Atmospheric
Chemistry
and Physics

Supplement of

Chemical and dynamical identification of emission outflows during the *HALO* campaign EMeRGe in Europe and Asia

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Supplement

S1 EMeRGe research flights

Table S1 gives an overview of the flight labelling, take-off, and departure times as well as flight duration and the base (departure airport) of HALO during EMeRGe-Europe (EM-EU) and EMeRGe-Asia (EM-AS). EM-EU-01 and EM-EU-02 are test flights and not listed. The transfer flights from Europe to Asia and back are not included in the Asian analysis. During the transfer flights EM-AS-02 and EM-AS-15, HALO had no permission to conduct any measurements.

Table S1. Overview of EMeRGe flights. UAE - United Arab Emirates.

Flight label	Flight date (dd.mm.yyyy)	Take-off (UTC)	Landing (UTC)	Duration (hh:mm)	Base/transfer	Probing targets (outflows)
EM-EU-03	11.07.2017	10:00	16:30	06:30	Oberpfaffenhofen/Germany	Po Valley, Rome
EM-EU-04	13.07.2017	10:40	15:00	04:20	Oberpfaffenhofen/Germany	S Germany (Allgäu), Munich
EM-EU-05	17.07.2017	10:30	18:30	08:00	Oberpfaffenhofen/Germany	London, Paris
EM-EU-06	20.07.2017	09:00	17:30	08:30	Oberpfaffenhofen/Germany	Po Valley, Rome, Munich
EM-EU-07	24.07.2017	09:45	18:15	08:30	Oberpfaffenhofen/Germany	Marseille, Barcelona, W Europe, W Mediterranean
EM-EU-08	26.07.2017	07:45	15:20	07:35	Oberpfaffenhofen/Germany	London, Ruhr area, Paris
EM-EU-09	28.07.2017	10:00	18:30	08:30	Oberpfaffenhofen/Germany	Barcelona, Madrid, Marseille, SE France, Munich
EM-EU				51:55:00		
EM-AS-01	10.03.2018	07:40	15:30	07:50	Oberpfaffenhofen/Germany → Abu Dhabi/UAE	Rome (Italy), Athens (Greece)
EM-AS-02	11.03.2018				Abu Dhabi/UAE →U-Tapao/Thailand	no measurement permission
EM-AS-03	12.03.2018	04:50	11:20	06:30	U-Tapao/Thailand →Tainan/Taiwan	Bangkok (Thailand), China
EM-AS-04	17.03.2018	01:10	09:45	08:35	Tainan/Taiwan	China
EM-AS-05	19.03.2018	00:20	08:25	08:05	Tainan/Taiwan	Shanghai, Taipei
EM-AS-06	19.03.2018	19.03.2018 23:50	20.03.2018 06:35	06:45	Tainan/Taiwan	Manila
EM-AS-07	22.03.2018	03:50	09:30	05:40	Tainan/Taiwan	China, Taiwan
EM-AS-08	24.03.2018	01:00	09:50	08:50	Tainan/Taiwan	China, Taiwan
EM-AS-09	26.03.2018	00:25	09:25	09:00	Tainan/Taiwan	China, Taipei
EM-AS-10	27.03.2018	27.03.2018 23:50	28.03.2018 08:30	08:40	Tainan/Taiwan	Manila, Pearl River Delta, Taiwan
EM-AS-11	30.03.2018	00:05	09:25	09:20	Tainan/Taiwan	Yangtze River Delta, S Japan
EM-AS-12	03.04.2018	00:25	06:25	06:00	Tainan/Taiwan	Taiwan
EM-AS-13	04.04.2018	00:30	09:25	08:55	Tainan/Taiwan	S Japan, Taiwan
EM-AS-14	07.04.2018	01:00	08:40	07:40	Tainan/Taiwan → U-Tapao/Thailand	China, SE Asia, Bangkok
EM-AS-15	08.04.2018				U-Tapao/Thailand → Abu Dhabi/UAE	no measurement permission
EM-AS-16	09.04.2018	06:00	14:45	08:45	Abu Dhabi/UAE → Oberpfaffenhofen/Germany	W Asia, N Africa, Greece, Munich (Germany)
EM-AS				110:35:00		

