

Supplementary Materials

Table S1: Pearson correlation coefficients between different BC measurements such as BC (HR-SP-AMS) with BC and BrC (AE31) and BC (MAAP)

BC (HR-SP-AMS)	
	Pearson Coefficient
BC (AE31)	0.98
BrC (AE31)	0.96
BC (MAAP)	0.95

Table S2: Correlation between BC (HR-SP-AMS) and CIMS measurements

HR-SP-AMS	CIMS DATA		
	HCN	HCNO	HONO
	Pearson Coefficient	Pearson Coefficient	Pearson Coefficient
rBC (HR-SP-AMS)	0.88	0.77	0.89

Table S3: Correlation between HR-Aerosols species Vs Aerosol and Gases (AMS)

HR Aerosol Species	Aerosol and Gases	Pearson Coefficient
rBC	BC_($\mu\text{g m}^{-3}$)	0.95
HROrg	Org_($\mu\text{g m}^{-3}$)	0.92
HRNH ₄	NH ₄ _($\mu\text{g m}^{-3}$)	0.92
HRNO ₃	NO ₃ _($\mu\text{g m}^{-3}$)	0.86
HRSO ₄	SO ₄ _($\mu\text{g m}^{-3}$)	0.91
HRChl	Chl_($\mu\text{g m}^{-3}$)	0.99

PMF Factorisation factors solution without inclusion of Fullerenes signals:

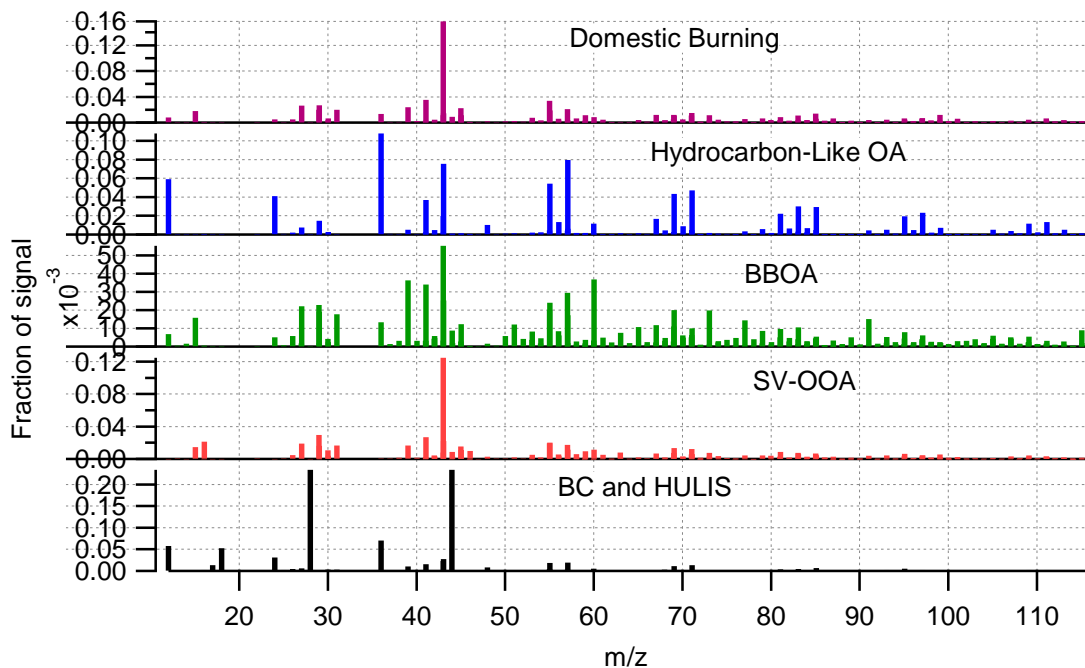


Figure S1a Mass Spectra of five factor solution (without inclusion of fullerene signals).

