Table S1. Dates of 2019, 2020, and 2021 O_3 exceedance days in the Chicago-Naperville-Elgin, Illinois-Indiana-Wisconsin, core-based statistical area (hereafter the Chicago metropolitan area, or "CMA" for short). An O_3 exceedance day is defined as having at least one ground monitor in the U.S. EPA Air Quality System (AQS) measuring a maximum daily 8-hour average (MDA8) O_3 value greater than 70 parts per billion (ppb). The "# stations" column indicates how many monitors in the CMA measured an exceedance.

2019		
Dates	**# stations**	**Day of week**
5-Jun	4	Wed
26-Jun	1	Wed
28-Jun	1	Fri
29-Jun	6	Sat
1-Jul	1	Mon
3-Jul	3	Wed
5-Jul	1	Fri
8-Jul	1	Mon
9-Jul	12	Tue
13-Jul	1	Sat
25-Jul	2	Thu
2-Aug	2	Fri
3-Aug	3	Sat
Total: 13 days		
10 weekdays, 3 weekends		

2020		
Dates	**# stations**	**Day of week**
4-Jun	5	Thu
5-Jun	10	Fri
8-Jun	3	Mon
16-Jun	2	Tue
17-Jun	15	Wed
18-Jun	20	Thu
19-Jun	16	Fri
27-Jun	2	Sat
1-Jul	4	Wed
2-Jul	1	Thu
3-Jul	14	Fri
6-Jul	14	Mon
7-Jul	6	Tue
8-Jul	3	Wed
9-Jul	4	Thu
17-Jul	2	Fri
25-Jul	5	Sat
7-Aug	1	Fri
15-Aug	4	Sat
21-Aug	3	Fri
Total: 20 days		
17 weekdays, 3 weekends		

2021		
Dates	**# stations**	**Day of week**
22-May	1	Sat
3-Jun	14	Thu
4-Jun	5	Fri
11-Jun	5	Fri
17-Jun	5	Thu
18-Jun	8	Fri
20-Jul	5	Tue
22-Jul	6	Thu
23-Jul	4	Fri
26-Jul	2	Mon
27-Jul	1	Tue
28-Jul	5	Wed
4-Aug	3	Wed
7-Aug	2	Sat
23-Aug	1	Mon
25-Aug	6	Wed
26-Aug	4	Thu
27-Aug	4	Fri
13-Sep	1	Mon
1-Oct	3	Fri
Total: 20 days		
18 weekdays, 2 weekends		

Table S2. Distribution of the number of CMA O_3 exceedance days by year and day of week. The last two columns report the percentage of exceedances that occurred on weekdays and weekends for that row's time period.

CMA ozone exceedance day of week distribution										
Year(s)	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**	**All days**	**Weekdays**	**Weekends**
2019	2	1	3	1	3	3	0	13	77 %	23 %
2020	2	2	3	4	6	3	0	20	85 %	15 %
2021	3	2	3	4	6	2	0	20	90 %	10 %
All years	7	5	9	9	15	8	0	53	85 %	15 %

Table S3. Kolmogorov-Smirnov (K-S) test results for comparison of the ozone season and CMA exceedance days composites. For each variable, 1000 K-S tests were performed using a random subsampling approach at the 98 % confidence level. In the "median p-value" column, values <0.001 are represented as 0, and bolded values indicate overall statistically significant results (median p-value <0.020). The "wind divergence – tails" variable refers to only subsampling values greater or less than one standard deviation from the mean wind divergence value. *Sig. diff. = significant difference

2-subsample K-S test results: ozone season vs. CMA exceedance days				
Variable	**Percentage of tests with a *sig. diff.**	**Median p-value**	**Full sample size**	**Subsample size**
HCHO bias corrected	100 %	**0.000**	1146	286
NO_2	100 %	**0.000**	1146	286
FNR bias corrected	100 %	**0.000**	1146	286
Wind divergence	1.8 %	0.117	880	220
Wind divergence – tails	97.1 %	**0.001**	241	60
2-m temperature	100 %	**0.000**	1242	310

