AGU Advances

Supporting Information for

Reductions in California's urban fossil fuel CO_2 Emissions during the COVID-19 pandemic

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Introduction

This document includes additional material to support the analysis described in the main text. Figures S1-S3 and Table S1 present further details about the on-road CO_2 dataset, including year-to-year changes, calibration coefficients, measurement dates, and the lack of a correlation between CO_{2xs} and vehicle speed. Figures S4-S6 enhance the plant radiocarbon analysis by showing the difference in ^{14}C for samples collected near each other over the two study years, and by demonstrating how the temporal variability of plant ^{14}C corresponds to other datasets.

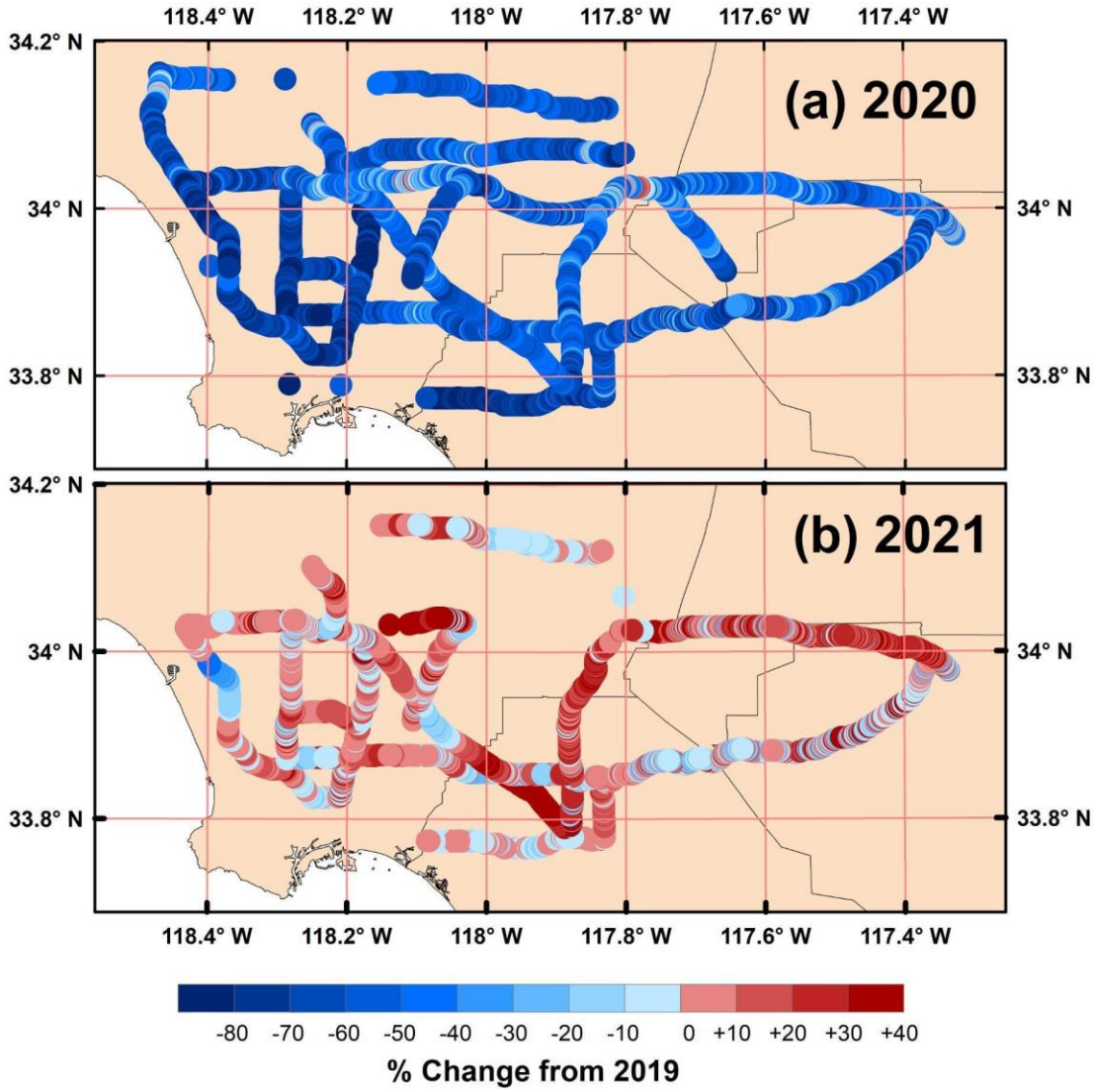

Figure S1. The percent change in CO_{2XS} in the Los Angeles metropolitan area in July relative to 2019 for a) 2020 and b) 2021 calculated from on-road surveys.