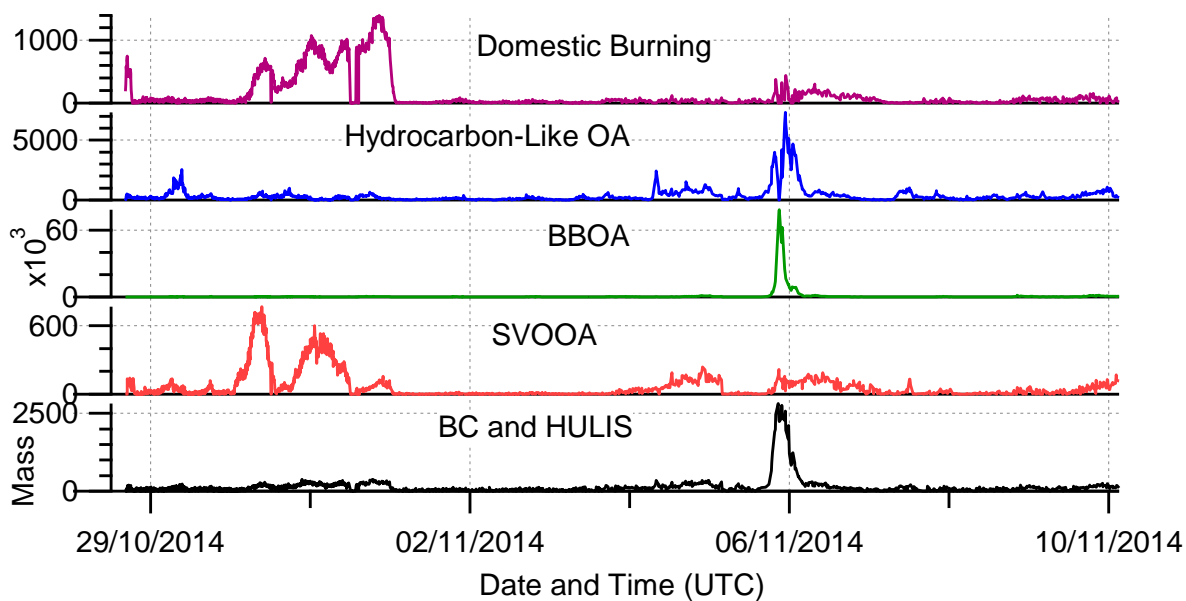


Figure S1b time series of five factors (without the inclusion of fullerene data).