S2 Assessment of measurement noise

We assess VOC-specific measurement noise by smoothing the raw signal with a Savitzky-Golay filter (Savitzky and Golay, 1964) and estimate the noise as the standard deviation of the residuals (Fig. S1). We choose this filter technique because it is preferred for retrieving the original signal structure while removing noise (Acharya et al., 2016). Since the raw signal includes

statistical noise caused by the measurement process itself as well as atmospheric fluctuations, the obtained noise represents

both instrumental and atmospheric noise. For the definition of VOC concentration thresholds, we use the average of all VOC-

15 specific noises during EMeRGe-Europe and EMeRGe-Asia, respectively.
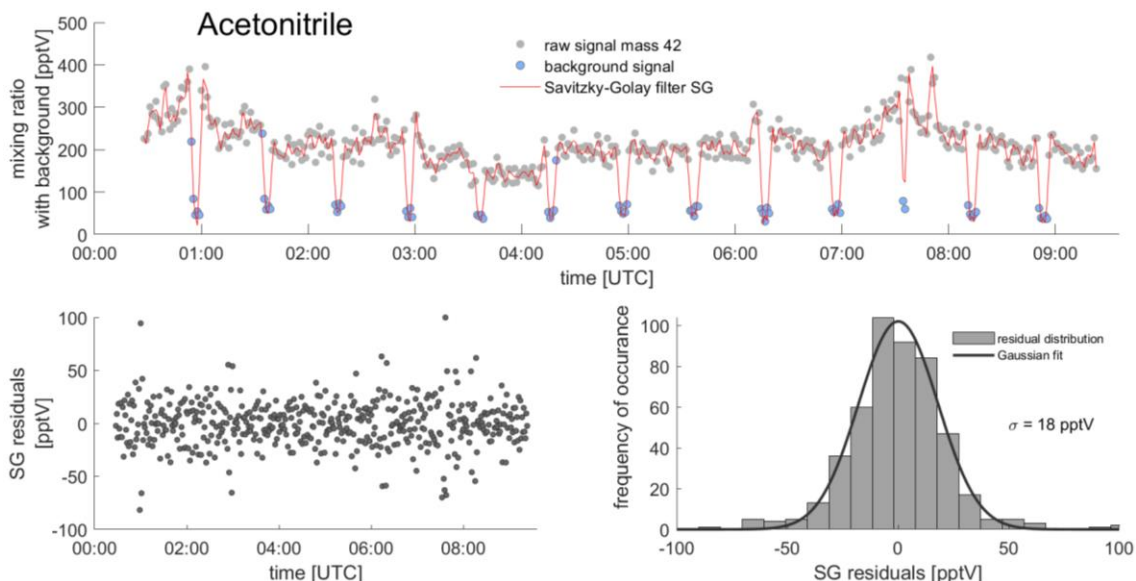

Figure S1. Noise assessment of acetonitrile using the Savitzky-Golay filter during EM-AS-13, 4 April 2018. The noise of 18 pptV is the standard deviation of the residuals distribution.

S3 Atmospheric background determination of acetonitrile

20 As described in Sect. 3.1.2 of the main document, we use long-term acetonitrile measurements in the tropopause from the

