Supplement of:

Design, operation and characterization of a mobile laboratory for community-scale atmospheric research

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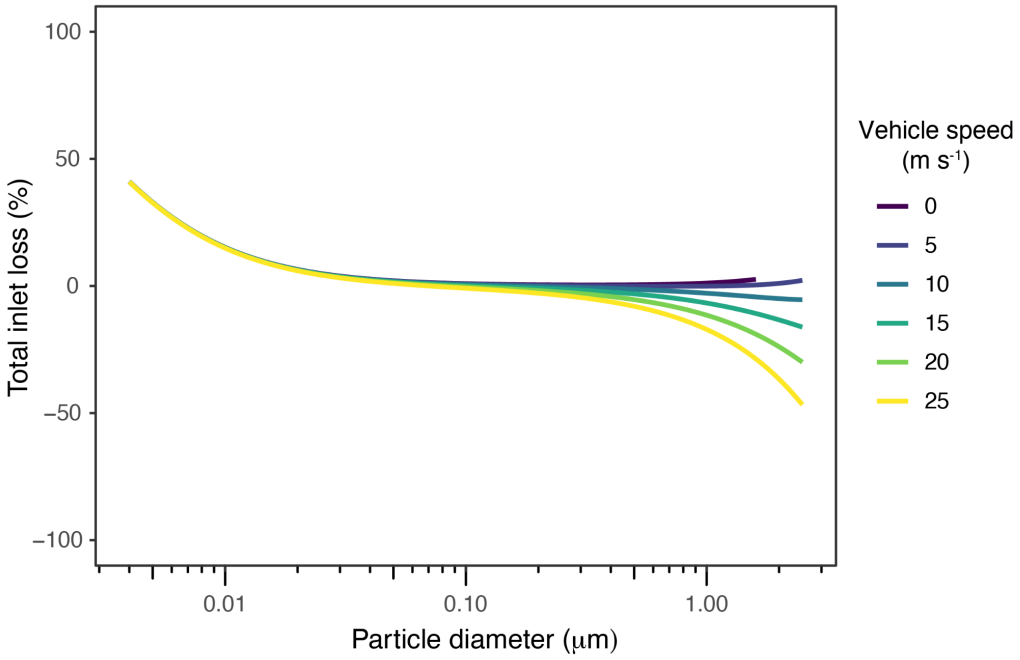

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Figure S1: Size disaggregated particle loss calculations for inlet at different driving speeds.