PMF Factorisation factors solution with inclusion of Fullerenes signal

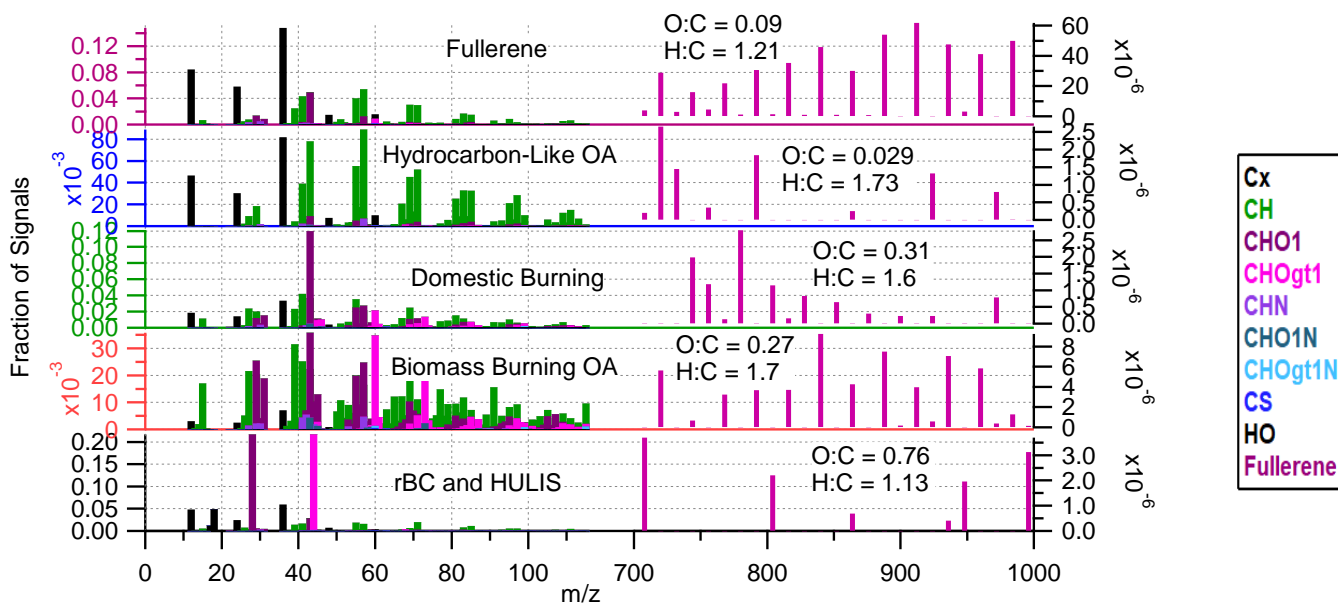


Figure S2a: PMF five factors source profile (factor 1 = BC and HULIS, factor 2 = BBOA, factor 3 = Domestic burning OA, factor 4 = Hydrocarbon-Like OA, factor 5 = Fullerene). Note the difference in scales of the fullerene signals (right hand axes).

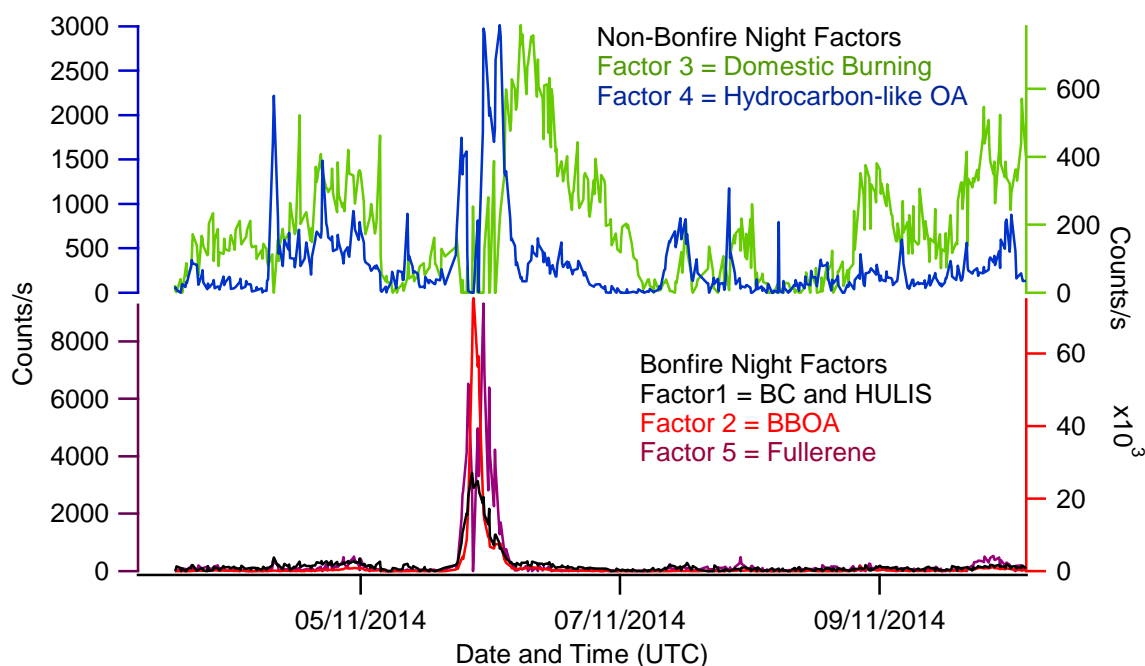


Figure S2b: The time series of (a) non-Bonfire night factors and (b) bonfire night factors obtained by PMF analysis of the HR-SP-AMS data.

