Supplement of

Atmospheric ethanol in London and the potential impacts of future fuel formulations

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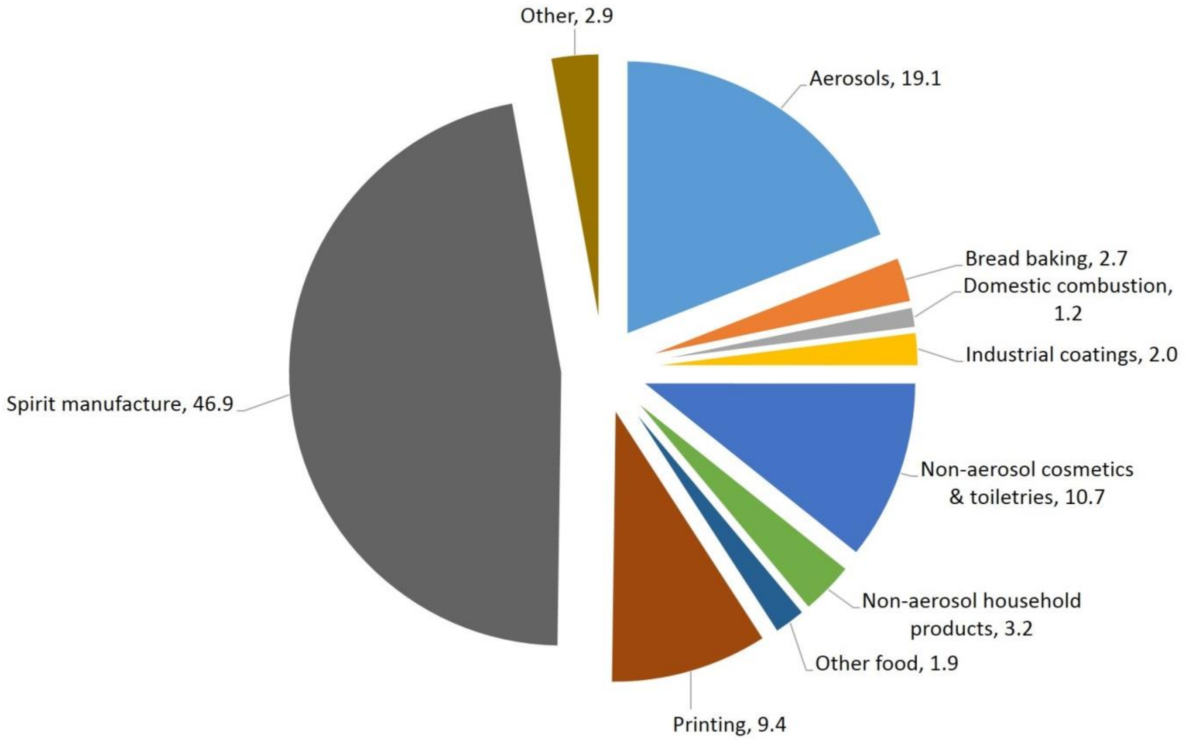
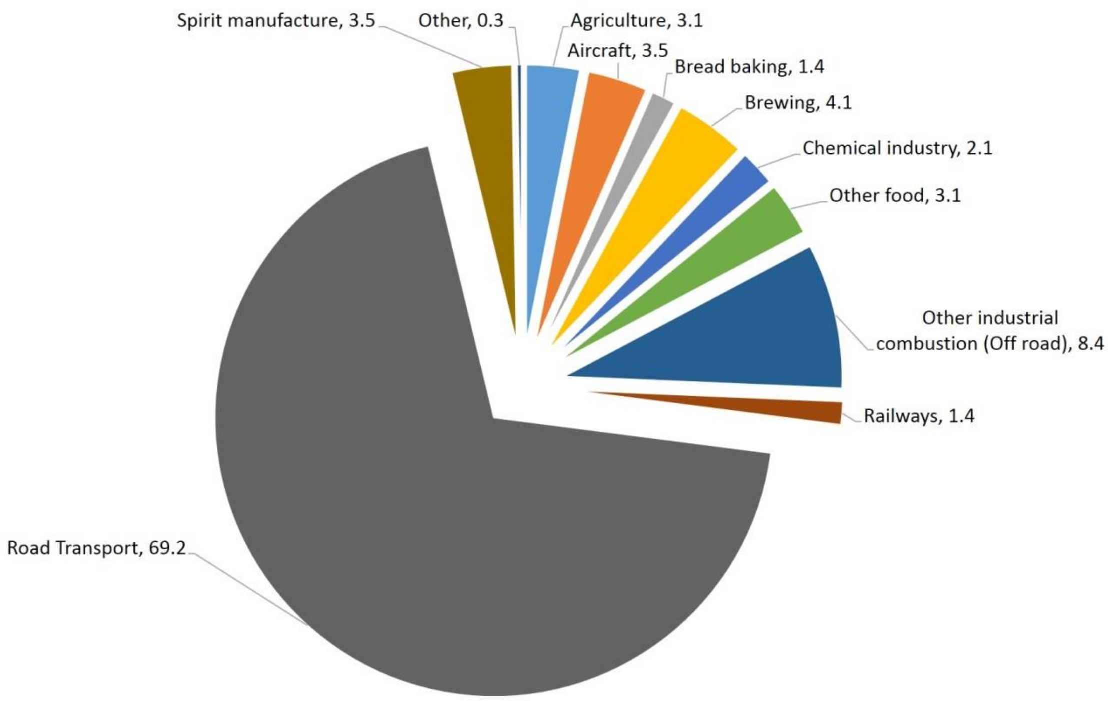
Supplementary Figures 1 and 2 show the emission source contributions for ethanol and acetaldehyde respectively from the National Atmospheric Emissions Inventory (NAEI) using the Passant (2002) VOC speciation profiles.



