CONTRIBUTIONS OF FOSSIL FUEL COMBUSTION, BIOMASS BURNING AND BIOGENIC SOURCES TO FINE CARBONACEOUS AEROSOL IN THE CITY CENTRE, SUBURBAN AREA AND REGIONAL BACKGROUND OF BUDAPEST OVER 1 YEAR

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METHODS

- $PM_{2.5}$ aerosol particles collected by HiVol samplers on quartz fibre filters in parallel in regional background (K-puszta station) of the Carpathian Basin, suburban area (Main Observatory of the Hungarian Meteorological Service) and city centre (BpART Laboratory) of its largest city, Budapest (Fig. 1) for 14, 14 and 7 days, respectively in each season over 1 year, + air pollutants and meteorological properties measured in-situ
- $PM_{2.5}$ mass, organic carbon (OC), elemental carbon (EC), water-soluble OC (WSOC), radiocarbon, levoglucosan (LVG) and its stereoisomers, and some chemical elements determined
- coupled ^{14}C-LVG marker method (Fig. 2, Salma et al., 2017) used to apportion the total carbon (TC=OC+EC) into EC and OC from FF combustion (EC_{FF} and OC_{FF}), from BB (EC_{BB} and OC_{BB}) and from biogenic sources (OC_{BIO})

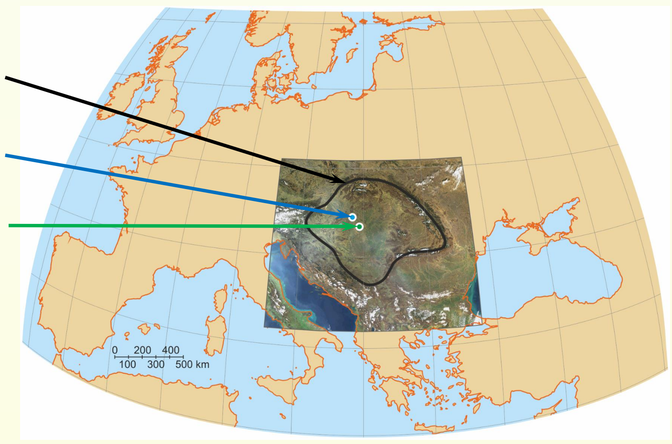

Figure 1. Sampling sites in Budapest and K-puszta in the Carpathian Basin.

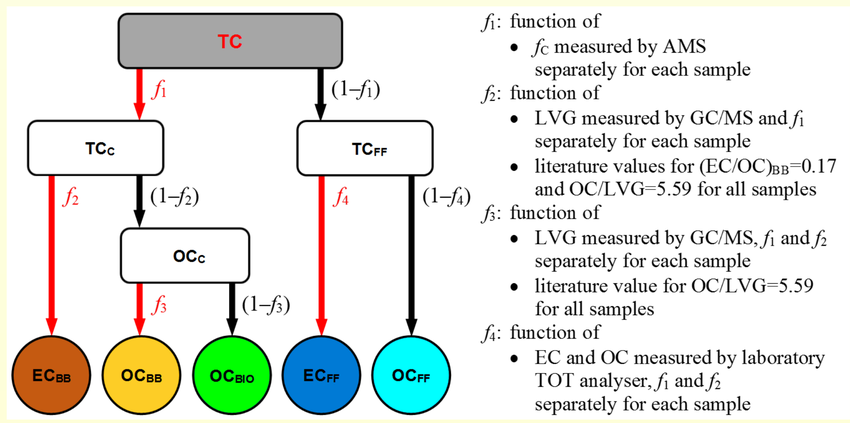

Figure 2. Apportionment steps of the coupled ^{14}C-LVG marker method.

SELECTED RESULTS

Table 1. Median concentrations of $PM_{2.5}$ mass, EC, OC, LVG, fraction of contemporary total carbon (f_c) and K for regional background in the Carpathian Basin, suburban area and city centre of Budapest in different seasons.

Constituent	Site type	Autumn	Winter	Spring	Summer
$PM_{2.5}$ mass ($\mu g\ m^{-3}$)	Region	12.5	16.5	8.6	10.7
	Suburb	25	26	9.7	11.7
	Centre	28	24	13.3	8.2
EC ($\mu g\ m^{-3}$)	Region	0.37	0.36	0.20	0.122
	Suburb	0.45	0.68	0.51	0.35
	Centre	0.99	0.77	0.79	0.37
OC ($\mu g\ m^{-3}$)	Region	2.3	3.2	2.0	2.2
	Suburb	4.5	5.4	2.4	2.7
	Centre	6.6	4.6	2.8	2.6
LVG ($\mu g\ m^{-3}$)	Region	0.172	0.40	0.0180	0.0081
	Suburb	0.44	0.71	0.040	0.0124
	Centre	0.38	0.48	0.036	0.0103
f_c (%)	Region	69	75	61	74
	Suburb	66	74	48	60
	Centre	76	74	48	60
K ($\mu g\ m^{-3}$)	Region	0.182	0.23	0.088	0.081
	Suburb	0.22	0.25	0.097	0.075
	Centre	0.26	0.27	0.106	0.057