Table S4. Kolmogorov-Smirnov (K-S) test results for comparison of the weekday and weekend composites. For each variable, 1000 K-S tests were performed using a random subsampling approach at the 98 % confidence level. In the "median p-value" column, values <0.001 are represented as 0, and bolded values indicate overall statistically significant results (median p-value <0.020). The "wind divergence – tails" variable refers to only subsampling values greater or less than one standard deviation from the mean wind divergence value. *Sig. diff. = significant difference

2-subsample K-S test results: weekdays vs. weekends				
Variable	**Percentage of tests with a *sig. diff.**	**Median p-value**	**Full sample size**	**Subsample size**
HCHO bias corrected	100 %	**0.000**	1146	286
NO_2	71.9 %	**0.013**	1146	286
FNR bias corrected	100 %	**0.000**	1146	286
Wind divergence	0 %	0.607	880	220
Wind divergence – tails	0 %	0.821	241	60
2-m temperature	65.5 %	0.023	1242	310

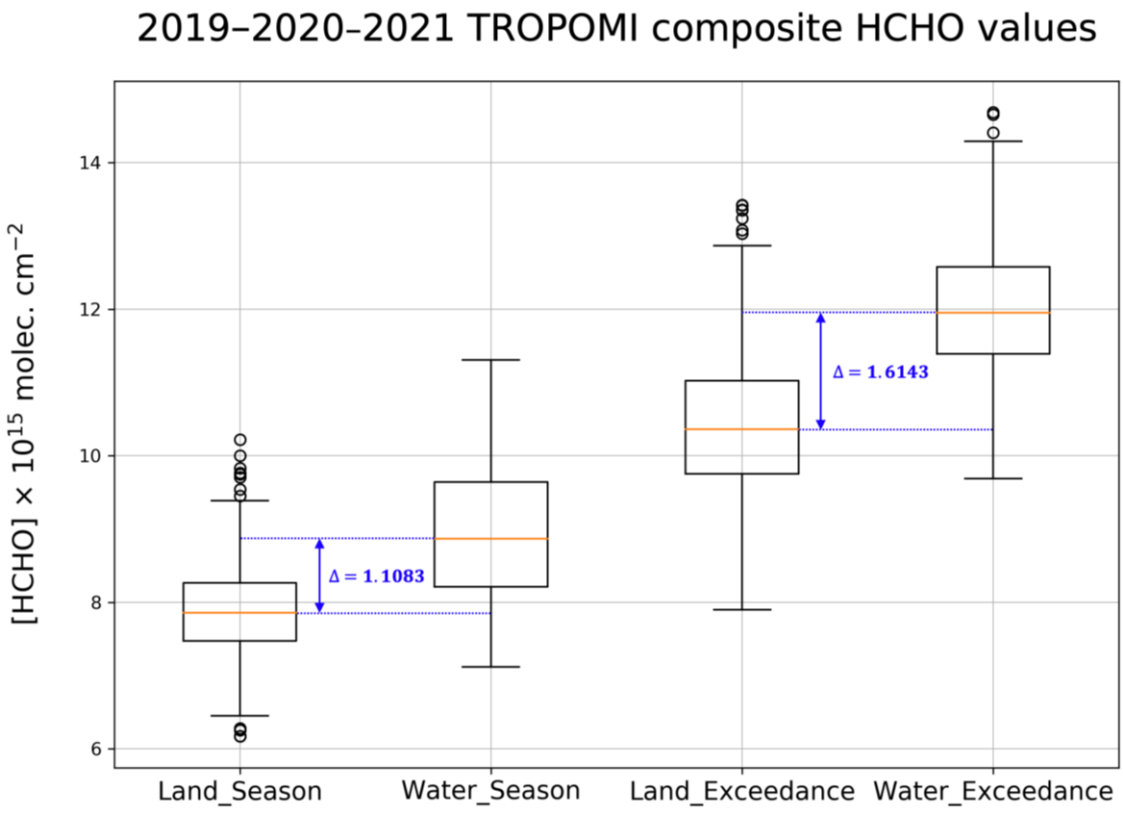

Figure S1. Boxplot distributions of TROPOMI HCHO vertical column densities (VCDs) for the O_3 season and CMA exceedance day composites separated by over land and over water values. The mean of each distribution is represented by an orange horizontal line. The difference in means between the over land and over water values (Δ) is the "over water bias value".