Model Error modification:

Here we use the term ‘model’ error to refer to the additional error term that can be added as part of the PET toolkit, whereby additional error is added proportional to the signal, as opposed to the square root of the signal as is done

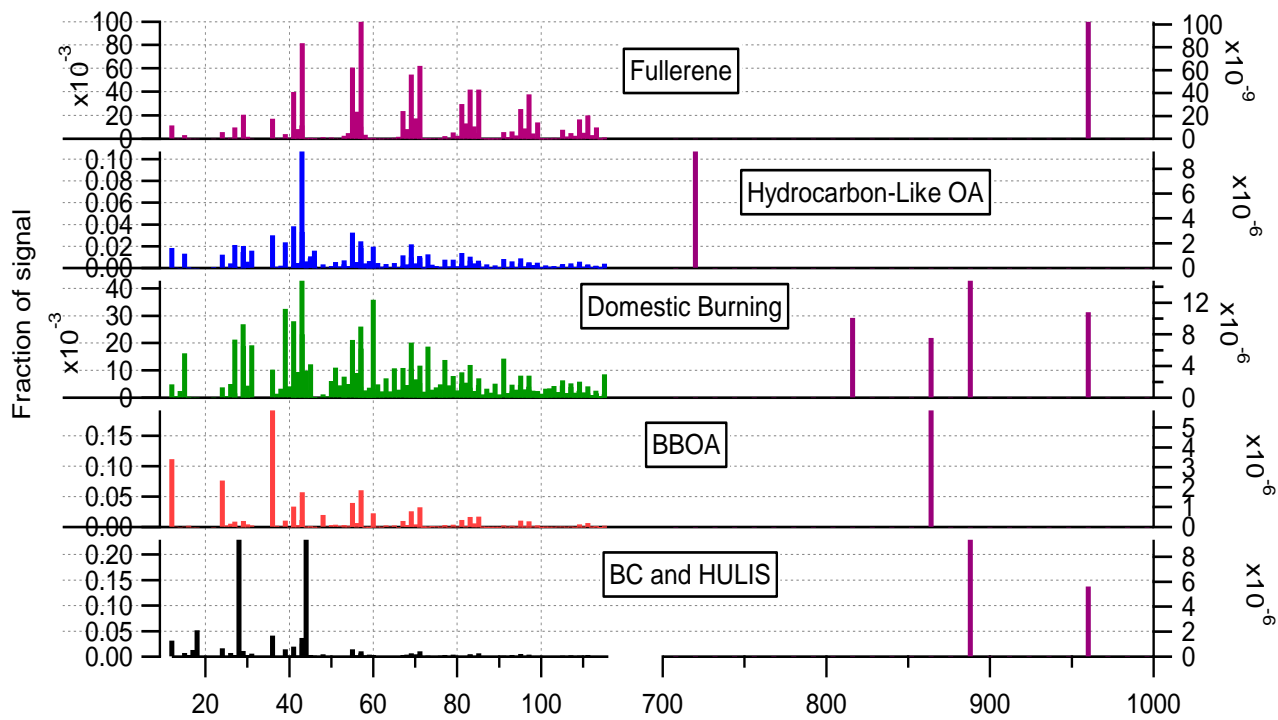


Fig S4a PMF five factors profile detected by the model error 0.05

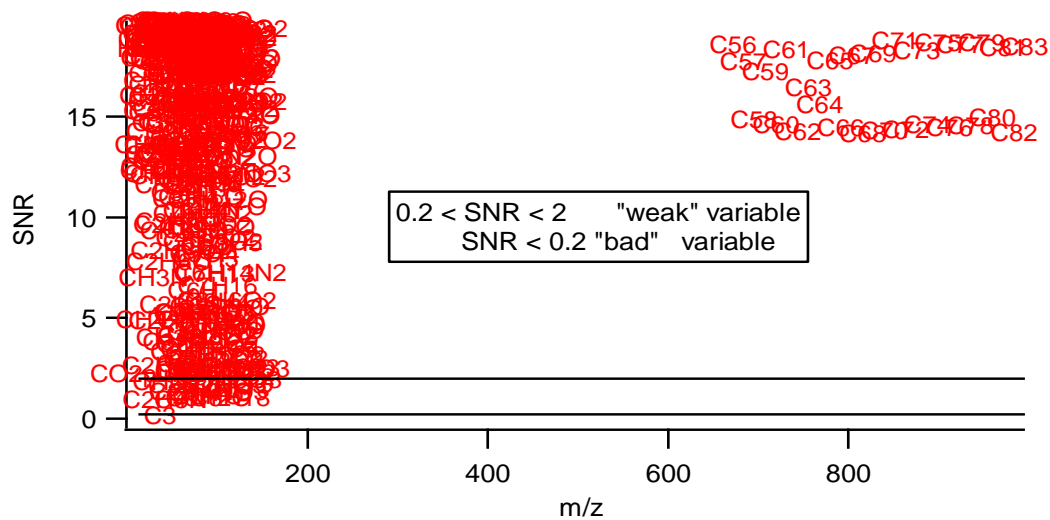


Figure S4b shows the SNR of organics and fullerenes with little modification in the model error value i.e. 0.05

