Gridded Emissions of Air Pollutants for the period 1970-2012 within EDGAR v4.3.2

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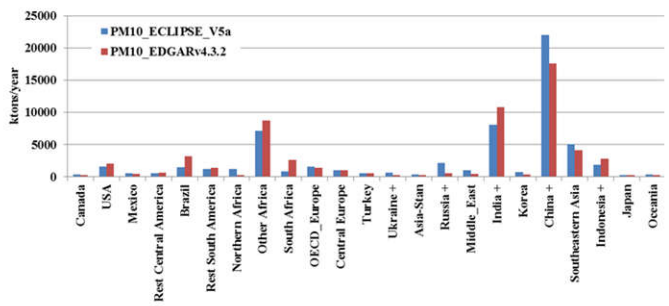
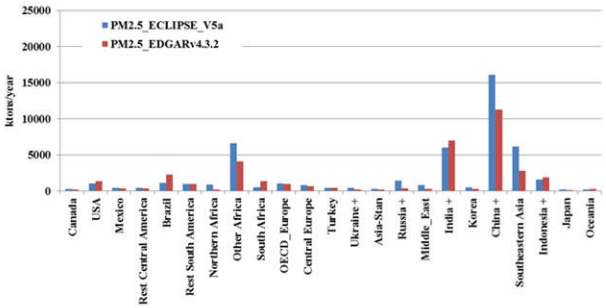
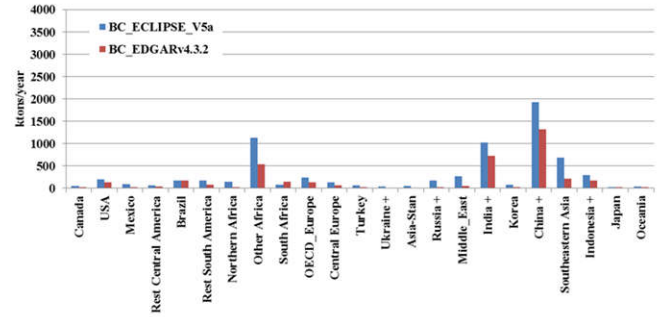
S1 - Intercomparison of the air pollutant emissions of EDGARv4.3.2 with other global inventories

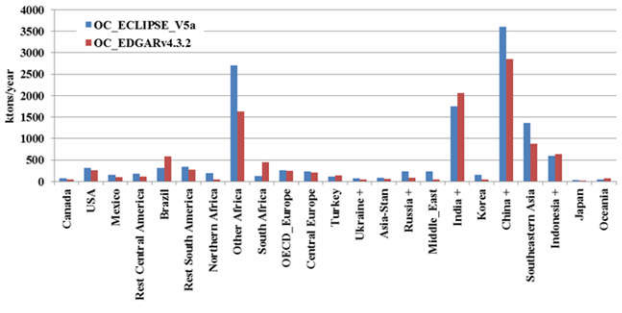
S1.1 - Intercomparison of the particulate EDGARv4.3.2 timeseries with other global inventories

Figures S1a-g show the regional comparison for the year 2010 of the EDGARv4.3.2 and ECLIPSE V5a aerosol emissions following the sector-specific detail provided by Klimont et al. (2017). Considering the higher uncertainty associated with the aerosol emission estimates compared to other pollutants, our comparison shows very good agreement for most of the regions, in particular for the top emitting regions, such as China+, India+ and Africa. Rather poor agreement is observed for Russia+ representing however less than 1% of the global PM_{10} emissions.

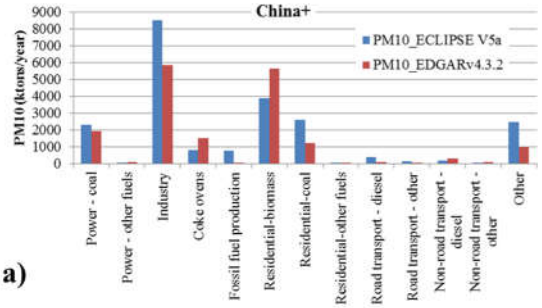

PM10_ECLIPSE_V5a
PM10_EDGARv4.3.2
ktons/year
25000
20000
15000
10000
5000
0
Canada
USA
Mexico
Rest Central America
Brazil
Rest South America
Northern Africa
Other Africa
South Africa
OECD_Europe
Central Europe
Turkey
Ukraine+
Asia-Stan
Russia+
Middle_East
India+
Korea
China+
Southeastern Asia
Indonesia+
Japan
Oceania

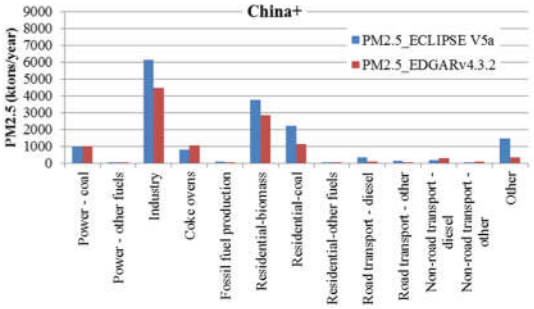

PM2.5_ECLIPSE_V5a
PM2.5_EDGARv4.3.2
ktons/year
25000
20000
15000
10000
5000
0
Canada
USA
Mexico
Rest Central America
Brazil
Rest South America
Northern Africa
Other Africa
South Africa
OECD_Europe
Central Europe
Turkey
Ukraine+
Asia-Stan
Russia+
Middle_East
India+
Korea
China+
Southeastern Asia
Indonesia+
Japan
Oceania

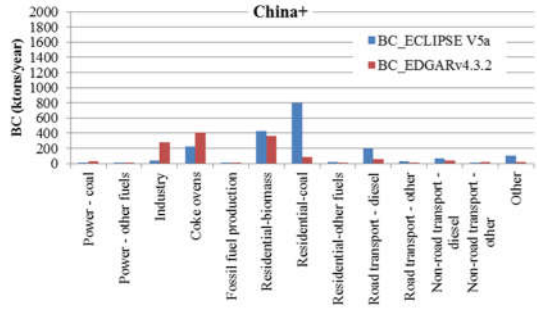

BC_ECLIPSE_V5a
BC_EDGARv4.3.2
ktons/year
4000
3500
3000
2500
2000
1500
1000
500
0
Canada
USA
Mexico
Rest Central America
Brazil
Rest South America
Northern Africa
Other Africa
South Africa
OECD_Europe
Central Europe
Turkey
Ukraine+
Asia-Stan
Russia+
Middle_East
India+
Korea
China+
Southeastern Asia
Indonesia+
Japan
Oceania

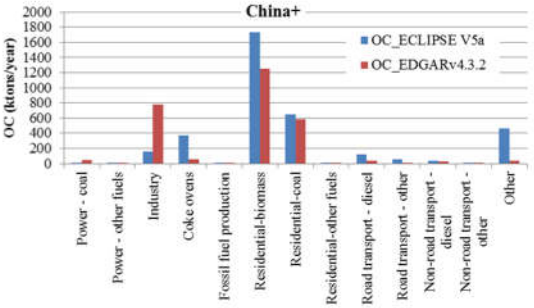

OC_ECLIPSE_V5a
OC_EDGARv4.3.2
ktons/year
4000
3500
3000
2500
2000
1500
1000
500
0
Canada
USA
Mexico
Rest Central America
Brazil
Rest South America
Northern Africa
Other Africa
South Africa
OECD_Europe
Central Europe
Turkey
Ukraine+
Asia-Stan
Russia+
Middle_East
India+
Korea
China+
Southeastern Asia
Indonesia+
Japan
Oceania

a)

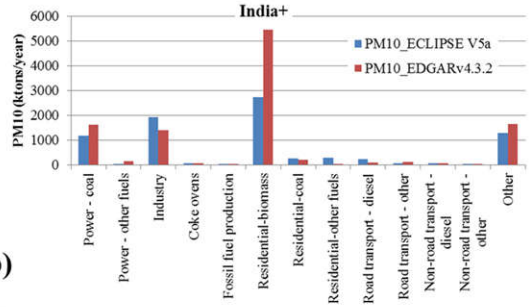

China+
PM10_ECLIPSE V5a
PM10_EDGARv4.3.2
PM10 (ktons/year)
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

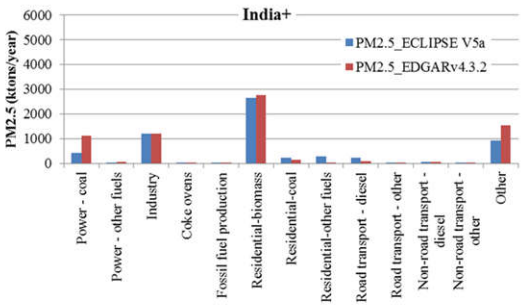

China+
PM2.5_ECLIPSE V5a
PM2.5_EDGARv4.3.2
PM2.5 (ktons/year)
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

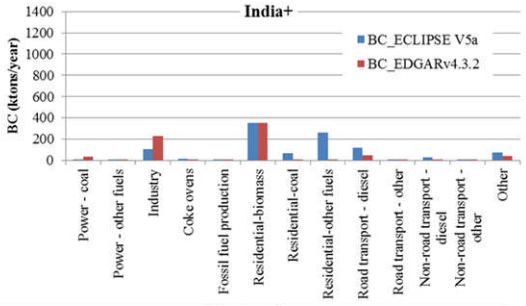

China+
BC_ECLIPSE V5a
BC_EDGARv4.3.2
BC (ktons/year)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

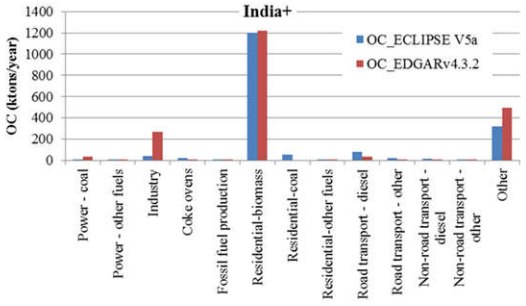

China+
OC_ECLIPSE V5a
OC_EDGARv4.3.2
OC (ktons/year)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

b)

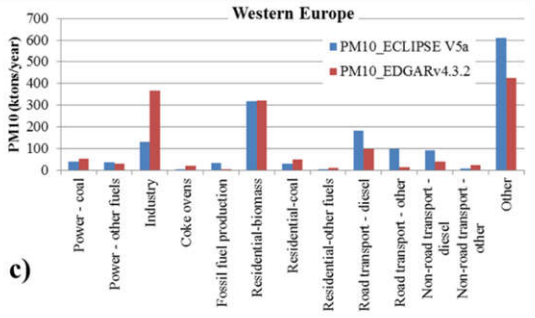

India+
PM10 (ktons/year)
PM10_ECLIPSE V5a
PM10_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

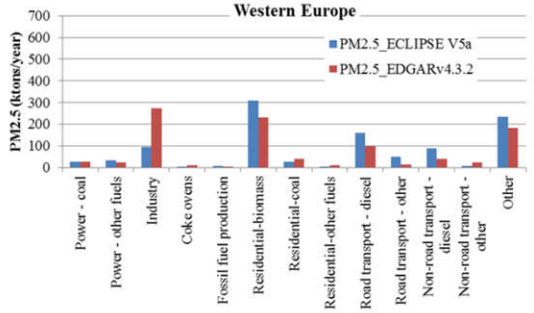

India+
PM2.5 (ktons/year)
PM2.5_ECLIPSE V5a
PM2.5_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

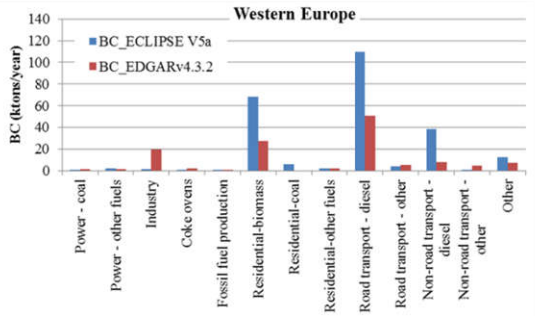

India+
BC (ktons/year)
BC_ECLIPSE V5a
BC_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

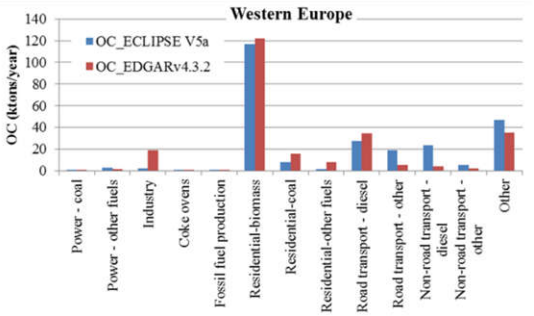

India+
OC (ktons/year)
OC_ECLIPSE V5a
OC_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

c)

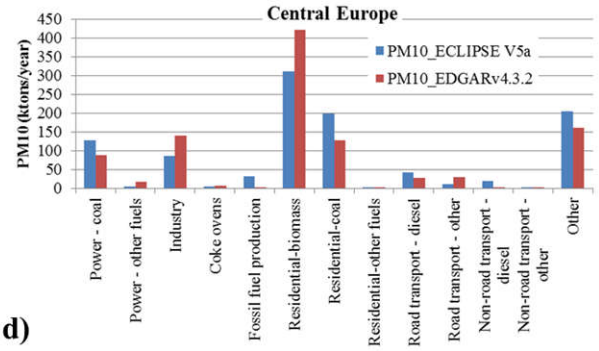

Western Europe
PM10 (ktons/year)
PM10_ECLIPSE V5a
PM10_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

