

Supporting Information

Benefits of High Resolution PM_{2.5} Prediction using Satellite MAIAC AOD and Land Use Regression for Exposure Assessment: California Examples

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Summary of contents: 9 pages, 2 figures, 4 tables

Table S1. The fixed and random effect estimates of the mixed effects model. The intercepts and slopes of random effects are demonstrated by standard deviations (SD). The (Week:Basin) and (Basin) represent PM_{2.5}-AOD relationships that vary by every 3-week period within each air basin.

Fixed Effect^a	Estimate	SE
Intercept	4.35	0.44
AOD	12.44	2.29
Temp	0.054	0.005
PBLH	-0.24	0.06
Dist_Highways	-4.18	0.62
Elevation	-1.81	0.10
Dist_Coast	0.95	0.10
AADT	0.0025	0.0004
Develop_500m	1.16	0.09
Random Effect	Category	SD
Date	Intercept	1.81
	AOD	18.08
Week:Basin	Intercept	1.93
	AOD	16.93
Basin	Intercept	1.42
	AOD	6.10

^aThe units of all the independent variables are following: AOD (unitless), Temp (temperature, °C), PBLH (planetary boundary layer height, km), Dist_Highways (distance to highways, degree), Elevation (km), Dist_Coast (distance to coast, degree), AADT (annual average daily traffic, ×1000 vehicles/day), and Develop_500m (percent developed areas within 500 m buffers, ×100 %).

Table S2. Seasonal performance of the mixed effects model. Seasonal average measured and estimated PM_{2.5} concentrations are compared. At least 10 pairs of measured and estimated PM_{2.5} concentrations are used to calculate site-specific seasonal averages. The MAE and RMSE values are in the unit of $\mu\text{g}/\text{m}^3$.

Season ^a	Model fit			Site-based CV			Obs-based CV		
	R ²	MAE	RMSE	R ²	MAE	RMSE	R ²	MAE	RMSE
Winter	0.83	1.63	2.18	0.76	1.95	2.58	0.80	1.76	2.35
Spring	0.64	1.06	1.30	0.49	1.28	1.56	0.60	1.12	1.37
Summer	0.67	1.28	1.59	0.54	1.56	1.92	0.65	1.33	1.65
Fall	0.83	1.01	1.29	0.75	1.26	1.57	0.81	1.07	1.36

^aWinter: December-February; Spring: March-May; Summer: June-August; Fall: September-November.

Table S3. Comparisons of within-urban and between-urban variabilities of satellite-based PM_{2.5} concentrations (Unit: µg/m³) by air basin. Within-urban and between-urban variabilities in the absolute term are in the unit of µg/m³ while those in the relative term are unitless. Ratios are calculated as (between-urban variability/within-urban variability).

