Supplemental information for

Evaluation of $\delta^{13}C$ in carbonaceous aerosol source apportionment at a rural measurement site

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Table S1. δ^{13}C-values for common C_3-tree species derived from the literature and complemented with own measurements.

Plant species	Plant tissue	δ^{13}C ± SD (‰)	Region	Treatment/Location	Reference
Acer platanoides	wood	-29.1 ± 0.6	Bihult, Sweden	None, wild plant	This study
Acer rubrum	wood	-27.2	Unknown	None, wild plant	(Benner et al., 1987)
Acer spp.	leaf	-26.8	Utah, USA	None, wild plant	(Buchmann et al., 1997)
Alnus glutinosa	wood	-28.6 ± 0.1	Köpinge, Sweden	None, wild plant	This study
Alnus oregana	leaf	-28.5	San Francisco, USA	None, wild plant	(Cloern et al., 2002)
Betula pendula (Roth)	wood	-26.4 ± 0.1	Bihult, Sweden	None, wild plant	This study
Betula pendula (Roth)	wood	-28.8 ± 0.3	Köpinge, Sweden	None, wild plant	This study
Betula pendula (Roth)	wood	-28.2	Neustadt, Germany	None, wild plant	(Czimczik et al., 2002)
Betula pendula (Roth)	leaf	-29.5	Umeå, Sweden	None, wild plant	(Hogberg et al., 1999)
Betula pendula (Roth)	leaf	-29.6	Uppsala, Sweden	None, wild plant	(Hogberg et al., 1999)
Betula pendula (Roth)	leaf	-28.8	Birmensdorf, Switzerland	Lab, high-fertilized	(Saurer et al., 1995)
Betula pendula (Roth)	leaf	-30.0	Birmensdorf, Switzerland	Lab, low-fertilized	(Schauer et al., 2001)
Betula pendula (Roth)	wood	-27.0	Birmensdorf, Switzerland	Lab, high-fertilized	(Schauer et al., 2001)
Betula pendula (Roth)	wood	-29.0	Birmensdorf, Switzerland	Lab, low-fertilized	(Saurer et al., 1995)
Carex walteriana	leaf	-25.1	Unknown	None, wild plant	(Benner et al., 1987)
Corylus avellana	wood	-27.6 ± 0.3	Bihult, Sweden	None, wild plant	This study
Fagus spp.	leaf	-28.5	Nièvre, France	None, wild plant	(Zeller et al., 2007)
Fagus spp.	branches	-26.9 ± 0.1	Nièvre, France	None, wild plant	(Zeller et al., 2007)
Fagus spp.	wood	-28.1 ± 0.9	Nièvre, France	None, wild plant	(Zeller et al., 2007)
Fagus sylvatica	leaf	-27.2	Gloucestershire, United Kingdom	Arboretum	(Lockheart et al., 1997)
Fagus sylvatica	wood	-27.8 ± 0.3	Bihult, Sweden	None, wild plant	This study
Juniperus communis	wood	-26.1 ± 0.3	Bihult, Sweden	None, wild plant	This study
Juniperus virginiana	wood	-24.0	Unknown	None, wild plant	(Benner et al., 1987)
Larix decidua	wood	-25.9 ± 0.5	Bihult, Sweden	None, wild plant	This study
Picea abies	wood	-24.9 ± 0.4	Bihult, Sweden	None, wild plant	This study
Picea abies	wood	-26.5 ± 0.2	Köpinge, Sweden	None, wild plant	This study
Picea abies	needles	-27.1	Nièvre, France	None, wild plant	(Zeller et al., 2007)
Picea abies	branches	-25.3 ± 0.8	Nièvre, France	None, wild plant	(Zeller et al., 2007)
Picea abies	wood	-24.9 ± 0.9	Nièvre, France	None, wild plant	(Zeller et al., 2007)
Picea abies	needles	-27.4	Umeå, Sweden	None, wild plant	(Hogberg et al., 1999)
Picea abies	needles	-27.8	Uppsala, Sweden	None, wild plant	(Hogberg et al., 1999)
Picea abies	wood	-25.6	Flakaliden, Sweden	None, wild plant	(Vaganov et al., 2009)
Picea abies	wood	-24.8	Hainich, Germany	None, wild plant	(Vaganov et al., 2009)
Picea abies	wood	-24.1	Renon, Italy	None, wild plant	(Vaganov et al., 2009)
Pinus elliottii	wood	-25.3	Unknown	None, wild plant	(Benner et al., 1987)
Pinus contorta	leaf	-27.2	Utah, USA	None, wild plant	(Buchmann et al., 1997)
Pinus pinaster	wood	-24.5	Cuenca, Spain	None, wild plant	(Bogino and Bravo, 2014)
Pinus sylvestris	wood	-27.3 ± 0.4	Bihult, Sweden	None, wild plant	This study
Pinus sylvestris	wood	-25.3 ± 0.2	Köpinge, Sweden	None, wild plant	This study
Pinus sylvestris	wood	-29.4	Neustadt, Germany	None, wild plant	(Czimczik et al., 2002)
Pinus sylvestris	needles	-27.0	Umeå, Sweden	None, wild plant	(Hogberg et al., 1999)
Pinus sylvestris	needles	-26.8	Uppsala, Sweden	None, wild plant	(Hogberg et al., 1999)
Pinus sylvestris	wood	-24.8	Soria, Spain	None, wild plant	(Bogino and Bravo, 2014)
Populus fremontii	leaf	-29.0	San Francisco, USA	None, wild plant	(Cloern et al., 2002)
Populus tremuloides	leaf	-25.8	Utah, USA	None, wild plant	(Buchmann et al., 1997)
Populus tremula	wood	-28.1 ± 0.1	Köpinge, Sweden	None, wild plant	This study
Prunus avium	wood	-27.4 ± 0.9	Bihult, Sweden	None, wild plant	This study
Quercus nigra	wood	-27.5	Unknown	None, wild plant	(Benner et al., 1987)
Quercus robur	leaf	-29.4	Gloucestershire, United Kingdom	Arboretum	(Lockheart et al., 1997)
Quercus robur	wood	-27.5 ± 0.3	Bihult, Sweden	None, wild plant	This study
Quercus robur	wood	-26.6 ± 0.1	Köpinge, Sweden	None, wild plant	This study
Quercus spp.	leaf	-28.6	Nièvre, France	None, wild plant	(Zeller et al., 2007)
Quercus spp.	branches	-28.8 ± 0.8	Nièvre, France	None, wild plant	(Zeller et al., 2007)
Quercus spp.	wood	-26.4 ± 0.1	Nièvre, France	None, wild plant	(Zeller et al., 2007)
Salix lasiandra	leaf	-28.3	San Francisco, USA	None, wild plant	(Cloern et al., 2002)
Sorbus aucuparia	wood	-27.1 ± 0.6	Bihult, Sweden	None, wild plant	This study