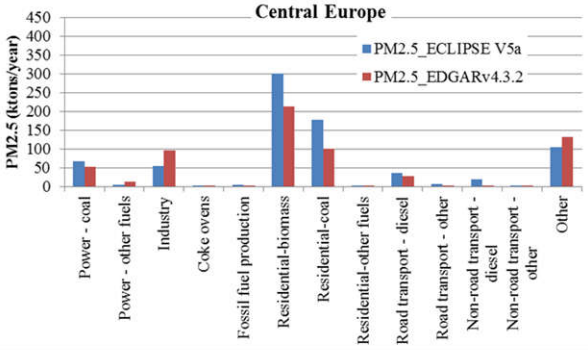

Western Europe
PM2.5 (ktons/year)
PM2.5_ECLIPSE V5a
PM2.5_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

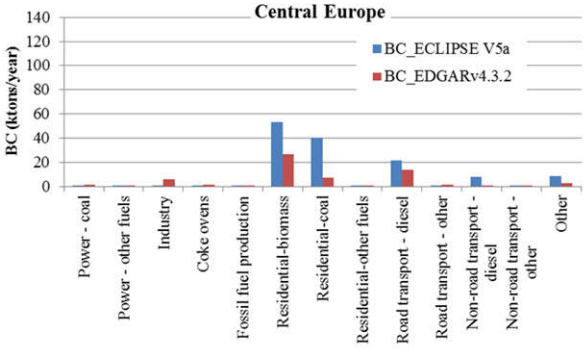

Western Europe
BC (ktons/year)
BC_ECLIPSE V5a
BC_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

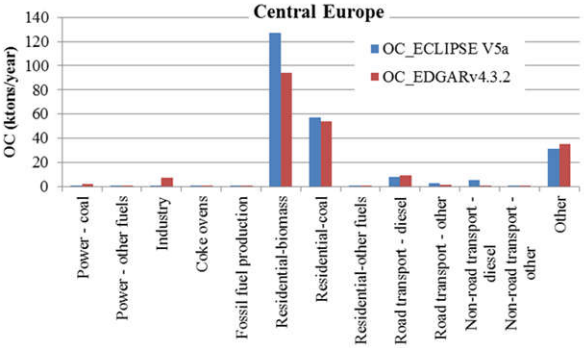

Western Europe
OC (ktons/year)
OC_ECLIPSE V5a
OC_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

d)

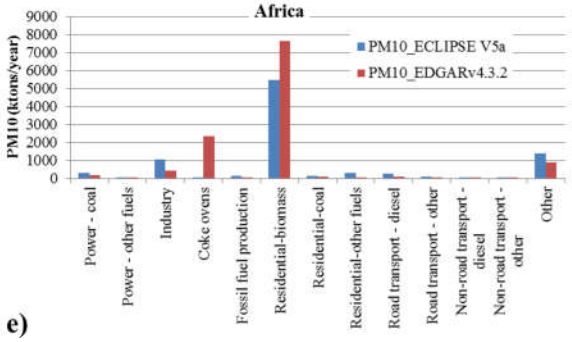

Central Europe
PM10 (ktons/year)
PM10_ECLIPSE V5a
PM10_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

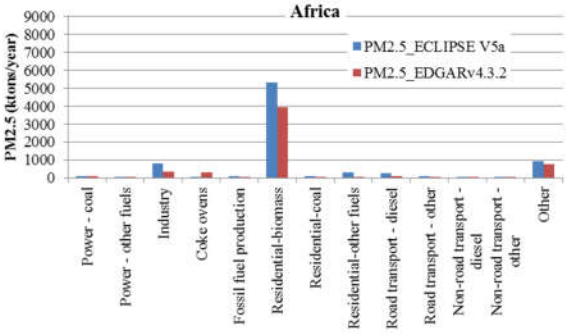

Central Europe
PM2.5 (ktons/year)
PM2.5_ECLIPSE V5a
PM2.5_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

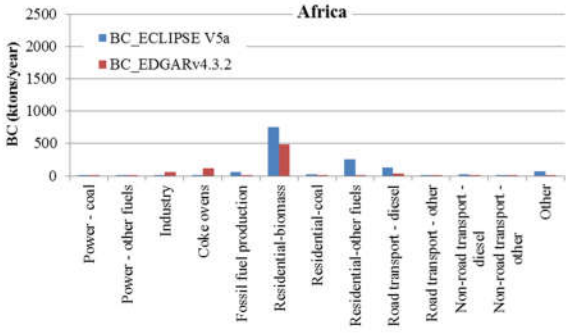

Central Europe
BC (ktons/year)
BC_ECLIPSE V5a
BC_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

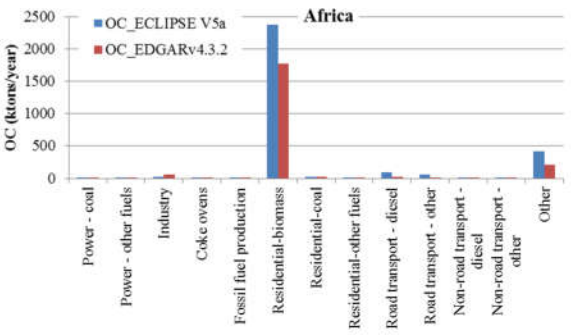

Central Europe
OC (ktons/year)
OC_ECLIPSE V5a
OC_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

e)


Africa
PM10 (ktons/year)
PM10_ECLIPSE V5a
PM10_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other


Africa
PM2.5 (ktons/year)
PM2.5_ECLIPSE V5a
PM2.5_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other


Africa
BC (ktons/year)
BC_ECLIPSE V5a
BC_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other


Africa
OC (ktons/year)
OC_ECLIPSE V5a
OC_EDGARv4.3.2
Power - coal
Power - other fuels
Industry
Coke ovens
Fossil fuel production
Residential-biomass
Residential-coal
Residential-other fuels
Road transport - diesel
Road transport - other
Non-road transport - diesel
Non-road transport - other
Other

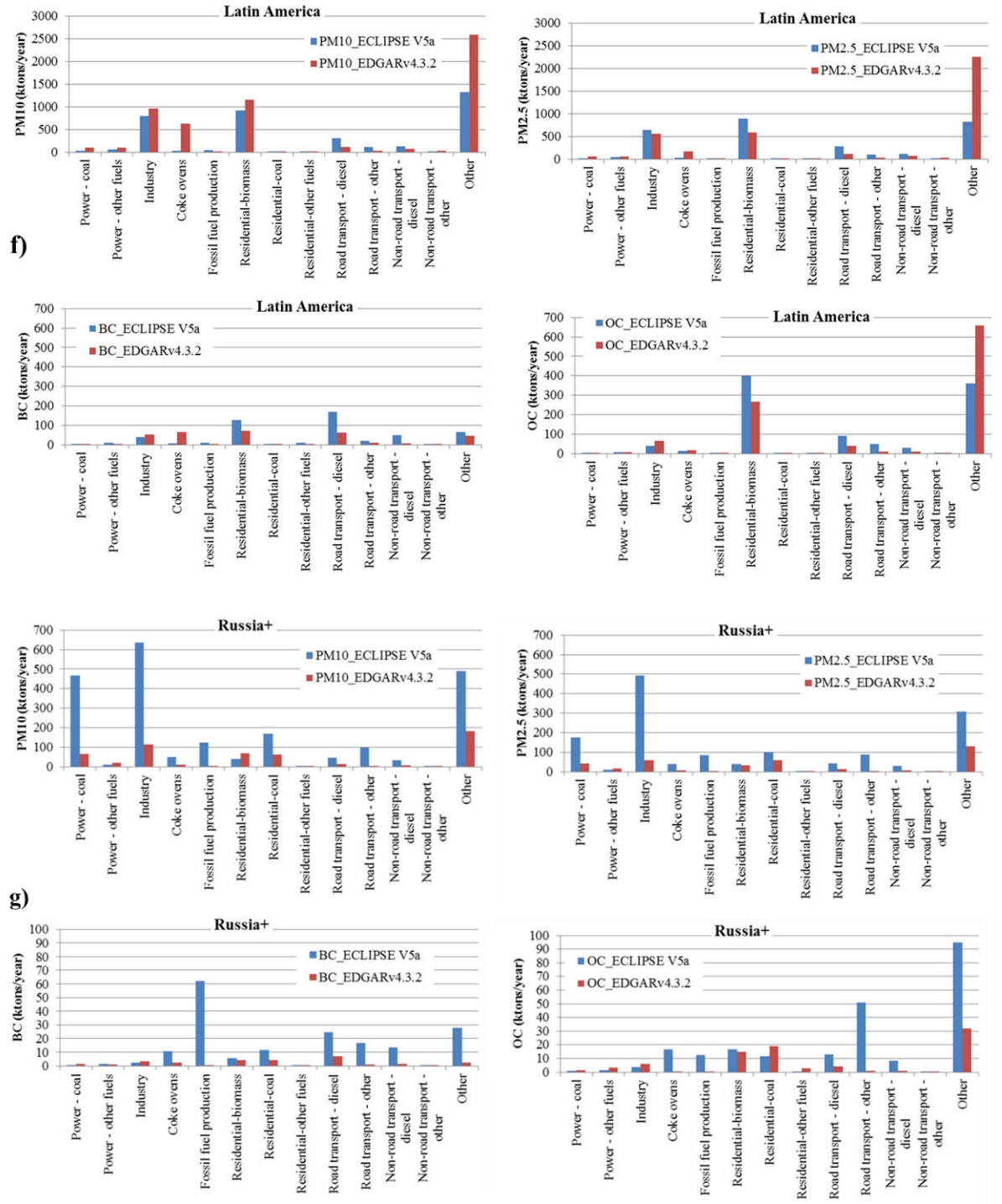


Figure S1.1 – Region-specific comparison of PM_{10}, $PM_{2.5}$, BC and OC emissions for 2010 estimated by EDGARv4.3.2 and by ECLIPSEv5a of Klimont et al. (2017). Detailed comparison of the sector-specific 2010 particulate emission species for different world regions estimated by EDGARv4.3.2 and ECLIPSEv5a (Klimont et al., 2017) are given in: (a) for China+, (b) for India+, (c) for Western Europe, (d) for Central Europe, (e) for Africa, (f) for Latin-America, and (g) for Russia+.

S1.2 - Intercomparison of the implied air pollutant emission factors of EDGAR v4.3.2

Tables S1- Implied EFs for all pollutants and sectors for selected regions and the world.

Implied EF - Energy (ton/TJ)	SO2	NOx	CO	NMVOC	PM10	PM2.5	BC	OC
world median	7.5E-01	3.2E-01	8.3E-02	8.0E-03	1.4E-02	9.1E-03	1.2E-03	6.5E-04
EU28 median	1.0E-01	1.6E-01	4.5E-02	7.2E-03	1.1E-02	6.1E-03	3.4E-04	2.6E-04
USA	2.8E-01	1.2E-01	2.9E-02	2.8E-03	1.5E-02	9.0E-03	4.4E-04	2.5E-04
China	2.1E-01	2.5E-01	2.7E-02	3.4E-03	4.3E-02	2.2E-02	5.7E-04	1.2E-03
India	5.0E-01	3.3E-01	6.1E-02	6.0E-03	1.6E-01	1.0E-01	3.5E-03	3.7E-03
Russia	1.1E-01	1.7E-01	7.1E-02	6.7E-03	6.5E-03	4.6E-03	1.6E-04	2.3E-04
Japan	3.7E-02	8.5E-02	2.3E-02	5.1E-03	3.2E-03	1.8E-03	2.0E-04	1.1E-04

Implied EF - Industry (ton/TJ)	SO2	NOx	CO	NMVOC	PM10	PM2.5	BC	OC
world median	1.8E-02	1.3E-02	6.8E-02	8.8E-02	1.2E-02	6.0E-03	9.1E-04	7.4E-04
EU28 median	1.1E-02	1.2E-02	1.2E-02	7.6E-02	3.5E-03	2.8E-03	2.3E-04	2.6E-04
USA	4.4E-03	6.5E-03	7.1E-03	4.2E-02	1.7E-03	1.6E-03	1.9E-04	3.4E-04
China	6.7E-02	3.3E-02	1.5E-01	6.0E-02	2.4E-02	2.0E-02	3.0E-03	3.7E-03
India	4.0E-02	2.2E-02	1.4E-01	3.9E-02	1.9E-02	1.7E-02	3.5E-03	4.1E-03
Russia	2.4E-03	3.2E-03	7.8E-03	4.2E-02	3.0E-04	2.3E-04	4.2E-05	4.9E-05
Japan	8.9E-03	1.1E-02	1.2E-02	3.5E-02	1.2E-03	9.1E-04	1.5E-04	9.2E-05

Implied EF - Residential (ton/TJ)	SO2	NOx	CO	NMVOC	PM10	PM2.5	BC	OC
world median	5.1E-02	5.2E-02	1.6E+00	2.1E-01	2.4E-01	1.3E-01	1.5E-02	5.7E-02
EU28 median	3.7E-02	5.7E-02	7.8E-01	7.2E-02	5.3E-02	3.9E-02	5.3E-03	2.0E-02
USA	9.8E-03	5.4E-02	2.1E-01	3.1E-02	2.9E-02	1.5E-02	1.8E-03	6.7E-03
China	1.3E-01	6.6E-02	2.9E+00	3.2E-01	4.2E-01	2.4E-01	2.7E-02	1.1E-01
India	8.2E-02	5.6E-02	3.2E+00	5.0E-01	5.0E-01	2.5E-01	3.1E-02	1.1E-01
Russia	7.0E-02	6.1E-02	3.4E-01	5.3E-02	4.0E-02	3.0E-02	2.6E-03	1.1E-02
Japan	5.2E-02	7.8E-02	6.0E-02	2.2E-02	7.0E-03	5.0E-03	4.9E-04	9.8E-04

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Implied EF - Transport (ton/TJ)	SO2	NOx	CO	NMVOC	PM10	PM2.5	BC	OC
world median	1.6E-02	3.5E-01	2.4E+00	3.9E-01	1.6E-02	1.6E-02	6.5E-03	4.6E-03
EU28 median	6.9E-03	2.5E-01	3.3E-01	5.5E-02	1.0E-02	1.0E-02	4.5E-03	3.1E-03
USA	1.8E-03	1.5E-01	1.0E+00	1.0E-01	4.1E-03	4.1E-03	1.2E-03	8.3E-04
China	9.7E-02	5.0E-01	1.2E+00	2.6E-01	4.5E-02	4.5E-02	1.2E-02	7.9E-03
India	4.1E-02	6.5E-01	4.8E+00	5.3E-01	4.9E-02	4.9E-02	1.5E-02	1.2E-02
Russia	2.1E-02	2.0E-01	7.6E-01	3.4E-01	4.9E-03	4.9E-03	1.8E-03	1.2E-03
Japan	3.7E-02	1.6E-01	5.8E-01	8.8E-02	8.9E-03	8.9E-03	2.7E-03	1.9E-03

Implied EF - Agriculture (ton/1000 heads)	NH3
world median	2.4E-01
EU28 median	1.3E-01
USA	1.6E-01
China	8.3E-02
India	4.8E-01
Russia	8.0E-02
Japan	5.4E-04

S1.3 - Intercomparison of the per capita and per GDP air pollutant emissions of EDGAR v4.3.2

Table S2: Per capita emissions for all pollutants and sectors for selected regions and the world.

per capita emissions (kton/million people)	SO2	NOx	CO	NMVOC	NH3	PM10	PM2.5	BC	OC
world median	7.3	13.0	64.0	25.9	6.2	5.7	3.4	0.4	1.0
EU28 median	10.2	20.6	43.9	40.0	10.9	5.2	3.4	0.4	0.9
USA	31.1	40.7	154.7	63.8	13.3	6.7	4.2	0.4	0.9
China	20.8	18.8	79.1	22.7	11.0	12.9	8.3	1.0	2.1
India	7.4	6.6	51.9	9.5	6.1	7.2	4.8	0.5	1.3
Russia	16.6	27.7	58.6	59.4	6.5	3.7	2.5	0.2	0.6
Japan	8.1	16.6	31.2	26.2	2.8	1.9	1.2	0.2	0.1

Table S3: Emissions per income for all pollutants and sectors for selected regions and the world.