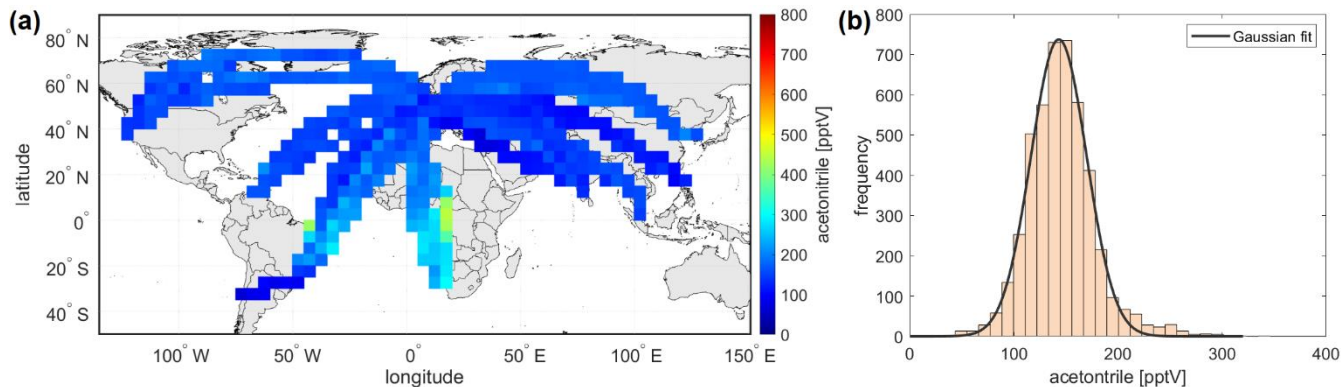IAGOS-CARIBIC data set (Fig. S2a) to assess the free tropospheric background.

Figure S2. IAGOS-CARIBIC acetonitrile measurements for the months DJFM. **(a)** Spatial distribution of all flights (2005-2016) and **(b)** frequency distribution from 2012 to 2016 for potential vorticities smaller than 2 PVU (tropospheric air) and 35-65° N with a fitted Gaussian 25 normal distribution.

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We selected the northern hemispheric winter seasons (DJFM) of four years prior to the campaign (2012 – 2016). During DJFM, northern hemispheric, tropospheric acetonitrile concentrations are the smallest. They indicate, therefore, the lower background because the active (northern hemispheric) BB season is in summer. By fitting a Gaussian normal distribution onto the frequency distribution of the selected subset (Fig. S2b), we calculated a mean acetonitrile background concentration of 145 pptV for the northern hemispheric troposphere. As the value indicates the lower background, we use it for both EMeRGe-Europe and EMeRGe-Asia.

S4 Assignment scheme for source signatures

Due to the PTR-MS duty cycle, where the tracers acetonitrile, isoprene and benzene are measured within time intervals of 10 - 30 s and raw signal integration of about 6 s each, we assign the identification of source signatures based on the tracer enhancement to cover the general measurement frequency of 1 s to extent the data coverage.

For the assignment, we use the following assumptions: If VMRs do exceed respective thresholds in two or more consecutive duty cycles, the time in-between is identified as source signature as well. If VMRs do exceed respective thresholds only in a single duty cycle, just the time of raw signal integration is marked as source signature. This assignment is also applied for non-exceedances (resulting in no source signature). If an exceedance is followed by a non-exceedance and vice versa, we consider the time in-between as not assessable (NA) because the exact time of threshold transition is unknown. During instrumental background detection, no ambient air measurements are available hence no indication of emissions signatures is possible, and we consider these times as NA as well.

These assumptions lead to higher availabilities of source signatures when continuous VOC exceedances/non-exceedances are measured and hence to less availability when VOC concentrations vary around the thresholds. Hence, also the use of isoprene as an additional tracer (together with acetonitrile and benzene) can lead to less availability compared to the use of only acetonitrile and benzene.

S5 Fractions of source signatures

Table S2 lists all values illustrated in Figure 4 for EMeRGe-Europe (top) and EMeRGe-Asia (bottom). The source signatures I (*aged BB*, *BB & BEN* and *AP)* are inferred from observed enhancements in acetonitrile and benzene, as well as with additional isoprene (*only BIO* and *BG*). The source signatures II are all inferred from observed enhancements in acetonitrile, benzene and isoprene.