Table S2. Stable carbon isotopes for aerosol from rural measurement stations

				$\delta^{13}C$ (‰) mean ± standard deviation					
Fraction	**Location**	**Type of site**	**Period**	**Average**	**Spring**	**Summer**	**Autumn**	**Winter**	**Reference**
PM10/EC	Akita, Japan	Rural	Apr 08 - Jan 10	-24.6 ± 0.7	-24.7 ± 0.7	-25.0 ± 0.4	-25.9 ± 0.4	-23.6 ± 0.5	(Kawashima and Haneishi, 2012)
PM2.5/EC	Akita, Japan	Rural	Apr 08 - Jan 11	-24.3 ± 0.4	-24.2 ± 0.2	-24.7 ± 0.4	-24.4 ± 0.3	-24.1 ± 0.4	(Kawashima and Haneishi, 2012)
PM10/TC	Vavihill, Sweden	Rural	May 08 - Apr 09	-26.2 ± 0.3	-25.9 ± 0.3	-26.3 ± 0.3	-26.1 ± 0.1	-26.1 ± 0.1	This study
PM2/TC	Santarém, Brazil	Rural	Aug 99 - Sept 00	-25.8 ± 0.5					(Martinelli et al., 2002)
TSP/TC	Gosan, South Korea	Rural	Apr 03 - Apr 04	-23.3 ± 0.7	-23.8 ± 0.9	-23.1 ± 0.7	-23.4 ± 0.7	-23.1 ± 0.4	(Kundu and Kawamura, 2014)
TSP/TC	Gosan, South Korea	Rural	Mar 07 - Jun 07	-23.4 ± 0.8	-23.4 ± 0.8				(Jung and Kawamura, 2011)
TC	Alert, Canada	Arctic	Feb 00 - May 00	-24.7 ± 1.3	-23.8 ± 0.9			-25.8 ± 0.1	(Narukawa et al., 2008)
TSP/OC	Millbrook, USA	Rural	Mar 07 - Aug 07	-25.3	-25.5	-24.7			(Wozniak et al., 2012)
TSP/OC	Harcum, USA	Rural	Feb 07 - Aug 07	-25.5	-26.5	-24.4		-26.2	(Wozniak et al., 2012)
PM10/TC	Galicia, Spain	Rural	Mar 09 - May 09	-26.1	-26.1				(Prada-Rodriguez, 2014)
TSP/TC	Mt. Tai, China	Semi rural	Early June 06	-25.0 ± 1.0		-25.0 ± 1.0			(Fu et al., 2012)
TSP/TC	Mt. Tai, China	Semi rural	Late June 06	-22.9 ± 0.6		-22.9 ± 0.6			(Fu et al., 2012)
PM1/TC	Vilnius, Lithuania	Semi rural	Oct 14 – Jan 15	-26.7 ± 0.4					(Garbariene et al., 2016)

