Supplemental information for:

Emission factors of longer-lived volatile organic compounds from the 2019-2020 Australian wildfires during the COALA campaign

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S1: PTR-ToF-MS and supporting observations

Calibrations Standards			
Compound	Formula	m/z	Limit of Detection (3σ , ppt)
Methanol	CH_4OH+	33.033	5
Acetonitrile	C_2H_3NH+	42.034	5
Acetaldehyde	C_2H_4OH+	45.033	5
Acrolein	C_3H_4OH+	57.033	15
Acetone	C_3H_6OH+	59.049	20
Isoprene	C_5H_8OH+	69.070	165
Methyl Vinyl Ketone	C_4H_6OH+	71.049	5
Methacrolein	C_4H_6OH+	71.049	5
Methyl Ethyl Ketone	C_4H_8OH+	73.065	5
Benzene	C_6H_6H+	79.054	10
Toluene	C_7H_8H+	93.070	15
C8-aromatics	$C_8H_{10}H+$	107.086	5
Chlorobenzene	C_6H_5ClH+	113.015	5
C3-benzene	$C_9H_{12}H+$	121.101	20
P-cymene	$C_{10}H_{14}H+$	135.117	10
α -pinene	$C_{10}H_{16}H+$	137.132	20
Cineole	$C_{10}H_{18}OH+$	155.143	20

Table S1: Standards used to calibrate PTR-TOF-MS as well as determine instrument transmission and limits of detection.

S2: Plume Origin and Transport Time

Figure S1: Altitudes corresponding by color to trajectories plotted in Fig. 1 For the periods closer to sunrise on 4 Feb 2020, the model predicts higher altitudes that reach 563 m agl at maximum. This resulted from air masses travelling over active fires. The decline in altitude results from these same masses travelling over the ocean which has less turbulent, cooler conditions.

S3: Calculating Emission Ratios

An emission ratio (ER) is defined in this work as the slope of a linear regression of a VOC of interest (X) to CO (both in units of ppb). From methodology further discussed in Sect. 5.2 of the main paper, an $R^2 \geq 0.5$ is set to ensure a robust correlation. Fig. S2 shows a comparison between ERs derived from two subsets of data over the smoke event – one from the freshest portion of the plume and the other using an average from 4 subsets making up the entirety of the event.

Figure S2: Comparison of ERs derived from solely period D and then from average of all periods. Standard deviation is reported for each average ER. If standard deviation is missing, then that compound had only one viable ER of the four periods. For all compounds here, variability is high enough to capture all period D ERs within 1σ .