Supplemental Information for SIBaR: A New Method for Background Quantification and Removal from Mobile Air Pollution Measurements

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Census Tracts	Population Total	# Metal Recyclers	# Concrete Batch Plants	# Petrochemical Facilities
Northwest Domain	**34873**	**7**	**2**	**0**
North Spring Branch	5126	0	0	0
South Spring Branch	3604	0	0	0
Memorial Park	6908	0	0	0
Washington Corridor	5432	2	0	0
North River Oaks	1803	0	0	0
South River Oaks	2775	0	0	0
West Eastex	2753	5	2	0
North Heights	6472	1	0	0
Southwest Domain	**24927**	**0**	**1**	**0**
Westchase	5548	0	0	0
Sharpstown	5616	0	0	0
Sharpstown North	3484	0	1	0
Sharpstown South	5196	0	0	0
Bayland Park	5083	0	0	0
South Beltway Central Domain	**2530**	**3**	**8**	**0**
South Beltway Central	2530	3	8	0
Rice Domain	**8247**	**0**	**0**	**0**
North Rice	2892	0	0	0
South Rice	5355	0	0	0
Ship Channel Domain	**20177**	**4**	**1**	**4**
Clinton	2127	2	1	1
West Galena Park	5245	0	0	0
East Galena Park	3000	0	0	0
Manchester	1647	0	0	1
Harrisburg	1496	2	0	2
Milby Park	6662	0	0	0

Table S1. Neighborhood summary table which includes the total population and number of important point source emitters within each neighborhood. Data courtesy of the U.S. Census and Environmental Defense Fund (Census 2010; Environmental Defense Fund). Domain names refer to direction from downtown or local landmarks (such as Rice University).

Parameter	Instrument
NO	T200 NO Analyzer
NO$_2$	T500U NO$_2$ Analyzer
CO$_2$	Li-COR CO$_2$ Analyzer
BC	AE33 Aethalometer

Table S2. Instruments used in campaign to make measurements.

	1	2	3	4	5	6	7	8	9	10	11	12
1	0.0000	0.0017	0.0040	0.0113	0.0145	0.0146	0.0153	0.0059	0.0059	0.0164	0.0115	0.0068
2		0.0000	0.0041	0.0112	0.0143	0.0147	0.0150	0.0058	0.0058	0.0163	0.0114	0.0075
3			0.0000	0.0101	0.0147	0.0146	0.0151	0.0042	0.0042	0.0154	0.0118	0.0081
4				0.0000	0.0154	0.0111	0.0158	0.0120	0.0119	0.0167	0.0130	0.0142
5					0.0000	0.0087	0.0039	0.0151	0.0152	0.0194	0.0183	0.0168
6						0.0000	0.0087	0.0153	0.0153	0.0196	0.0181	0.0165
7							0.0000	0.0148	0.0148	0.0192	0.0195	0.0168
8								0.0000	0.0003	0.0144	0.0128	0.0069
9									0.0000	0.0143	0.0128	0.0068
10										0.0000	0.0168	0.0161
11											0.0000	0.0135
12												0.0000

Table S3. Pairwise RMSE values between different iterations of SIBaR.
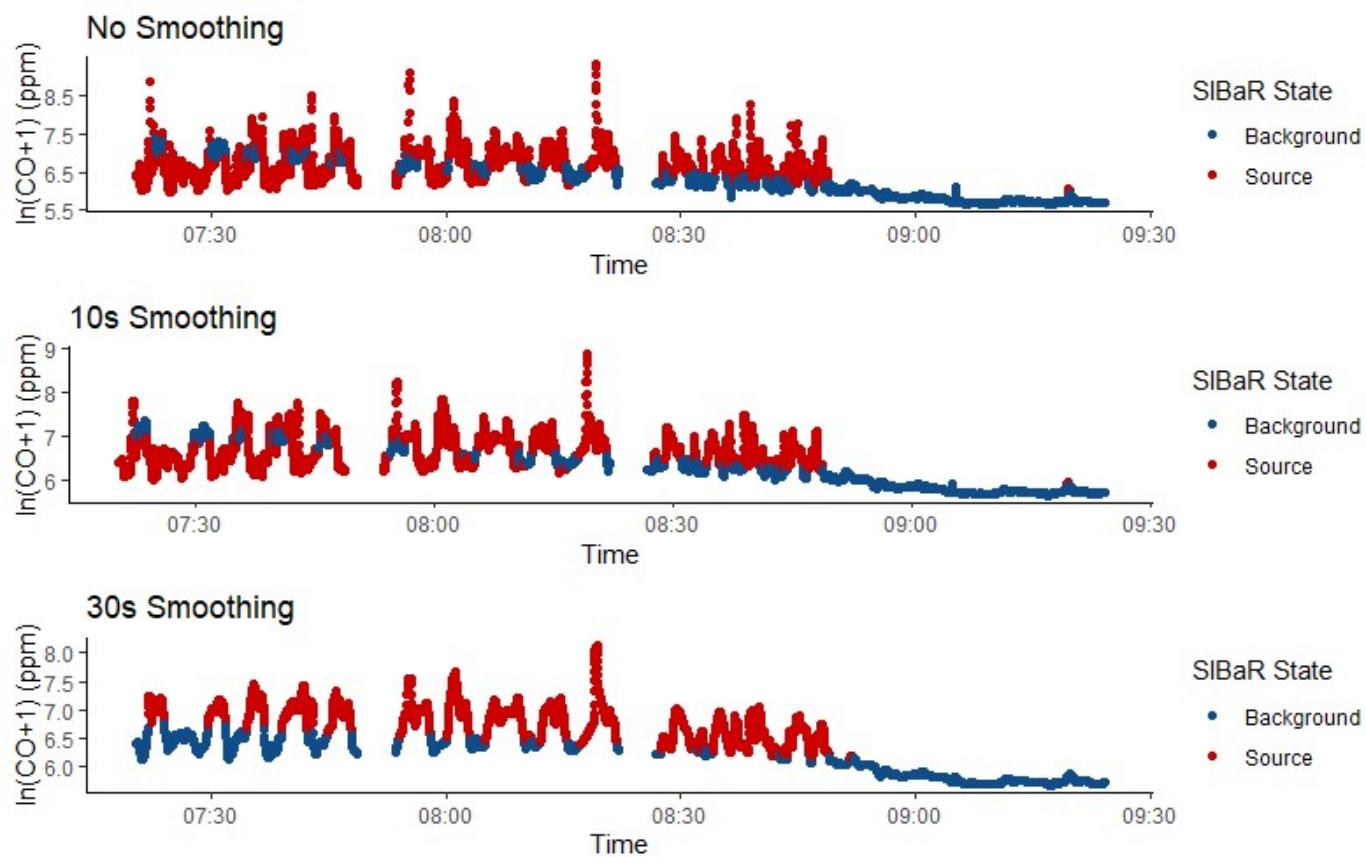
Figure S1. SIBaR state designation time window sensitivity.