Table S3. Summary of measured parameters from aerosols collected at Vavihill measurement station. Data of $F^{14}C$, levoglucosan, OC and EC have been published in Genberg et al. (Genberg et al., 2011).

Date	$\delta^{13}C$ (‰)	$F^{14}C$	Levoglucosan (ng/m^3)	OC (µg/m^3)	EC (µg/m^3)	Levoglucosan/EC
2008-05-27	-26.02	0.94	52.14	1.96	0.16	0.33
2008-06-16	-26.64	0.9	6.58	0.94	0.07	0.09
2008-06-30	-26.5	0.97	6.22	1.23	0.18	0.03
2008-07-07	-26.15	0.9	2.87	2.48	0.15	0.02
2008-07-15	-26.08	1.17	1.97	1.34	0.15	0.01
2008-07-28	-26.32	0.93	3.15	1.71	0.09	0.04
2008-08-01	-26.56	0.87	6	2.11	0.12	0.05
2008-09-01	-25.86	0.93	6.93	1.32	0.15	0.05
2008-09-16	-26.39	1.06	17.22	1.34	0.12	0.14
2008-09-23	-26.73	0.95	17.82	1.69	0.18	0.1
2008-10-01	-26.22	1.08	36.51	2.78	0.28	0.13
2008-10-08	-26.1	0.99	39.84	0.94	0.25	0.16
2008-10-16	-26.12	0.79	17.29	2	0.3	0.06
2008-10-24	-26.07	0.87	11.24	1.38	0.24	0.05
2008-11-07	-26.23	0.79	13.42	0.96	0.15	0.09
2008-12-08	-26.02	0.77	105.66	1.69	0.27	0.39
2008-12-16	-26.03	0.74	80.97	2.09	0.3	0.27
2009-01-14	-26.25	0.86	83.23	2.13	0.4	0.21
2009-01-27	-25.94	0.71	76.62	1.98	0.23	0.33
2009-02-11	-26.12	0.73	209.35	4.41	0.49	0.43
2009-02-26	-26.05	0.84	106.78	1.61	0.18	0.59
2009-03-06	-25.69	0.74	11.55	3.03	0.26	0.04
2009-03-22	-26.35	0.83	18.43	1.01	0.26	0.07
2009-03-26	-25.64	0.74	34.91	0.97	0.23	0.15
2009-04-22	-25.96	0.93	15.99	0.6	0.07	0.23

Table S4. Calculated contribution of each source to TC with given standard deviation (SD) for the MCMC2 model.