Table S2. Fractions (%) of **(a)** enhancements observed in acetonitrile, benzene and isoprene (1 - over threshold, 0 – below threshold, NA - not assessable, for respective thresholds see Table 2); **(b)** source signatures I* and **(c)** source signatures II*. EU-05 is not available due to instrument failure. The summary of EMeRGe-Asia excludes the non-Asian transfer flights AS-01 and AS-16. *AP – anthropogenic signatures, BB – biomass burning signatures, BEN – benzene enhancements, BIO – fresh biogenic signatures, BG – background, NA – not assessable during instrumental background detection and threshold transitions (due to PTR-MS measurement resolution of 1 min per tracer).

Region	Acetonitrile 1	Acetonitrile 0	Acetonitrile NA	Benzene 1	Benzene 0	Benzene NA	Isoprene 1	Isoprene 0	Isoprene NA	Aged BB	BB & BEN	AP	Only BIO	BG	NA	Only BB	Only BB & BIO	Only BB & BEN	BB & BEN & BIO	Only BEN	Only BEN & BIO	NA
Italy, EU-03	0.6	76.8	22.6	15.6	58.3	26.2	7.7	57.0	35.3	0.1	0.5	14.0	1.8	47.5	36.0			0.1		4.7	4.9	40.9
S Germany, EU-04	2.4	73.8	23.8	0.6	71.9	27.5	8.2	48.5	43.3	1.3	0.4	0.1	7.7	43.7	46.8	1.3		0.4				46.9
London, Paris, EU-05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Italy, Munich, EU-06	2.5	71.2	26.3	29.6	39.6	30.8	12.4	56.0	31.6	0.1	2.1	24.5	0.3	36.8	36.1	0.1		1.3	0.2	8.5	10.5	42.3
Spain, S France, EU-07	2.5	71.5	26.0	19.3	48.9	31.8	8.0	60.4	31.5	0.0	2.2	16.0	1.1	42.6	38.0				2.2	9.9	3.2	40.9
London, BNR, Paris, EU-08	1.0	74.2	24.8	20.8	42.7	36.4	4.5	62.8	32.7	1.0	0.0	20.5	0.1	38.3	40.2	1.0				10.3	3.0	47.4
Spain, S France, EU-09	5.5	66.0	28.5	35.1	32.3	32.6	4.0	69.2	26.8	0.1	5.1	24.4	0.0	29.9	40.5	0.1		3.7	0.6	18.4	2.8	44.5
EM-EU	2.5	71.9	25.6	22.2	46.5	31.3	7.4	60.0	32.6	0.4	2.0	18.2	1.3	39.1	39.1	0.3		1.0	0.6	9.6	4.4	43.6
Germany→U-Tapao, AS-01		58.5	41.5	7.9	44.8	47.3	2.9	51.5	45.7			7.9	1.9	37.6	52.6					7.0	0.7	52.8
U-Tapao→Tainan, AS-03	16.0	52.8	31.2	14.3	57.1	28.6	9.6	60.6	29.8	3.8	10.0	1.9	1.7	42.5	40.0	3.6		3.3	5.8	0.5	0.9	41.7
China, AS-04	9.4	55.5	35.1	62.8	6.4	30.8	5.5	57.1	37.4		9.1	40.9	0.3	4.3	45.4			4.4	2.5	32.5	1.7	54.3
Shanghai, Taipei, AS-05	52.3	17.5	30.1	61.6	12.1	26.3	5.7	67.7	26.6	2.0	46.9	8.0		6.9	36.2	1.7		41.4	3.1	6.1	0.9	39.9
Manila, AS-06	38.3	20.7	41.0	36.3	31.8	31.9	0.7	73.5	25.8	7.4	25.4	5.8		11.6	49.8	7.3		22.9	0.6	5.7		51.8
China, Taiwan, AS-07		75.9	24.1	66.6	3.1	30.3	11.0	51.7	37.3			65.4	1.0	0.9	32.7					46.5	7.2	44.4
China, Taiwan, AS-08	3.8	78.2	18.1	61.0	15.7	23.2	5.3	69.1	25.7		3.7	53.6		15.0	27.6			2.7	0.2	41.1	4.1	36.7
China, Taipei, AS-09	10.9	72.4	16.7	82.7	3.7	13.6	1.6	84.5	13.9		10.9	65.2		3.5	20.4			10.9		60.6	1.5	23.5
Manila, PEA, Taiwan AS-10	24.8	46.8	28.4	61.3	13.5	25.3	1.9	79.6	18.5	0.1	22.6	28.6		12.1	36.6	0.1		20.8	0.9	27.3	0.2	38.6
YAN, S Japan, AS-11	5.1	72.4	22.5	42.9	32.5	24.6	2.4	73.4	24.2	0.2	4.4	36.6		30.3	28.4	0.2		3.5	0.5	33.8	1.0	30.6
Taiwan, AS-12	8.8	64.0	27.3	39.1	23.5	37.5	1.5	78.8	19.8	5.1	0.8	35.7		11.0	47.4	5.1		0.8		31.3	1.2	50.6
S Japan, Taiwan, AS-13	9.5	56.3	34.2	32.1	25.7	42.2	0.5	73.2	26.3	1.5	4.4	26.2		17.4	50.6	1.5		4.4		25.4	0.4	51.0
Tainan→U-Tapao, AS-14	36.7	33.4	29.9	43.7	41.1	15.2	1.6	82.7	15.7	6.0	29.3	12.4		18.6	33.7	6.0		25.7	0.8	10.6	0.7	37.6
U-Tapao→Germany, AS-16		67.9	32.1	1.9	63.6	34.5	0.3	66.5	33.2			1.9	0.2	60.7	37.1					1.0		38.0
EM-AS (03-14)	17.8	54.2	27.9	51.3	21.6	27.1	3.7	71.5	24.8	1.9	14.1	32.3	0.2	14.5	36.9	1.9		11.9	1.2	27.6	1.6	41.1

