Short description for TNO European emissions at 1/10° x 1/20° resolution (TNO_GHGco_v1.1)

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The TNO Greenhouse gas and co-emitted species (TNO_GHGco) emission inventory provides annual emissions of CO_2 and CH_4 as well as the co-emitted species CO, NOx and NMVOC at high spatial resolution for UNECE-Europe for the years 2005-2015. Please find in the tables below the characteristics of the emission file as well as the explanation of GNFR sectors.

TNO_GHGco_v1.1 emissions characteristics	
Pollutants covered	CO_2_ff (fossil fuel), CO_2_bf (biofuel), CO_ff (fossil fuel), CO_bf (biofuel), CH_4, NO_x (as NO_2), NMVOC
Resolution	0.1° x 0.05° (longitude latitude, ~ 6x6 km over central Europe)
Period covered	2005-2015 (annual emissions)
Domain	30° W – 60° E 30° N – 72°N
Sector aggregation	GNFR (A to L), with GNFR F (Road Transport) split in F1 to F4 (total 15 sectors) ***(see Table 2)***
Emission unit	kg (both in CSV and NetCDF files)
Countries	42 countries + 13 sea regions ***(see Annex)*** ***Note:*** Emissions for non-European countries within the domain are added based on EDGAR v4.3.2

Table 1: Characteristics of the European emissions for TNO_GHGco_v1.1 emissions

Table 2 provides the explanation of the GNFR sectors, including the split that was made for road transport specifically to distinguish different fuel types.

GNFR_Category	GNFR_Category_Name	Link to SNAP
A	A_PublicPower	SNAP 1, only power and heat plants
B	B_Industry	SNAP 1 (non-power and heat plants) + SNAP 34 (or SNAP 3+4)
C	C_OtherStationaryComb	SNAP 2
D	D_Fugitives	SNAP 5
E	E_Solvents	SNAP 6
G	G_Shipping	SNAP 8, only shipping (all types)
H	H_Aviation	SNAP 8, only aviation
I	I_OffRoad	SNAP 8, non-shipping and non-aviation
J	J_Waste	SNAP 9
K	K_AgriLivestock	SNAP 10, livestock only
L	L_AgriOther	SNAP 10, non-livestock only
F1	F_RoadTransport_exhaust_gasoline	SNAP 71
F2	F_RoadTransport_exhaust_diesel	SNAP 72
F3	F_RoadTransport_exhaust_LPG_gas	SNAP 73
F4	F_RoadTransport_non-exhaust	SNAP 74 + SNAP 75 Note that SNAP 74 has only NMVOC and SNAP 75 has only PM emissions

Table 2: GNFR Sector explanation and link to SNAP nomenclature previously used in TNO-MACC-III

Time profiles

In addition to the grid files, temporal profiles are provided per GNFR sector code (consisting of a variation between months, between days of the week and hours in the day). These can be used to disaggregate from annual emissions to hourly emissions as needed.

Results

Annual emissions 2015 per country are shown in Table 3.

Figure 1 shows annual total emissions (year 2015) for CO2 from fossil fuels (top panel) and CO2 from biofuels (bottom panel).