Supplementary Figure 1: Emission source contributions for ethanol from the NAEI. The Other category refers to the sum of categories that have less than 1% each: agrochemicals use, brewing, chemical industry, cider manufacture, coating manufacture, domestic adhesives, film coating, glass, industrial adhesives, landfill, non-aerosol automotive products, other industrial combustion (wood), paper printing, solvent and oil recovery, textile coating and wine manufacture.



Supplementary Figure 2: Emission source contributions for acetaldehyde from the NAEI. The Other category refers to the sum of categories that have less than 1% each: cement (non-de-carbonising), glass, house and garden machinery, miscellaneous-landfill gas, power stations, public services and solvent and oil recovery.

Supplementary Tables 1 and 2 show the linear regression coefficient values for all individual and grouped VOC species with ethanol.

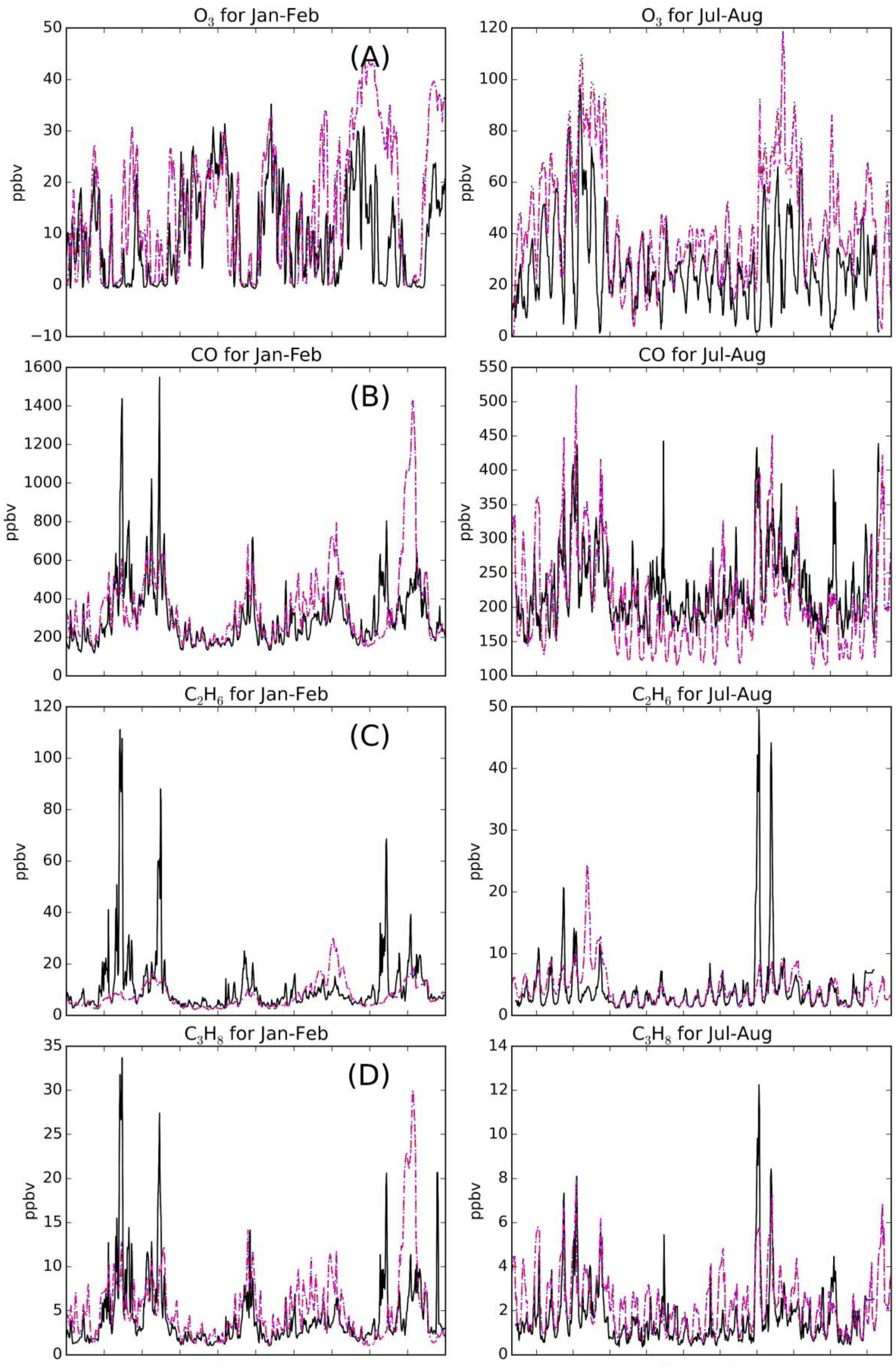
Supplementary Table 1: Correlation of all individually quantified VOCS with ethanol during the ClearfLo campaigns. Values in bold indicate R correlations of greater than 0.75.