S6 Source regions with coordinates

Table S3. Source regions and MPCs (in italics) with coordinates for EMeRGe-Europe and EMeRGe-Asia (supplement of Table 4).

EMeRGe-Europe

No.	Abbr.	Source region/*MPC*	Coordinates
1	CAN	Canada	134.0W-55.0W, 47.0N-71.0N
2	USA	United States of America	134.0W-55.0W, 25.0N-47.0N
3	NAT	North Atlantic Ocean	55.0W-10.5W, 25.0N-71.0N
4	IRE	Ireland	5.4W-10.5W, 50.6N-55.4N
5	NGB	Northern Great Britain	5.4W-0.6E, 54.5N-60.0N
6	SGB	Southern Great Britain	5.4W-2.2E, 50.0N-54.5N
7	BNR	Belgium, Netherlands and Ruhr area	2.2E-8.0E, 50.0N-54.5N
8	NFR	Northern France	5.4W-8.0E, 46.8N-50.0N
9	SFR	Southern France	5.4W-8.0E, 42.8N-46.8N
10	IBE	Iberian Peninsula	10.5W-3.4E, 37.1N-42.8N

EMeRGe-Asia

No.	Abbr.	Source region/*MPC*	Coordinates
1	EUA	Europe/Northern Africa	18.0W-34.0E, 5.0N-60.0N
2	WAS	Western Asia	34.0E-68.0E, 5.0N-48.9N
3	WCH	Western China	68.0E-91.4E, 30.6N-48.9N
4	IND	India	68.0E-91.4E, 5.0N-30.6N
5	CCH	Central China	91.4E-108.0E, 26.5N-48.9N
6	SCH	Southern China	91.4E-119.8E, 21.6N-26.5N
7	SEA	Southeast Asia	91.4E-111.2E, 5.0N-21.6N
8	MOR	Mongolia/Southern Russia	68.0E-122.6E, 48.9N-60.0N
9	ECH	Eastern China	108.0E-122.6E, 26.5N-48.9N
10	TAW	Taiwan	119.8E-122.6E, 21.6N-26.5N