	Biogenic		Fossil		Biomass burning	
	Contribution (%)	SD	Contribution (%)	SD	Contribution (%)	SD
2008-05-27	49.8	16.3	14.9	4.0	35.1	14.1
2008-06-16	73.7	11.4	15.4	2.2	10.9	9.8
2008-06-30	88.4	8.0	7.6	1.6	4.1	6.9
2008-07-07	83.7	5.2	14.0	1.1	2.3	4.6
2008-07-15	27.8	16.4	3.0	3.3	68.4	15.1
2008-07-28	84.3	7.6	11.5	1.7	4.1	6.5
2008-08-01	76.6	8.7	17.5	1.6	5.9	7.5
2008-09-01	82.9	9.0	11.6	1.7	5.5	7.8
2008-09-16	78.5	16.9	1.8	3.0	19.4	14.7
2008-09-23	77.8	12.6	10.6	2.4	11.6	10.9
2008-10-01	72.0	19.3	1.7	3.2	26.0	17.0
2008-10-08	73.7	15.6	7.1	3.0	18.6	13.5
2008-10-16	67.9	9.3	25.4	1.8	6.8	7.8
2008-10-24	77.0	9.0	17.4	1.7	5.6	7.7
2008-11-07	63.5	10.9	25.9	2.1	10.6	9.4
2008-12-08	29.4	13.0	31.7	3.7	38.8	11.5
2008-12-16	37.5	13.1	33.4	3.2	28.8	11.3
2009-01-14	55.7	14.6	21.1	3.2	23.4	12.6
2009-01-27	29.1	12.2	36.9	3.4	33.8	10.6
2009-02-11	23.6	11.7	35.8	3.7	40.6	10.2
2009-02-26	21.4	12.1	26.7	4.4	51.5	10.8
2009-03-06	64.8	8.0	30.0	1.5	5.3	7.0
2009-03-22	70.0	10.1	21.7	1.9	8.3	8.8
2009-03-26	51.0	12.3	31.7	2.6	17.3	10.6
2009-04-22	59.8	16.0	14.5	3.5	25.6	13.8

Table S5. Calculated contribution of each source to TC with given standard deviation (SD) for the MCMC3 model.

	Biogenic		Fossil		Biomass burning	
	Contribution (%)	SD	Contribution (%)	SD	Contribution (%)	SD
2008-05-27	42.8	17.5	15.7	4.3	41.5	15.3
2008-06-16	67.6	17.3	16.0	3.0	16.3	15.2
2008-06-30	84.4	17.8	8.1	3.0	7.6	15.5
2008-07-07	81.6	17.6	14.3	2.8	4.3	15.3
2008-07-15	24.1	15.9	3.2	3.4	71.6	14.6
2008-07-28	80.9	17.8	11.9	2.8	7.3	15.6
2008-08-01	72.3	16.4	17.9	2.8	9.8	14.3
2008-09-01	78.6	18.2	12.1	3.1	9.5	15.8
2008-09-16	69.4	21.4	2.8	3.7	27.5	18.7
2008-09-23	71.4	19.2	11.2	3.5	17.3	16.6
2008-10-01	61.0	22.5	2.7	3.9	36.0	19.8
2008-10-08	65.5	20.1	8.8	3.9	25.7	17.5
2008-10-16	63.2	16.0	25.8	2.7	11.1	14.0
2008-10-24	73.0	17.1	17.9	2.9	9.2	14.9
2008-11-07	59.3	14.8	14.5	2.6	26.3	13.1
2008-12-08	26.0	13.0	32.0	3.9	41.7	11.6
2008-12-16	33.5	13.4	33.4	3.4	32.9	11.9
2009-01-14	48.8	16.8	21.6	3.6	29.4	14.7
2009-01-27	25.6	12.3	36.9	3.5	37.4	11.0
2009-02-11	20.8	11.6	35.6	3.8	43.1	10.4
2009-02-26	19.2	11.7	26.5	4.5	53.8	10.6
2009-03-06	61.6	14.5	30.2	2.4	8.3	12.6
2009-03-22	64.4	16.8	22.2	2.9	13.3	14.8
2009-03-26	45.2	14.8	32.2	3.0	22.5	13.0
2009-04-22	51.7	18.3	15.4	3.9	32.6	16.0