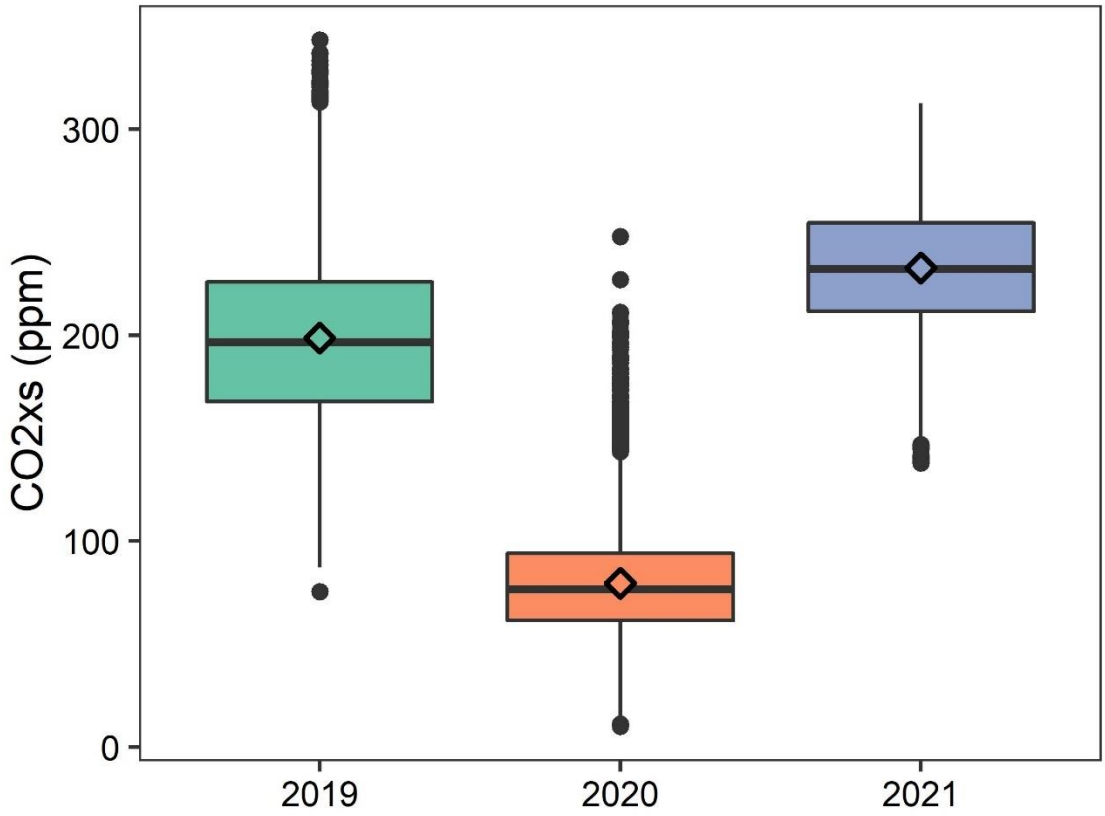

Figure S2. Boxplots showing the distribution of on-road CO_{2XS} values measured on Los Angeles freeways before the COVID-19 pandemic (2019) and during the pandemic (2020 and 2021). Diamond symbols indicate the mean of each year.