11	NGE	Northern Germany	8.0E-14.3E, 50.0N-54.5N		11	NPH	Northern Philippines	119.8E-122.6E, 14.0N-18.7N
12	SGE	Southern Germany	8.0E-14.3E, 46.8N-50.0N		12	NEC	Northeastern China	122.6E-135.0E, 40.4N-55.0N
13	NIT	Northern Italy	8.0E-14.3E, 42.8N-46.8N		13	KOR	Korea	122.6E-129.6E, 30.6N-40.4N
14	SIT	Southern Italy	11.6E-18.0E, 37.1N-42.8N		14	JAP	Japan	129.6E-150.0E, 30.6N-40.4N
15	NAF	Northern Africa	10.5W-23.9.0E, 25.0N-37.1N		15	ECS	East China Sea	122.6E-150.0E, 14.0N-30.6N
16	NEU	Northern Europe	0.6E-37.0E,54.5N-71.0N			UA	Unspecified areas	
17	EEU	Eastern Europe	14.3W-37.0W, 42.8N-54.5N		*M1*	*XBS*	*Δ Xian-Beijing-Shanghai (incl.in ECH)*	*109.8E-122.6E, 30.6N-40.4N*
	UA	Unspecified areas			*M2*	*BEI*	*Beijing (incl.in XBS)*	*115.6E-119.0E, 38.8N-40.4N*
M1	*LON*	*London (incl.in SGB)*	*2.0W-1.5W, 50.5N-52.0N*		*M3*	*YAN*	*Yangtze River Delta (incl.in XBS)*	*118.0E-122.6E, 30.6N-32.8N*
M2	*PAR*	*Paris (incl.in NFR)*	*1.0E-3.5E, 48.0N-50.0N*		*M4*	*PEA*	*Pearl River Delta (incl.in SEC)*	*112.0E-114.8E, 21.6N-24.0N*
M3	*MAD*	*Madrid (incl.in IBE)*	*6.1W-3.0W, 39.5N-41.9N*		*M5*	*TOK*	*Tokyo (incl.in SJA)*	*139.2E-140.6E, 35.2N-36.4N*
M4	*BAR*	*Barcelona (incl.in IBE)*	*0.8E-3.0E, 40.9N-41.9N*		*M6*	*OSA*	*Osaka (incl.in JAP)*	*135.0E-137.3E, 34.4N-35.6N*
M5	*POV*	*Po Valley/Milano (incl.in NIT)*	*8.0E-13.0E, 44.0N-46.0N*		*M7*	*BAN*	*Bangkok (incl.in SEA)*	*100.0E-101.0E, 13.4N-14.3N*
M6	*ROM*	*Rome (incl.in SIT)*	*11.6E-13.7E, 41.2N-42.8N*		*M8*	*MAN*	*Manila (incl.in NPH)*	*120.5E-121.5E, 14.0N-15.0N*
M7	*MUN*	*Munich (incl.in SGE)*	*10.4E-12.0E, 47.9N-49.0N*		*M9*	*TAI*	*Taipei (incl.in TAW)*	*120.8E-122.0E, 24.8N-25.7N*

65 ## S7 Linking and partitioning modelled source region emissions to observations (considering all uptakes)

Table S4. Trajectory-based emission contributions from different source regions (left from EMeRGe-Europe, right EMeRGe-Asia), listed according to temporal frequency and magnitude (contribution in percentage, flight time in minutes, uptake sum in kilogram). Mixtures (of significant uptakes) from different source regions are indicated by en dashes, e.g. "IRE–SGB". MPCs are highlighted with bold letters. "All uptakes" are divided into non-mixed and mixture, indicated by italics. Contributions of less than 10 min flight time are omitted. The upper
70 part indicates the overview (sums) of both campaigns. For full names of source regions see Table 4.