Figure S2. CO$_2$ mapped fractional contributions. A value of 1 implies all measurements reflect background, while a value of 0 implies all measurements reflect non-background. Basemap generated by Matlab geobasemap 'streets' and is hosted by ESRI (Sources: Esri, DeLorme, HERE, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, Tomtom).
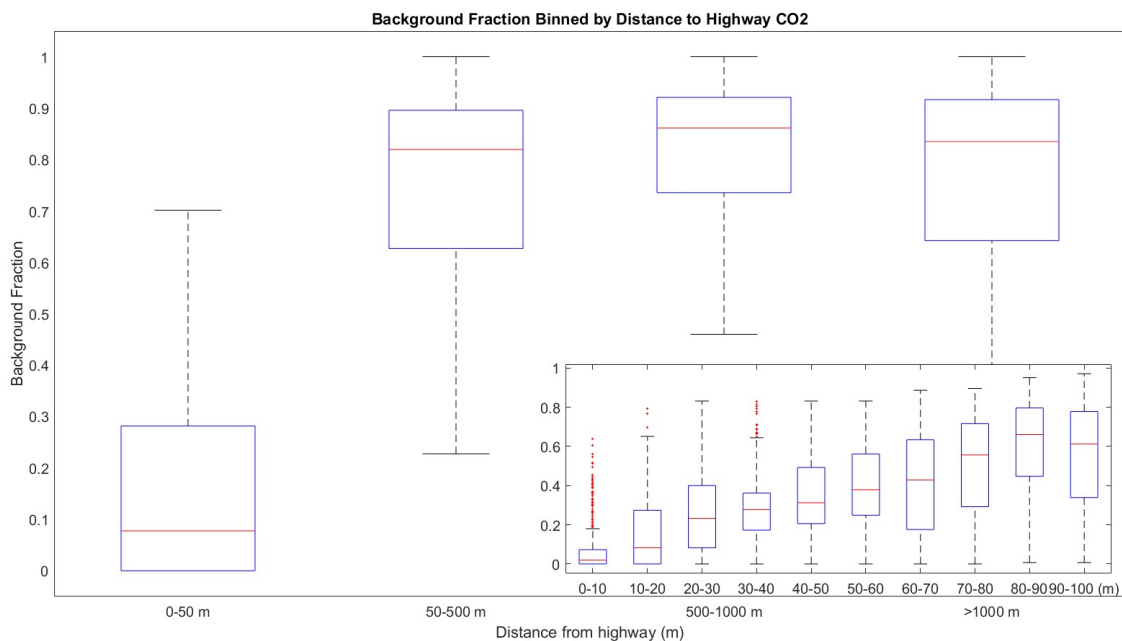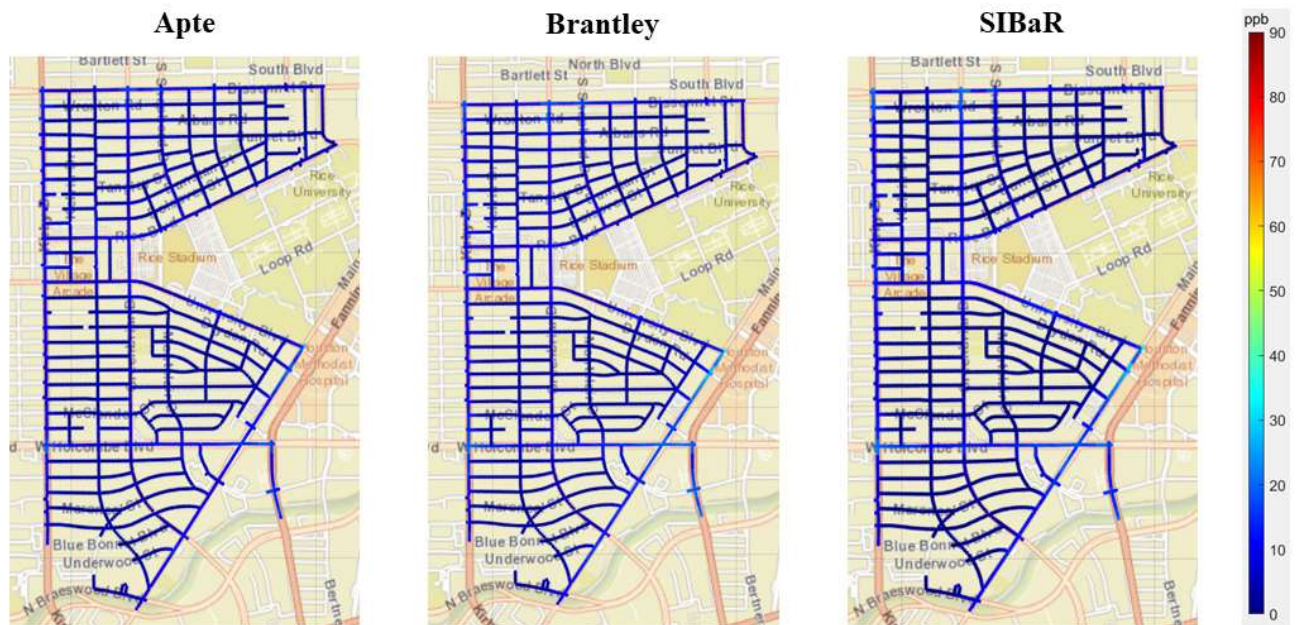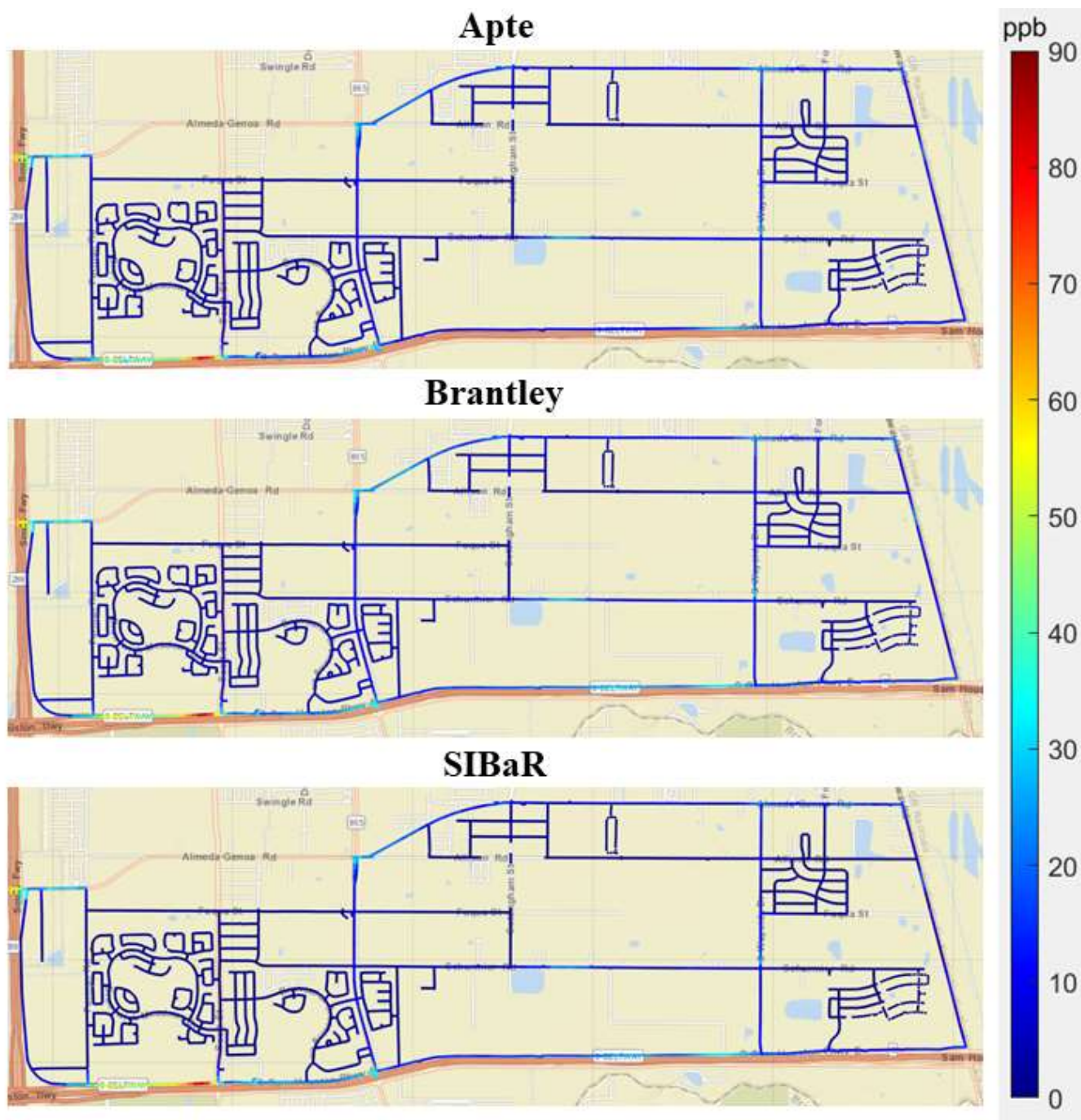