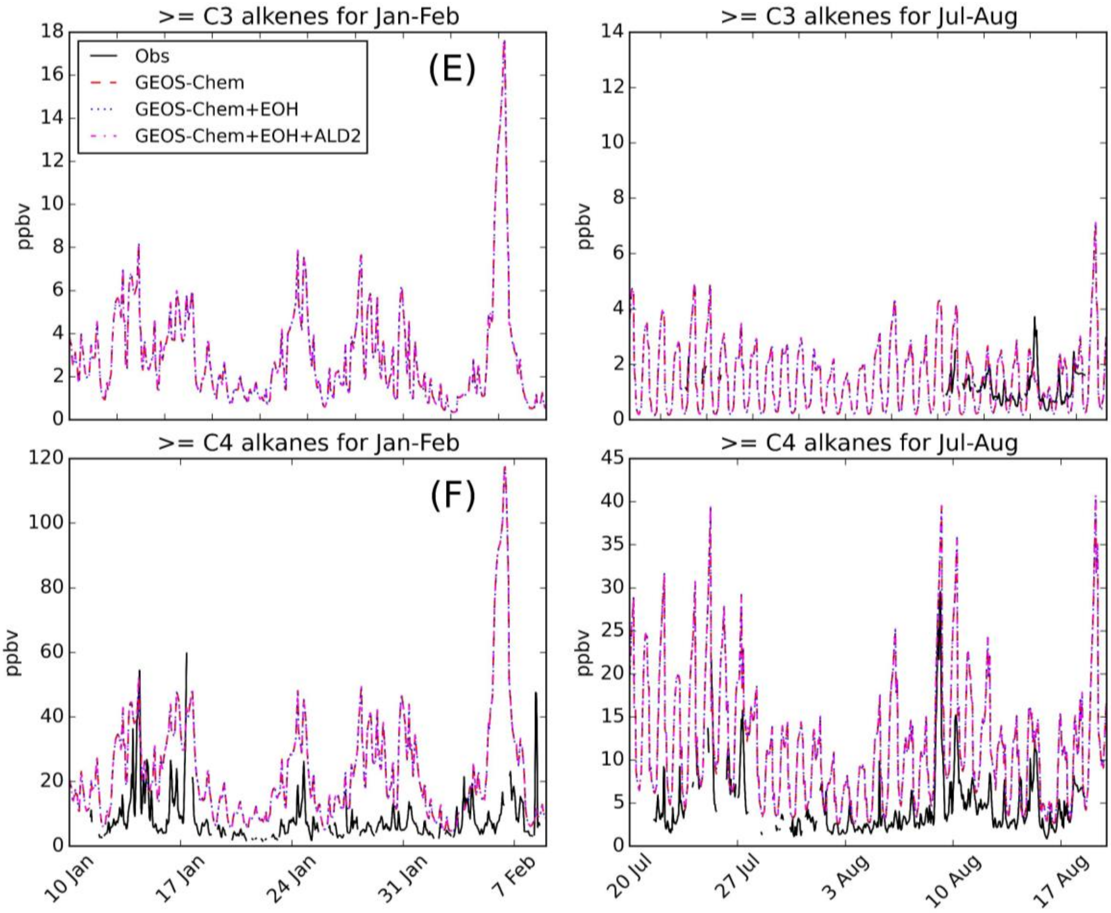
Compound	Correlation with Ethanol Winter	Correlation with Ethanol Summer	Compound	Correlation with Ethanol Winter	Correlation with Ethanol Summer
Saturated			**Aromatics continued**		
Methane	**0.88**	0.75	m- and p-Xylene	**0.88**	**0.90**
Ethane	**0.86**	**0.81**	o-Xylene	**0.86**	**0.90**
Propane	**0.89**	**0.89**	Benzene, iso-propyl-	0.71	-
n-Butane	**0.89**	**0.85**	Benzene, propyl-	**0.84**	0.67
iso-Butane	**0.86**	**0.84**	Toluene, 3-ethyl-	**0.85**	0.68
n-Pentane	**0.91**	**0.88**	Toluene, 4-ethyl-	**0.77**	0.66
iso-Pentane	**0.89**	**0.87**	Benzene, 1,3,5-trimethyl-	**0.82**	0.73
Cyclopentane	**0.76**	**0.82**	Toluene, 2-ethyl-	**0.78**	0.63
n-Hexane	**0.91**	**0.79**	Benzene, 1,2,4-trimethyl-	**0.79**	0.60
Pentane, 2+3-methyl-	**0.89**	**0.88**	Toluene, 4-isopropyl-	0.63	0.31
n-Heptane	**0.80**	**0.84**	Benzene, 1,2,3-trimethyl-	**0.88**	**0.72**
Butane, 2,2,3-trimethyl-	**0.83**	**0.85**	Indan	**0.84**	-
n-Octane	**0.90**	**0.85**	Benzene, tert-butyl-	0.28	0.41
Pentane, 2,2,4-trimethyl-	**0.80**	**0.87**	Benzene, 1,3-diethyl-	**0.86**	0.61
n-Nonane	**0.88**	**0.77**	Benzene, 1,4-diethyl-	**0.86**	**0.79**
n-Decane	**0.89**	0.65	Naphthalene	**0.83**	0.66