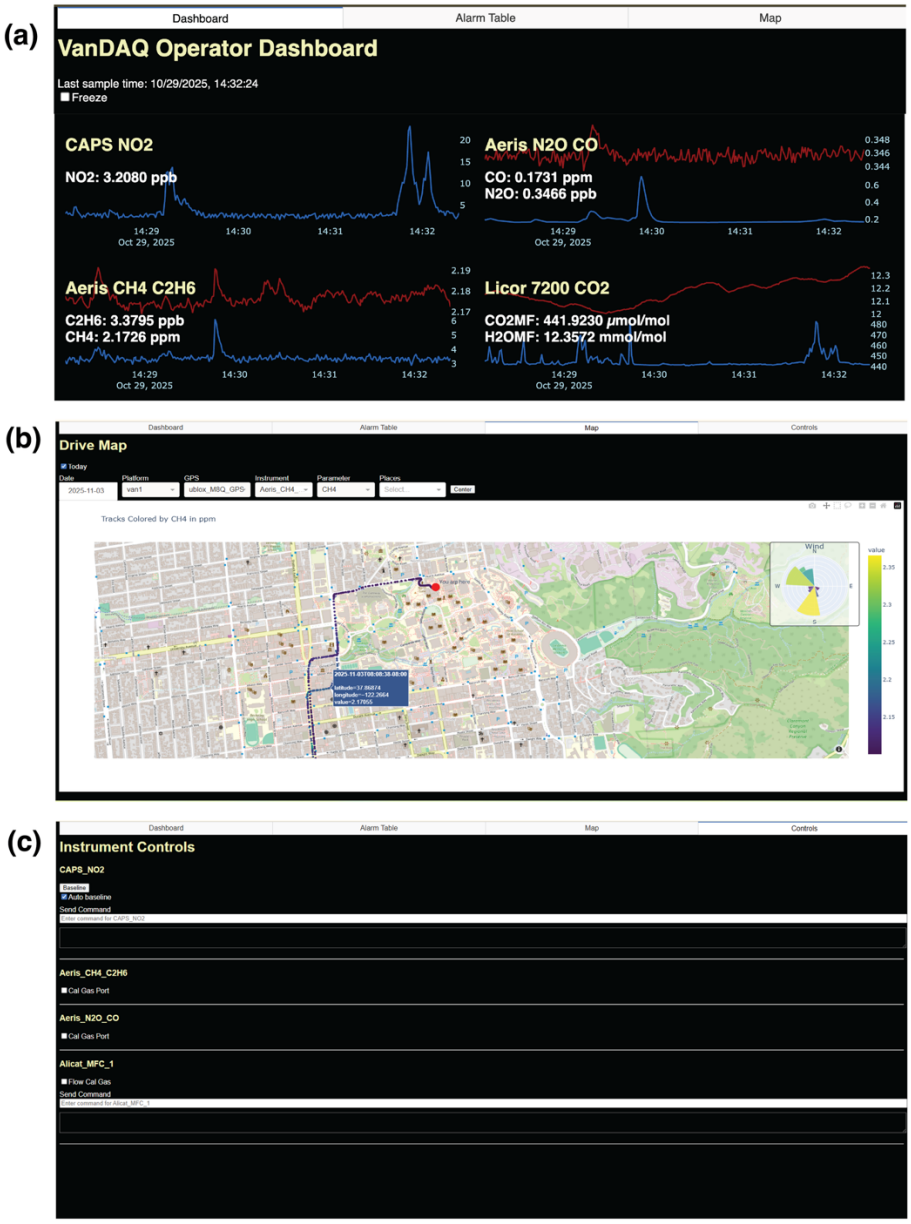


Figure S2: VanDAQ operator dashboard including the three most commonly used tabs of a) measurement time series dashboard, b) live spatial mapping and c) instrument valve controls.

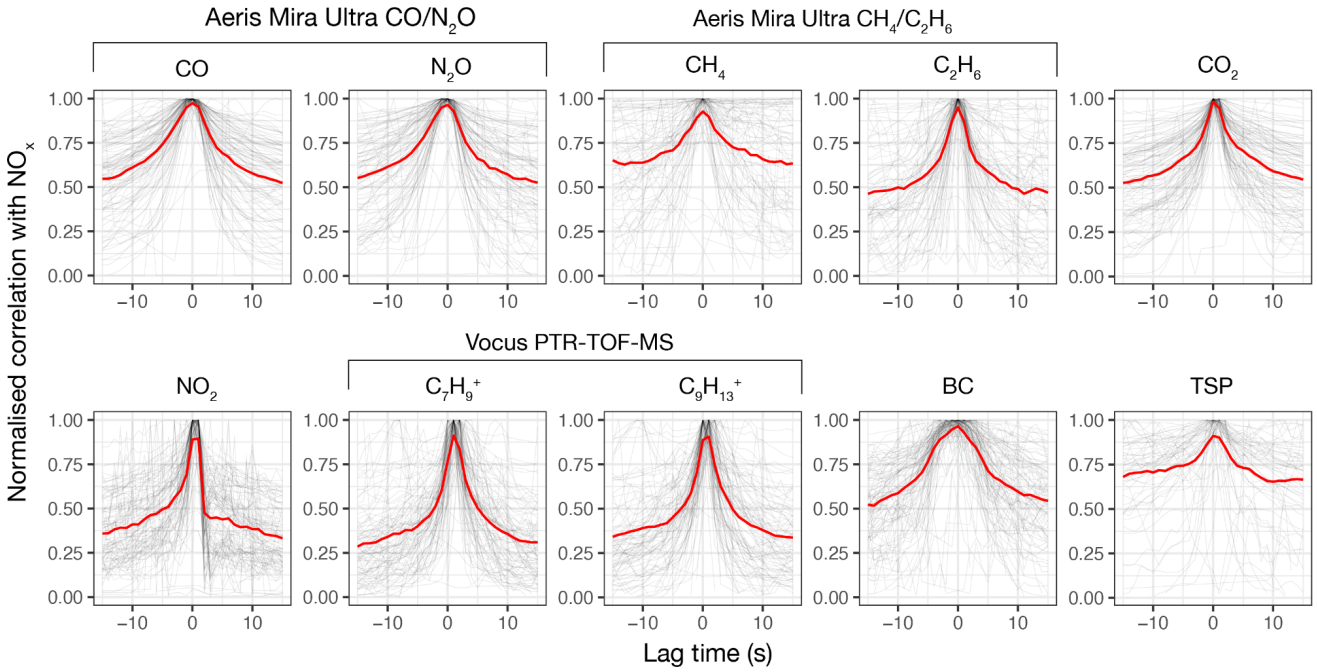


Figure S3: Lag verification from cross correlation statistics of individual drives and measured variables compared to NO_x, where sufficient co-emission in vehicle exhausts enables a lag comparison between all instrumentation excluding the 2BTech 211-G O_3 (no emissions) and $PM_{2.5}$ (slow acquisition rate). Black traces are individual drives and the red trace is the mean average of all drives.