Figure S3. CO$_2$ background fraction boxplot binned by distance.
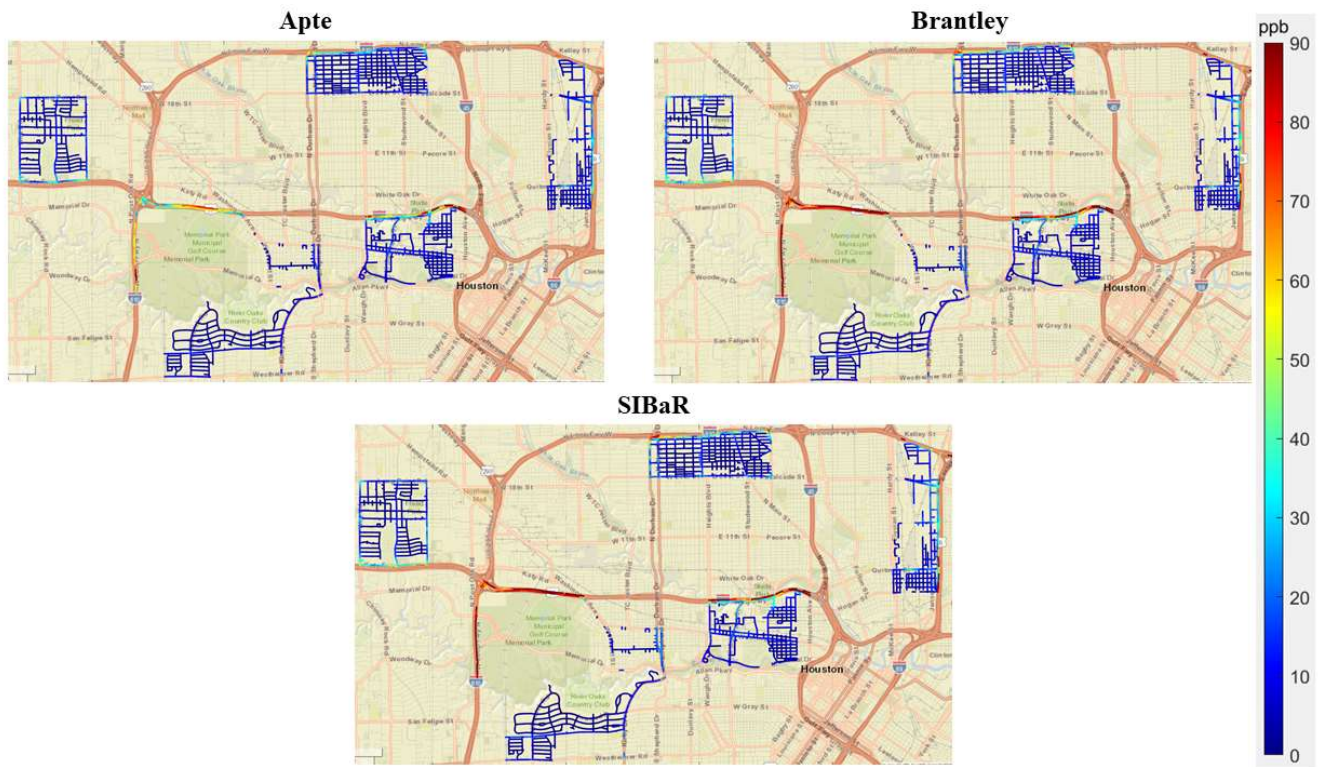
Figure S4. Mapped median NO_x source contributions. Northwest quadrant. Basemap generated by Matlab geobasemap 'streets' and is hosted by ESRI (Sources: Esri, DeLorme, HERE, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, Tomtom).
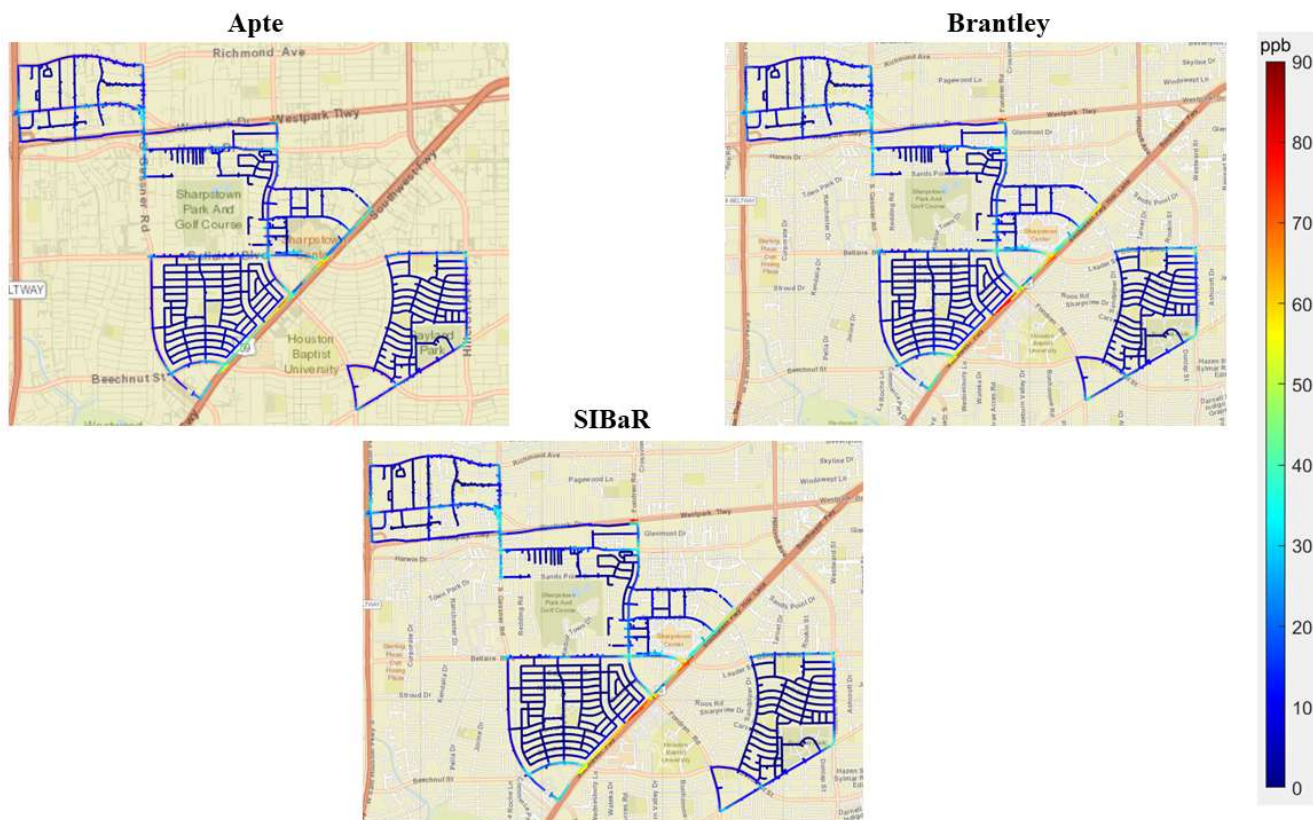

