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Supplement of

High spatial resolution CO_2 measurement using low-cost commercial sensors in Seoul megacity

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Sect. S1 Videos

We interpolated the (corrected) Bongcheon Intersection measurement data from HT-2000 meters 2-dimensionally using *scatteredinterpolant* function in Matlab, which uses Delaunay triangulation. This was performed for each timestep, then plotted on the map of the region. The resulting .png files were then made into .mp4 movies using FFMPEG, resulting in supplement videos S1-S4.

Video S1. CO_2 concentration over time at Bongcheon Intersection during the 2022 session, https://doi.org/10.5446/70548

Video S2. Rate of CO_2 concentration change at Bongcheon Intersection during the 2022 session, https://doi.org/10.5446/70549

Video S3. CO_2 concentration over time at Bongcheon Intersection during the 2023 session, https://doi.org/10.5446/70550

Video S4. Rate of CO_2 concentration change at Bongcheon Intersection during the 2023 session, https://doi.org/10.5446/70551

Sect. S2. Figures

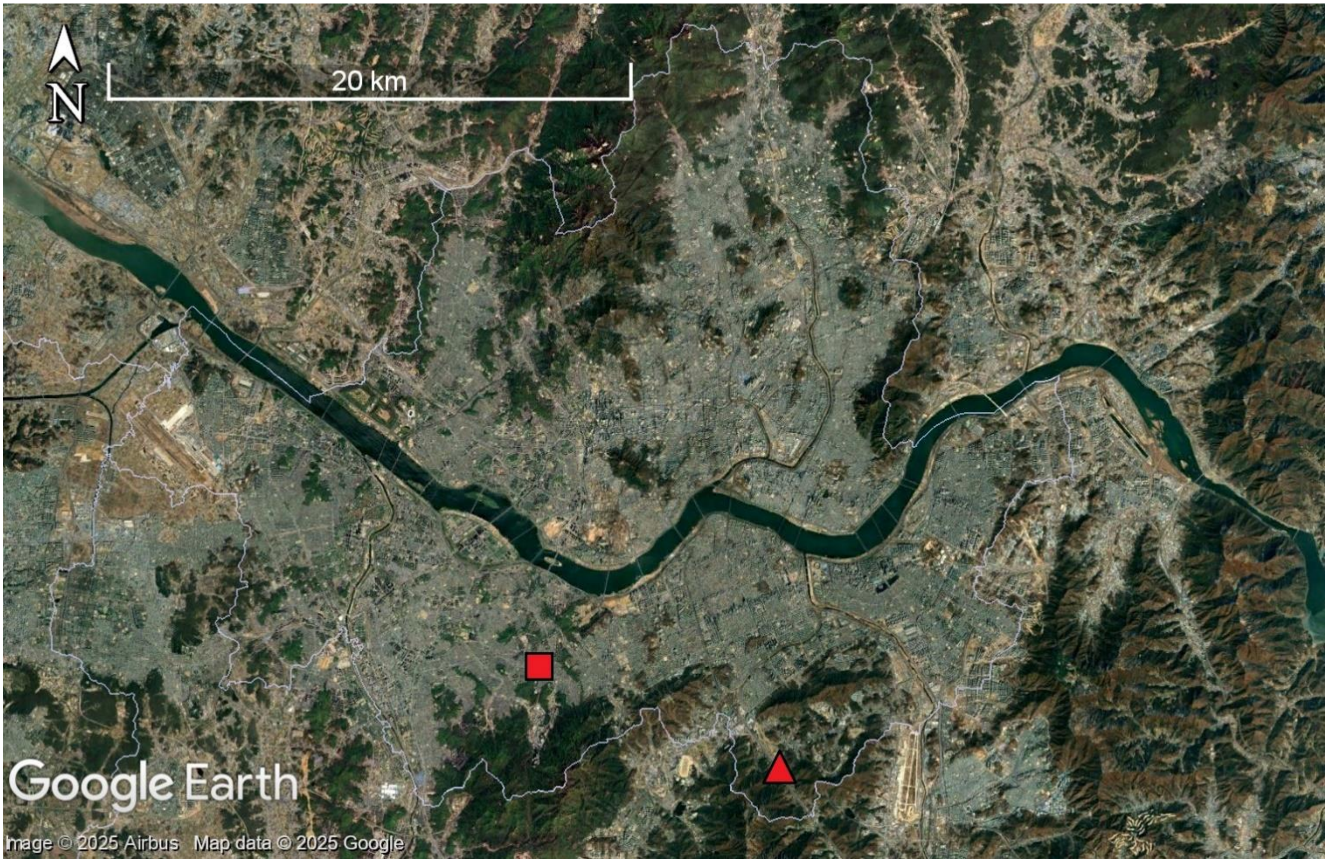

Figure S1. Location of Bongcheon Intersection (red square) and Guryong Tunnel (red triangle). Imagery © Airbus 2025, Map data © 2025 Google.