Nonane, 2-methyl-	**0.83**	0.66	**Oxygenates**		
n-Undecane	**0.88**	**0.86**	Acetaldehyde	**0.89**	**0.91**
n-Dodecane	**0.88**	**0.79**	Propanal, 2-methyl-	-	0.14
Unsaturated			Butanal	0.49	0.19
Ethene	**0.88**	**0.85**	Butanal, 3-methyl-	-	0.18
Acetylene	**0.90**	**0.86**	Butanal, 2-methyl-	-	0.17
Propene	**0.86**	**0.81**	Methacrolein (MACR)	-	0.16
Propadiene	**0.88**	**0.81**	Pentanal	-	0.19
Propyne	-	**0.79**	Hexanal	**0.87**	0.24
Butene, trans-2-	**0.88**	**0.82**	Benzaldehyde	0.69	0.72
1-Butene	**0.91**	**0.82**	Methanol	0.66	0.81
iso-Butene	**0.90**	**0.89**	Ethanol	-	-
Butene, cis-2-	**0.88**	**0.82**	Propanol	0.54	**0.85**
1,2-Butadiene	-	-0.17	Butanol	0.49	0.62
1,3-Butadiene	**0.88**	**0.75**	Acetone	**0.80**	0.75
Pentene, trans-2-	0.43	**0.83**	Butanone	**0.81**	0.31
1-Pentene	0.49	**0.88**	Ketone, methyl-vinyl- (MVK)	-	0.19
Isoprene	**0.90**	0.11	Pentanone, 2-	-	0.15
Styrene	**0.80**	0.41	Pentanone, 4-methyl-2-	0.70	0.22
α-Pinene	-0.37	0.36	Hexanone, 2-	-	0.17
Limonene	**0.90**	0.27	Cyclohexanone	-	0.18
Aromatics			Acetate, ethyl-	-0.48	0.23
Benzene	**0.87**	**0.91**	**Halogenated**		
Toluene	**0.89**	**0.91**	Methane, dichloro	**0.85**	**0.78**
Benzene, ethyl-	**0.85**	**0.90**	Trichloroethylene	-	**0.85**