Emissions per GDP (ton/million USD)	SO2	NOx	CO	NMVOC	NH3	PM10	PM2.5	BC	OC
world median	0.80	1.16	6.64	2.55	0.73	0.51	0.31	0.03	0.09
EU28 median	0.29	0.70	1.43	1.34	0.34	0.14	0.10	0.01	0.02
USA	0.63	0.83	3.14	1.30	0.27	0.14	0.09	0.01	0.02
China	2.26	2.05	8.59	2.46	1.19	1.40	0.90	0.11	0.23
India	1.63	1.46	11.42	2.09	1.35	1.59	1.05	0.11	0.30
Russia	0.77	1.28	2.71	2.75	0.30	0.17	0.12	0.01	0.03
Japan	0.23	0.48	0.90	0.76	0.08	0.05	0.03	0.01	0.00

S1.4 – Regional air pollutant emission uncertainties

Tables S4- Uncertainty estimates (in %) of all air pollutants for top emitting regions based on Crippa et al. 2017.

SO2 (%)	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
σ China	24.7	23.2	22.1	21.4	21.4	21.5	21.7	21.6	21.7	21.7	22.0	21.8	22.0	22.2	22.1	22.2
σ India	54.8	54.1	51.6	51.3	51.3	51.0	51.1	50.7	50.1	49.6	49.0	48.7	47.7	46.4	45.4	45.5
σ Brazil	55.3	50.6	44.8	43.8	43.2	42.8	41.6	41.6	41.5	41.2	41.4	42.4	43.4	43.4	43.8	44.7
σ Rest non-Annex I	56.1	54.7	53.2	51.1	51.3	51.4	50.8	50.2	49.7	49.4	49.1	48.7	48.6	48.3	47.9	47.7
σ USA	10.7	12.3	16.1	13.4	13.5	14.0	13.6	13.3	13.3	13.0	13.1	12.8	13.0	12.5	13.0	14.6
σ Russia	18.7	18.6	18.5	17.7	17.9	17.5	17.3	17.2	16.4	16.3	16.2	16.3	16.0	15.5	15.5	14.4
σ EU28	29.3	29.5	31.6	35.0	34.8	34.9	34.3	34.0	33.5	33.4	33.4	32.9	32.5	31.8	31.8	31.8

NOx (%)	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
σ China	65.0	56.0	55.6	59.6	59.3	58.2	56.7	54.7	54.2	54.1	54.1	52.7	52.4	54.0	55.8	56.2
σ India	107.7	94.7	76.6	59.6	59.7	59.6	59.7	60.1	59.5	59.7	59.4	60.3	60.0	60.4	65.6	65.8
σ Brazil	120.5	127.6	129.6	121.1	120.2	120.4	117.1	117.3	115.9	115.1	115.9	115.9	119.2	117.9	120.8	123.5
σ Rest non-Annex I	83.1	77.5	78.7	76.5	76.4	75.2	73.6	72.0	70.8	68.9	68.2	67.3	66.8	67.2	68.3	69.4
σ USA	29.9	27.4	29.3	27.9	27.8	27.9	27.5	27.0	26.9	27.5	27.1	27.0	26.7	26.2	26.6	28.8
σ Russia	23.9	20.7	19.7	19.0	19.1	18.9	18.8	19.2	19.0	18.9	18.4	18.5	18.6	17.9	18.1	17.2
σ EU28	46.4	48.3	55.6	53.6	53.1	52.9	52.4	52.5	52.2	52.5	52.2	51.7	52.2	50.6	50.9	50.7

CO (%)	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
σ China	151.1	138.0	135.4	115.2	115.2	115.4	112.3	108.5	106.0	103.8	102.2	100.0	99.5	98.5	95.4	94.4
σ India	148.0	149.2	134.7	131.1	131.7	131.3	132.3	132.5	132.4	130.9	129.4	127.8	124.7	121.2	119.0	118.7
σ Brazil	121.2	112.2	96.3	114.7	114.2	109.5	104.3	99.2	98.4	98.1	97.4	98.1	108.9	110.5	116.6	123.4
σ Rest non-Annex I	118.3	113.5	109.7	115.2	115.7	116.2	115.6	114.5	113.6	112.5	111.1	110.4	110.3	109.1	108.1	108.1
σ USA	44.5	46.1	47.0	46.4	46.5	46.6	45.9	45.5	44.8	45.1	44.7	44.3	44.6	44.2	44.1	44.2
σ Russia	32.4	31.2	31.6	30.9	31.1	31.5	31.3	31.4	31.3	31.0	30.0	29.5	28.7	27.3	27.1	25.9
σ EU28	75.0	78.0	83.3	75.2	73.7	72.5	70.0	67.7	65.8	64.5	63.5	63.1	64.4	64.7	63.9	64.6

NMVOC (%)	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
σ China	150.8	139.1	132.7	124.4	125.7	126.8	128.8	130.7	133.1	134.0	135.4	136.2	137.7	138.2	138.6	138.6
σ India	153.4	151.8	139.7	131.1	131.0	130.4	130.6	130.4	130.3	129.3	128.1	127.4	125.9	124.2	122.9	122.4
σ Brazil	122.7	141.9	162.6	153.2	152.3	153.8	157.0	160.1	160.4	160.2	160.9	160.2	152.3	152.0	150.8	147.5
σ Rest non-Annex I	129.2	126.5	126.5	127.5	127.8	127.8	128.8	131.0	132.0	132.6	133.6	133.8	133.0	133.8	134.1	133.9
σ USA	33.9	33.7	33.5	33.8	34.2	34.0	34.0	34.2	34.0	34.1	33.9	33.9	33.7	33.8	33.7	33.6
σ Russia	32.9	32.3	30.1	31.8	31.9	32.2	32.3	32.4	32.5	32.5	32.5	32.4	32.6	32.6	32.6	32.7
σ EU28	64.3	65.6	66.1	69.0	69.2	69.6	69.6	69.7	70.1	70.5	70.8	71.7	71.9	73.3	73.5	73.6

NH3 (%)	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
σ China	229.3	260.0	277.9	288.9	289.8	291.6	291.8	292.9	294.0	294.5	294.6	295.0	294.9	294.6	294.6	294.4
σ India	226.9	241.1	255.6	261.7	262.4	260.3	261.5	262.4	263.8	265.4	266.5	266.7	266.4	267.2	267.9	268.2
σ Brazil	238.9	251.6	258.8	271.0	270.3	269.6	269.8	267.7	267.9	267.5	268.0	268.4	272.0	271.0	272.6	272.1
σ Rest non-Annex I	233.8	248.8	258.0	263.8	264.1	264.9	265.6	266.2	266.5	267.1	267.6	267.9	268.2	267.5	267.5	267.3
σ USA	190.9	185.7	189.5	186.1	187.0	187.3	186.4	185.2	184.4	185.0	184.6	184.8	185.3	185.0	185.3	186.0
σ Russia	192.9	195.7	199.4	199.0	198.7	198.5	198.3	198.0	197.2	196.6	195.7	195.8	195.9	195.4	194.9	194.8
σ EU28	231.0	233.4	234.5	231.2	231.5	231.8	232.1	232.0	232.2	232.2	232.4	232.7	232.9	232.6	232.7	233.0

PM10 (%)	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
σ China	149.0	135.7	125.0	107.1	108.0	108.0	103.6	99.3	96.3	93.6	90.9	89.1	87.4	86.0	83.6	81.7
σ India	157.0	155.0	139.4	136.1	135.4	135.1	134.7	132.0	130.3	128.1	124.3	122.4	119.0	114.9	111.2	109.1
σ Brazil	124.5	87.8	64.9	61.3	61.9	63.0	62.2	61.1	61.2	60.9	59.5	59.2	60.9	58.6	57.4	57.4
σ Rest non-Annex I	141.8	134.5	126.2	119.8	121.9	122.2	120.0	116.9	115.2	113.5	111.1	110.2	109.8	108.1	106.1	104.3
σ USA	48.8	53.7	67.0	63.0	62.4	63.5	65.1	64.5	66.0	62.5	64.9	68.1	70.4	68.3	69.2	70.0
σ Russia	127.2	125.0	120.0	90.2	92.7	85.6	81.9	78.0	76.0	75.4	75.1	79.5	76.8	74.1	71.9	62.6
σ EU28	92.4	83.0	78.6	83.0	84.2	84.0	84.4	85.2	85.0	86.5	85.7	89.5	95.3	98.2	95.4	96.8

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PM2.5 (%)	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
σ China	139.0	124.9	116.0	96.5	97.8	98.4	94.2	90.3	87.8	85.7	83.4	81.9	80.5	79.4	77.4	75.7
σ India	140.8	138.1	120.5	118.3	117.7	117.4	117.2	114.5	112.6	110.3	106.7	104.7	101.2	96.8	93.2	91.4
σ Brazil	127.5	93.7	67.5	62.0	62.4	63.9	63.7	62.6	62.9	62.4	60.3	59.6	60.7	58.0	56.7	56.5
σ Rest non-Annex I	127.5	93.7	67.5	62.0	62.4	63.9	63.7	62.6	62.9	62.4	60.3	59.6	60.7	58.0	56.7	56.5
σ USA	44.0	45.7	53.2	47.2	45.1	43.4	46.9	47.2	49.1	44.9	46.7	49.1	50.7	49.4	49.8	49.0
σ Russia	127.3	127.9	128.7	98.1	101.7	93.6	88.7	84.7	81.6	81.3	79.1	87.1	80.5	76.7	73.8	61.8
σ EU28	96.9	85.8	78.9	76.3	77.7	77.3	77.6	78.6	78.5	80.3	79.2	83.5	89.7	93.5	90.2	91.8

BC (%)	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
σ China	160.2	144.1	124.9	99.8	100.4	101.4	96.3	87.6	85.7	83.8	80.7	80.2	79.2	77.9	76.1	74.3
σ India	113.3	116.0	104.7	114.3	115.7	115.9	117.1	116.7	115.7	113.9	111.9	109.6	104.6	99.1	94.1	93.1
σ Brazil	94.1	67.6	53.9	53.1	53.5	54.3	54.4	54.0	54.3	54.2	53.1	52.6	53.4	52.4	52.1	52.1
σ Rest non-Annex I	128.7	121.2	110.3	104.4	105.7	106.7	105.0	101.6	100.9	100.0	97.8	97.4	97.1	95.3	93.7	92.0
σ USA	37.0	36.3	41.4	42.5	40.9	38.4	40.7	40.9	42.9	40.2	41.2	46.9	48.3	47.6	47.7	46.8
σ Russia	98.0	99.1	98.7	85.6	88.8	81.9	77.6	73.5	70.5	70.6	71.5	75.7	66.7	67.1	65.3	59.5
σ EU28	68.8	61.6	59.2	61.9	62.6	63.2	64.3	65.4	66.5	67.8	67.9	71.2	75.3	80.3	78.7	79.4

OC (%)	1970	1980	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
σ China	178.3	172.2	168.5	150.9	151.8	152.5	148.4	142.7	140.1	138.4	136.7	134.1	133.2	133.0	130.2	129.2
σ India	180.4	178.0	169.4	168.3	168.2	167.3	167.6	166.1	164.4	162.6	160.3	159.2	156.1	151.2	147.2	147.4
σ Brazil	180.3	160.9	123.6	103.7	104.0	107.0	107.2	105.5	105.9	104.1	99.2	97.3	98.5	93.0	89.4	88.7
σ Rest non-Annex I	181.9	177.1	171.6	163.2	163.9	164.3	162.3	160.1	158.8	157.8	156.4	155.4	155.0	154.0	152.2	151.4
σ USA	75.5	91.3	88.9	83.6	77.8	73.9	83.2	84.7	89.7	79.5	84.1	88.3	92.9	89.8	92.2	93.1
σ Russia	175.9	175.8	175.9	168.8	171.0	166.4	163.1	160.6	147.1	147.6	147.1	149.1	139.9	137.2	135.4	127.5
σ EU28	160.7	152.4	140.6	130.2	131.8	131.4	133.3	135.2	136.4	139.5	138.7	143.9	149.2	154.1	151.7	153.2