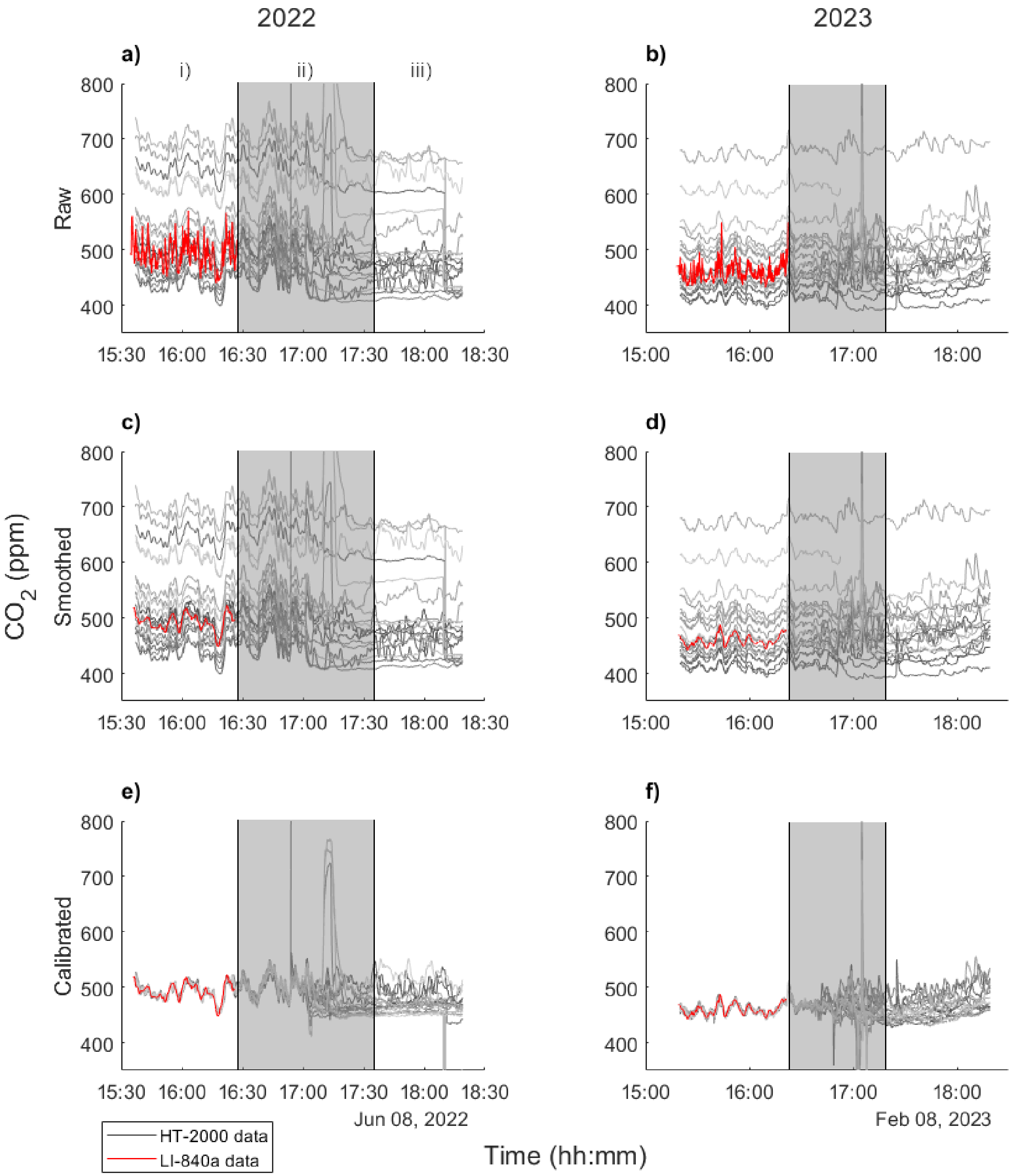

Figure S2: CO_2 concentrations measured in Bongcheon Intersection, before and after correction. a) and b) Plots of CO_2 values measured by HT-2000 (grayscale) and LI-840a (red), before any correction was applied. c) and d) The LI-840a values smoothed with a 137-second window. Note that the HT-2000 sensor values closely follow the smoothed LI-840 values, though with fixed offsets. e) and f) Results after linear correction of the HT-2000 meters. i)-iii) sections (labelled in a)) each represents: co-located measurement

for obtaining data for correction of HT-2000 (i), moving HT-2000 sensors to its assigned location (ii), HT-2000 measurement in its assigned location (iii).

Sect. S3. Coefficients for multiple linear regressions

Table S1: Coefficients for linear regression for 2022 and 2023 measurements.