Supplementary Table 2: Correlation of the grouped species with ethanol during the ClearfLo campaigns. Values in bold indicate R correlations of greater than 0.75.

	Correlation with Ethanol	
Grouped species	**Winter**	**Summer**
C_6 Aliphatics	**0.79**	0.74
C_7 Aliphatics	**0.85**	**0.77**
C_8 Aliphatics	**0.87**	**0.78**
C_9 Aliphatics	**0.85**	0.73
C_{10} Aliphatics	0.71	0.70
C_{11} Aliphatics	**0.87**	0.65
C_{12} Aliphatics	**0.85**	0.65
C_{13} Aliphatics	**0.88**	0.70
C_4 substituted monoaromatics	**0.86**	0.72
C_{10} Monoterpenes	**0.87**	0.17

Supplementary Figure 3 shows the time series comparisons between measured and modelled values for multiple species.

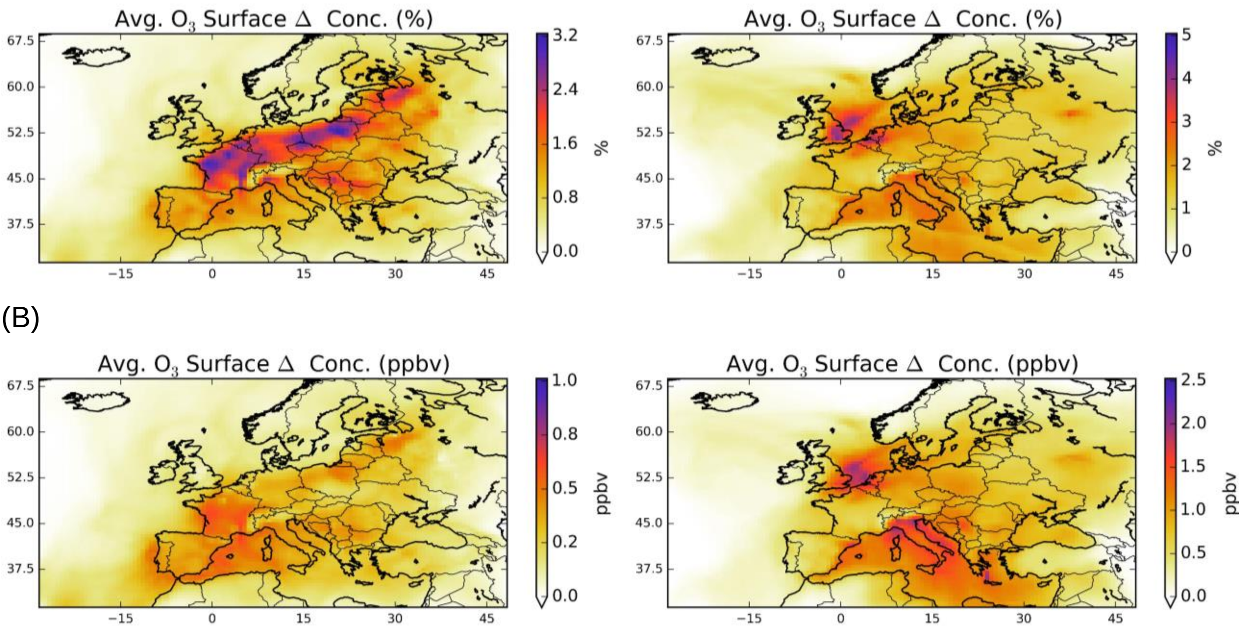




Supplementary Figure 3: Comparison between modelled values and observed for ozone (A), carbon monoxide (B), ethane (C), propane (D), >=C3 alkenes (E), and >=C4 alkanes (F), for winter (left) and summer (right) observation periods. Plots show the simulation without