Table S5. HCHO absolute and relative over water bias values for the O_3 season and CMA exceedance day composites. The absolute over water bias value is calculated by subtracting the mean over HCHO land value from the mean HCHO over water value. The relative over water bias value is calculated as $(\frac{HCHO_{water\_mean} - HCHO_{land\_mean}}{HCHO_{land\_mean}}) \times 100\ \%$.

Composite category	Absolute over water bias	Relative over water bias
Ozone season	1.1083×10^{15} molec. cm^{-2}	+14.05 %
CMA exceedance days	1.6143×10^{15} molec. cm^{-2}	+15.51 %

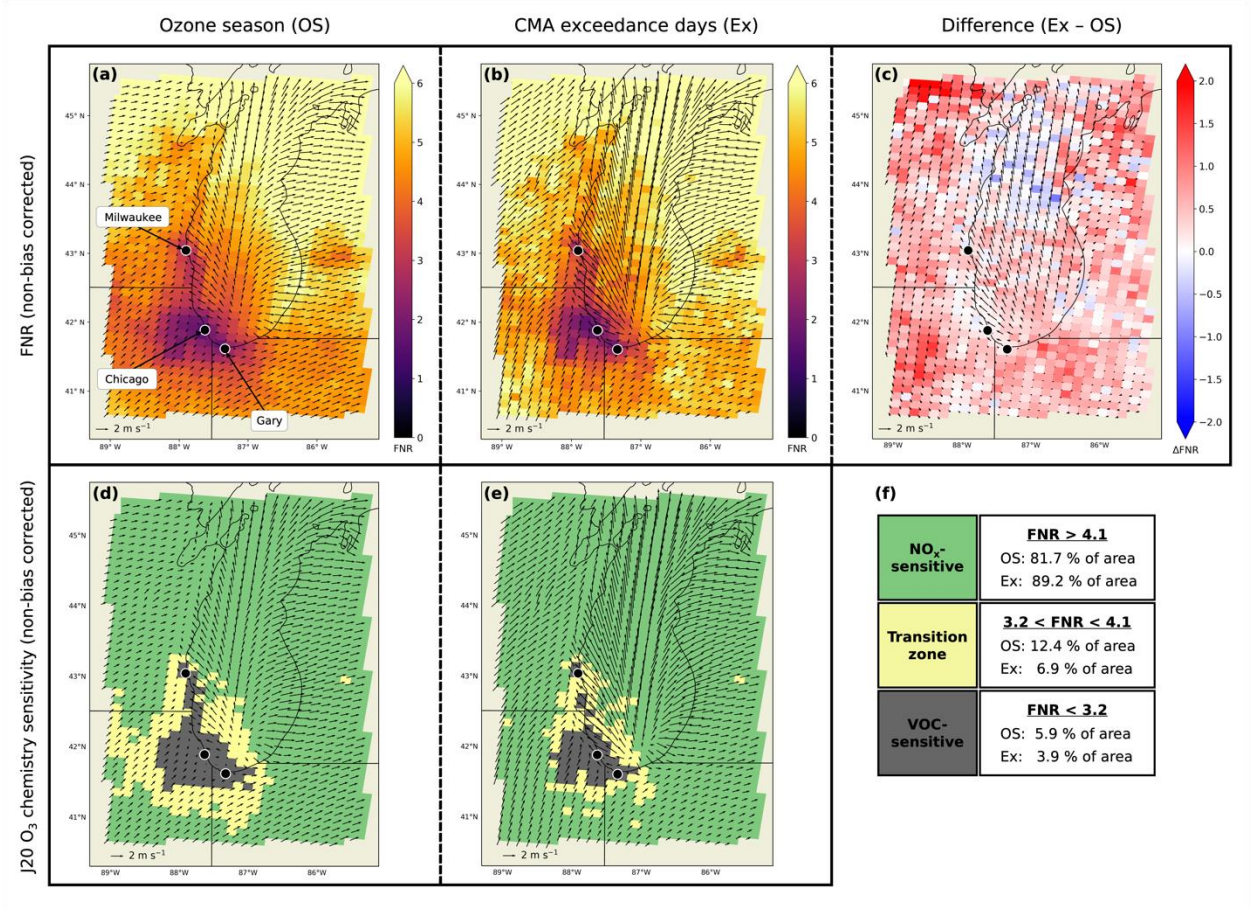

Figure S2. TROPOMI-derived 2019–2021 FNR values (calculated using non-bias corrected HCHO values) in the Lake Michigan region during: (a) the ozone season (OS), (b) CMA exceedance days (Ex), and (c) the difference between them (Ex – OS). Jin et al. (2020; "J20") threshold interpretation of 2019–2021 ozone chemistry sensitivity (using non-bias corrected FNR values) during: (d) the ozone season, (e) CMA exceedance days, and (f) the percent of the domain area classified as each J20 sensitivity regime. Mean 10-meter winds are represented by arrows.

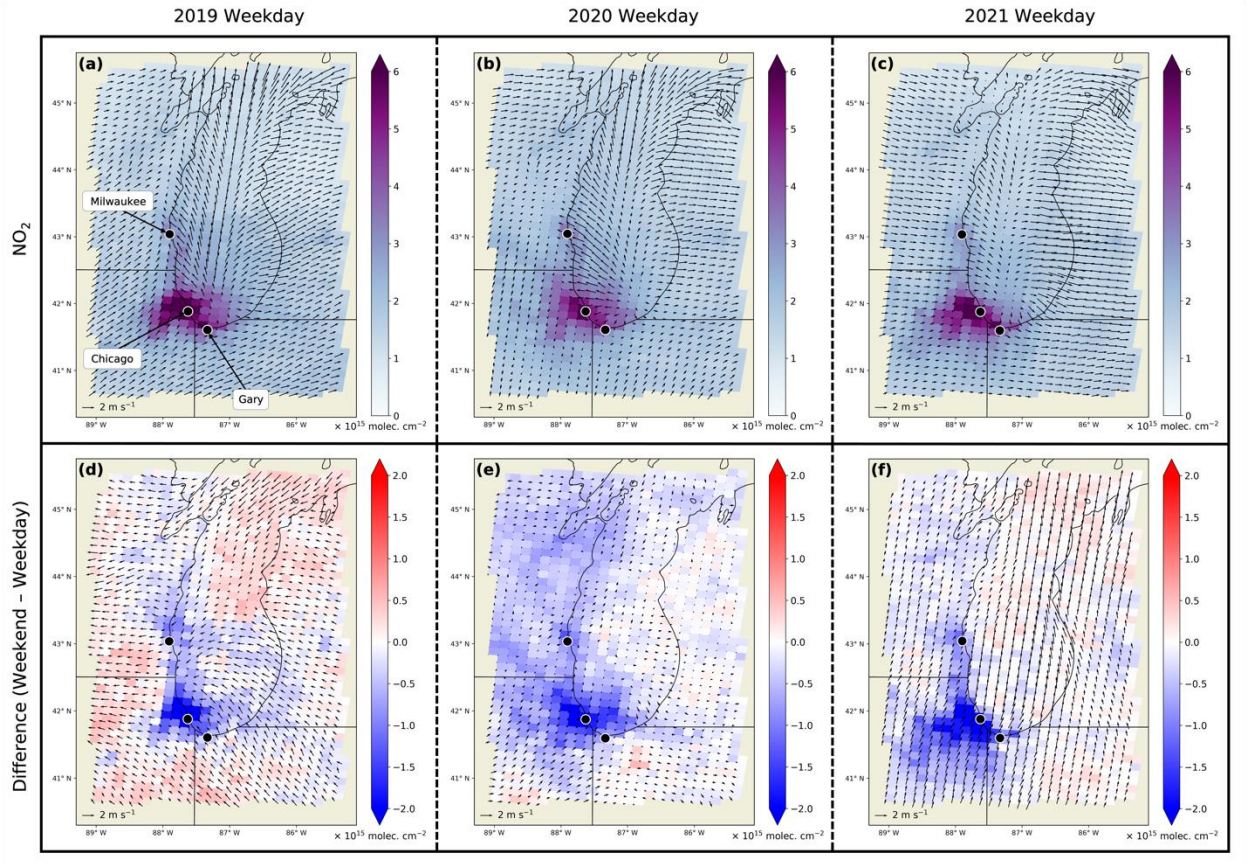

Figure S3. TROPOMI-derived composites of mean weekday tropospheric NO_2 VCDs in the Lake Michigan region during: (a) 2019, (b) 2020, and (c) 2021. The difference between weekday and weekend tropospheric NO_2 VCDs in the Lake Michigan region during: (d) 2019, (e) 2020, and (f) 2021. Mean 10-meter winds are represented by arrows.