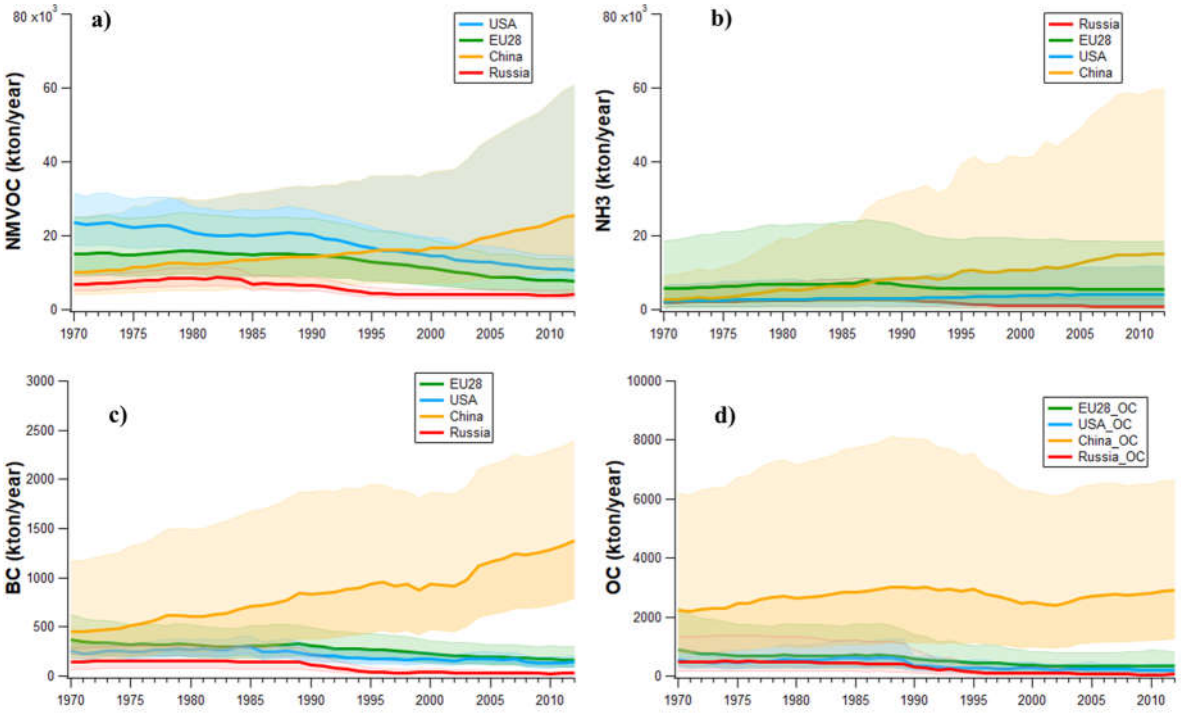

Figure S1.4 - Emission time series of NMVOC, NH3, BC and OC with uncertainty bands for top emitting countries/regions (China, USA, Russia and EU28).

S1.5 - Countries aggregation based on their income

Table S5 reports for each world country the classification based on its income level (low income (LIC), lower middle income (LMC), upper middle income (UMC) and high income (HIC)). The definition of country groups based in their income is consistent with the approach adopted by Janssens-Maenhout et al. (2015). Country codes definition are consistent with the International Organization for Standardization definition (ISO 3166-1).

Tables S5- Countries aggregation based on their income.

Country Code	IncomeGroup	Code
ABW	High income: nonOECD	HIC_non_OECD
AND	High income: nonOECD	HIC_non_OECD
ARE	High income: nonOECD	HIC_non_OECD
ATG	High income: nonOECD	HIC_non_OECD
BHR	High income: nonOECD	HIC_non_OECD
BHS	High income: nonOECD	HIC_non_OECD
BMU	High income: nonOECD	HIC_non_OECD
BRB	High income: nonOECD	HIC_non_OECD
BRN	High income: nonOECD	HIC_non_OECD
CHI	High income: nonOECD	HIC_non_OECD
CUW	High income: nonOECD	HIC_non_OECD
CYM	High income: nonOECD	HIC_non_OECD
CYP	High income: nonOECD	HIC_non_OECD
FRO	High income: nonOECD	HIC_non_OECD
GNQ	High income: nonOECD	HIC_non_OECD
GRL	High income: nonOECD	HIC_non_OECD
GUM	High income: nonOECD	HIC_non_OECD
HKG	High income: nonOECD	HIC_non_OECD
HRV	High income: nonOECD	HIC_non_OECD
IMN	High income: nonOECD	HIC_non_OECD
KNA	High income: nonOECD	HIC_non_OECD
KWT	High income: nonOECD	HIC_non_OECD
LIE	High income: nonOECD	HIC_non_OECD
LTU	High income: nonOECD	HIC_non_OECD
LVA	High income: nonOECD	HIC_non_OECD
MAC	High income: nonOECD	HIC_non_OECD
MAF	High income: nonOECD	HIC_non_OECD
MCO	High income: nonOECD	HIC_non_OECD
MLT	High income: nonOECD	HIC_non_OECD
MNP	High income: nonOECD	HIC_non_OECD
NCL	High income: nonOECD	HIC_non_OECD
OMN	High income: nonOECD	HIC_non_OECD
PRI	High income: nonOECD	HIC_non_OECD
PYF	High income: nonOECD	HIC_non_OECD
QAT	High income: nonOECD	HIC_non_OECD
RUS	High income: nonOECD	HIC_non_OECD
SAU	High income: nonOECD	HIC_non_OECD
SGP	High income: nonOECD	HIC_non_OECD
SMR	High income: nonOECD	HIC_non_OECD
SXM	High income: nonOECD	HIC_non_OECD
TCA	High income: nonOECD	HIC_non_OECD
TTO	High income: nonOECD	HIC_non_OECD
TWN	High income: nonOECD	HIC_non_OECD
URY	High income: nonOECD	HIC_non_OECD
VIR	High income: nonOECD	HIC_non_OECD

Country Code	IncomeGroup	Code
ARM	Lower middle income	LMC
BOL	Lower middle income	LMC
BTN	Lower middle income	LMC
CIV	Lower middle income	LMC
CMR	Lower middle income	LMC
COG	Lower middle income	LMC
CPV	Lower middle income	LMC
DJI	Lower middle income	LMC
EGY	Lower middle income	LMC
FSM	Lower middle income	LMC
GEO	Lower middle income	LMC
GHA	Lower middle income	LMC
GTM	Lower middle income	LMC
GUY	Lower middle income	LMC
HND	Lower middle income	LMC
IDN	Lower middle income	LMC
IND	Lower middle income	LMC
KGZ	Lower middle income	LMC
KIR	Lower middle income	LMC
KSV	Lower middle income	LMC
LAO	Lower middle income	LMC
LKA	Lower middle income	LMC
LSO	Lower middle income	LMC
MAR	Lower middle income	LMC
MDA	Lower middle income	LMC
MNG	Lower middle income	LMC
MRT	Lower middle income	LMC
NGA	Lower middle income	LMC
NIC	Lower middle income	LMC
PAK	Lower middle income	LMC
PHL	Lower middle income	LMC
PNG	Lower middle income	LMC
PRY	Lower middle income	LMC
PSE	Lower middle income	LMC
SDN	Lower middle income	LMC
SEN	Lower middle income	LMC
SLB	Lower middle income	LMC
SLV	Lower middle income	LMC
SSD	Lower middle income	LMC
STP	Lower middle income	LMC
SWZ	Lower middle income	LMC
SYR	Lower middle income	LMC
TLS	Lower middle income	LMC
UKR	Lower middle income	LMC
UZB	Lower middle income	LMC
VNM	Lower middle income	LMC
VUT	Lower middle income	LMC
WSM	Lower middle income	LMC
YEM	Lower middle income	LMC
ZMB	Lower middle income	LMC

Country Code	IncomeGroup	Code
AUS	High income: OECD	HIC
AUT	High income: OECD	HIC
BEL	High income: OECD	HIC
CAN	High income: OECD	HIC
CHE	High income: OECD	HIC
CHL	High income: OECD	HIC
CZE	High income: OECD	HIC
DEU	High income: OECD	HIC
DNK	High income: OECD	HIC
ESP	High income: OECD	HIC
EST	High income: OECD	HIC
FIN	High income: OECD	HIC
FRA	High income: OECD	HIC
GBR	High income: OECD	HIC
GIB	High income: OECD	HIC
GRC	High income: OECD	HIC
IRL	High income: OECD	HIC
ISL	High income: OECD	HIC
ISR	High income: OECD	HIC
ITA	High income: OECD	HIC
JPN	High income: OECD	HIC
KOR	High income: OECD	HIC
LUX	High income: OECD	HIC
NLD	High income: OECD	HIC
NOR	High income: OECD	HIC
NZL	High income: OECD	HIC
POL	High income: OECD	HIC
PRT	High income: OECD	HIC
SVK	High income: OECD	HIC
SVN	High income: OECD	HIC
SWE	High income: OECD	HIC
USA	High income: OECD	HIC

Country Code	IncomeGroup	Code
AFG	Low income	LIC
BDI	Low income	LIC
BEN	Low income	LIC
BFA	Low income	LIC
BGD	Low income	LIC
CAF	Low income	LIC
COD	Low income	LIC
COM	Low income	LIC
ERI	Low income	LIC
ETH	Low income	LIC
GIN	Low income	LIC
GMB	Low income	LIC
GNB	Low income	LIC
HTI	Low income	LIC
KEN	Low income	LIC
KHM	Low income	LIC
LBR	Low income	LIC
MDG	Low income	LIC
MLI	Low income	LIC
MMR	Low income	LIC
MOZ	Low income	LIC
MWI	Low income	LIC
NER	Low income	LIC
NPL	Low income	LIC
PRK	Low income	LIC
RWA	Low income	LIC
SLE	Low income	LIC
SOM	Low income	LIC
TCD	Low income	LIC
TGO	Low income	LIC
TJK	Low income	LIC
TZA	Low income	LIC
UGA	Low income	LIC
ZWE	Low income	LIC

Country Code	IncomeGroup	Code
AGO	Upper middle income	UMC
ALB	Upper middle income	UMC
ARG	Upper middle income	UMC
ASM	Upper middle income	UMC
AZE	Upper middle income	UMC
BGR	Upper middle income	UMC
BIH	Upper middle income	UMC
BLR	Upper middle income	UMC
BLZ	Upper middle income	UMC
BRA	Upper middle income	UMC
BWA	Upper middle income	UMC
CHN	Upper middle income	UMC
COL	Upper middle income	UMC
CRI	Upper middle income	UMC
CUB	Upper middle income	UMC
DMA	Upper middle income	UMC
DOM	Upper middle income	UMC
DZA	Upper middle income	UMC
ECU	Upper middle income	UMC
FJI	Upper middle income	UMC
GAB	Upper middle income	UMC
GRD	Upper middle income	UMC
HUN	Upper middle income	UMC
IRN	Upper middle income	UMC
IRQ	Upper middle income	UMC
JAM	Upper middle income	UMC
JOR	Upper middle income	UMC
KAZ	Upper middle income	UMC
LBN	Upper middle income	UMC
LBY	Upper middle income	UMC
LCA	Upper middle income	UMC
MDV	Upper middle income	UMC
MEX	Upper middle income	UMC
MHL	Upper middle income	UMC
MKD	Upper middle income	UMC
MNE	Upper middle income	UMC
MUS	Upper middle income	UMC
MYS	Upper middle income	UMC
NAM	Upper middle income	UMC
PAN	Upper middle income	UMC
PER	Upper middle income	UMC
PLW	Upper middle income	UMC
ROU	Upper middle income	UMC
SCG	Upper middle income	UMC
SUR	Upper middle income	UMC
SYC	Upper middle income	UMC
THA	Upper middle income	UMC
TKM	Upper middle income	UMC
TON	Upper middle income	UMC
TUN	Upper middle income	UMC
TUR	Upper middle income	UMC
TUV	Upper middle income	UMC
VCT	Upper middle income	UMC
VEN	Upper middle income	UMC
ZAF	Upper middle income	UMC

S2 - Evaluation of emission ratios of co-emitted air pollutants in EDGAR v4.3.2

Figures S2 a and b give an overview of the current (2012) emission ratio of the air pollutants in EDGAR v4.3.2 with CO/CO_2, NOx/CO_2, SO_2/CO_2, PM_{10}/ CO_2 and NH_3/CO_2 for world regions. The CO/CO_2 ratio shows the highest values for the residential and transport (in particular in regions with higher share of gasoline vehicles) sectors due to the low combustion efficiency. On the contrary, the NOx/CO_2 ratio is higher for the energy sector due to the high combustion temperatures leading to the formation of NOx and for the transport sector in countries where the diesel share in the fleet is dominant. The SO_2/CO_2 ratio reflects the composition and quality of the fuel (suplhur content), being larger in countries where the deployment of coal and dirty fuels is significant in particular for the energy and industrial sectors (e.g. Latin America, Africa, Middle, East, etc.). The PM_{10}/CO_2 ratio is higher in the residential and partly in the industrial sectors, due to the deployment of less clean technologies and still poor abatament measures in place, in particular in African, Asian and Latin American countries. The NH_3/CO_2 ratio is dominant in the residential sector mainly due to the combustion of biofuels, in particular in Africa, Asia and Latin America.

a)