increase ethanol or aldehyde emissions ('GEOS-Chem') in magenta, with added EOH emissions ('GEOS-Chem+EOH') in red, and with both additional ethanol and acetaldehyde emissions ('GEOS-Chem+EOH+ALD2') in blue.

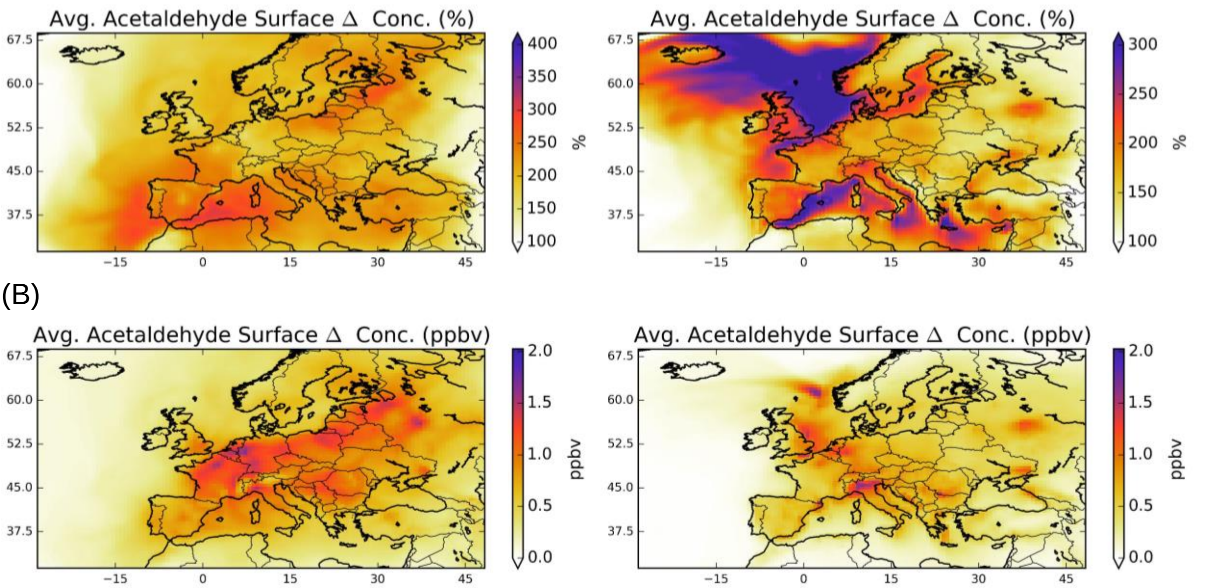
Supplementary Figures 4 and 5 show spatial changes in ozone and acetaldehyde concentrations between the ‘GEOS-Chem’ and ‘GEOS-Chem+EOH’ models.

(A)



Supplementary Figure 4: Spatial change in ozone concentration between (‘GEOS-Chem’) and additional ethanol emissions (‘GEOS-Chem+EOH’) for winter (left) and summer (right) observation periods. Actual changes in ppbv are shown below (B), and percentage changes are shown above (A).

(A)



Supplementary Figure 5: Spatial change in acetaldehyde concentration between (‘GEOS-Chem’) and additional ethanol emissions (‘GEOS-Chem+EOH’) for winter (left) and summer (right) observation periods. Actual changes in ppbv are shown below (B), and percentage changes are shown above (A).