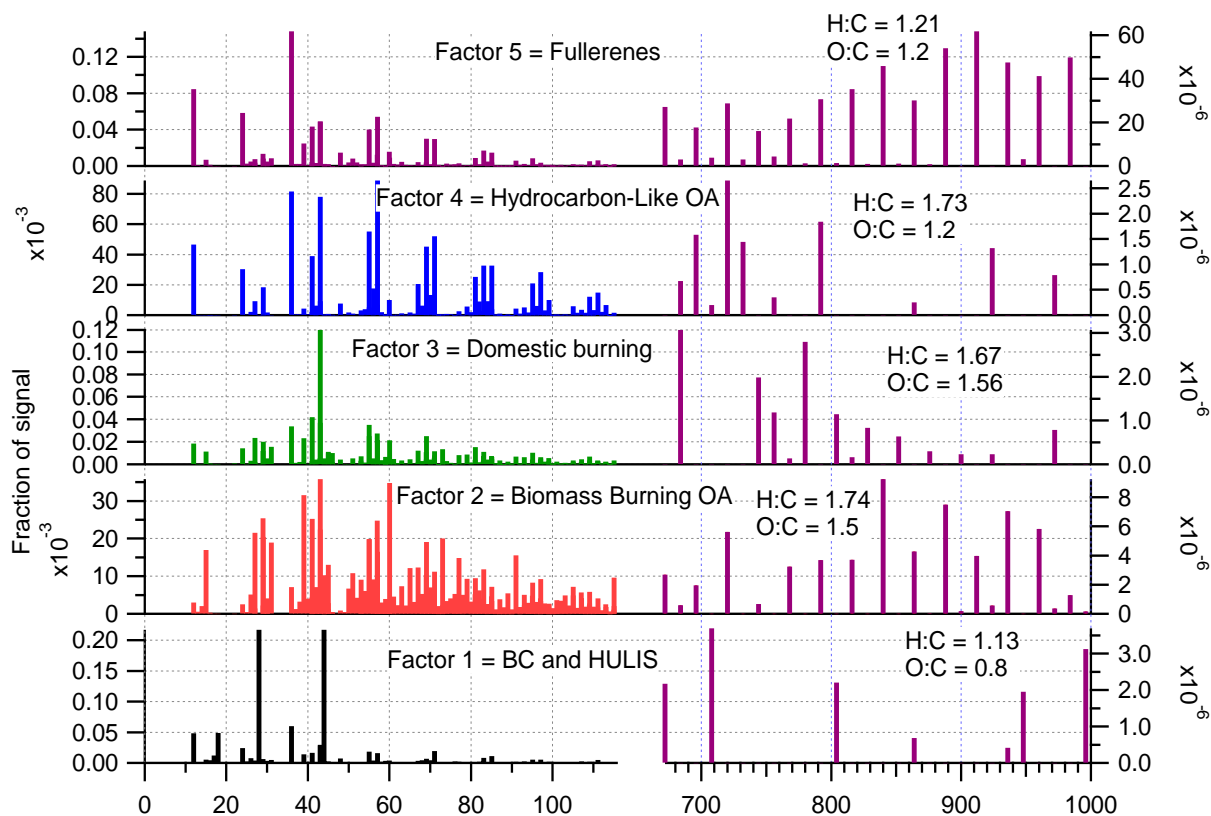


Fig S5a PMF five factors profile detected by the model error 0.10

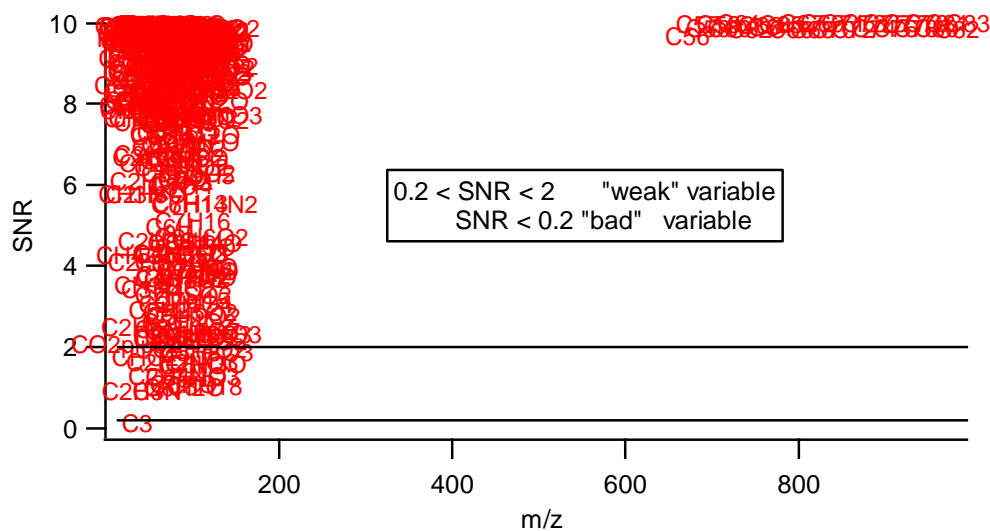


Figure S5b shows the SNR of organics and fullerenes with more modification in the model error value i.e. 0.10.

PMF factors-solution selection:

A range of solutions were obtained using different parameters as part of the PMF analysis and here we present the reasons behind the choice of solution used in the paper. Regarding the number of factors, a 5-factor solution was chosen instead of 6-factor solution because all the five factors are separated from one another and represent a specific soot source (fig S6a, b). In comparison, the 6-factor solution has two 'split' factors representing the same

emissions. These are factor 2 and factor 4 in figure S7b and represent domestic wood burning sources because their peaks were evident before and after the bonfire night event (fig. S7a, S7b).