Figure S5. Mapped median NO_x source contributions. North and South Rice. Basemap generated by Matlab geobasemap 'streets' and is hosted by ESRI (Sources: Esri, DeLorme, HERE, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, Tomtom).
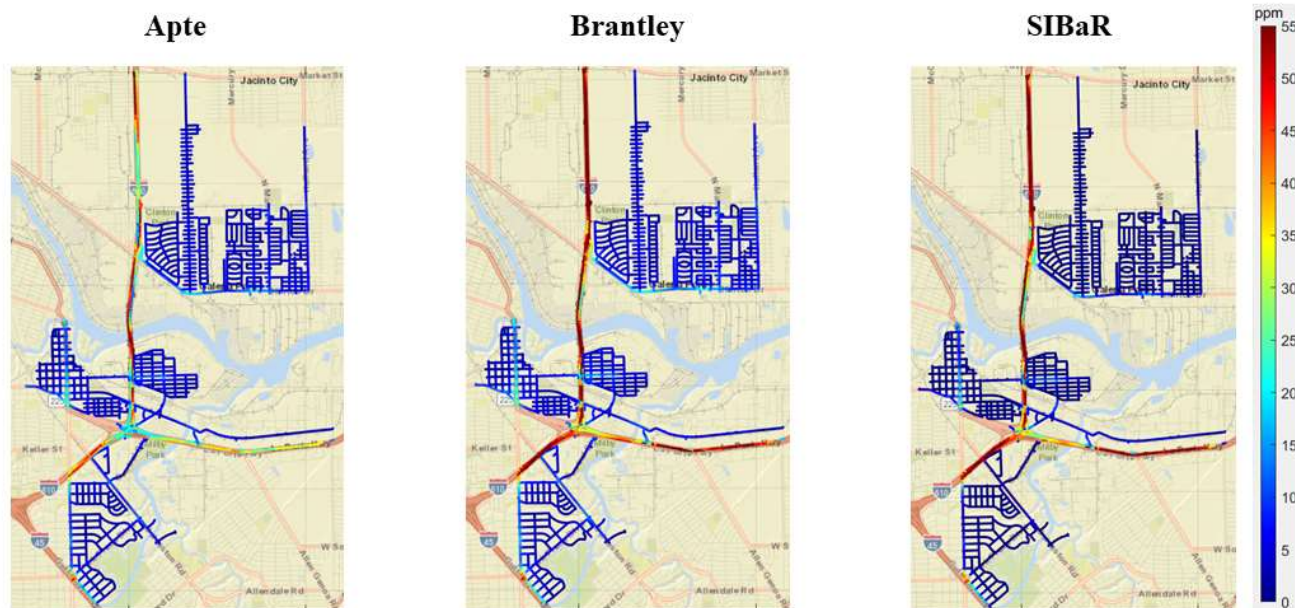
Figure S6. Mapped median NOₓ source contributions. South Beltway Central. Basemap generated by Matlab geobasemap 'streets' and is hosted by ESRI (Sources: Esri, DeLorme, HERE, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, Tomtom).
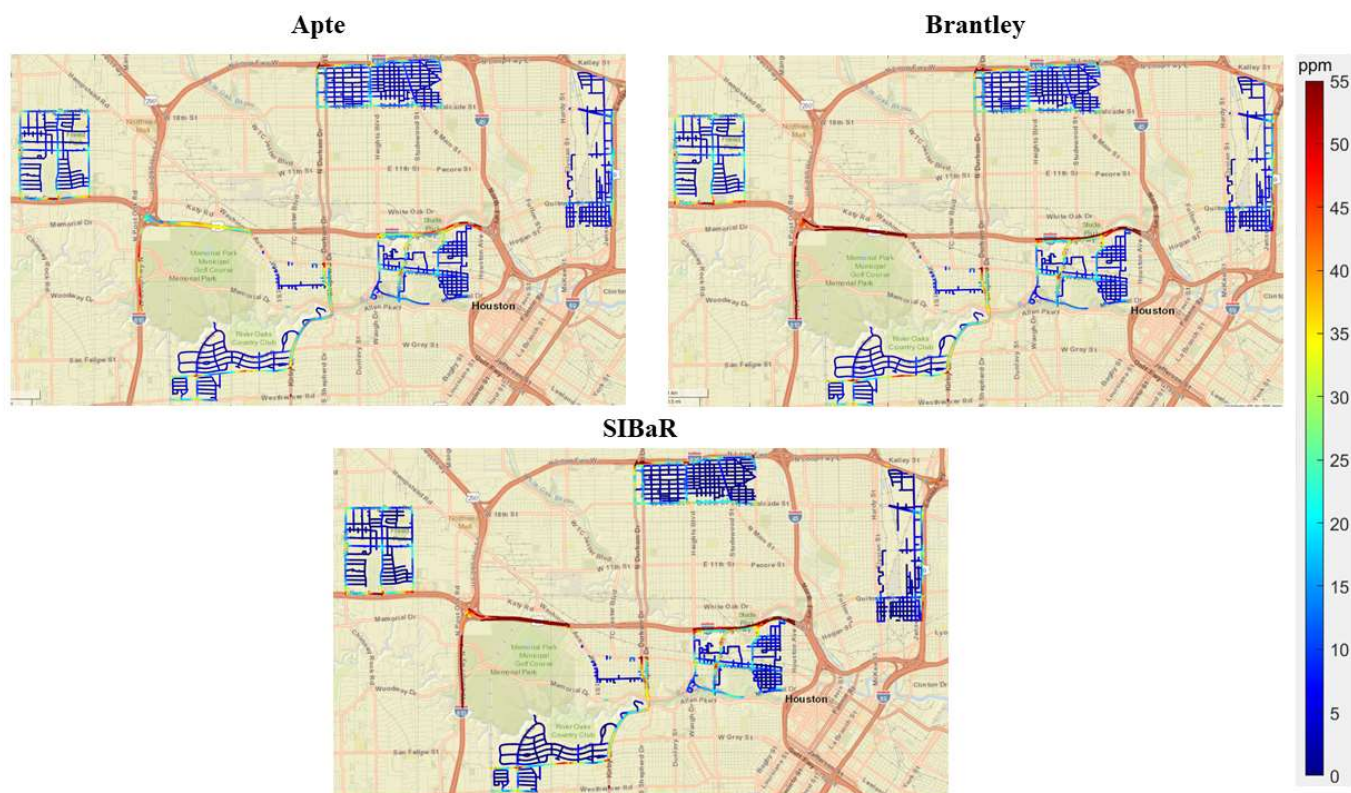
Figure S7. Mapped median NO$_x$ source contributions. Southwest quadrant. Basemap generated by Matlab geobasemap 'streets' and is hosted by ESRI (Sources: Esri, DeLorme, HERE, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, Tomtom).
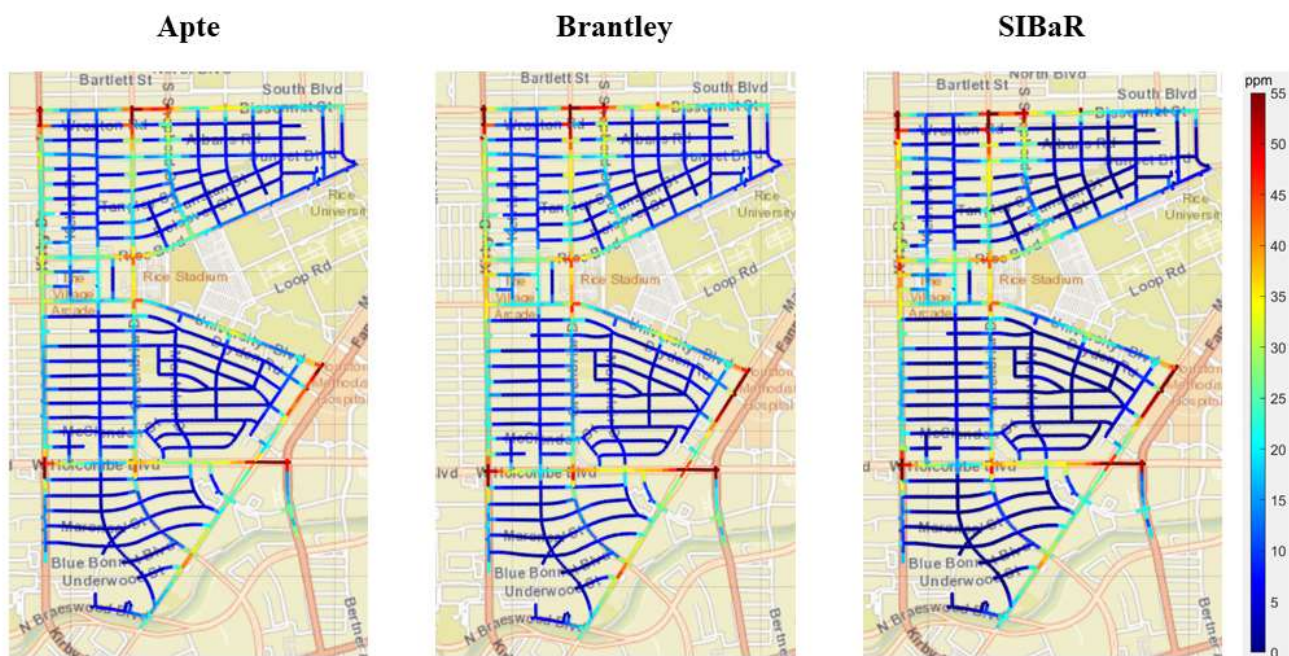