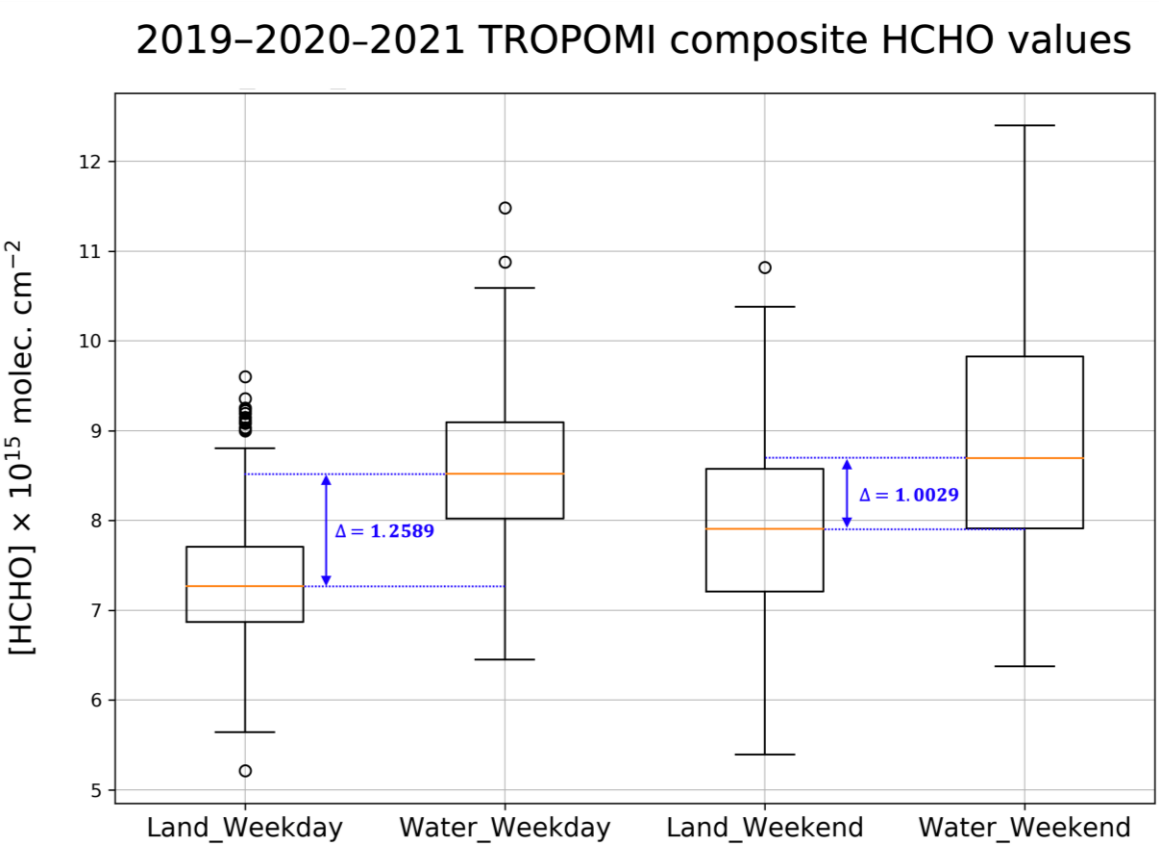

Figure S4. Boxplot distributions of TROPOMI HCHO VCDs for the weekday and weekend composites separated by over land and over water values. The mean of each distribution is represented by an orange horizontal line. The difference in means between the over land and over water values (Δ) is the "over water bias value".

Table S6. HCHO absolute and relative over water bias values for the weekday and weekend composites. The absolute over water bias value is calculated by subtracting the mean over HCHO land value from the mean HCHO over water value. The relative over water bias value is calculated as $\left(\frac{HCHO_{water\_mean} - HCHO_{land\_mean}}{HCHO_{land\_mean}}\right) \times 100\ \%$.