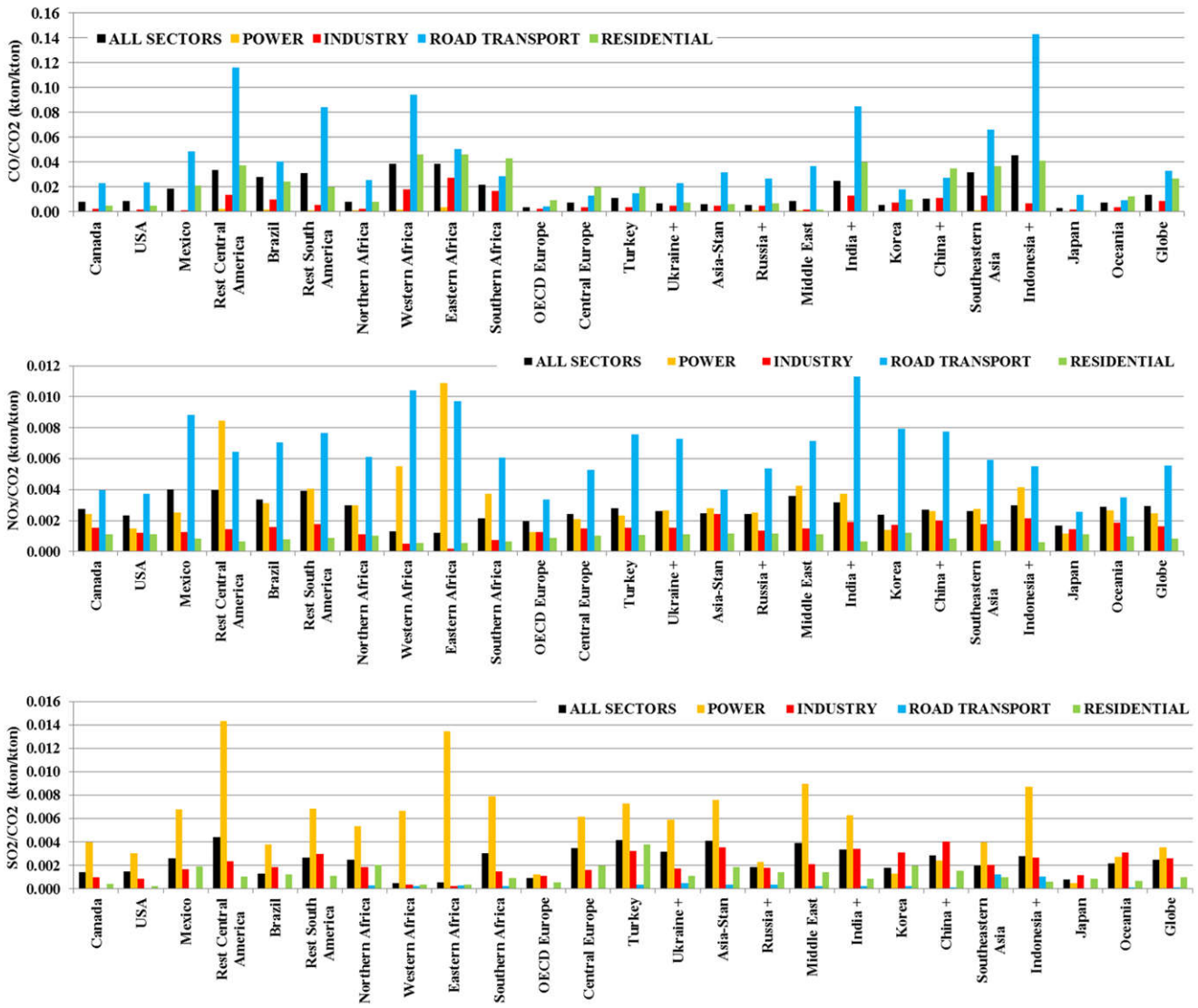

Figure S2a – CO/CO_2, NOx/CO_2 and NOx/CO emission ratios by sector and world region in 2012.

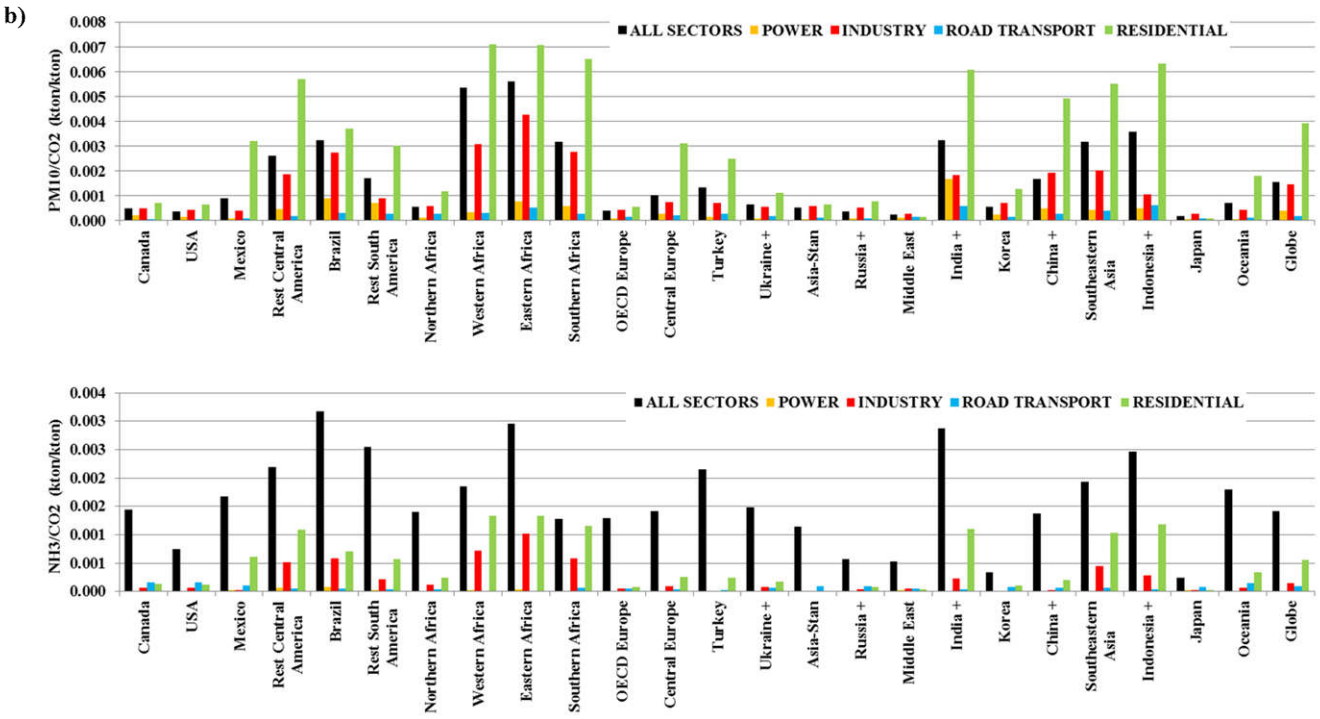

Figure S2b – SO_2/CO_2, PM_{10}/CO_2 and NH_3/CO_2 emission ratios by sector and world region in 2012.

Figures S3a-c represent the regional comparison of CO/CO_2, NOx/CO_2 and SO_2/CO_2 emission ratios in 5 year time steps from 1970 to 2012 for the power generation, transport and residential sectors, respectively, as discussed in the manuscript.

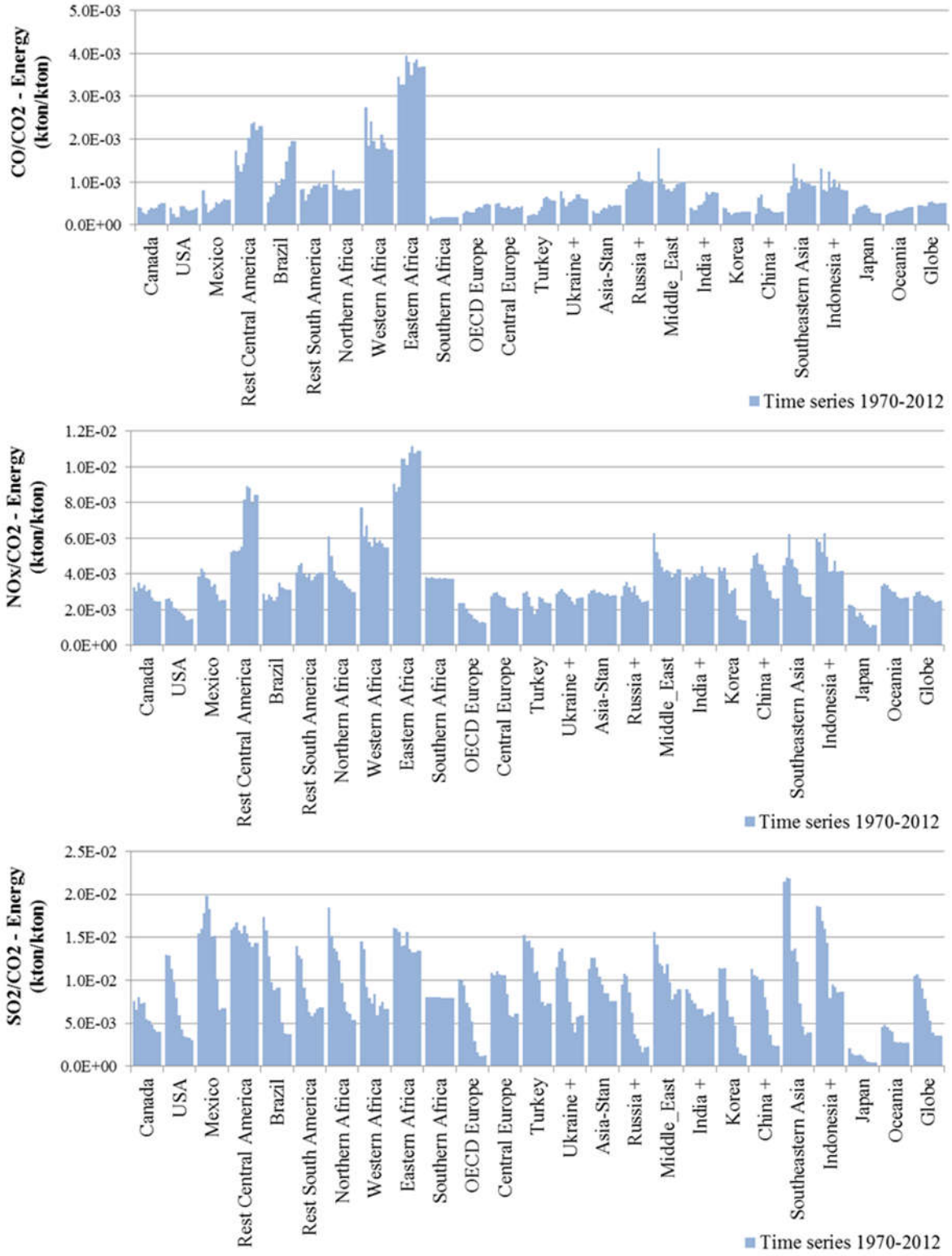

Figure S3a - Regional comparison of CO/CO_2, NOx/CO_2 and SO_2/CO_2 emission ratios in 5 year time steps from 1970 to 2012 for the power generation sector.

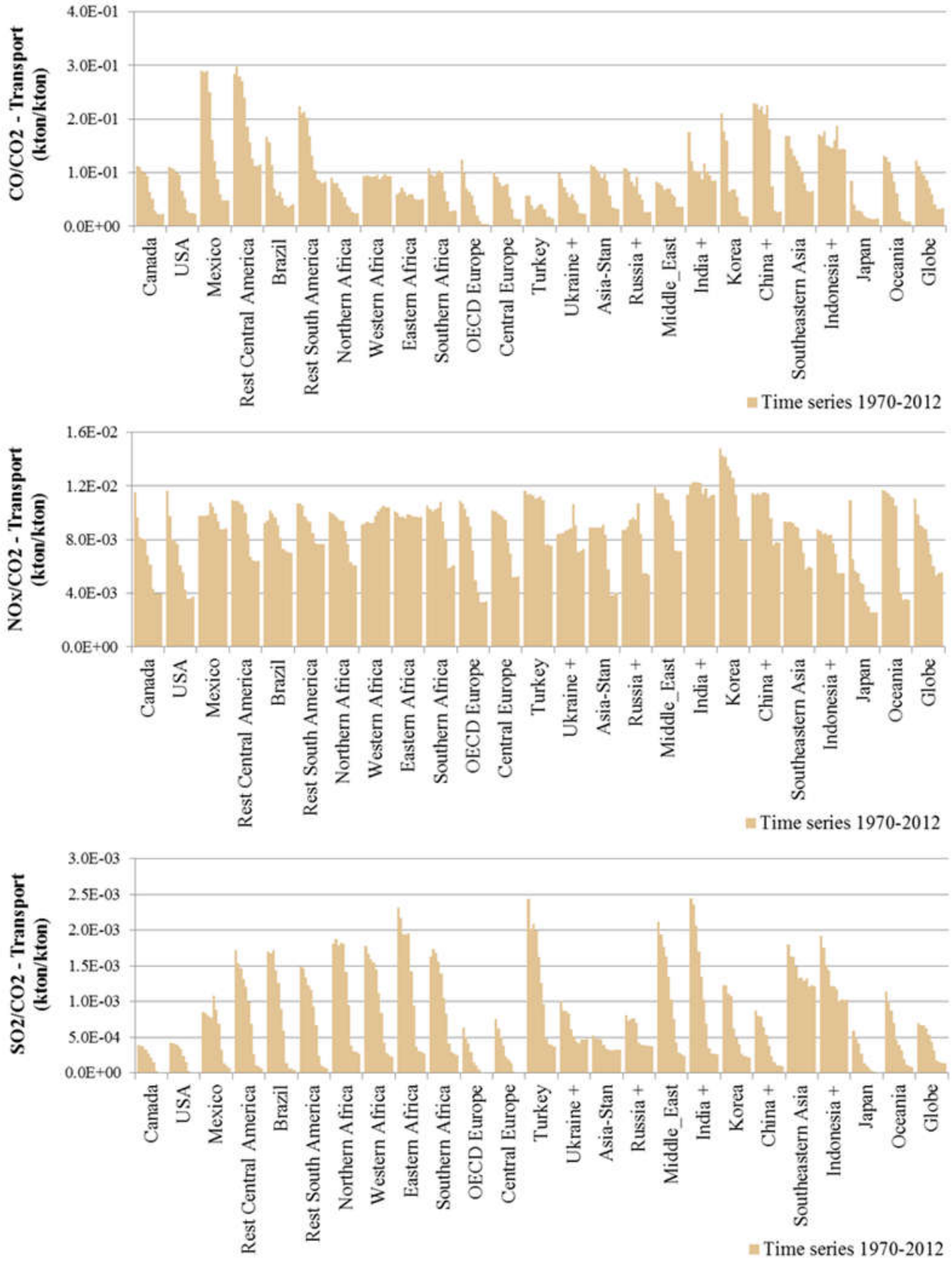

Figure S3b - Regional comparison of CO/CO_2, NOx/CO_2 and SO_2/CO_2 emission ratios in 5 year time steps from 1970 to 2012 for the transport sector.