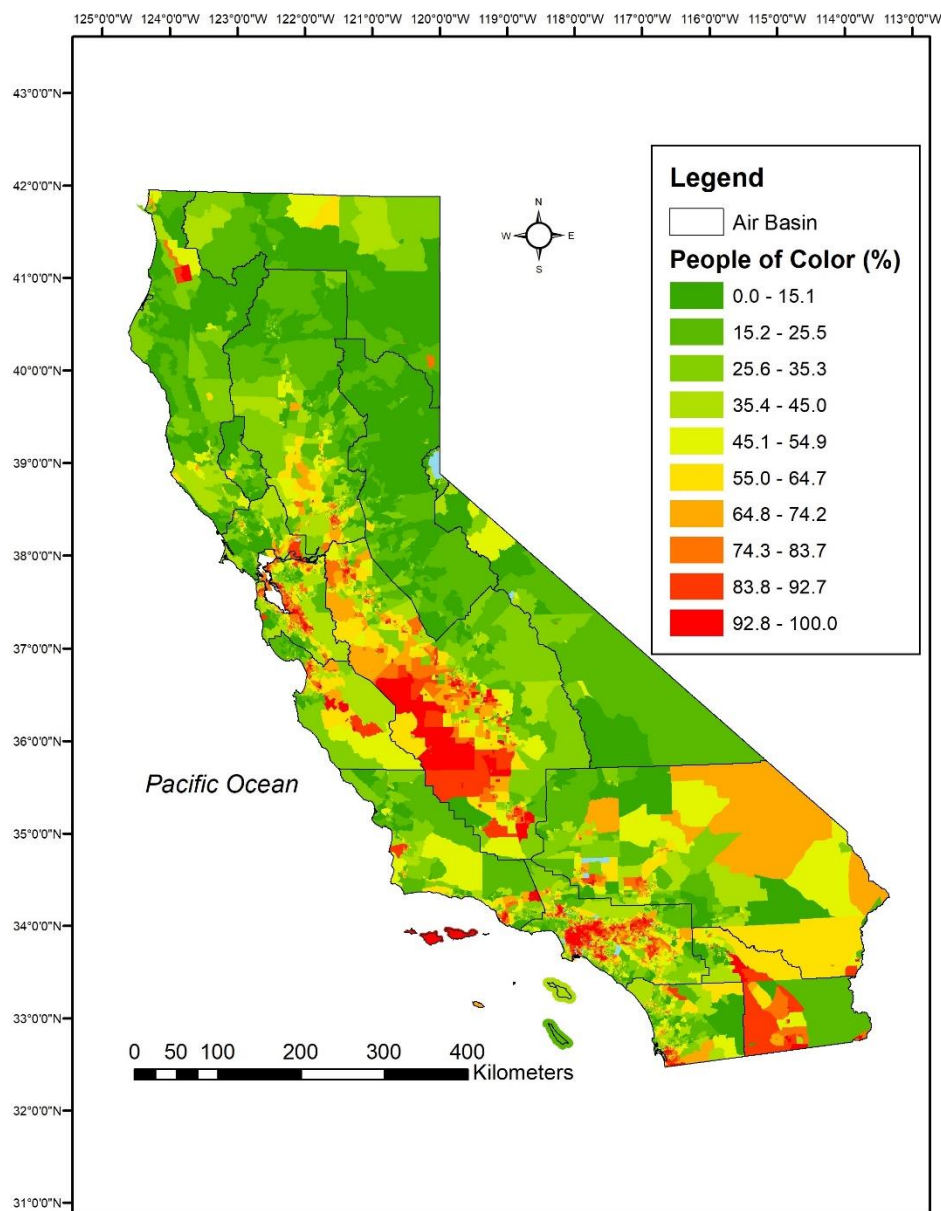
Region	Absolute			Relative		
	Within-Urban	Between-Urban	Ratio	Within-Urban	Between-Urban	Ratio
Statewide	2.42	6.95	2.871	0.29	0.81	2.807
Bay Area	2.11	0.60	0.283	0.29	0.08	0.283
San Joaquin Valley	2.57	2.12	0.826	0.22	0.19	0.827
South Coast	3.26	1.31	0.402	0.31	0.13	0.426

Table S4. Basin-specific population-weighted mean PM_{2.5} concentrations (Unit: µg/m³) by the level of each demographic factor. The subgroups of ‘high’, ‘moderate’, and ‘low’ are defined as block groups with $\geq 75^{\text{th}}$, $25^{\text{th}} \leq < 75^{\text{th}}$, and $< 25^{\text{th}}$ percentiles of each demographic factor, respectively. Basins with < 10 block groups in a specific level of a given demographic factor are not shown.