Figure S8. CO$_2$ mapped median source contributions. Ship Channel. Basemap generated by Matlab geobasemap 'streets' and is hosted by ESRI (Sources: Esri, DeLorme, HERE, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, Tomtom).
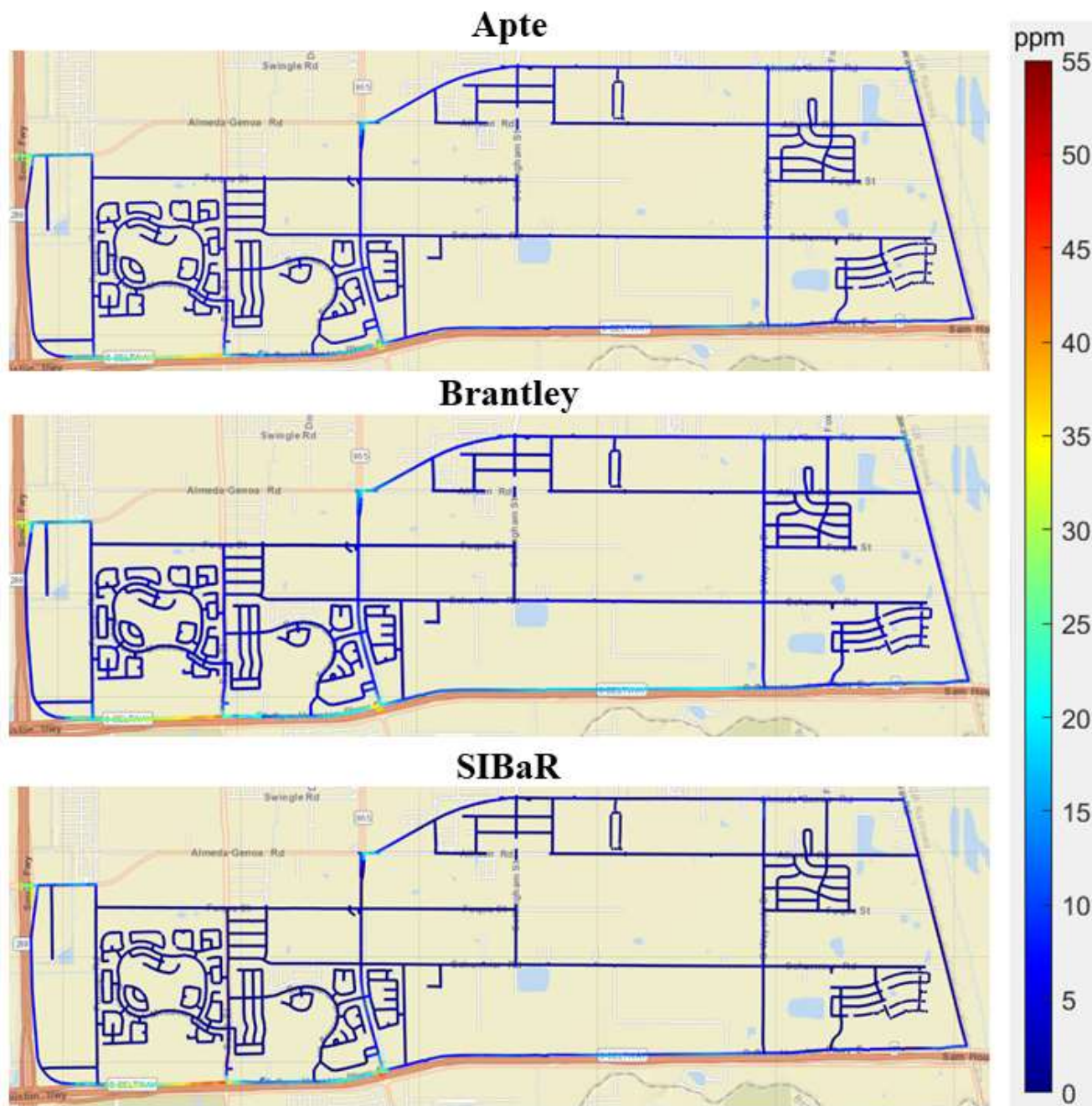
Figure S9. CO₂ mapped median source contributions. Northwest domain. Basemap generated by Matlab geobasemap 'streets' and is hosted by ESRI (Sources: Esri, DeLorme, HERE, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, Tomtom).