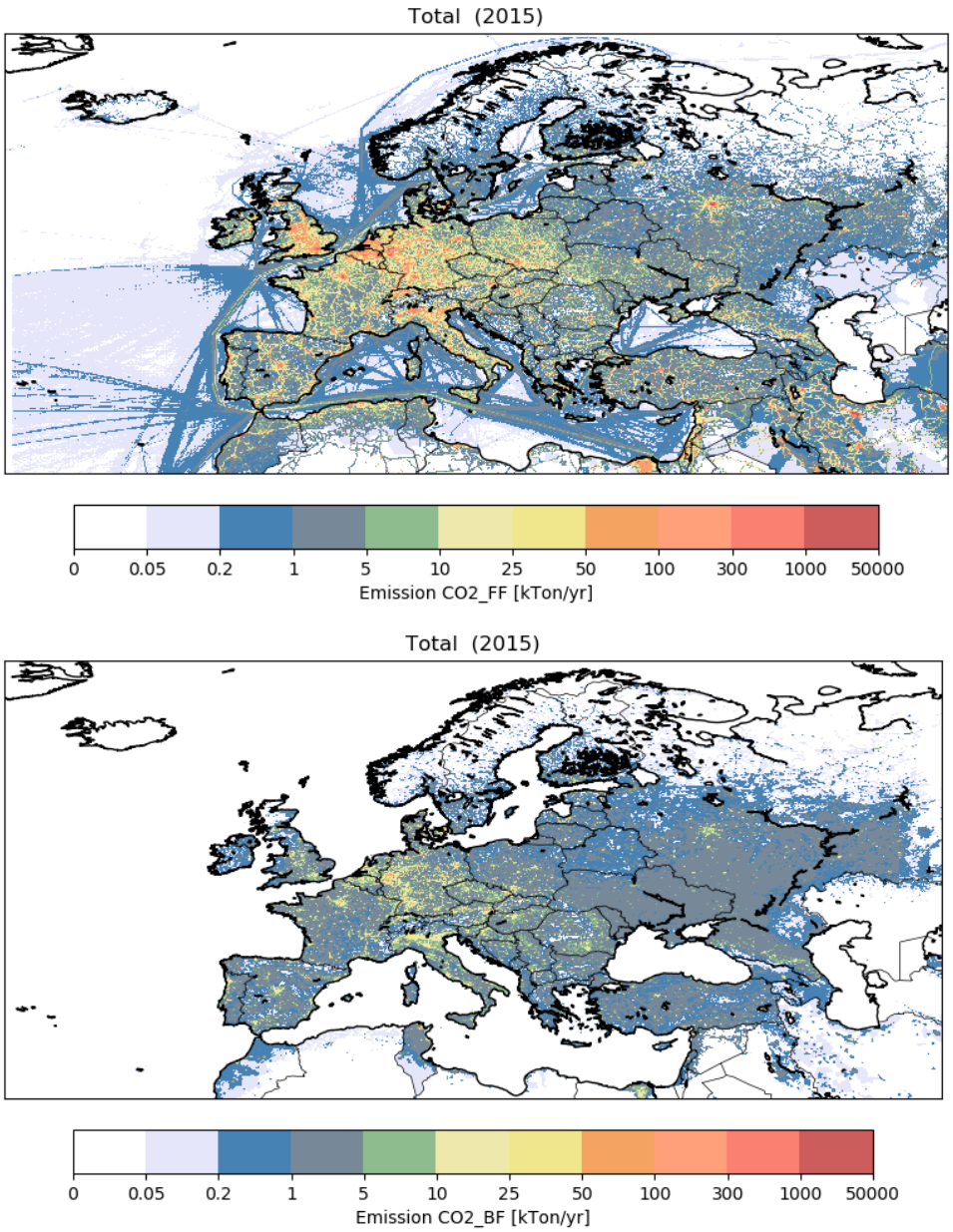

Figure 3: Spatially distributed annual emissions for CO2_ff and CO2_bf (year 2015)