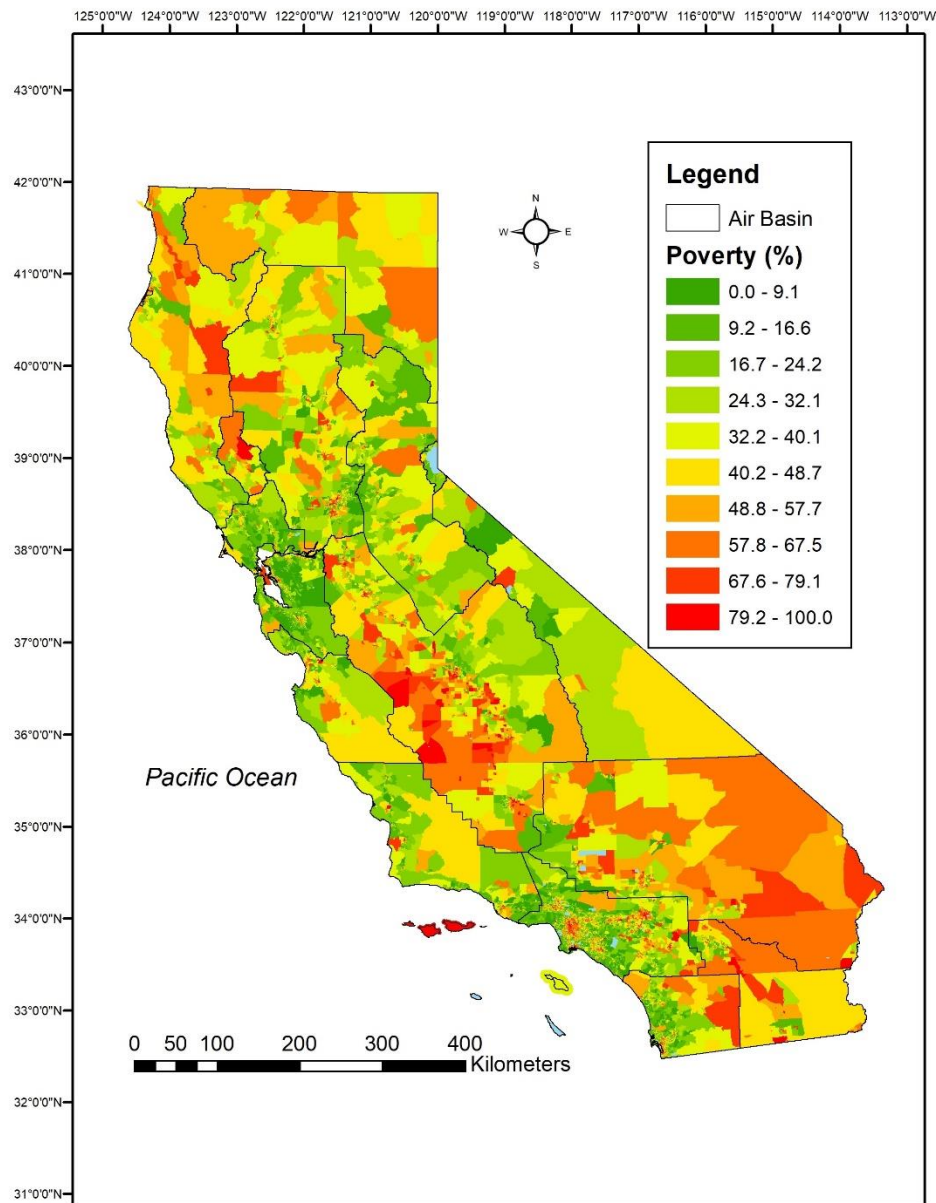
Region	Factor	Low		Moderate		High	
		N	PM _{2.5}	N	PM _{2.5}	N	PM _{2.5}
Sacramento Valley	% People of Color	530	6.81	659	7.24	94	7.54
	% Poverty	224	7.06	713	7.01	346	7.41
	% Low Education	319	7.10	766	7.08	198	7.32
San Diego County	% People of Color	301	8.51	531	8.62	153	8.89
	% Poverty	290	8.56	538	8.63	157	8.83
	% Low Education	334	8.61	502	8.59	149	8.90
North Central Coast	% People of Color	113	5.27	122	5.51	79	5.97
	% Poverty	73	5.26	172	5.56	69	5.92
	% Low Education	98	5.22	110	5.61	106	5.83
Mojave Desert	% People of Color	97	6.25	291	6.98	82	7.19
	% Poverty	34	6.91	215	6.84	221	7.05
	% Low Education	38	6.78	288	6.87	144	7.11
South Central Coast	% People of Color	242	7.67	286	8.13	75	8.54
	% Poverty	193	7.97	333	8.02	77	8.32
	% Low Education	208	7.83	293	8.04	102	8.41
Salton Sea	% People of Color	70	8.12	91	8.12	100	8.56
	% Poverty	17	8.23	134	8.30	110	8.38
	% Low Education	42	8.08	116	8.24	103	8.47

Figure S1. Spatial maps of demographic factors at the block-group level: (A) % people of color, (B) % poverty, and (C) % low educational attainment.