Figure S10. CO₂ mapped median source contributions. North and South Rice. Basemap generated by Matlab geobasemap 'streets' and is hosted by ESRI (Sources: Esri, DeLorme, HERE, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, Tomtom).
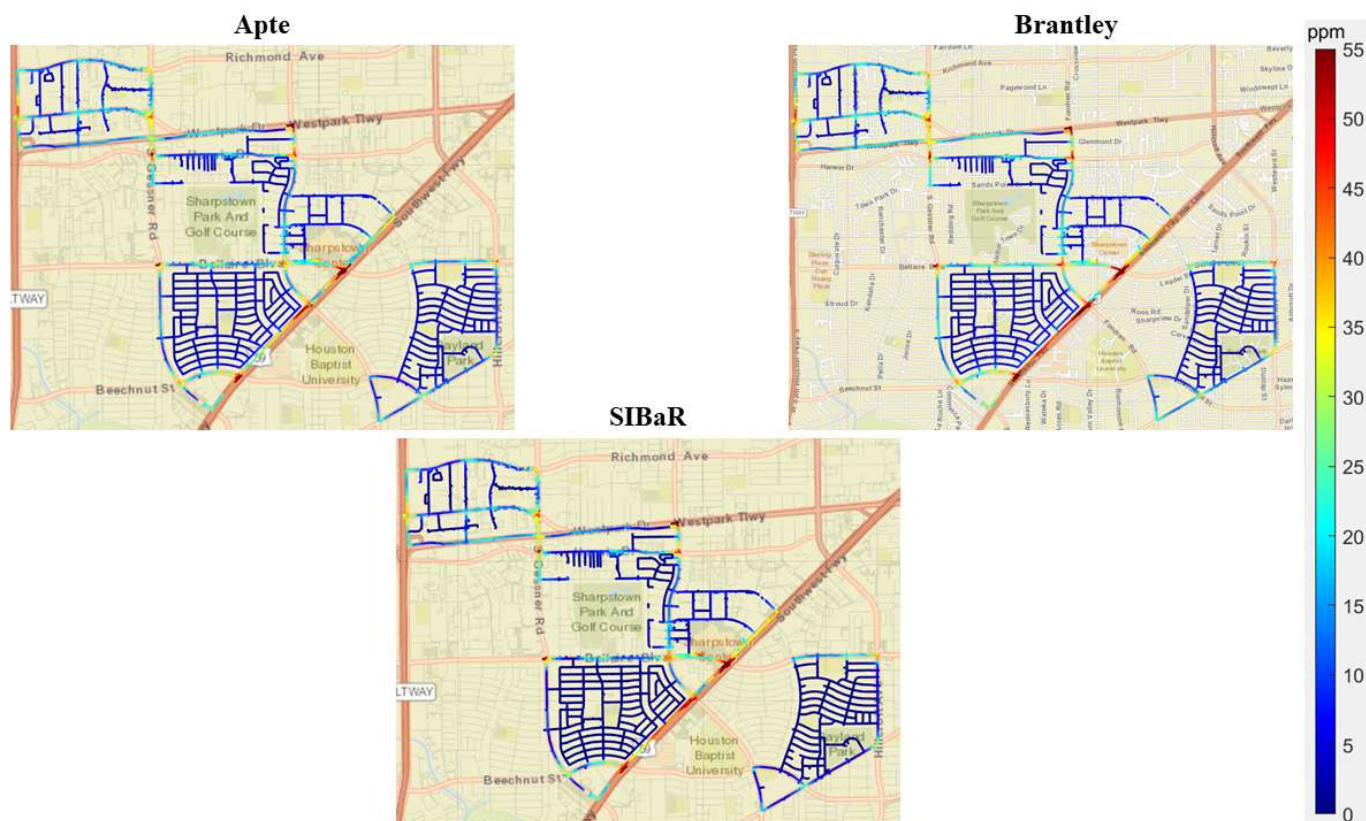
Figure S11. CO₂ mapped median source contributions. South Beltway Central. Basemap generated by Matlab geobasemap 'streets' and is hosted by ESRI (Sources: Esri, DeLorme, HERE, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, Tomtom).
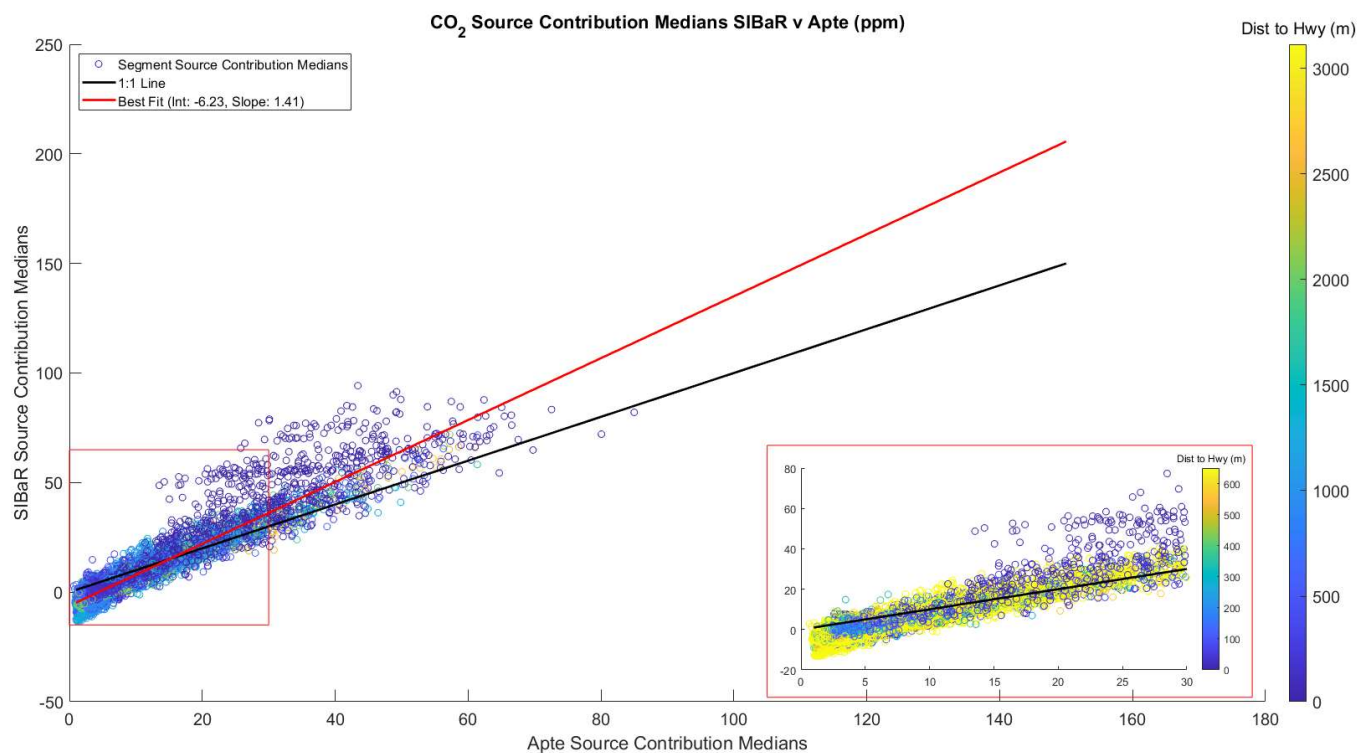
Apte

Brantley

SIBaR

Figure S12. CO_2 mapped median source contributions. Southwest quadrant. Basemap generated by Matlab geobasemap 'streets' and is hosted by ESRI (Sources: Esri, DeLorme, HERE, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, Tomtom).

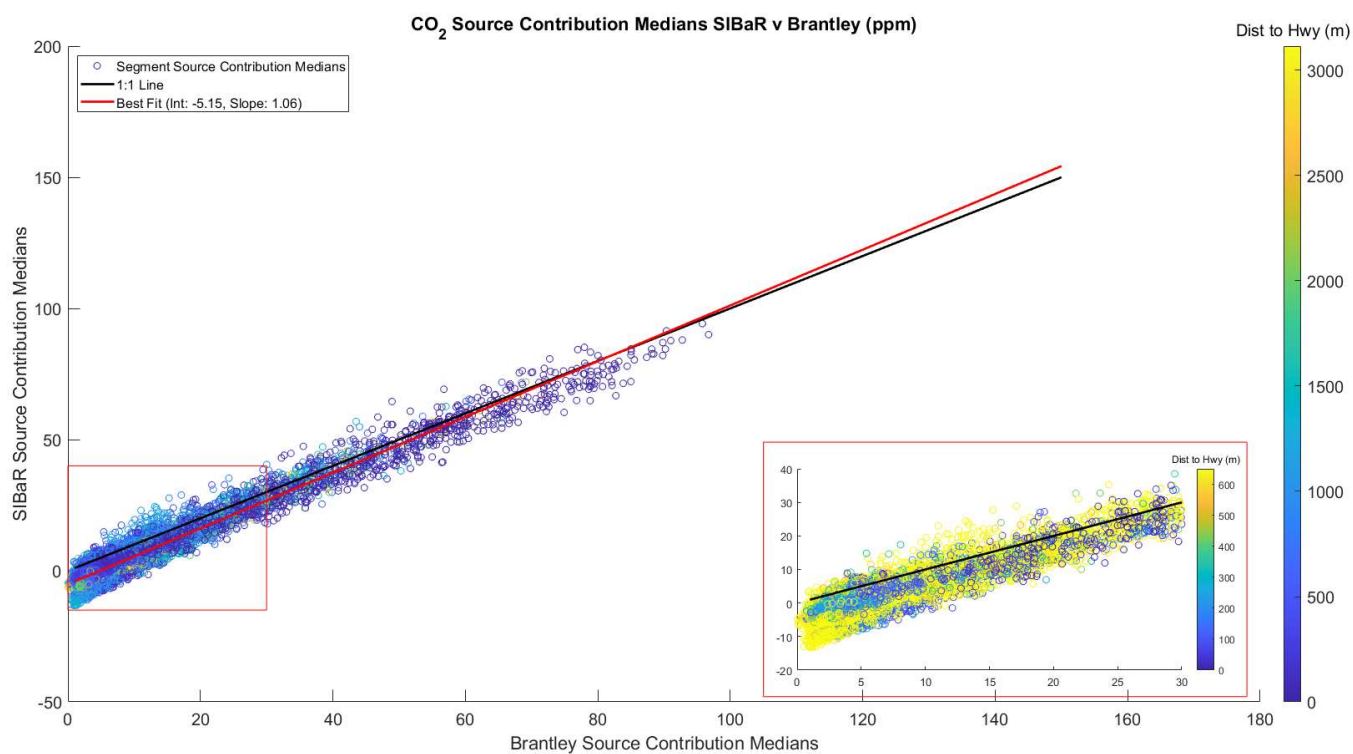**Figure S13. Comparison of CO₂ Road Segment Median Source Contributions for SIBaR and Apte.**