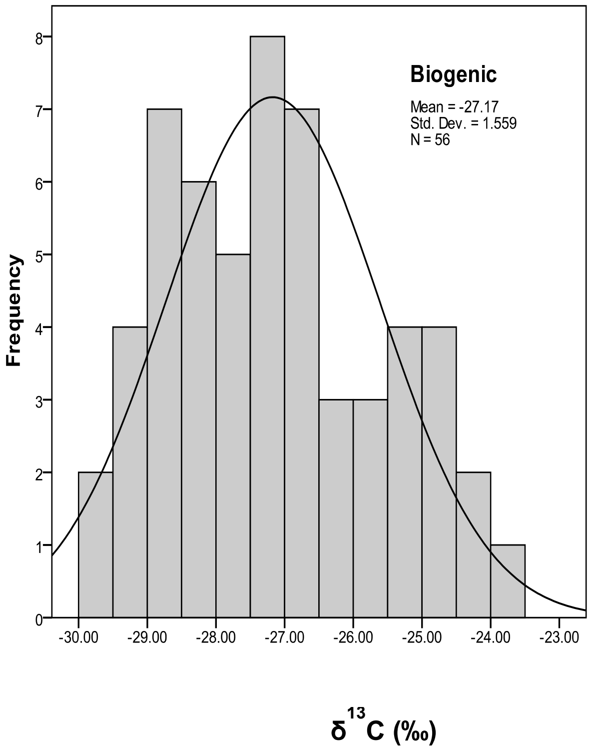

Figure S1. Frequency distribution of $\delta^{13}C$ for all tree species in Table S1.

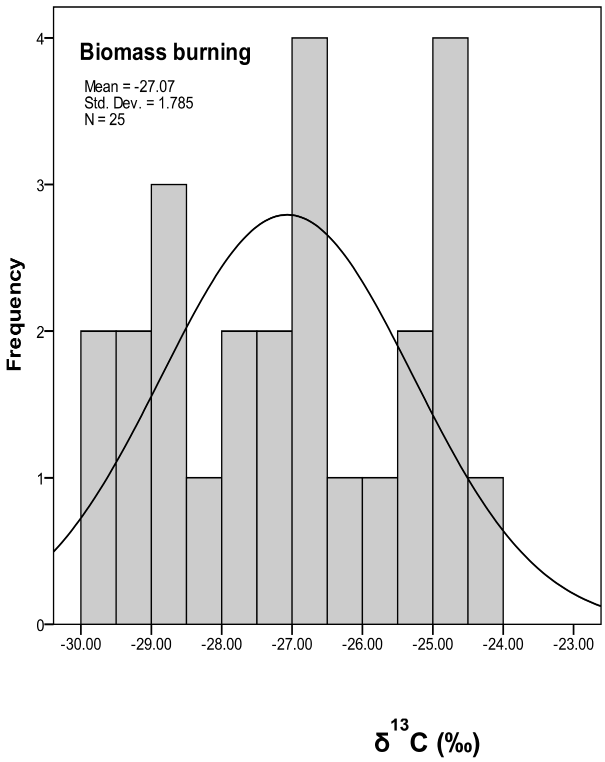

Figure S2. Frequency distribution of $\delta^{13}C$ for birch (*Betula pendula Roth*), pine (*Pinus sylvestris*) and spruce (*Picea abies*) in Table S1.

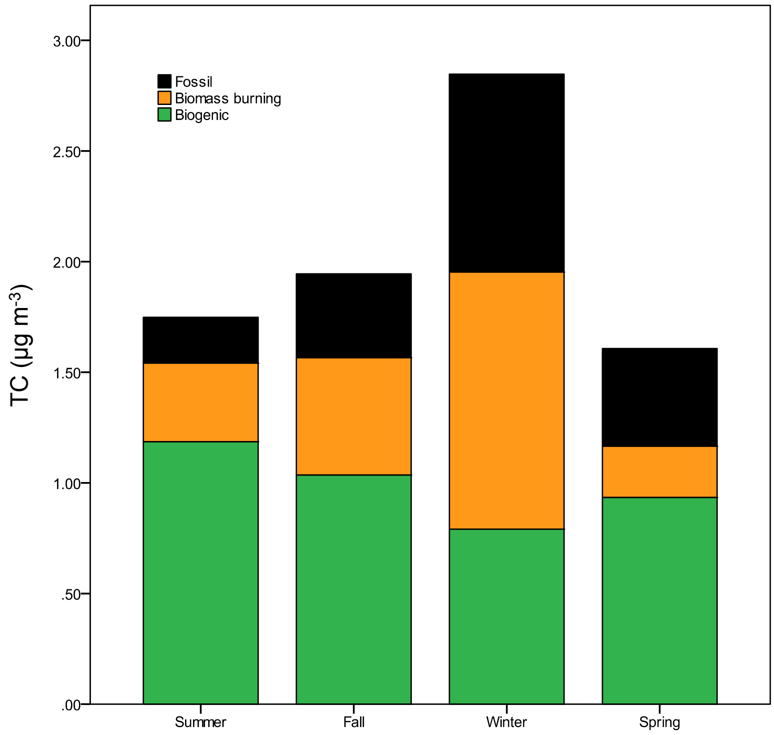

Figure S3. MCMC3-model ($\delta^{13}C$, $F^{14}C$, levoglucosan/EC) output of contributions of each source to TC divided into seasons.