Composite category	Absolute over water bias	Relative over water bias
Weekday	1.2589×10^{15} molec. cm^{-2}	+17.2 %
Weekend	1.0029×10^{15} molec. cm^{-2}	+12.7 %

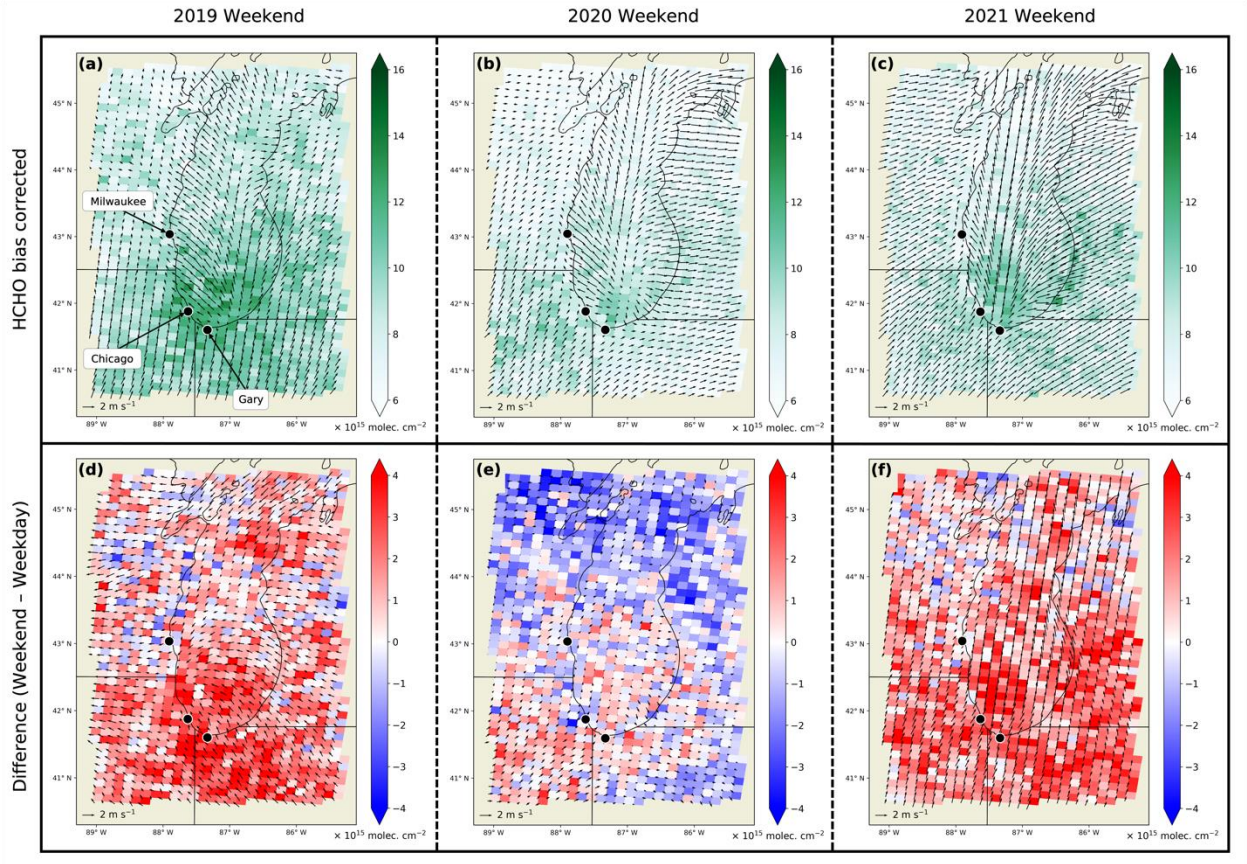

Figure S5. TROPOMI-derived composites of mean weekend tropospheric HCHO VCDs in the Lake Michigan region during: (a) 2019, (b) 2020, and (c) 2021. The difference between weekday and weekend tropospheric HCHO VCDs in the Lake Michigan region during: (d) 2019, (e) 2020, and (f) 2021. Mean 10-meter winds are represented by arrows.