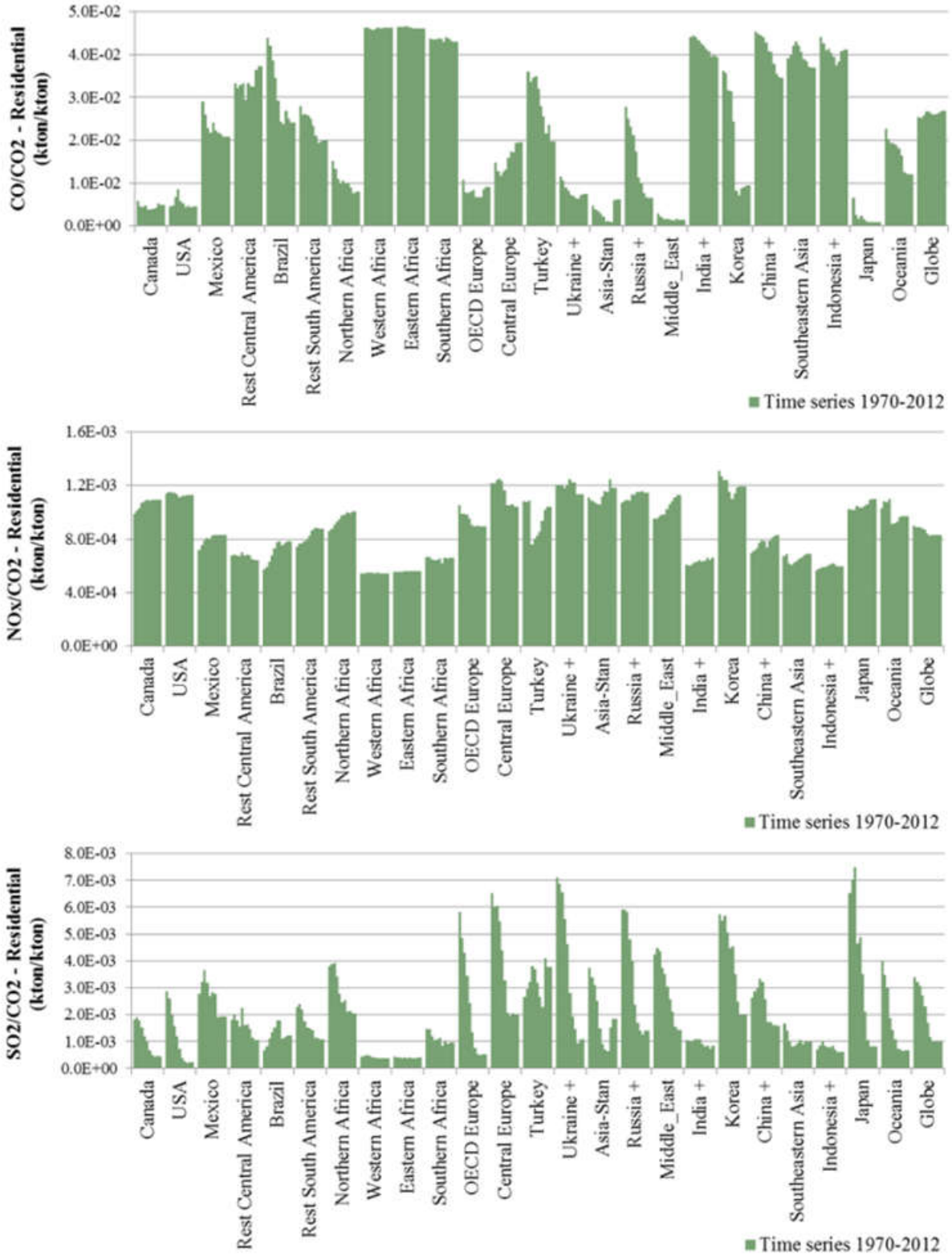

Figure S3c – Regional comparison of CO/CO_2, NOx/CO_2 and SO_2/CO_2 emission ratios in 5 year time steps from 1970 to 2012 for the residential sector.

S3 - Gridded emissions in EDGARv4.3.2

S3.1 - Impact of proxy data

As discussed in Sect. 3.5 of the manuscript, the shares at gridcell level for the energy sector are strongly affected by the spatial proxies used to distribute the energy emissions. In EDGAR v4.3.2 we use the CARMAv3.0 (2012) which reports the location, capacity etc. of point sources for power plants all over the world differentiating three fuel types (coal, gas and oil), intensities and time series (years 2004, 2009 and 2014). Therefore the EDGAR v4.3.2 power emissions in 2007 are distributed using the 2009 CARMA spatial proxies and the 2012 emissions with the 2014 point sources. As shown in Fig. S4, the number of points which are not on the 1:1 line are 1441 which are in the same order of magnitude of the number of cells which are outside the 20% deviation band of the emission scatter plots of Fig. 12 (they are 1.12E+03 for SO_2, 9.50E+02 for NOx, 5.55E+02 for CO, 6.68E+02 for $PM_{2.5}$ and 8.72E+02 for CO_2). When using the same proxy data the same proxies from CARMA (e.g. 2010 vs 2007 comparison), only 0.7% of the points of the energy share are outside the 20% band deviation, as shown in Fig. S5.

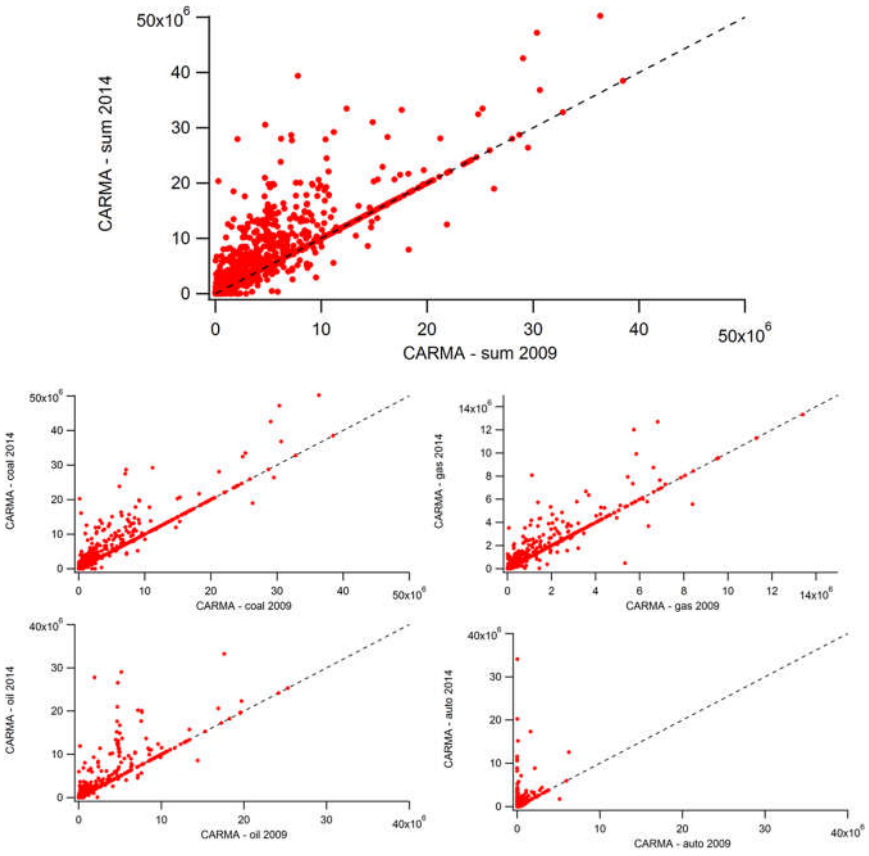

Figure S4- Comparison of point sources provided by CARMA to distribute energy emissions for the year 2009 and 2014.

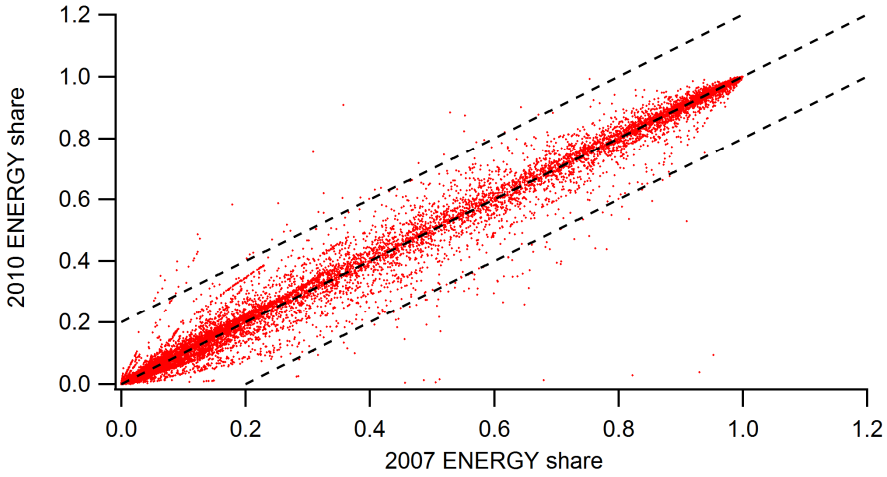

Figure S5 – Comparison of CO_2 energy emission shares in 2010 and 2007 (using the same spatial proxy data).

S3.2 – Gridded emission sector shares

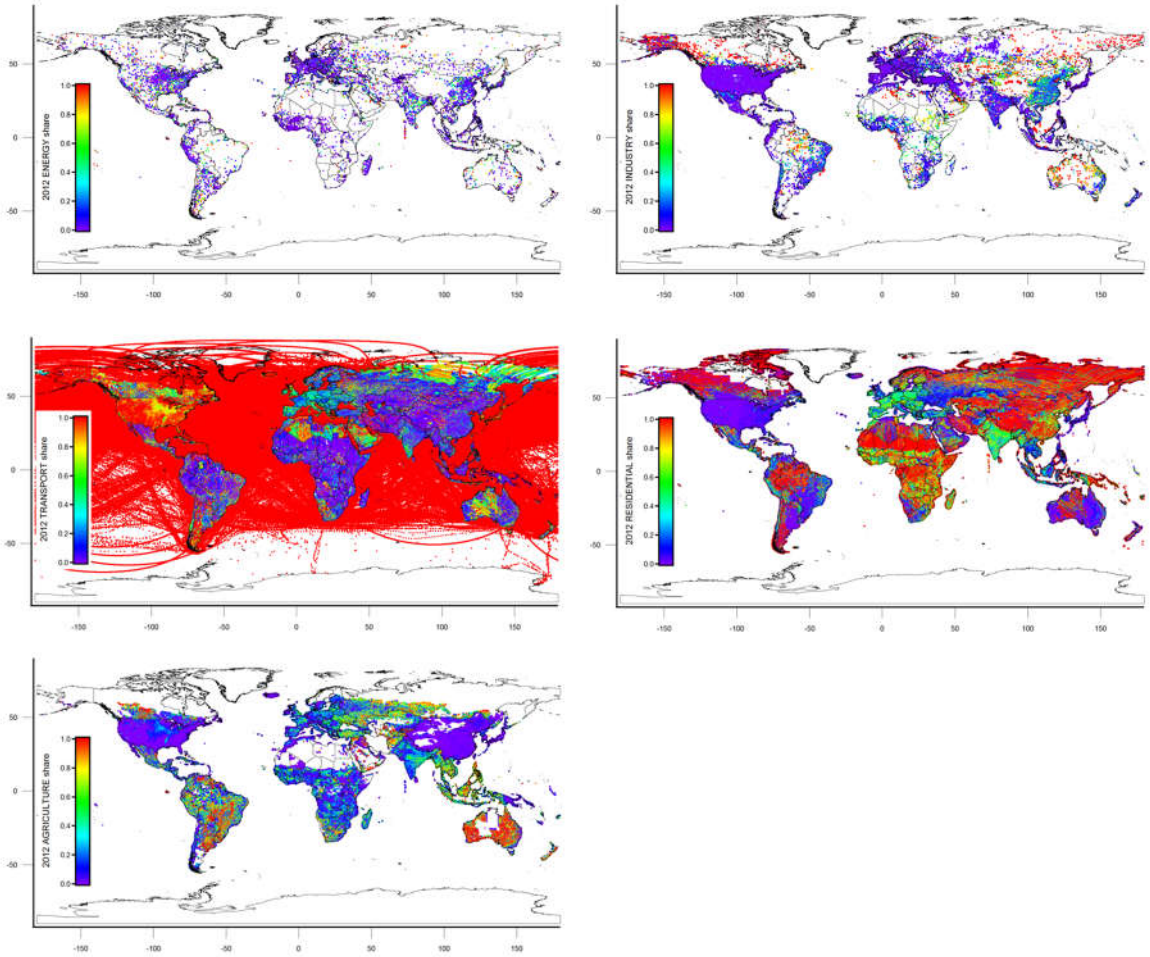

Figure S6 – CO emission sector shares for the year 2012 at gridcell level.