EMeRGe-Europe					EMeRGe-Asia			
Observations linked to	Contribution to total flight time (%)	Linked flight time (min)	Uptake sum (kg)		Observations linked to	Contribution to total flight time (%)	Linked flight time (min)	Uptake sum (kg)
No uptake	35.4	1103	0		No uptake	39.9	2248	0
All uptakes *(MPCs)*	64.6 **(32.1)**	2017 **(1004)**	42.0 **(31.3)**		All uptakes *(MPCs)*	60.1 **(18.6)**	3392 **(1045)**	454.0 **(398.9)**
Non-mixed (MPCs)	*19.3* **(3.6)**	*603* **(114)**	*3.3* **(0.5)**		*Non-mixed (MPCs)*	*16.2* **(0.5)**	*915* **(27)**	*23.2* **(2.4)**
Mixture (MPCs involved)	*45.3* **(28.4)**	*1414* **(889)**	*38.7* **(30.8)**		*Mixture (MPCs involved)*	*43.9* **(18.1)**	*2477* **(1017)**	*430.8* **(396.5)**
EM-EU (7 flights)	100	3120	42.0		EM-AS (12 flights)	100	5640	454.0
Source region(s)/ **MPCs**	Contribution to total flight time (%)	Linked flight time (min)	Uptake sum (kg)		Source region(s)/ **MPCs**	Contribution to total flight time (%)	Linked flight time (min)	Uptake sum (kg)
NAT	3.4	106.0	0.0		TAW–ECS	2.6	145.0	5.8
IBE	3.1	98.0	0.2		SEA	2.3	131.0	6.2
USA	2.5	78.0	0.8		WAS	2.2	126.0	1.0
CAN	2.4	75.0	0.1		TAW	1.8	99.0	6.1
IBE–**MAD**	2.0	63.0	0.4		CCH	1.7	98.0	1.4
MAD	1.9	59.0	0.3		ECS	1.7	95.0	0.0
CAN–USA	1.0	32.0	0.3		EUA	1.6	88.0	0.8
SFR	1.0	32.0	0.6		TAW–JAP–ECS	1.5	87.0	2.5
MUN	1.0	32.0	0.1		SCH–TAW–ECS	1.4	80.0	2.5
NAF	1.0	30.0	0.1		SCH	1.1	62.0	3.0
NEU	0.9	29.0	0.1		WCH	1.0	59.0	0.1
SFR–IBE–UA	0.9	28.0	0.2		TAW–ECS–**TAI**	1.0	58.0	5.7
BNR–NEU	0.9	27.0	1.6		UA	0.9	53.0	0.1
IBE–NAF	0.7	21.0	0.2		TAW–JAP–ECS–**TAI**	0.8	47.0	2.1
NAT–SFR–UA	0.6	20.0	0.2		NPH–ECS	0.8	47.0	1.2
NAT–IRE–SGB–**LON**	0.6	19.0	0.7		ECH	0.8	44.0	0.2
NAT–SFR–IBE–UA	0.6	18.0	0.2		ECH–**XBS**	0.8	44.0	5.2
SFR–NIT–**POV**–UA	0.6	18.0	1.2		IND	0.7	42.0	1.6
NFR–SGE–**PAR**–**MUN**	0.5	17.0	0.7		SCH–SEA	0.7	42.0	3.2
IBE–UA	0.5	17.0	0.1		CCH–ECH–**XBS**	0.7	40.0	5.0
USA–SFR–UA	0.5	16.0	0.3		SEA–UA	0.7	38.0	3.3
UA	0.5	16.0	0.0		ECH–ECS–**XBS**	0.7	38.0	2.1
CAN–**MUN**	0.5	15.0	0.2		CCH–ECH	0.6	36.0	0.9
USA–NAT–IRE–SGB	0.5	15.0	0.3		SCH–TAW	0.6	35.0	0.3
NAT–SFR	0.5	15.0	0.1		IND–SCH	0.6	32.0	5.6
SFR–IBE–**BAR**–UA	0.5	15.0	0.2		IND–SEA	0.5	31.0	2.0
NFR	0.4	14.0	0.0		ECS–UA	0.5	31.0	0.0