Country		CO2_ff	CO2_bf	CO_ff	CO_bf	NOX	CH4	NMVOC
EU15 plus Norway/Switzerland	AUT	66 722	23 399	317	248	138	263	113
	BEL	101 417	12 269	298	103	187	324	92
	CHE	38 572	4 971	149	37	60	204	78
	DEU	791 558	102 145	2 217	473	1 071	2 241	822
	DNK	35 086	15 779	218	106	81	279	73
	ESP	269 328	36 974	671	892	742	1 548	547
	FIN	43 923	38 686	159	143	120	196	71
	FRA	343 866	58 995	1 633	1 217	807	2 398	614
	GBR	414 196	36 006	1 395	214	878	2 113	726
	GRC	81 072	6 261	798	200	196	406	183
	IRL	38 110	2 025	93	21	73	531	62
	ITA	353 471	45 182	859	1 467	665	1 735	826
	LUX	5 371	421	10	6	12	25	8
	NLD	164 866	12 847	486	84	211	763	139
	NOR	42 347	4 493	276	104	114	202	145
	PRT	51 521	12 581	92	192	158	437	180
	SWE	40 456	29 323	272	160	110	196	134
New Member States	BGR	48 227	6 583	130	205	123	293	94
	CYP	6 852	148	13	1	15	35	7
	CZE	103 790	16 944	322	210	165	557	144
	EST	15 843	4 093	52	83	29	43	19
	HRV	17 860	6 612	82	156	49	140	57
	HUN	46 751	12 692	190	276	109	307	122
	LTU	13 141	6 125	40	113	46	138	54
	LVA	7 214	6 399	36	105	32	77	36
	MLT	1 694	27	2	1	3	7	2
	POL	310 313	35 750	1 793	643	669	1 887	535
	ROU	78 747	21 553	227	699	215	1 184	277
	SVK	33 861	7 604	165	69	79	175	83
	SVN	13 598	2 984	39	72	34	82	26
Non-EU countries	ALB	5 047	1 243	25	54	16	101	26
	BIH	15 680	3 812	34	195	31	119	55
	BLR	57 698	10 993	250	222	156	608	174
	ISL	2 899	-	118	0	9	22	5
	KOS	6 609	1 368	53	69	25	56	25
	MDA	6 176	1 789	39	78	15	86	30
	MKD	9 447	1 763	24	80	28	48	24
	MNE	1 928	669	22	32	7	20	12
	RUS	978 822	108 603	5 531	4 066	2 090	16 173	2 299
	SRB	45 370	5 704	208	281	88	204	102
	TUR	386 360	36 660	1 589	1 429	926	1 894	644
	UKR	294 834	27 334	2 308	1 077	642	3 137	500
Sea regions	ATL*	34 709	-	56	-	797	-	6
	BAS	16 079	-	22	-	342	-	3
	BLS	7 099	-	11	-	149	-	1
	MED	54 851	-	83	-	1 237	-	10
	NOS**	31 224	-	48	-	643	-	6
	OTH***	1 599	-	2	-	32	-	0

Table 3: Annual country total emissions for the year 2015 (kton) in TNO_GHGco_v1.1

List of countries included

Country Group	ISO3	Country Name
EU 15	AUT	Austria
	BEL	Belgium
	CHE	Switzerland
	DEU	Germany
	DNK	Denmark
	ESP	Spain
	FIN	Finland
	FRA	France
	GBR	United Kingdom
	GRC	Greece
	IRL	Ireland
	ITA	Italy
	LUX	Luxembourg
	NLD	Netherlands
	NOR	Norway
	PRT	Portugal
	SWE	Sweden
EU New Member States (NMS)	BGR	Bulgaria
	CYP	Cyprus
	CZE	Czech Republic
	EST	Estonia
	HRV	Croatia
	HUN	Hungary
	LTU	Lithuania
	LVA	Latvia
	MLT	Malta
	POL	Poland
	ROU	Romania
	SVK	Slovakia
	SVN	Slovenia

Country Group	ISO3	Country Name
Non EU countries	ALB	Albania
	BIH	Bosnia and Herzegovina
	BLR	Belarus
	ISL	Iceland
	KOS	Kosovo
	MDA	Moldova
	MKD	Macedonia
	MNE	Montenegro
	RUS	Russian Federation
	SRB	Serbia
	TUR	Turkey
	UKR	Ukraine
Sea regions	ATL	Atlantic Ocean
	BAR	Barentz Sea
	BAS	Baltic Sea
	BLS	Black Sea
	CAS	Caspian Sea
	ENC	English Channel
	GRS	Greenland Sea
	IRC	Irish Sea
	KAR	Kara Sea
	MED	Mediterranean Sea
	NOS	North Sea
	NWS	Norwegian Sea
	PSG	Persian Gulf

Structure of the dataset

The data in the CSV file are probably self explaining using the information in the header.

- Lon (longitude)
- Lat (latitude)
- ISO3 (country code)
- Year
- GNFR sector code
- SourceType (A for an area source, P for a point source)
- Emissions (different pollutants in different columns, as defined in the top row)

The NetCDF has already the information included on the structure and characteristics of the dataset.

Update v1.1

Version 1.1 has been released just before Christmas 2018 and contains a number of bug fixes and error corrections. Generally these are small, but up to a few % of CO2 emissions has been changed, and also the allocation between fossil and biofuel for CO2 and CO has been revised.
We recommend to use v1.1 instead of v1.0 when possible.

If you are using these data and find anything you think may be an issue, please provide your feedback to TNO (see email addresses on the top of this document) so this can be taken into account for possible future updates.