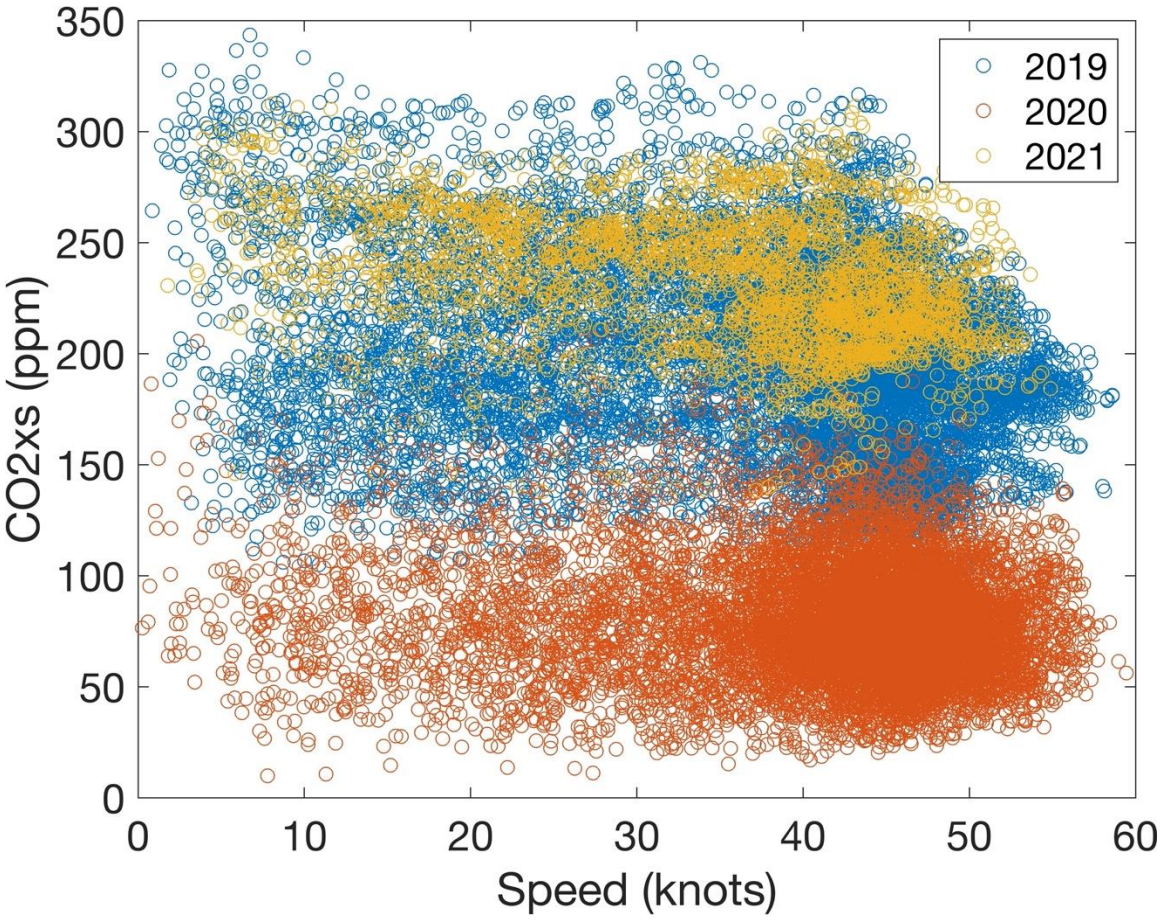

Figure S3. The relationship between vehicle speed and CO_{2xs} values measured for each year's mobile surveys.