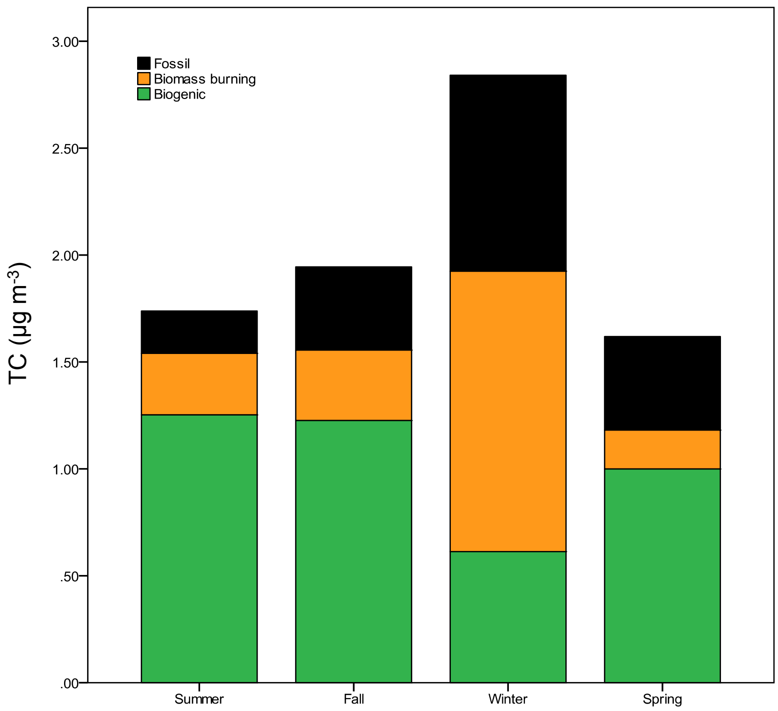

Figure S4. MCMC2-model ($F^{14}C$ and levoglucosan/EC) output of contributions of each source to TC divided into seasons.

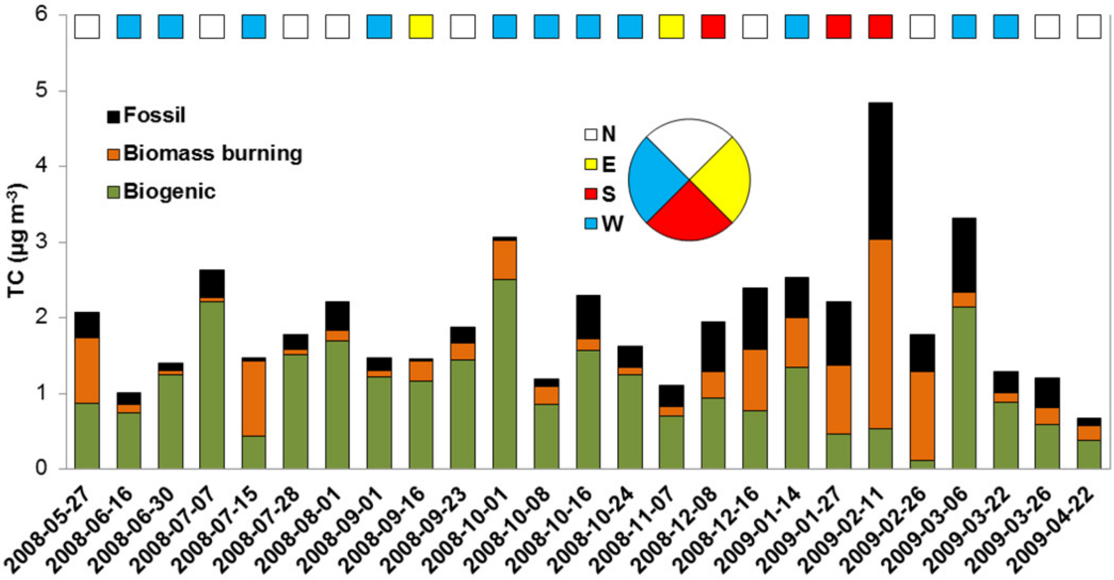

Figure S5. Apportionment of TC for all samples using the MCMC2 model with Lev/EC and $F^{14}C$. Wind direction from trajectory analysis is showed by the top colored squares.

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