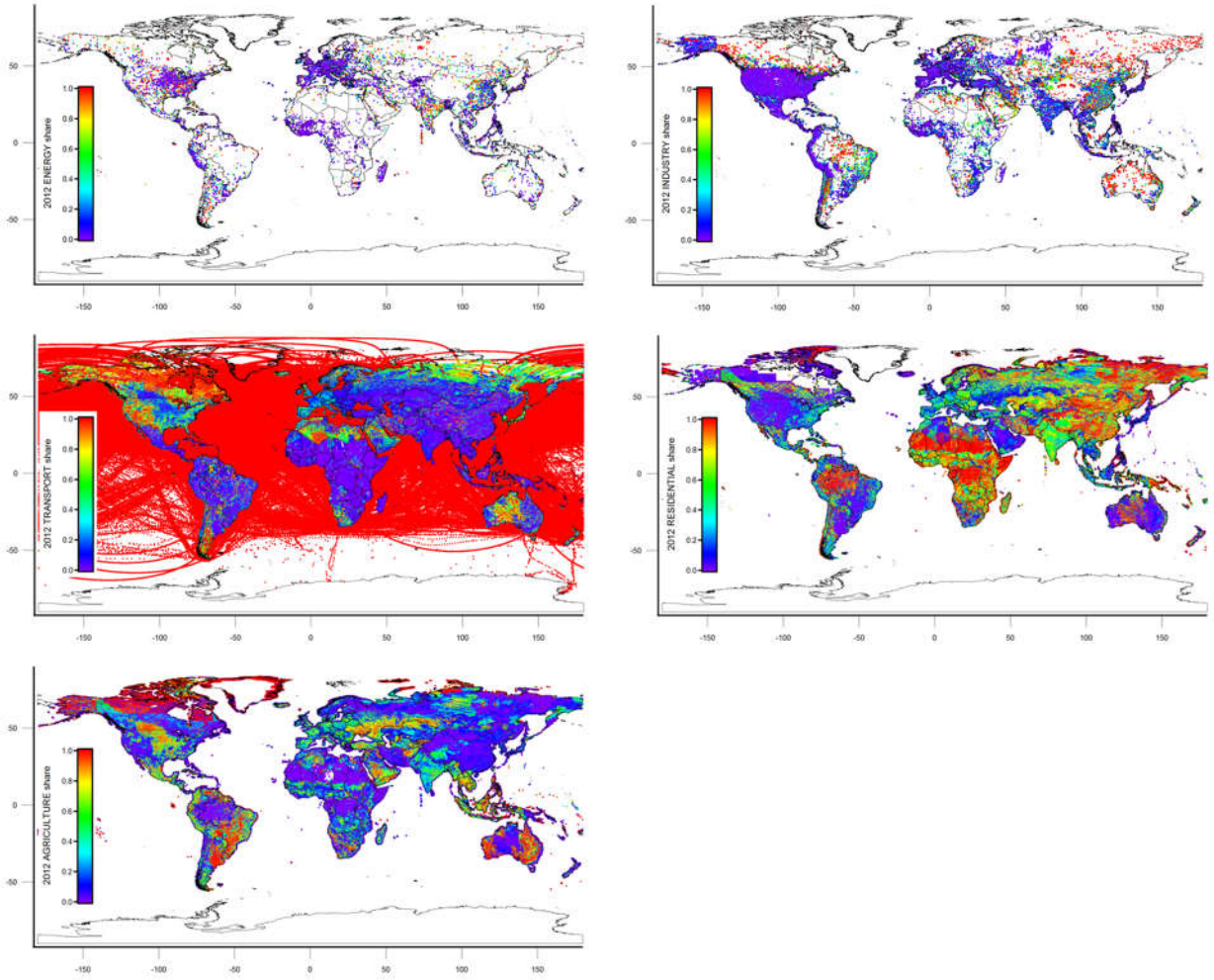

Figure S7 – $PM_{2.5}$ emission sector shares for the year 2012 at gridcell level.

S3.3 – Hot spots evolution over time

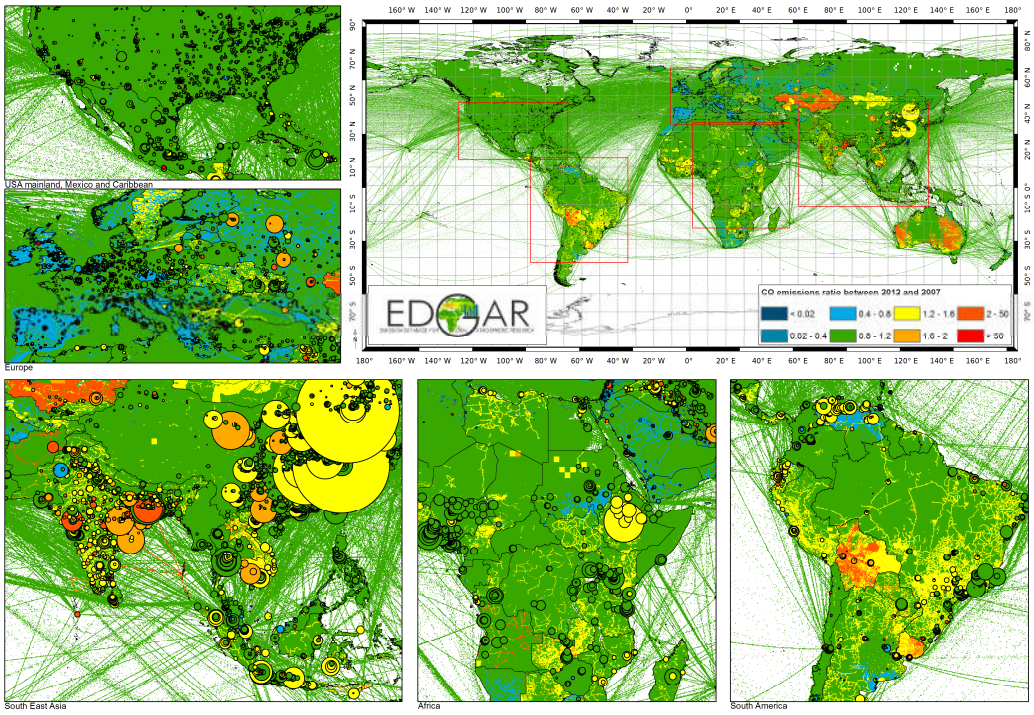

Figure S8a – Ratio of all sectors CO emissions between 2012 and 2007 at gridcell level. The colored bubbles represent the top emitting cells, as described in the text.

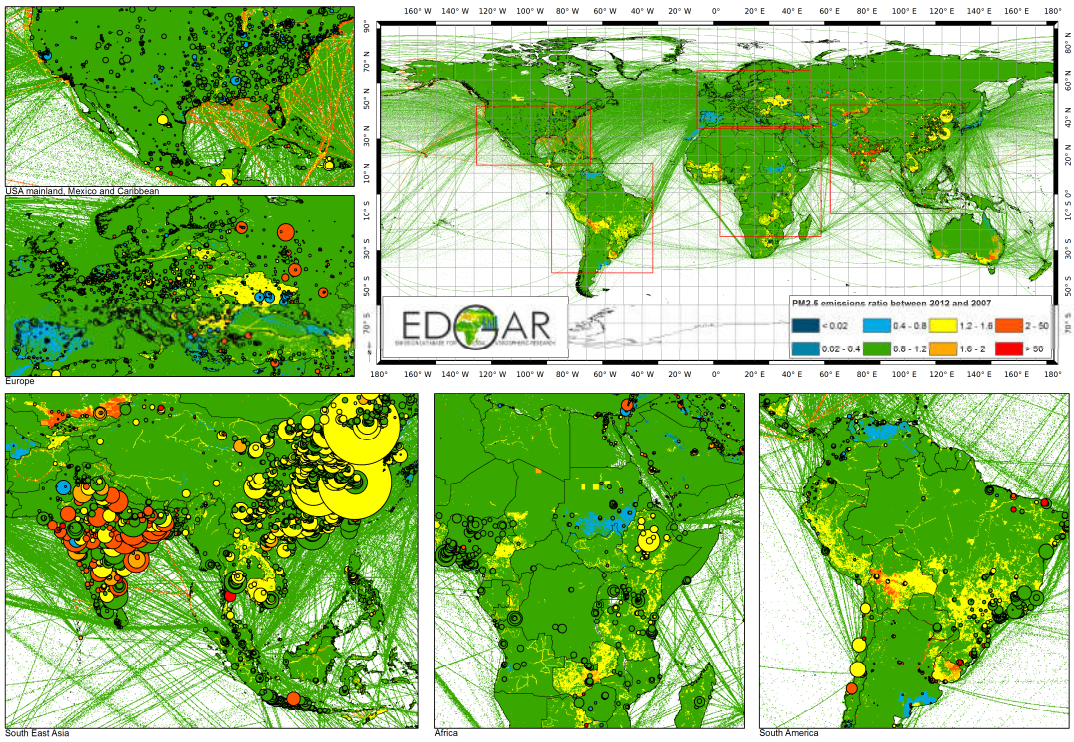

Figure S8b – Ratio of all sectors $PM_{2.5}$ emissions between 2012 and 2007 at gridcell level. The colored bubbles represent the top emitting cells, as described in the text.

S3.2 – Spatial proxies used in EDGAR v4.3.2

Table S6 - Overview of the spatial proxy data used for distributing the sector-specific country totals of EDGAR v4.3.2 to 0.1degx0.1deg gridmaps from Janssens-Maenhout et al. (2017).

EDGAR sector	Sector description	Gridmaps	Reference
AGS	**Agricultural soils**	Animals: buffaloes, cattles, chickens, ducks, goats, pigs, poultry, sheeps	livestock: http://livestock.geo-wiki.org/ buffaloes: http://www.fao.org/AG/AGAInfo/resources/en/glw/GLW_dens.html
		Crops: barley, beans, broad bean, cassava, chick peas, cow peas, pasture, lentils, maize, millet, oats, other cereals, other pulses, other roots tubers, peas, potatoes, rice, rye, sorghum, soy bean, sugar beet, sugarcane, sweet potatoes, wheat, yams	Ramankutty, N., A.T. Evan, C. Monfreda, and J.A. Foley (2008), Farming the planet: 1. Geographic distribution of global agricultural lands in the year 2000. Global Biogeochemical Cycles 22, GB1003, doi:10.1029/2007GB002952.
		Histosols	FAO Geonetwork, 2007
		Grassland	Global Land Cover map JRC (2000)
AWB	**Agricultural waste burning**	Crops: barley, beans, broad bean, cassava, chick peas, cow peas, pasture, lentils, maize, millet, oats, other cereals, other pulses, other roots tubers, peas, potatoes, rice, rye, sorghum, soy bean, sugar beet, sugarcane, sweet potatoes, wheat, yams	Ramankutty, N., A.T. Evan, C. Monfreda, and J.A. Foley (2008), Farming the planet: 1. Geographic distribution of global agricultural lands in the year 2000. Global Biogeochemical Cycles 22, GB1003, doi:10.1029/2007GB002952.
		Grassland	Global Land Cover map JRC (2000)
CHE	**Production of chemicals**	adipic acid, ammonia, caprolactam, glyoxal, nitric acid, sulfuric acid	In-house EDGAR proxy
		Urban population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/
ENE	**Power industry**	Power plants: auto-producers, coal, gas, oil	CARMA v3 (http://carma.org/) and local data for China
ENF	**Enteric fermentation**	Animals: buffaloes, cattles, goats, pigs, sheeps	livestock: http://livestock.geo-wiki.org/ buffaloes: http://www.fao.org/AG/AGAInfo/resources/en/glw/GLW_dens.html

		Grassland	Global Land Cover map JRC (2000)
FOO	**Production of foods**	Urban population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/
FFF	**Fossil Fuel Fires**	coal fires	In-house EDGAR proxy
		gas flaring	In-house EDGAR proxy based on https://www.ngdc.noaa.gov/eog/viirs.html
IND	**Combustion for manufacturing industry**	cement	In-house EDGAR proxy based on USGS (http://mrdata.usgs.gov/mineral-operations/) and EPRTR (http://prtr.ec.europa.eu) and CEC (http://takingstock.cec.org/)
		chemical	In-house EDGAR proxy
		mining	In-house EDGAR proxy based on USGS (https://mrdata.usgs.gov/mrds/)
		paper	In-house EDGAR proxy based on EPRTR (http://prtr.ec.europa.eu) and CEC (http://takingstock.cec.org/)
		steel	In-house EDGAR proxy
		Urban population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/
IRO	**Iron and steel production**	Blast furnace, Basic oxygen furnace, Open hearth furnace, Crude steel,Electric furnace, Sinter, Steel	In-house EDGAR proxy
MNM	**Manure management**	Animals: buffaloes, cattles, chickens, ducks, goats, pigs, poultry, sheeps	livestock: http://livestock.geo-wiki.org/ buffaloes: http://www.fao.org/AG/AGAInfo/resources/en/glw/GLW_dens.html
		Grassland	Global Land Cover map JRC (2000)
NEU	**Non energy use of fuels**	Urban population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/
NFE	**Non-ferrous metals production**	Aluminum production (primary and secondary)	In-house EDGAR proxy
		Copper production (primary and secondary)	In-house EDGAR proxy based on USGS (https://mrdata.usgs.gov/mrds/)
		Magnesium production (primary and secondary)	In-house EDGAR proxy
		Lead production (primary and secondary)	In-house EDGAR proxy
		Zinc production (primary and secondary)	In-house EDGAR proxy based on USGS (https://mrdata.usgs.gov/mrds/)

