Preliminary comparison of the environmental justice impacts of different high spatial resolution $PM_{2.5}$ datasets

Therese (Tess) S. Carter, Susan Anenberg, and Gaige Kerr

Milken Institute School of Public Health
THE GEORGE WASHINGTON UNIVERSITY

GW

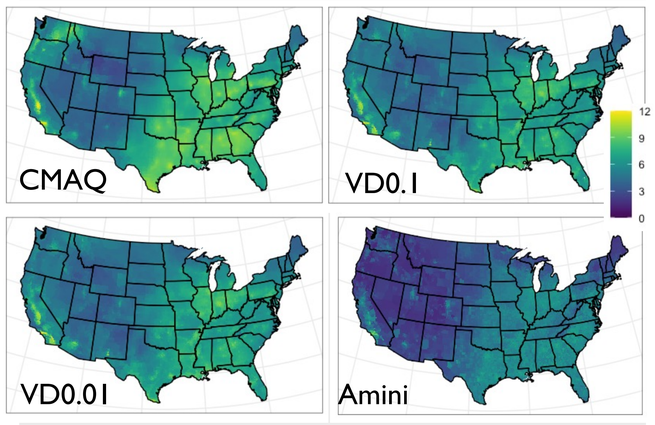
EJ mapping tools use different PM2.5 data sources

- EPAEJ Screen uses CMAQ fusion
- CDC Environmental Justice Index combines monitor and model data
- CalEnviroScreen combines $PM_{2.5}$ concentrations from monitors along with satellite observations
- Washington's tool based on CalEnviroScreen; several other states have at least preliminary tools

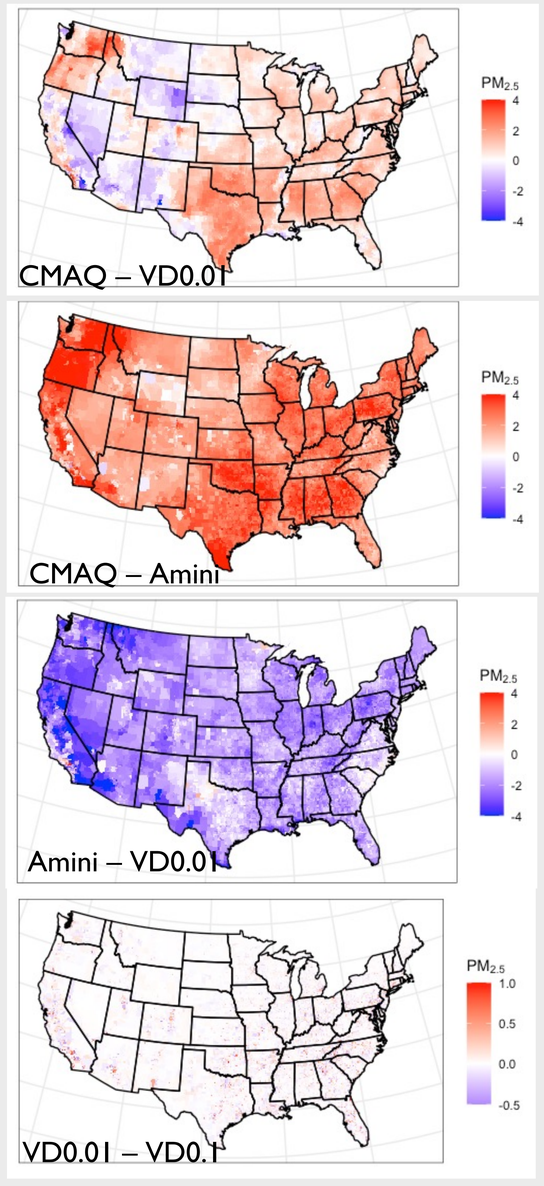
Recent available datasets

	Available years	Spatial resolution	Approach
CMAQ fusion	2002 - 2019	12 km	Bayesian downscaler to fuse ground monitors & model
Van Donkelaar et al. 2021 (VD)	1998 - 2020	0.01 and 0.1 degrees	Satellite + ground obs & CTM
Amini et al. in review	2000 - 2019	Urban at 50 m & non-urban at 1km	Obs (ground, satellite, + reanalysis) & machine learning

Annual mean 2019 $PM_{2.5}$ concentrations at census tracts



How do recent high resolution datasets compare?