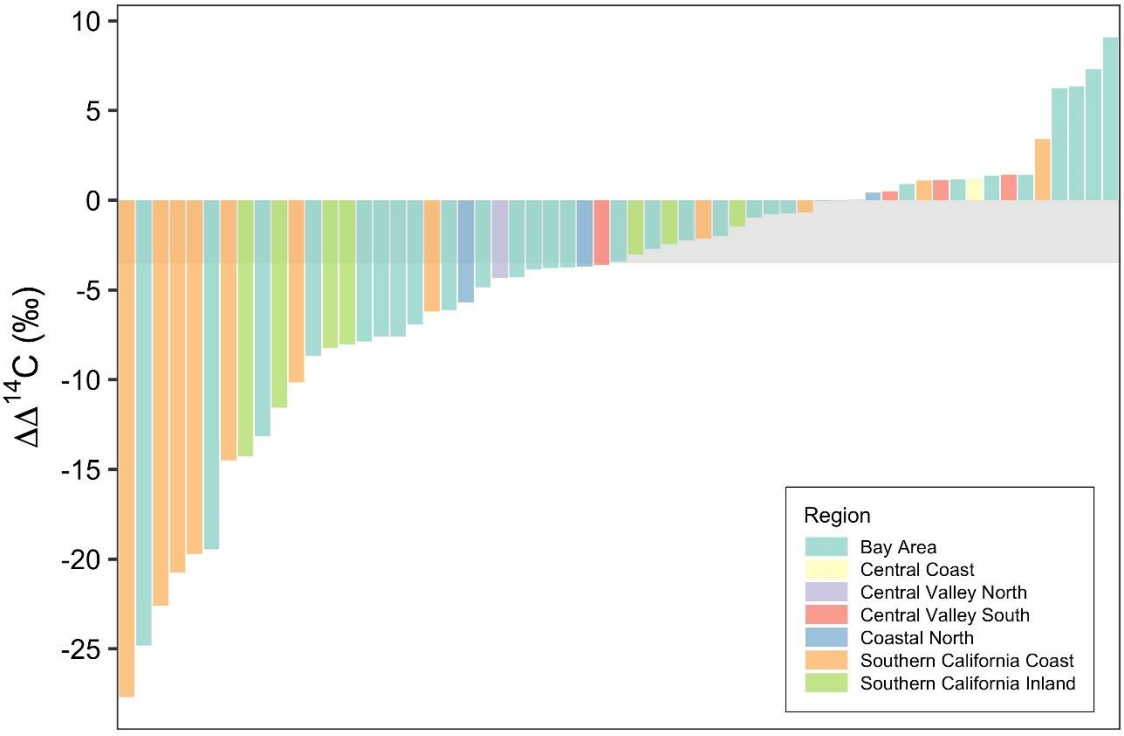

Figure S4. Difference in radiocarbon values of plant samples collected in the same locations in California in 2020 and 2021. Each bar represents the difference between samples collected within 500 m of each other ($\Delta\Delta^{14}C = \Delta^{14}C_{2021} - \Delta^{14}C_{2020}$, N=59 pairs). The shaded region indicates -3.5‰, the expected annual global change in atmospheric $^{14}CO_2$, hence any ΔΔ value more negative than -3.5‰ indicates an increase in fossil fuel CO_2 from 2020 to 2021

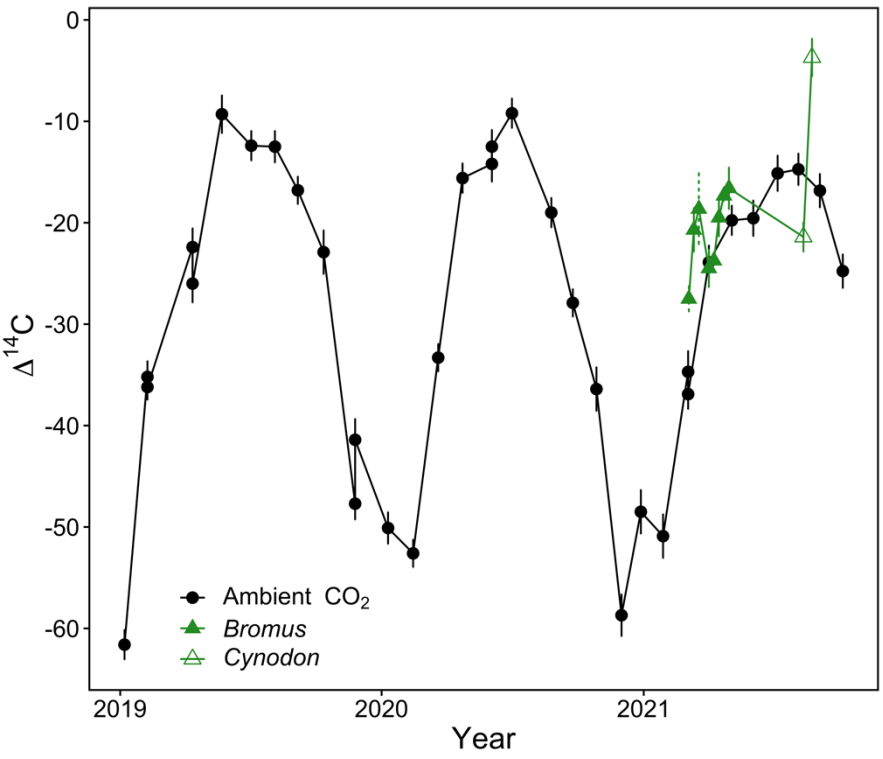

Figure S5. The $\Delta^{14}C$ of ambient CO_2 and plant samples collected at the University of California in Irvine, CA. Solid error bars show the measurement error and dashed error bars show SD of replicated samples. Open triangles are Bermuda turfgrass samples (*Cynodon dactylon*) while closed triangles are annual grass species (*Bromus diandrus* Roth).