		Urban population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/
NMM	**Non-metallic minerals production**	cement	In-house EDGAR proxy based on USGS (http://mrdata.usgs.gov/mineral-operations/) and EPRTR (http://prtr.ec.europa.eu) and CEC (http://takingstock.cec.org/)
		lime	In-house EDGAR proxy based on USGS (http://mrdata.usgs.gov/mineral-operations/) and EPRTR (http://prtr.ec.europa.eu) and CEC (http://takingstock.cec.org/)
		Urban population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/
PAP	**Production of pulp and paper**	paper	In-house EDGAR proxy based on EPRTR (http://prtr.ec.europa.eu) and CEC (http://takingstock.cec.org/)
PRO	**Fuel exploitation**	Coal mining: brown and hard coal	In-house EDGAR proxy based on EPRTR (http://prtr.ec.europa.eu) and USGS (https://www.usgs.gov/) and Global Energy Observatory (http://globalenergyobservatory.org/)
		gas flaring	In-house EDGAR proxy based on https://www.ngdc.noaa.gov/eog/viirs.html
		Gas pipelines transmission	In-house EDGAR proxy
		oil pipelines	In-house EDGAR proxy
		oil terminals	In-house EDGAR proxy based on World Port Index (PUB 150) (http://msi.nga.mil/MSISiteContent/StaticFiles/NAV_PUBS/WPI/Pub150bk.pdf)
		shipping tankers	In-house EDGAR proxy based on LRIT and Wang et al. (2007)
		population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/
		Roads: commercial heavy duty, residential	In-house EDGAR proxy based on OpenStreetMap
PRU	**Production and use of other products**	Urban population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/

RCO	**Energy for buildings**	fishing	In-house EDGAR proxy based on KNB (Benjamin Halpern, Melanie Frazier, John Potapenko, Kenneth Casey, Kellee Koenig, et al. 2015. Cumulative human impacts: raw stressor data (2008 and 2013). KNB Data Repository. doi:10.5063/F1S180FS.) https://knb.ecoinformatics.org/#view/raw_2013_inorganic_mol_20150714095441
		Rural population, urban population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/
REF_TRF	**Oil refineries and Transformation industry**	coke	In-house EDGAR proxy
		gas flaring	In-house EDGAR proxy based on https://www.ngdc.noaa.gov/eog/viirs.html
		Iron Blast furnace	In-house EDGAR proxy
		mining	In-house EDGAR proxy based on USGS (https://mrdata.usgs.gov/mrds/)
		oil refinerie	In-house EDGAR proxy
		oil terminals	In-house EDGAR proxy based on World Port Index (PUB 150) (http://msi.nga.mil/MSISiteContent/StaticFiles/NAV_PUBS/WPI/Pub150bk.pdf)
		Residential Roads	In-house EDGAR proxy based on OpenStreetMap
		Urban population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/
SOL	**Application of solvents**	Urban population, rural population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/
SWD_INC	**Solid waste incineration**	Solid waste incineration	In-house EDGAR proxy based on EPRTR (http://prtr.ec.europa.eu)
SWD_LDF	**Solid waste landfills**	Solid waste landfills	In-house EDGAR proxy based on EPRTR (http://prtr.ec.europa.eu) and CEC (http://takingstock.cec.org/)
TNR_Aviation_CDS	**Aviation climbing&descent**	domestic aviation climb-out/descending, international aviation climb-out/descending	In-house EDGAR proxy based on Airline Route Mapper (http://arm.64hosts.com/)
TNR_Aviation_CRS	**Aviation cruise**	domestic aviation cruise, international aviation cruise	In-house EDGAR proxy based on Airline Route Mapper (http://arm.64hosts.com/)
TNR_Aviation_LTO	**Aviation landing&takeoff**	domestic aviation takeoff landing, international aviation takeoff landing	In-house EDGAR proxy based on Airline Route Mapper (http://arm.64hosts.com/)
TNR_Aviation_SPS	**Aviation supersonic**	supersonic aviation	In-house EDGAR proxy

TNR_Other	**Railways, pipelines, off-road transport**	Residential Roads	In-house EDGAR proxy based on OpenStreetMap
		railways	In-house EDGAR proxy
TNR_Ship	**Shipping**	Shipping: cargo, passengers, tankers	In-house EDGAR proxy based on LRIT and Wang et al. (2007)
		inland waterways	In-house EDGAR proxy
TRO	**Road transportation**	Roads: commercial heavy and light duty, residential	In-house EDGAR proxy based on OpenStreetMap
WWT	**Waste water handling**	Waste water treatment	In-house EDGAR proxy based on EPRTR (http://prtr.ec.europa.eu) and CEC (http://takingstock.cec.org/)
		Urban population, rural population	In-house EDGAR proxy based on http://sedac.ciesin.columbia.edu/

S4 – Technologies and abatements in EDGAR v4.3.2

In this section an overview on the technologies and abatements implemented in EDGAR v4.3.2 is reported in Table S7. Additional details on the energy, industry and road transport sectors can be found in the supplementary material of Crippa et al. (2016) as well as in Tables S8-S11 for the energy sector and in Tables S12 and S13 for the transport sector, while table S14 gives an overview of the technologies implemented for the buildings sector.

Table S7 - Overview of the main technologies and abatements implemented in EDGAR v4.3.2.

Aggregated sectors	EDGAR sector	Sector description	References for technologies	References for abatements	Additional details
	AGS	**Agricultural soils**			
	AWB	**Agricultural waste burning**			
	ENF	**Enteric fermentation**	FAOSTAT (2014); IPCC (2006); Bouwman et al. (2005)		Janssens-Maenhout et al. (2017)
Agriculture	**MNM**	**Manure management**		Not applied	
Energy industry	**ENE**	**Power industry**	UCI Platts Power Plant Database (2008); Zhao et al. (2012)	IEA Clean coal power DB, 2008, http://www.iea-coal.co.uk/; EPRTR (2012), EPA (1992), Zhao et al. (2012)	Crippa et al. (2016)
Non-energy Industry	**IND**	**Combustion for manufacturing industry**	mainly from EMEP/EEA Emission Inventory Guidebook 2009; Bond et al., (2007) for coke ovens and cement plants	Abatement measures (e.g. fuel quality: sulphur and ash content) are included in the implied EFs calculations	Crippa et al. (2016)
Energy for buildings	**RCO**	**Energy for buildings**	EMEP/EEA Emission Inventory Guidebook 2009 (sect. on Small Combustion Installations)	No abatements applied	-
Transport	**TRO**	**Road transportation**	International Road Federation (IRF, 1990, 2005, 2007); Borken et al. (2007), CONCAWE; COPERT IV; GAINS; ACEA	CONCAWE (CONCAWE, report 6/1997 and 2/2001; dieselnet; ADB; Faiz, 1996: CAI ASIA; UNECE Corinair Guidebook,	Crippa et al. (2016)

				May 2008); RAINS model (IIASA, 2007); ACEA (2008); Eurostat (2007); UNECE transport statistic database (2007).	
	TNR_Aviation_CDS	**Aviation climbing&descent**			
	TNR_Aviation_CRS	**Aviation cruise**			
	TNR_Aviation_LTO	**Aviation landing&takeoff**			
	TNR_Aviation_SPS	**Aviation supersonic**	Eyers et al. (2005)	Not applied	
	TNR_Other	**Railways, pipelines, off-road transport**	Not applied	Not applied	
	TNR_Ship	**Shipping**	Dalsoeren et al. (2009)	Not applied	-
Production processes	**CHE**	**Production of chemicals**	EMEP/EEA Guidebook (2009)	Not applied	
	FOO	**Production of foods**	Not applied	Not applied	
	IRO	**Iron and steel production**	EMEP/EEA Guidebook (2009)	Not applied	
	NEU	**Non energy use of fuels**	EMEP/EEA Guidebook (2009)	Not applied	
	NFE	**Non-ferrous metals production**	EMEP/EEA Guidebook (2009)	Not applied	
	NMM	**Non-metallic minerals production**	CEMBUREAU	Kupainen and Klimont (2007)	
	PAP	**Production of pulp and paper**	Not applied	Not applied	
	SOL	**Application of solvents**	Not applied	Not applied	
	PRU	**Production and use of other products**	Not applied	Not applied	-
Fuel production and transformation	**PRO**	**Fuel exploitation**	EMEP/EEA Guidebook (2009)	Not applied	
	REF_TRF	**Oil refineries and Transformation industry**	EMEP/EEA Emission Inventory Guidebook 2009 (furnaces, gas turbines and internal combustion engines)	Abatament measures (i.e. sulphur and ash content) are included in the implied EFs	-

				calulations	
Other	**FFF**	**Fossil Fuel Fires**	Not applied	Not applied	
	SWD_INC	**Solid waste incineration (including hazardous wastes)**	Not applied	Not applied	
	SWD_LDF	**Solid waste landfills (including composted wastes)**	Not applied	Not applied	
Waste	**WWT**	**Waste water handling**	IPCC (2006);Van Drecht et al. (2009); Doorn and Liles (1999);Doorn et al. (1997)	Not applied	Janssens-Maenhout et al. (2017)

Table S8 – Overview of the technologies used in the energy sector in EDGAR v4.3.2.

Power industry (ENE)			
Process	**Description**	**Technology**	**Description**
ENE.PEL	public electricitiy production	**NSF**	Non-specified technology
ENE.CHP	public cogeneration of heat and electricity	**GF0**	grate firing
ENE.DHE	public district heating	**PW0**	Pulverized coal wet bottom
ENE.AEL	Autoproduced electricity	**PD0**	Pulverized coal dry bottom
ENE.AHP	Autoproduced cogeneration of heat and electricity	**FB0**	Fluidized bed
ENE.AHE	Autoproducer heat plants	**BO0**	Boiler for gas/liquids
ENE.POW	own of electricity and heat (no emission)	**IC0**	Internal combustion engine
ENE.PUM	pumped storage of electricity (no emission)	**GT0**	Gas turbine

Table S9 reports the control measures of NOx emissions from the Platts and IEA Clean Coal databases and applied in EDGAR v4.3.2 for the energy sector. Note that NOx abatement measures also influence NH3 emissions, increasing them by a factor 5.5 and 11.2 for SC1/SC2 and SN1/SN2, respectively.

Table S9 – Overview of the NOx abatements implemented for the energy sector in EDGAR v4.3.2.

Abatement code	Description	Emission reduction
CLN	Combustion modification: low nox burners	30%
CL0	Combustion modification: low excess air	30%
CAF	Combustion modification: air staging in furnace	30%
CFF	Combustion modification: flue gas recirculation - in furnace	30%
CR0	Combustion modification: reduced air preheat	30%
CSF	Combustion modification: fuel staging (burn or low nox	30%
SC1	Secondary: selective catalytic reduction	60%
SC2	Secondary: selective catalytic reduction+ combustion modification	90%
SN1	Secondary: selective non-catalytic reduction	30%
SN2	Secondary: selective non-catalytic reduction+ combustion modification	60%
NSN	SOxNOx combined measures	90%
NSF	Non-specified	0 %
NOC	No control	0 %

Table S10 reports the control measures of SOx emissions implemented in EDGAR v4.3.2 for the energy sector.

Table S10 – Overview of the SOx abatements implemented for the energy sector in EDGAR v4.3.2.

Abatement code	Description	Emission reduction
SND	Non-regenerative-dry (dry FGD)	50%
SNS	Non-regenerative semidry	90%
SNW	Non-regenerative wet (wet FGD)	90%
SRN	Regenerative	90%
NSN	SOxNOx	90%
NSF	Non-specified	0 %
NOC	No control	0 %

Table S11 reports the control measures of PM emissions implemented in EDGAR v4.3.2 for the energy sector.

Table S11 – Overview of the PM abatements implemented for the energy sector in EDGAR v4.3.2.

Abatement code	Description	Reduction PM10	Reduction PM2.5	Reduction BC	Reduction OC
ESP	Electrostatic precipitator	99.95 %	98.30 %	96.50 %	96.50 %
FBF	Fabric filter	99.95 %	99.60 %	99.60 %	99.60 %
CYC	Cyclone	90 %	0 %	0 %	0 %
SCR	Wet scrubber	99.90 %	99.50 %	98.50 %	98.50 %
COM	Combination of measures	99.95 %	98.30 %	96.50 %	96.50 %
NSF	Non specified	0 %	0 %	0 %	0 %
NOC	No control	0 %	0 %	0 %	0 %

Abatement measures for the road transport sector were mainlyb retrieved from CONCAWE (CONCAWE, report 6/1997 and 2/2001; National Communications, dieselnet,http://www.dieselnet.com, ADB, Faiz, 1996, CAI ASIA, UNECE Corinair Guidebook, May 2008). Also the information of the EU27 of the emissions standards of the RAINS model (IIASA, 2007) was taken into account and percentage reduction (non control measures to EURO 4 standard, US and Japans regulated standards) from 1970 onwards for the respective technology and substance was implemented. Specific methodologies for non-EU countries were developed both for the technologies and abatements for this sector.

Table S12 – Technologies implemented for the road transport sector in EDGAR v4.3.2.

Process	Technology	Description
TRO.ROA	**BS0**	Buses
	HD0	Heavy Duty vehicles
	LD0	Light Duty vehicles
	PC0	Passenger cars
	MC0	Motorcylces
	MP0	Mopeds (Scooters)

Table S13 – Abatements implemented for the road transport sector in EDGAR v4.3.2 in Europe and USA.

Abatement measure (EU)	Description
NOC	Non controlled or conventional
PEU	Pre Euro standards (EU technologies before 1990 were combined together to PEU)
EU1-EU5	From Euro standard 1 to 5
For bus (globally)	
PEU	Pre Euro standards
EU1-EU3	From Euro standard 1 to 3
EEV	Standard for Enhanced Environmental Vehicles
Abatement measure (North America)	
NOC	Non controlled or conventional
PEU	Pre standards (technologies before 1990 were combined together to PEU)
UT1-UT3	From US Tier 1 to 3
PH1-PH2	From US Phase Tier1 to 2 (used for HDV)

Table S14 – Technologies implemented for the buildings sector in EDGAR v4.3.2, based on the EMEP/EEA Guidebook (2009).

	Technology	Description
	NSF	non-specified combustion technology
	FRP	Fireplace (both heating and esthetical)
	STV	Stoves (either for cooking or heating)
	SBO	Small boilers (<50 kWth) for single household heating
	MBO	Medium boilers (50 kWth-50MW) for multi-residential or commercial buildings
RCO	CHP	Combined heat and electricity production (in large buildings)

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