References

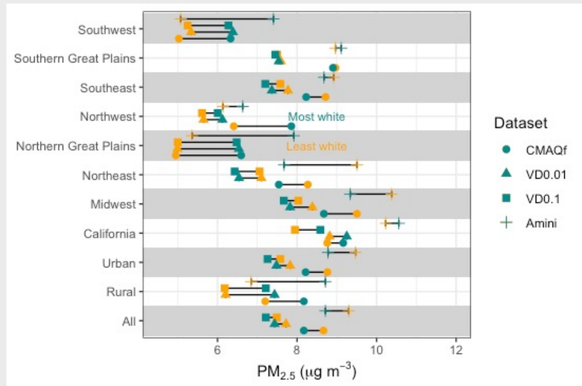
Amini, H. *et al. Hyperlocal super-learned PM2.5 components across the contiguous US.* https://www.researchsquare.com/article/rs-1745433/v1 (2022) doi:10.21203/rs.3.rs-1745433/v1.

US EPA, O. RSIG-Related Downloadable Data Files. https://www.epa.gov/hesc/rsig-related-downloadable-data-files (2015).

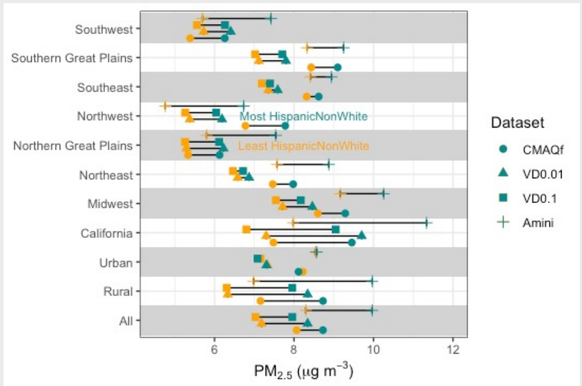
van Donkelaar, A. et al. Monthly Global Estimates of Fine Particulate Matter and Their Uncertainty. Environ. Sci. Technol. 55, 15287–15300 (2021).

Relative $PM_{2.5}$ exposure estimates generally agree

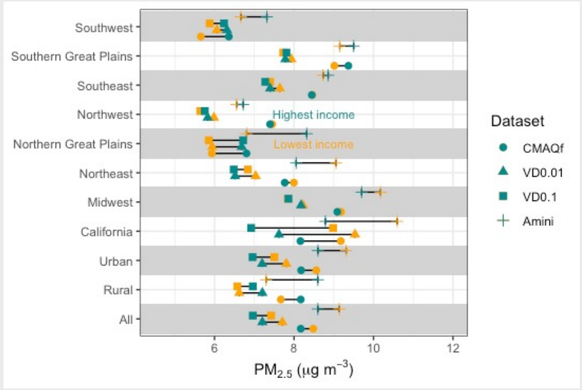
Race



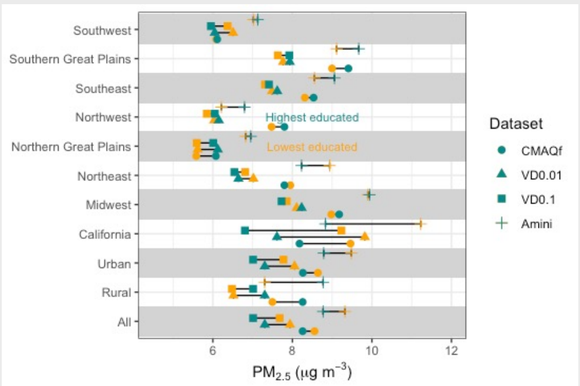
Higher exposure for Hispanics



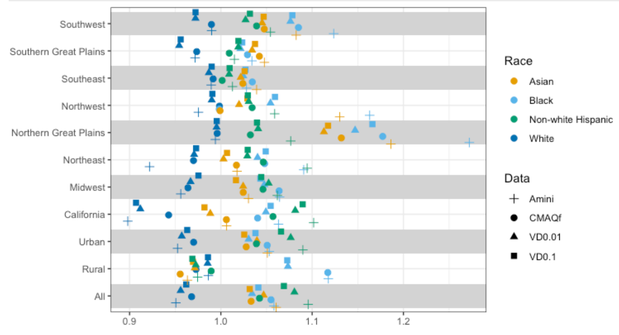
Higher incomes in West → higher exposure



Educational attainment varies regionally



$PM_{2.5}$ disparities



Disparities are calculated as the ratio of population-weighted $PM_{2.5}$ for each population subgroup to the population-weighted overall average for different aggregations (i.e., all, urban, or rural tracts) and regions.

Conclusions & next steps

- Datasets generally agree on relative $PM_{2.5}$ exposure differences by group with some variation (e.g., Amini shows larger disparities than VD in many regions across variables)
- Absolute magnitude exposure differs across datasets with Amini and CMAQ often larger
- Urban and rural differences provide insights on other EJ variables
- Amini and VD resolve intraurban differences particularly in the west, unlike CMAQ

- *Investigate relative versus absolute EJ exposure differences*
- Differences among datasets may be due to source differences, such as differences in underlying smoke emissions; more work needed to confirm
- Consider comparing PM composition, sources, and regional datasets if possible

Tess.carter@gwu.edu