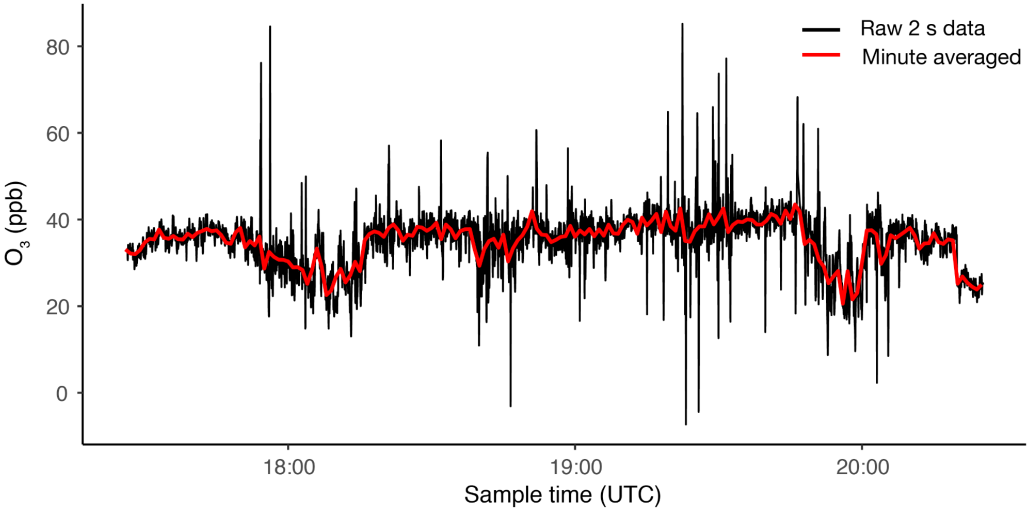
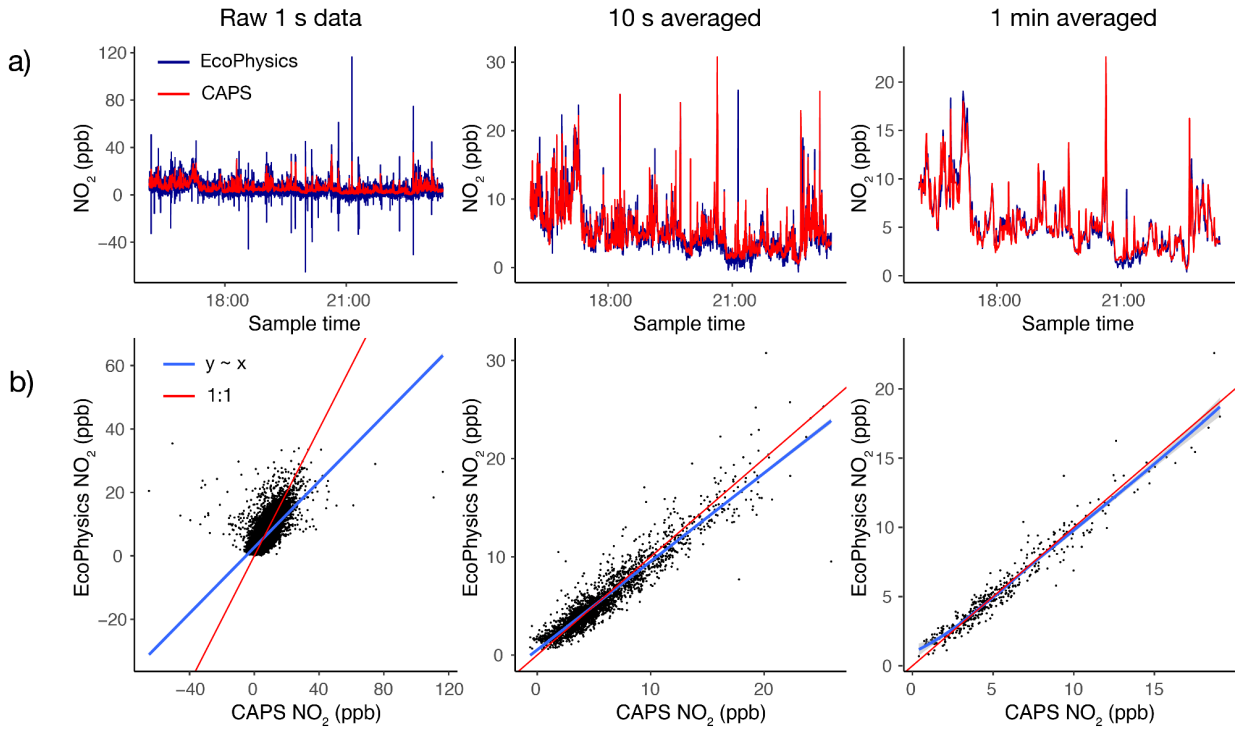