Figure S14. Comparison of CO₂ Road Segment Median Source Contributions for SIBaR and Brantley.
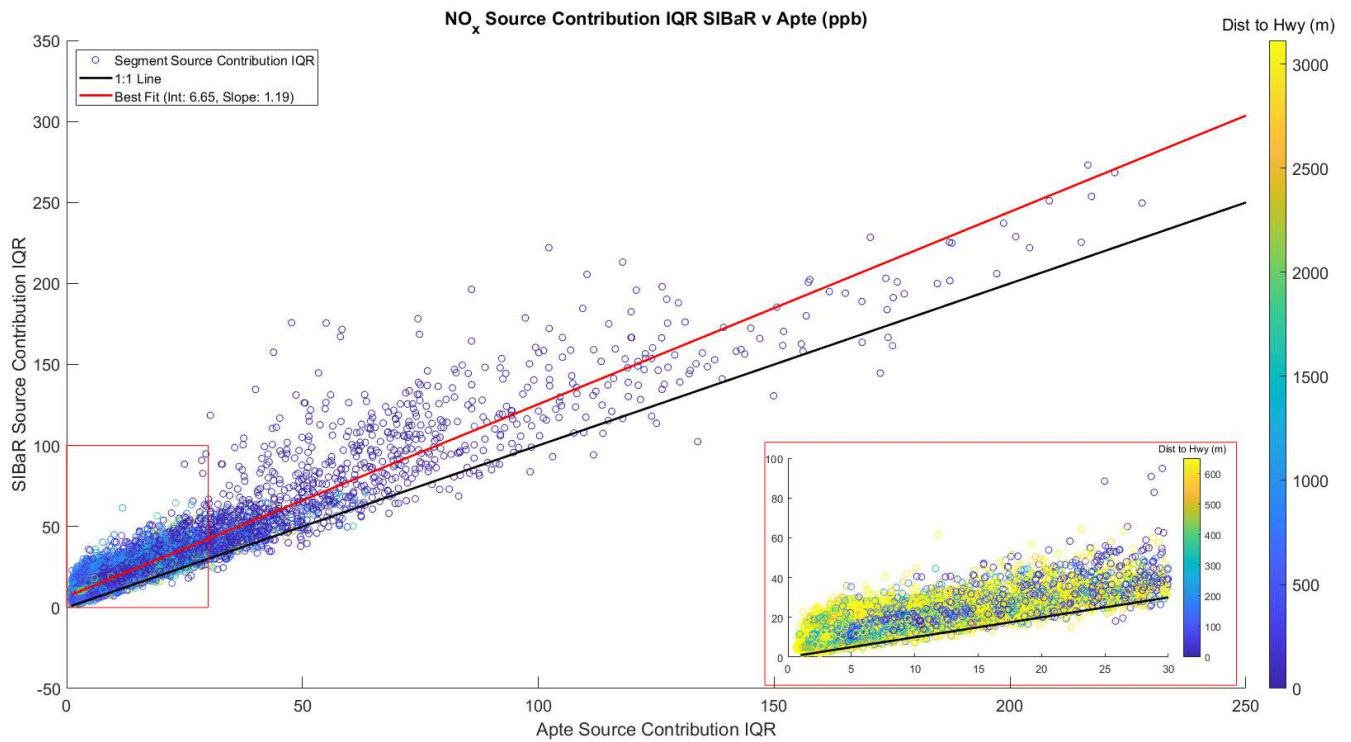
Figure S15. Comparison of NO$_x$ Road Segment IQR Source Contribution for SIBaR and Apte.
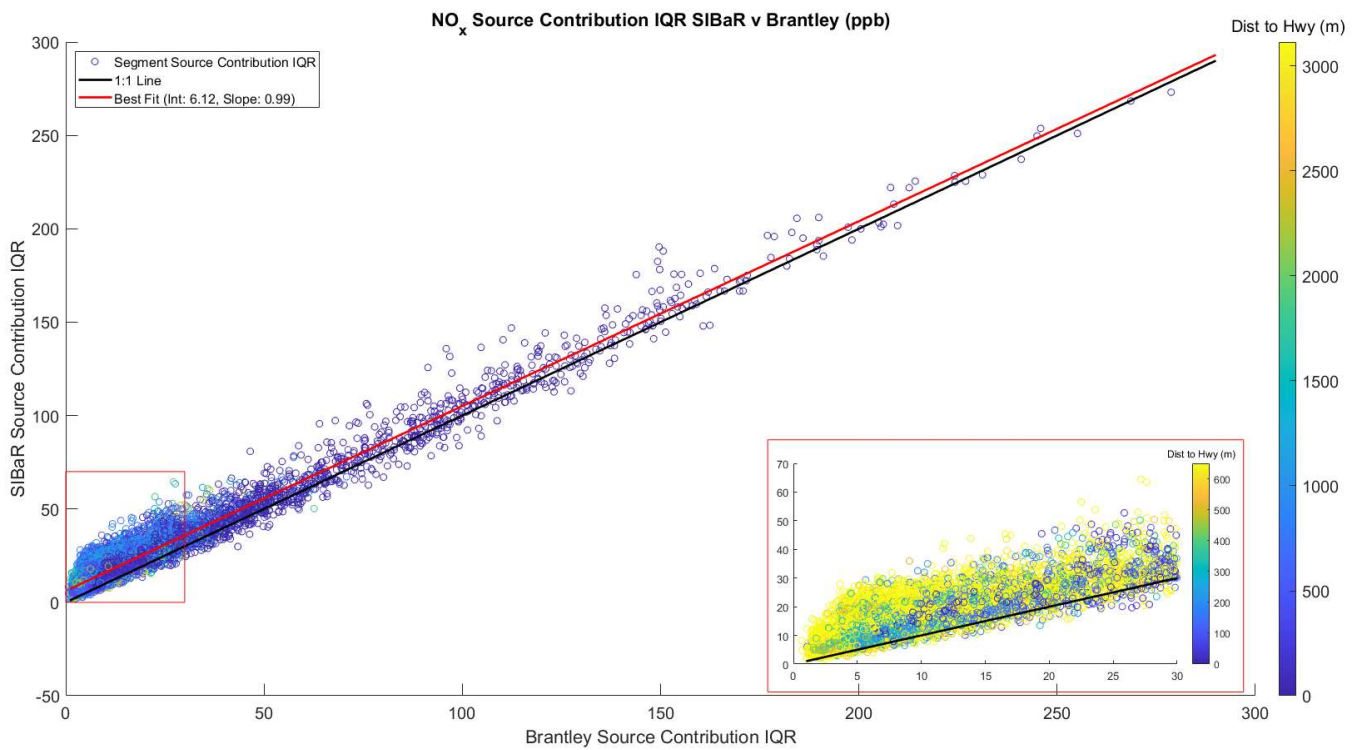