2022					2023			
T (ppm/°C)	RH (ppm/%)	CO_2 (no unit)	Constant (ppm)	Sensor labels	T (ppm/°C)	RH (ppm/%)	CO_2 (no unit)	Constant (ppm)
0.525	-5.714	0.837	39.953	A	0.208	-7.031	1.155	-30.691
-1.411	-8.905	0.762	122.760	B				
2.730	-3.420	0.797	84.138	C	-1.795	-19.607	1.167	29.175
-0.045	-3.033	0.839	159.580	D	-1.551	-8.198	0.880	95.467
				F	-2.060	5.590	1.130	-0.738
2.409	-0.711	0.826	68.067	G	-2.545	-18.634	0.914	90.704
3.011	0.588	0.705	-87.184	H	1.832	-12.320	0.984	47.800
1.660	1.891	0.777	-99.890	T				
1.521	-4.190	0.788	84.501	J	0.159	-9.172	0.993	42.583
4.492	6.629	0.778	-164.213	K	0.977	-8.062	0.971	21.644
-0.160	-2.638	0.799	130.939	M	-1.775	-9.749	1.066	-29.074
-2.806	-3.627	0.797	198.222	N	-0.267	-6.115	1.074	-174.254
3.978	-2.533	0.817	14.004	O	-2.369	-3.139	0.869	14.915
-0.774	-1.342	0.757	102.910	P	0.614	-19.607	0.967	29.398
1.883	-5.241	0.789	145.374	Q	-0.546	-1.974	1.044	-12.646
-2.522	-0.236	0.767	200.096	R	-7.151	-20.344	0.982	69.266
-2.874	-3.385	0.825	101.342	S	-2.412	-11.497	1.061	42.685
-2.158	-6.804	0.782	251.920	T				
-1.637	-3.156	0.827	167.689	U	-0.314	-8.192	0.919	90.593
				V	-3.113	-16.161	0.969	78.047
				W	-1.850	-2.714	1.102	27.024

-0.734	-0.421	0.789	141.517	X	0.424	-11.256	0.875	44.127
				Z	-0.979	-0.265	0.864	-109.843

Table S2: Coefficients for linear regression for 2022 and 2023 measurements, normalized such that the LI-COR data and HT-2000 data were shifted and scaled to have mean 0 and standard deviation 1.

2022				2023		
T	RH	CO_2	Sensor labels	T	RH	CO_2
-0.106	-0.185	1.065	A	0.048	-0.127	0.904
-0.081	-0.052	0.947	B			
0.031	-0.079	0.977	C	-0.092	-0.238	0.922
-0.019	-0.070	0.961	D	-0.207	-0.179	0.906
			F	-0.279	-0.025	0.878
-0.168	-0.050	0.997	G	-0.267	-0.258	0.897
-0.040	-0.017	0.939	H	0.243	-0.154	0.936
-0.039	-0.085	0.994	I			
-0.009	-0.041	0.955	J	0.065	-0.141	0.916
-0.032	-0.104	0.967	K	0.145	-0.141	0.908
0.043	-0.013	0.950	M	-0.202	-0.150	0.917
0.009	-0.039	0.960	N	-0.027	-0.127	0.895
-0.045	-0.059	0.963	O	-0.115	-0.088	0.883
0.021	-0.087	0.959	P	0.123	-0.219	0.923
0.016	-0.020	0.954	Q	-0.006	-0.092	0.903
0.018	-0.124	0.993	R	-0.572	-0.307	1.051
-0.007	-0.051	0.983	S	-0.253	-0.180	0.900
-0.064	-0.075	0.988	T			
-0.084	-0.140	0.974	U	-0.030	-0.109	0.894
			V	-0.226	-0.194	0.930
			W	-0.169	-0.112	0.851
-0.101	-0.087	1.004	X	0.116	-0.172	0.881
			Z	-0.031	-0.062	0.881

Sect. S4. MATLAB code used for estimating the time delay of individual HT-2000 kits

```
stdev_loop = zeros(1,2*Search_Window+1);
stdev = zeros(1, 20);
timelag = zeros(1, 20);
TR_LICOR = timerange(min(LICOR_2.Time), max(LICOR_2.Time), "closed");

for i = 1:Len
    for j = -Search_Window:Search_Window
        LL = Cal_2.LICOR(Search_Window+1-j:end-Search_Window-j);
        BB = Cal_2.CO2_dry(:,i);
        stdev_loop(j+1+Search_Window) = std(LL-BB);
    end
    timelag(i) = min(find(stdev_loop == min(stdev_loop))-Search_Window);
    stdev(i) = min(stdev_loop);
end
```

`Len` used in the outer `for` loop represents the number of HT-2000 kits used in the measurement. `Search_Window` is currently set as 60(seconds). The inner `for` loop shifts the smoothed LI-840 data (`Cal_2.LICOR`) in time then calculating the standard deviation of difference against HT-2000 measurement (`Cal_2.CO2_dry`). The time delay with lowest standard deviation is then selected as the device's time delay.