Figure S4: 2BTech O_3 motion sensitivity for a single drive where averaging data removes the data spikes.



30 **Figure S5:** NO_2 comparison between EcoPhysics and Aerodyne CAPS analyser. Data from a single drive at three different aggregation periods: raw 1s, 10s and 1 minute. a) is the drive time series, and b) is a scatter plot of the individual points.

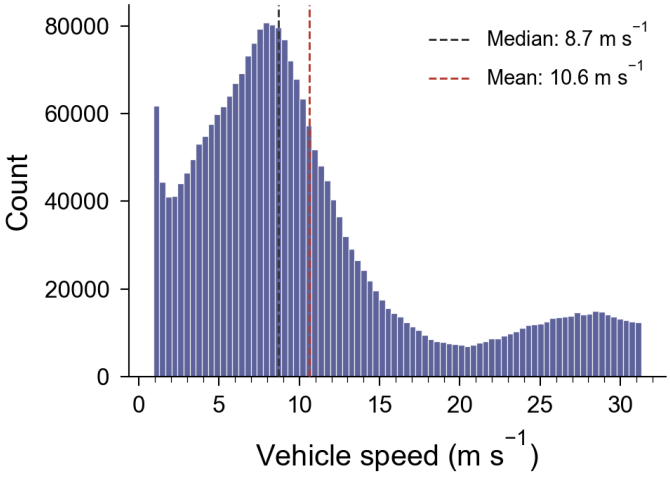


Figure S6: Distribution of mobile vehicle speeds with mean and median statistics indicated as vertical lines.

Table S1: Typical Vocus PTR-ToF-MS operating conditions.

Parameter	Value setpoint
Reagent ion flow	15 sccm
IMR pressure	2.5 mbar
IMR temperature	100 C
Electric field gradient	610 V
RF	450 V
Skimmer 1	-10.0 V
Skimmer 2	-17.6 V
BSQ	200 V

Table S2: Typical Spider-MAGIC operating conditions.

Parameter	Value setpoint
Sheath flow	900 ccm
Aerosol flow	300 ccm
DP 1	9.6 nm
DP 2	507.6 nm
Charge distribution	Soft X-Ray
HV polarity	+/-
Direction	Both
Bins / dec	40
Diffusional losses correction	TRUE
Multi charge correction	TRUE
Dynamic Z+/Z-	TRUE
Total scan length	29.6 s

Table S3: Parameter precision (1σ) and bias (μ) of the 1 Hz measurement data within in-drive target calibrations across the testing measurement period.

Instrument	Parameter	Precision (1σ, ppb)	Bias (μ, ppb)
Aeris Mira Ultra CO/N_2O	CO	0.63	-1.99
	N_2O	1.09	-0.82
Aeris Mira Ultra CH_4/C_2H_6	CH_4	1.55	18.90
	C_2H_6	0.22	-0.13
Vocus PTR-ToF-MS	$C_2H_5O^+$	0.16	0.14
	$C_2H_7O^+$	0.46	0.17
	$C_3H_4N^+$	0.11	0.05
	$C_3H_7O^+$	0.10	0.08
	$C_4H_7O^+$	0.12	0.00
	$C_4H_9O^+$	0.11	0.06
	$C_5H_9^+$	0.09	0.19
	$C_7H_9^+$	0.11	0.13
	$C_8H_{11}^+$	0.14	0.06
	$C_9H_{13}^+$	0.22	0.00
	$C_{10}H_{17}^+$	0.24	0.03