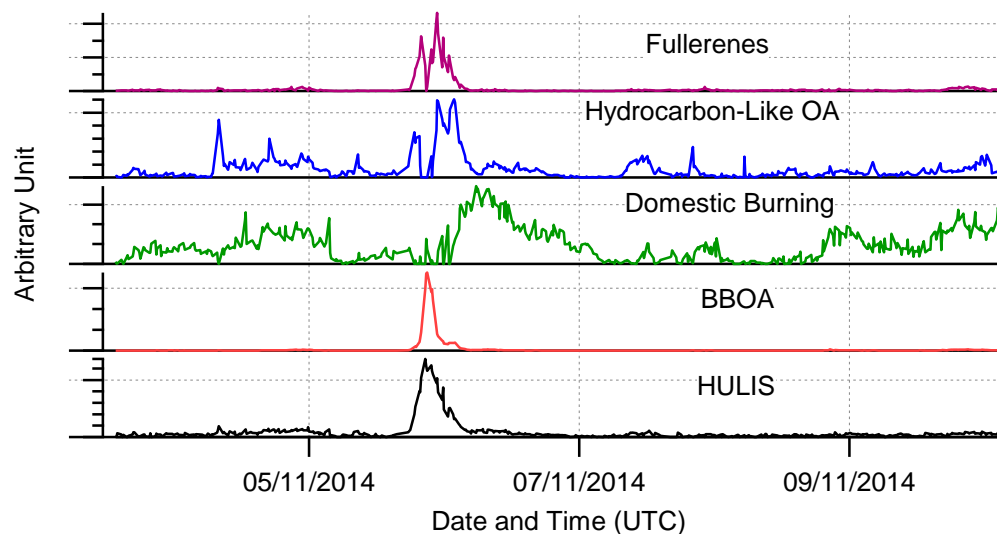
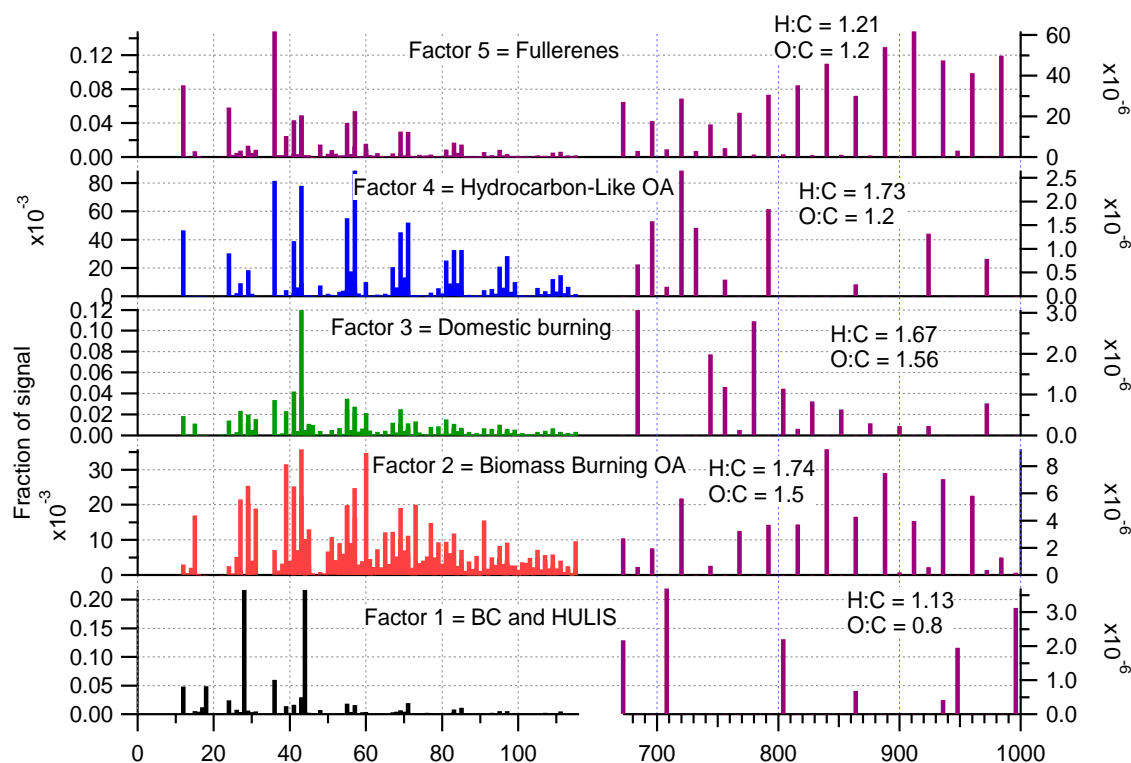


Figure S6a: Time series of five factors solution detected separately under the condition of 0.10 model error.



Figure

S6b: The factor profile of five factors solution detected separately under the condition of 0.10 model error.