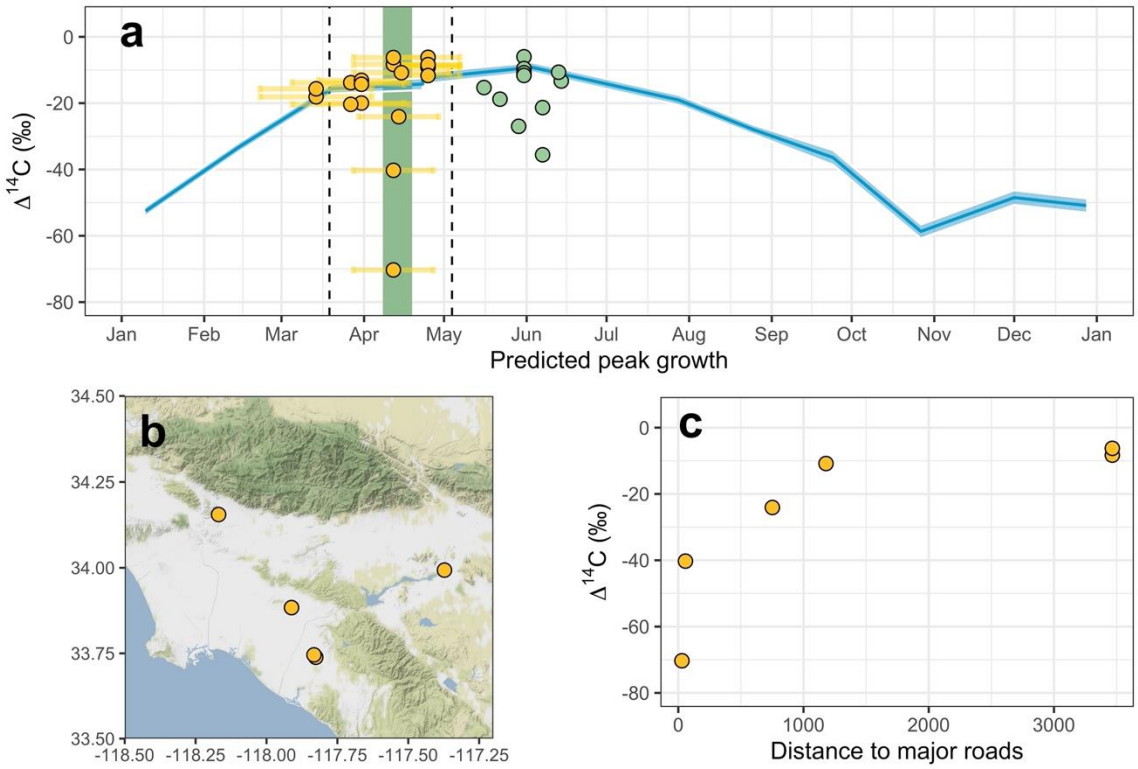

Figure S6. An attempt to use remotely sensed measurements of solar induced fluorescence (SIF) to better predict the timing of plant sample growth. (a) $\Delta^{14}C$ of plants collected in 2020, with the timing of peak growth predicted by SIF if the plant was already senesced during collection (yellow points) or predicted by the collection date if the plant was green (green points). Error bars surrounding the yellow points show the range of dates when 30% of peak plant growth occurred. Blue line shows $\Delta^{14}CO_2$ of air samples collected in Irvine, CA (Xu, pers. Com). Vertical dashed lines indicate the period where the Stay-At-Home Order was in effect. (b) Locations of plant samples that had similar predicted peak growth dates (April 15, 2020 ± 2 days) but vastly different $\Delta^{14}C$ values from each other. (c) $\Delta^{14}C$ increased nonlinearly with distance from major roads for the same set of samples from panel (b).

Year	**Survey dates**	**Standard 1** ($ppm\ CO_2$)	**Standard 2** ($ppm\ CO_2$)	**Slope** (mean ± SD)	**Intercept** (mean ± SD)	**Precision*** ($ppm\ CO_2$)
2019	July 15-17, 19, 23-26, 29-31	564	1021	0.985 ± 0.001	19.0 ± 0.4	0.5
2020	July 9-10, 23-24, 30-31	551	1028	1.00 ± 0.01	3.2 ± 8.0	0.9
2021	July 16-17	420.4	551	1.00 ± 0.001	-1.1 ± 0.3	0.1

*****Precision was defined as the average standard deviation of all calibration runs

Table S1. Mobile survey dates and calibration parameters used to correct on-road CO_2 data measured using a Picarro G2401 analyzer.