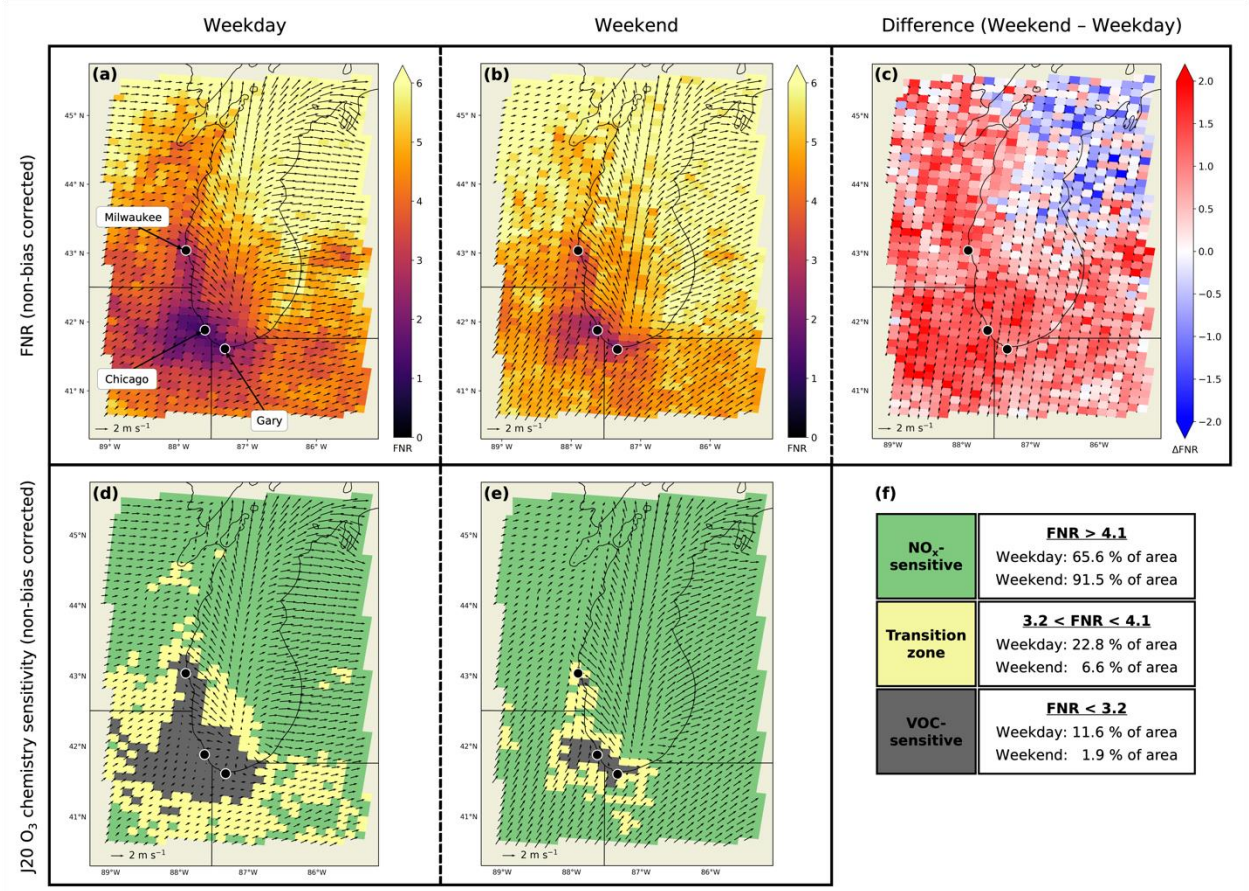

Figure S6. TROPOMI-derived 2019–2021 FNR values (calculated using non-bias corrected HCHO values) in the Lake Michigan region during: (a) weekdays, (b) weekends, and (c) the difference between them (weekend – weekday). J20 threshold interpretation of 2019–2021 ozone chemistry sensitivity (using non-bias corrected FNR values) during: (d) weekdays, (e) weekends, and (f) the percent of the domain area classified as each J20 sensitivity regime. Mean 10-meter winds are represented by arrows.