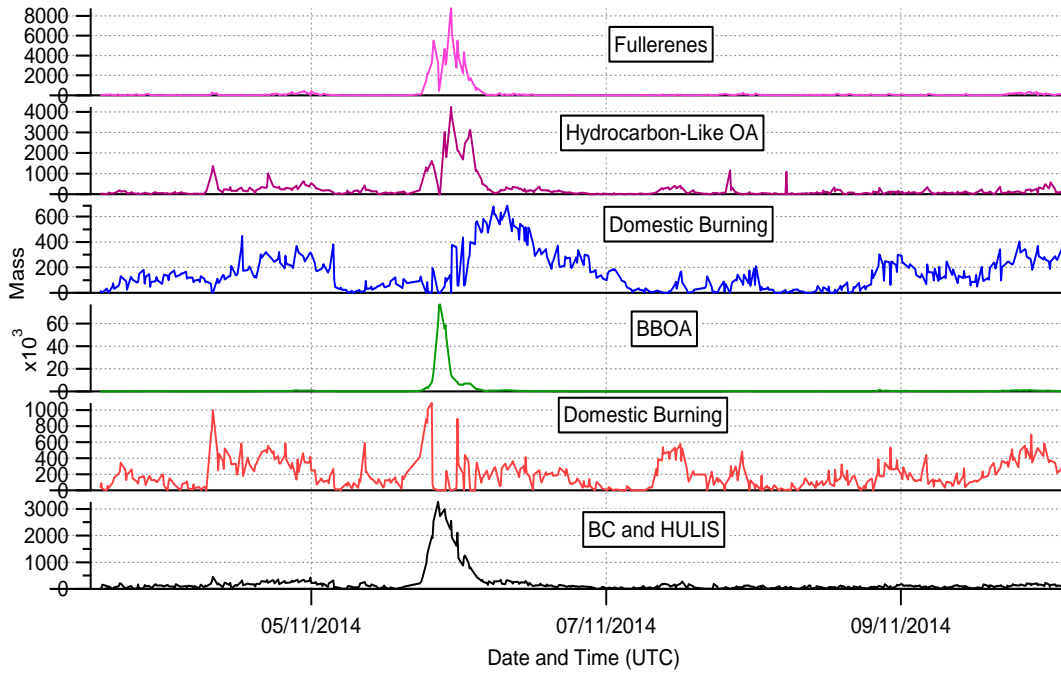


Figure S7a: Time series of six factors solution in which two same factors are split in to two different factors i.e. 2 and 4 under the condition of 0.10 model error.

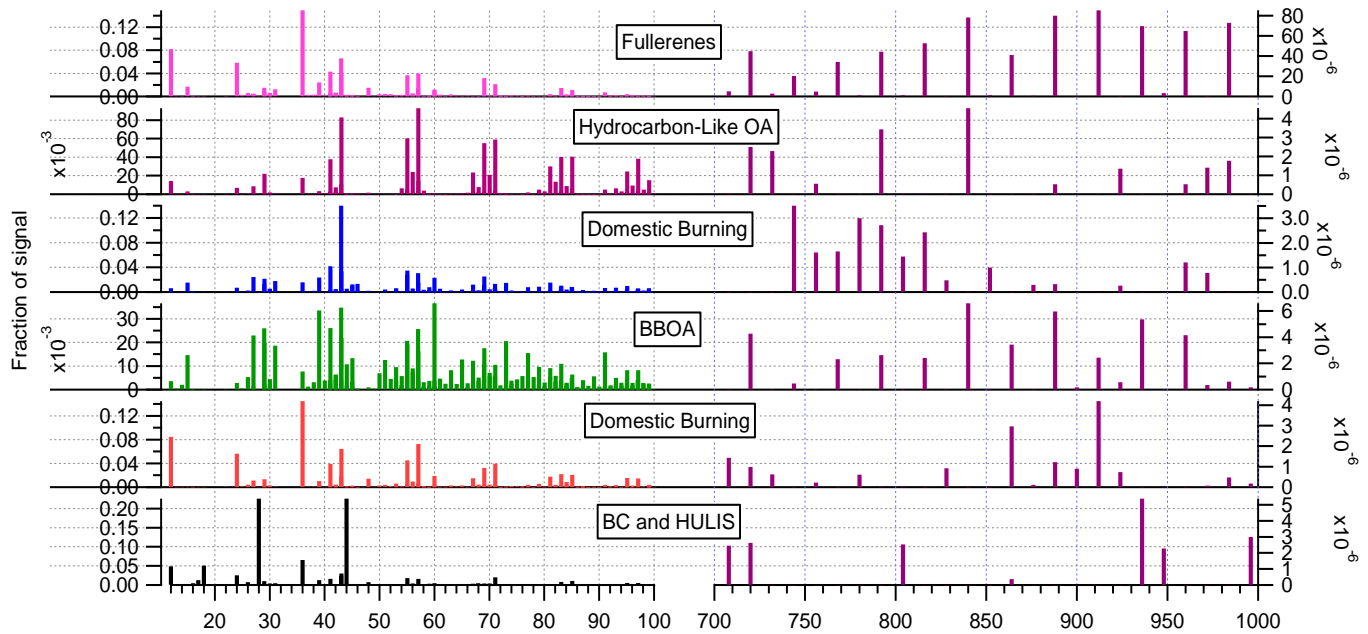


Figure S7b: Factor profiles of the 6-factor solution in which factor 2 and 4 have the same m/z spectrum, under the condition of 0.10 model error.