Supplement of

A new laser-based and ultra-portable gas sensor for indoor and outdoor formaldehyde (HCHO) monitoring

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J. D. Shutter et al.

Correspondence to: J. D. Shutter (shutter@g.harvard.edu)

Table S1. Frequencies and line intensities of HITRAN lines used by HAPP fits

Wavenumber / cm ⁻¹	Molecular species	Spectral line intensity (296 K) / cm ⁻¹ / molecule · cm ⁻²
2831.2598	CH ₄	2.863e-22
2831.2701	CH ₄	2.308e-25
2831.2737	HCHO	2.101e-20
2831.2780	CH ₄	2.471e-22
2831.2802	CH ₄	3.408e-25
2831.3160	CH ₄	3.394e-23
2831.3259	HCHO	2.900e-21
2831.3366	CH ₄	2.603e-25
2831.3501	CH ₄	3.240e-25
2831.3550	HCHO	1.420e-20
2831.3657	CH ₄	3.587e-25
2831.4055	HDO	1.812e-28
2831.4097	HDO	1.812e-28
2831.4209	CH₄	1.553e-23
2831.5393	HCHO	5.622e-21
2831.5534	CH ₄	8.870e-25
2831.5576	HCHO	5.543e-21
2831.5616	CH₄	1.549e-23
2831.5801	HDO	4.140e-28
2831.6413	HCHO	5.839e-20
2831.6879	HCHO	1.499e-21
2831.6892	HCHO	1.499e-21
2831.6961	CH ₄	6.671e-25
2831.6989	HCHO	1.410e-20
2831.8134	HCHO	6.509e-21
2831.8214	CH ₄	3.671e-24
2831.8413	HDO	3.014e-24
2831.8516	CH ₄	1.983e-24
2831.8906	HDO	9.812e-28
2831.8948	H ₂ O	1.595e-28
2831.9199	CH₄	1.622e-21
2831.9569	HDO	2.713e-27

Spectral lines from the same molecular species are fitted together rather than independently. Lines bolded in blue were used in experiments that utilized ultra-zero air, and it was discovered that all the lines listed produced a more superior fit than only the lines bolded in blue when sampling ambient air. Spectral frequencies and line intensities were accessed using HITRAN on the Web (<http://hitran.iao.ru/>) (Rothman et al., 2013).

Table S2. 1σ standard deviation for Aeris sensor at various integration times. All values are in pptv and were obtained by either (1) bubbling ultra-zero air (1000 sccm) through water (HDO mode) or (2) adding chemically-pure 99.5% CH₄ (< 1 sccm) to 5000 sccm ultra-zero air (CH₄ mode).

Integration time / s	ART fit HDO mode / pptv HCHO	HAPP fit HDO mode / pptv HCHO	Average of the two HDO modes / pptv HCHO	HAPP fit CH ₄ mode / pptv HCHO
30	1200	1000	700	1350
60	1000	800	660	1100
120	730	600	530	720
300	430	380	330	460
900	230	190	180	320
1800	160	140	120	280
3600	140	100	100	230
7200	160	110	110	140
20000	170	160	160	200

Figure S1. Correlation plot between the Aeris Real-time (ART) fit and the Harvard Aeris-Post Processing (HAPP) fit ($R^2 = 0.941$).

Figure S2. Time series showing the HCHO mixing ratios from the Aeris sensor (HAPP HDO fit) and NASA ISAF and CAFE during a multi-hour stepped intercomparison performed at NASA Goddard in November 2017. All data is reported with an integration time of 30 s.

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