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SFR–IBE	0.4	14.0	0.1	JAP	0.5	30.0	0.0
NAT–IRE–SGB	0.4	13.0	0.3	EUA–UA	0.5	28.0	0.3
NAT–SGB–**LON**	0.4	13.0	0.4	WCH–CCH	0.5	28.0	0.2
NAT–SFR–IBE–**BAR**–UA	0.4	13.0	0.1	**XBS**	0.5	26.0	2.4
SGB–**LON**	0.4	12.0	0.1	KOR–JAP–ECS	0.4	25.0	0.4
NIT–EEU–**POV**	0.4	12.0	0.4	SEA–NPH–ECS–UA	0.4	21.0	2.0
USA–SFR	0.4	11.0	0.2	KOR–ECS	0.4	21.0	0.0
IBE–NAF–UA	0.4	11.0	0.3	EUA–TAW	0.4	20.0	1.0
IBE–NAF–**MAD**	0.3	10.0	0.2	CCH–SCH	0.4	20.0	2.7
NEU–EEU	0.3	10.0	0.1	SEA–ECS–UA	0.4	20.0	1.7
POV	0.3	10.0	0.1	NPH–**MAN**	0.4	20.0	6.3
				NEC–JAP–ECS	0.3	19.0	1.6
				JAP–ECS	0.3	19.0	0.2
				SEA–TAW–ECS–UA	0.3	18.0	1.9
				TAW–**TAI**	0.3	18.0	0.4
				ECS–XBS	0.3	18.0	2.3
				IND–SCH–SEA	0.3	17.0	2.0
				SCH–TAW–JAP–ECS	0.3	17.0	0.1
				SCH–ECS–UA	0.3	17.0	0.0
				TAW–NEC–KOR–ECS	0.3	17.0	2.2
				TAW–KOR–JAP–ECS	0.3	17.0	1.2
				TAW–KOR–JAP–ECS–**TAI**	0.3	17.0	1.0
				KOR–JAP	0.3	16.0	0.5
				EUA–WAS	0.3	15.0	0.3
				NPH–ECS–**MAN**	0.3	15.0	4.1
				TAW–NEC–KOR–JAP–ECS–**TAI**	0.3	14.0	4.4
				TAW–NEC–KOR–JAP–ECS	0.2	14.0	0.3
				NPH	0.2	14.0	0.3
				TAW–ECS–UA	0.2	12.0	1.8
				SCH–TAW–ECS–UA	0.2	12.0	1.7
				TAW–KOR–ECS–**TAI**	0.2	12.0	1.2
				EUA–TAW–**TAI**	0.2	11.0	0.5
				SEA–NPH–JAP–ECS–UA	0.2	11.0	1.7
				TAW–JAP–ECS–UA	0.2	10.0	0.2
				ECH–TAW–NEC–KOR–JAP–ECS–**YAN–XBS–TAI**	0.2	10.0	9.4
				WAS–CCH	0.2	10.0	0.1
				CCH–SCH–SEA	0.2	10.0	0.5
∑	33.6	1054	11.5	∑	41.8	2367	124.8

To obtain significant CO uptakes (as described in Sect. 4.2.3 in the main document), we omit uptakes below 2.6 g CO (EMeRGe-Europe) and 20.6 g CO (EMeRGe-Asia), respectively. The sum of all small uptakes below the given thresholds add up to 5% of the total CO uptake sum of the respective campaign part. However, we investigated also smaller and larger thresholds (0.25, 0.5, 2, 4 and 8 times) as well. The larger the threshold, the more source regions with large emission uptake sums dominate, and the smaller the overall contributing number of source regions. However, the dominating source regions do not change when applying these thresholds, only their contribution to the flight time. The selected filter is a compromise of neglecting small uptakes and obtaining a sufficient data basis to assess chemical fingerprints.

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References

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