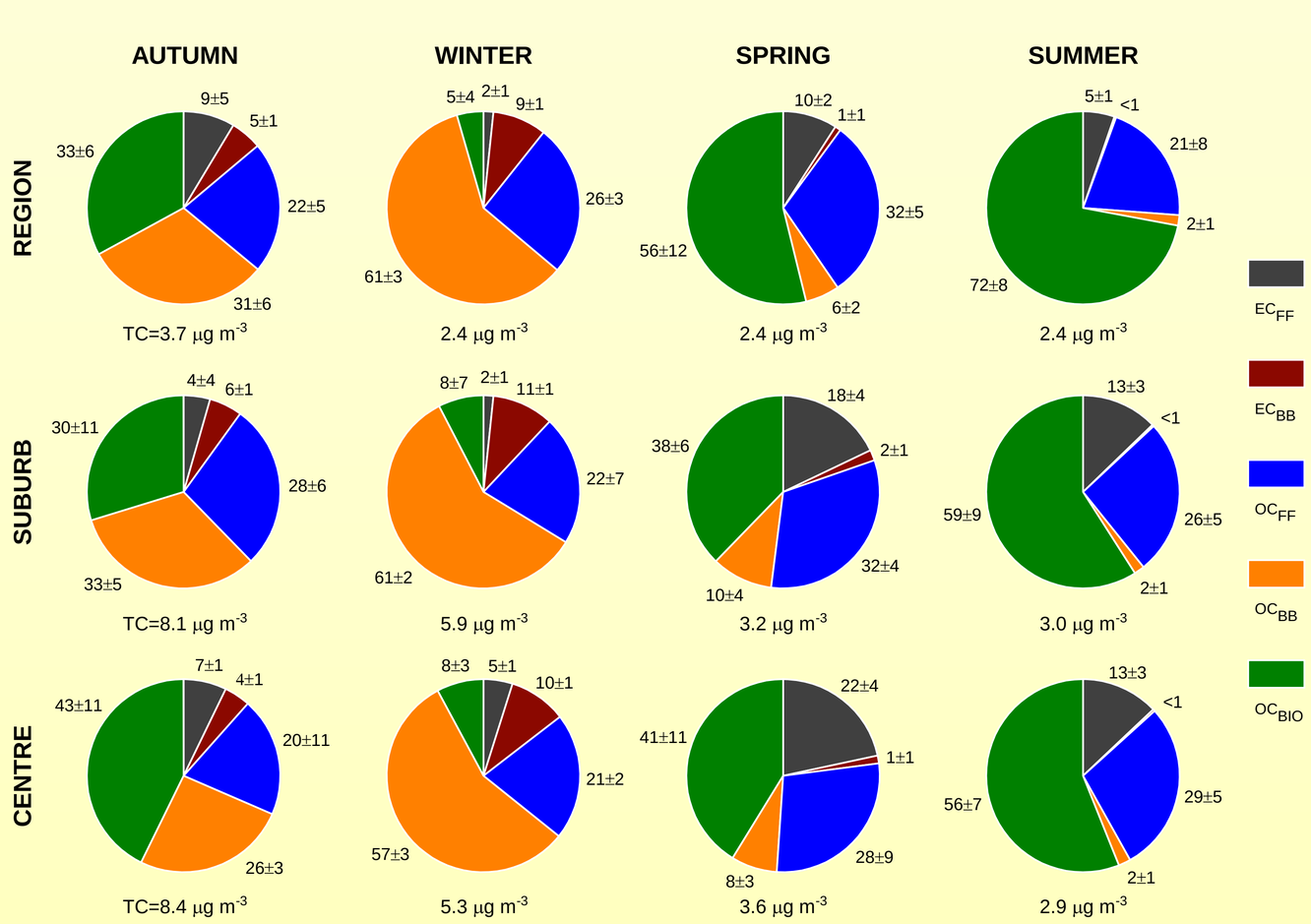

Figure 3. Mean contributions with SDs of EC_{FF}, EC_{BB}, OC_{FF}, OC_{BB} and OC_{BIO} to TC in % for regional background in the Carpathian Basin, suburban area and city centre of Budapest in each season. Median TC concentrations are indicated under individual circle charts.

CONCLUSIONS

- Carbonaceous aerosol species made up 36% of the $PM_{2.5}$ mass with a modest seasonal variation and with a slightly increasing tendency from the regional background to the city centre.
- FF combustion showed constant seasonal contributions (of 35%) to the TC in the whole year at all sites.
- Daily and seasonal mean contributions of BB and biogenic sources changed radically over the year at all locations (from <2% up to 70–85%).
- Autumn: the 3 major sources contributed equally to the TC in all atmospheric environments.
  Winter: it was the BB that was the major source with a share of 70% at all sites. The contributions from biogenic sources were the smallest, although they were still non-negligible.
  Spring: FF combustion and biogenic sources were the largest two contributors at all locations with typical shares of 45%–50% each.
  Summer: biogenic sources became the major source with a monotonically increasing tendency from the city centre to the regional background (from 56% to 72%). BB hardly quantifiable.

For more info: Salma et al., Atmos. Chem. Phys., 17, 13767–13781, 2017 or URL: www.salma.elte.hu.