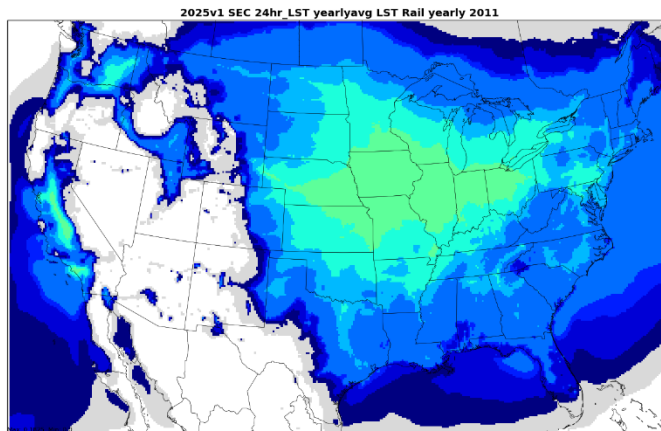
Rail: 2025 primary



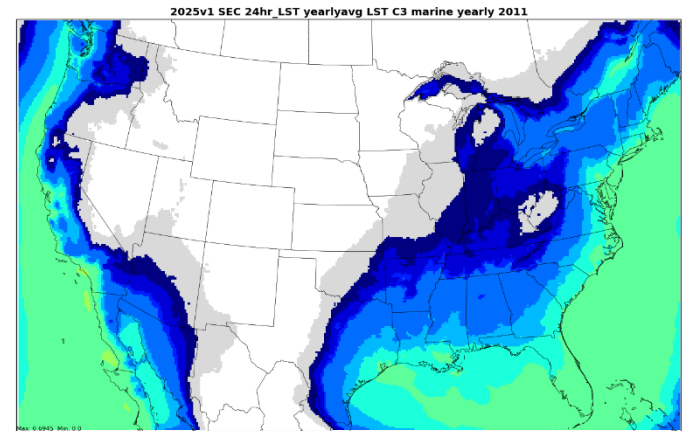
C3 Marine: 2025 primary



Rail: 2025 secondary

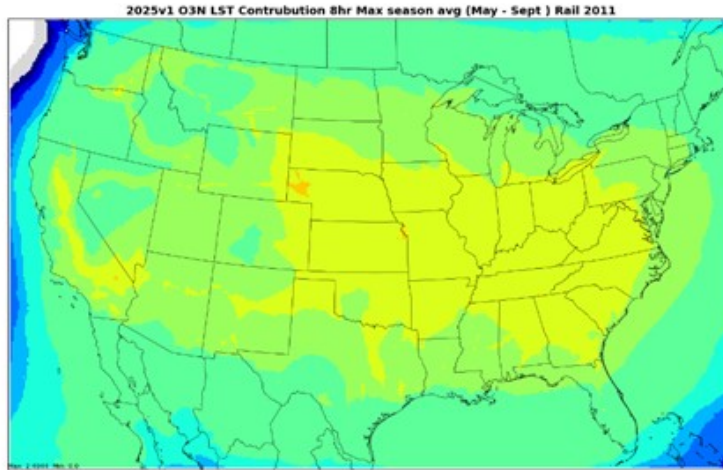


C3 Marine: 2025 secondary

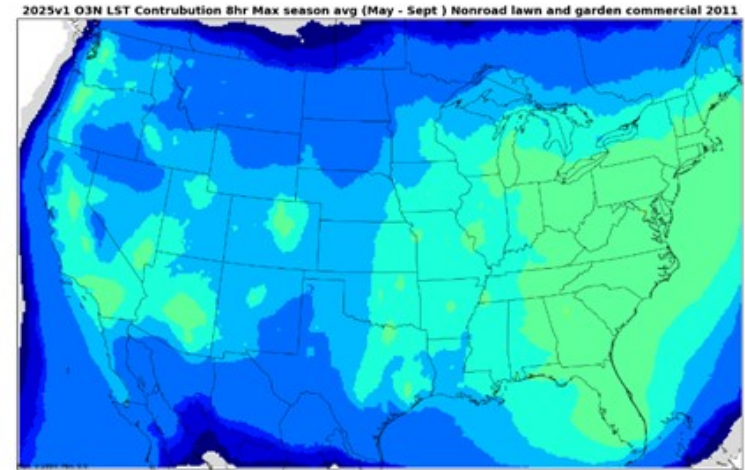


Mobile Source Contributions to Ambient Ozone: NO_x (top) and VOC (bottom)

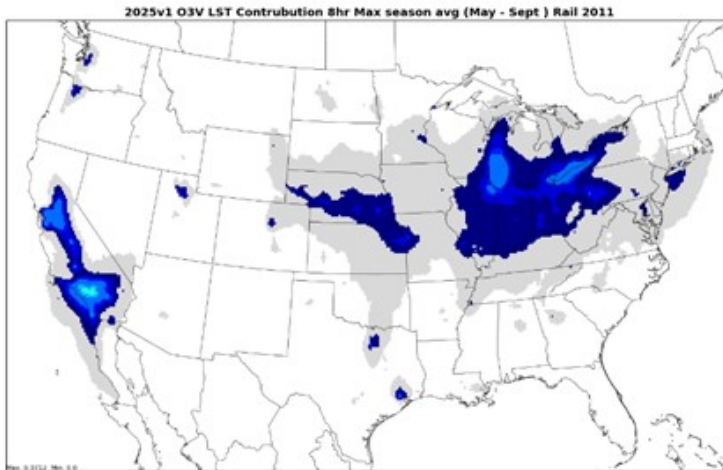
Rail – 2025 NO_x



Lawn and Garden Commercial – 2025 NO_x



Rail – 2025 VOC



Lawn and Garden Commercial – 2025 VOC