(A)



(B)



(C)

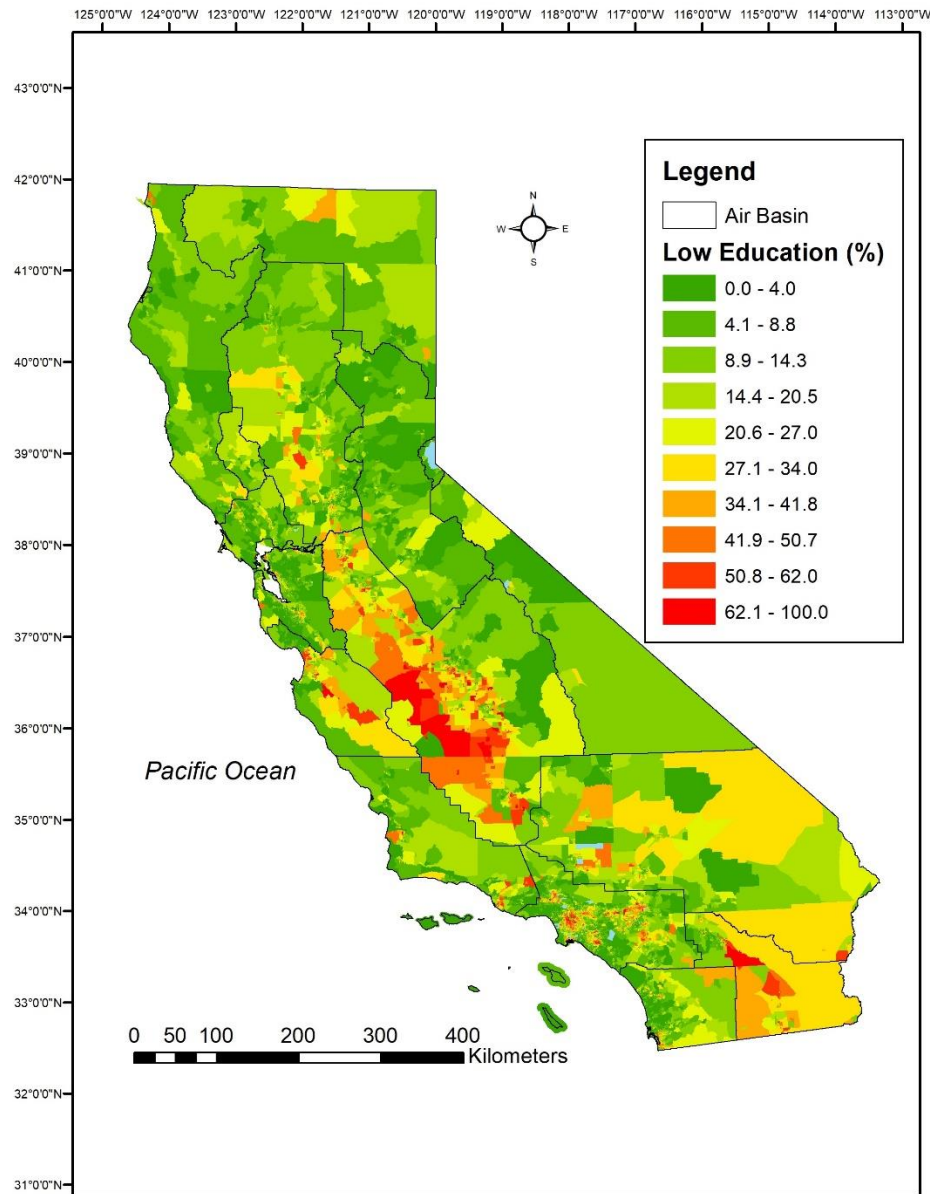


Figure S2. Forest plot showing within-urban and between-urban PM_{2.5} variability. The means and interquartile ranges (25th to 75th percentiles) are in the unit of $\mu\text{g}/\text{m}^3$. The dashed vertical line displays arithmetic mean of urban-specific mean PM_{2.5} concentrations.