Figure S16. Comparison of NO$_x$ Road Segment IQR Source Contribution for SIBaR and Brantley.
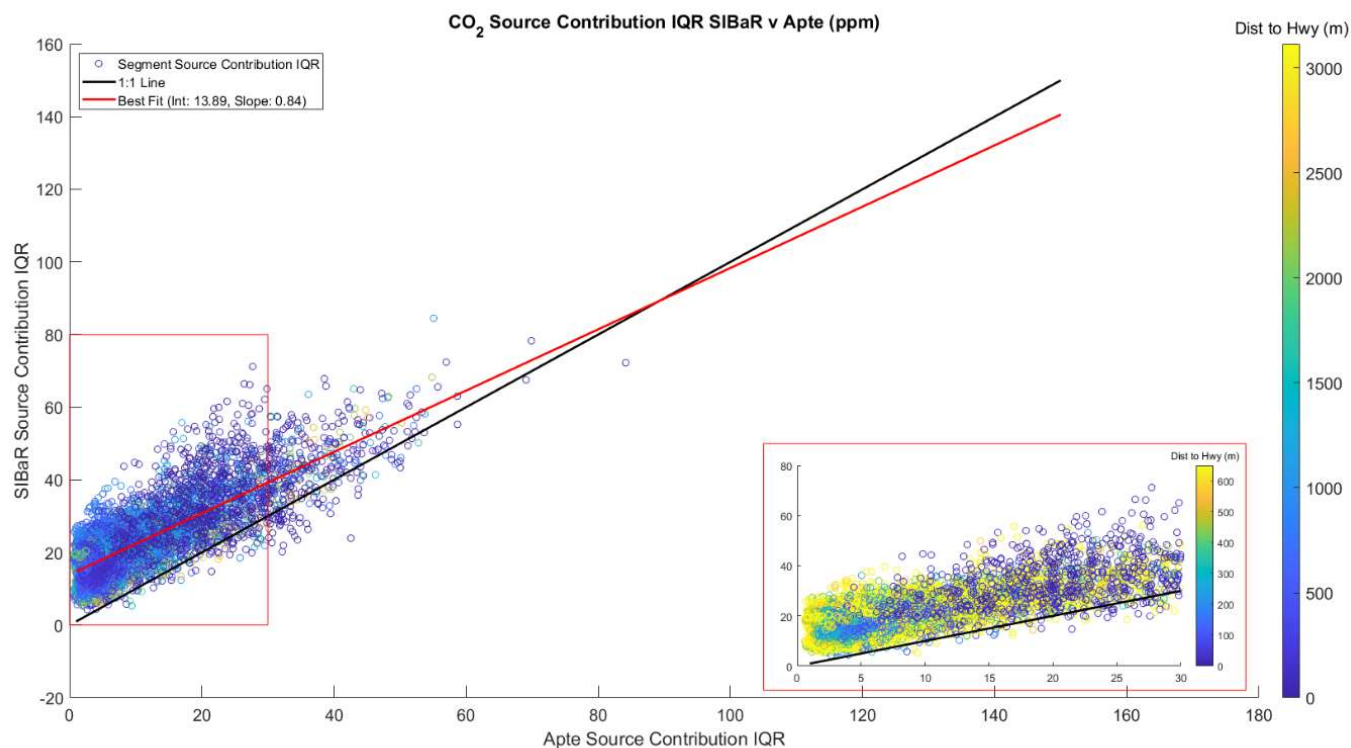
Figure S17. Comparison of CO₂ Road Segment IQR Source Contribution for SIBaR and Apte.
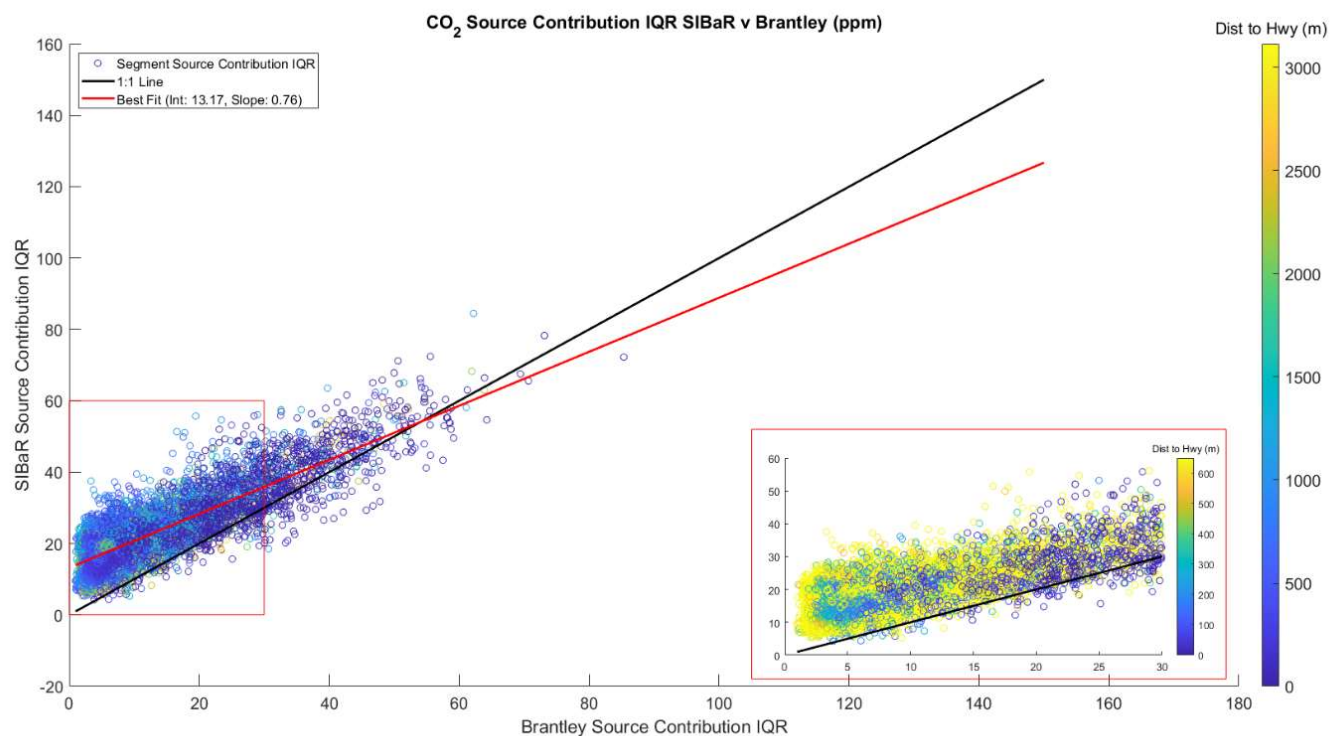

Figure S18. Comparison of CO₂ Road Segment IQR Source Contribution for SIBaR and Brantley.

References

Census 2010 Tracts, [online] Available from: https://cohgis-mycity.opendata.arcgis.com/datasets/census-2010-tracts (Accessed 23 November 2020)

Finding pollution—and who it impacts most—in Houston, Environmental Defense Fund [online] Available from: https://www.edf.org/maps/airqualitymaps/houston/pollution-map/ (Accessed 23 November 2020).