



Supplement of

Global anthropogenic emissions (CAM5-GLOB-ANT) for the Copernicus Atmosphere Monitoring Service simulations of air quality forecasts and reanalyses

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Supplement Tables

Table S1: Sector correspondence between CAMS-GLOB-ANT, EDGARv5 and CEDS sectors

5

CAMS-GLOB-ANTv5 sectors	EDGARv5 Sectors	CEDS sectors	Species
Power generation (ENE)	ene	1A1a Electricity-autoproducer	CO ₂ excluding short cycle, CO ₂ organic cycle, CH ₄ , N ₂ O, BC, CO, NH ₃ , NMVOCs, NO _x , OC, SO ₂
		1A1a Electricity-public	
		1A1a Heat-production	
		1A5 Other-unspecified	
Refineries (REF)	ref_trf	1A1bc_Other-transformation	CO ₂ excluding short cycle, CO ₂ organic cycle, CH ₄ , N ₂ O, BC, CO, NH ₃ , NMVOCs, NO _x , OC, SO ₂
Industrial processes (IND)	ind	1A2a Ind-Comb-Iron-steel	CO ₂ excluding short cycle, CO ₂ organic cycle, CH ₄ , N ₂ O, BC, CO, NH ₃ , NMVOCs, NO _x , OC, SO ₂
		1A2b Ind-Comb-Non-ferrous-metals	
		1A2c Ind-Comb-Chemicals	
		1A2d Ind-Comb-Pulp-paper	
		1A2e Ind-Comb-Food-tobacco	
		1A2f Ind-Comb-Non-metalic-minerals	
		1A2g Ind-Comb-Construction	
		1A2g Ind-Comb-machinery	
		1A2g Ind-Comb-mining-quarrying	
		1A2g Ind-Comb-other	
		1A2g Ind-Comb-textile-leather	
		1A2g Ind-Comb-transpequip	
	1A2g Ind-Comb-wood-products		
	nmm	2A1 Cement-production	CO ₂ excluding short cycle, BC, CO, NH ₃ , NMVOCs, SO ₂
		2A2 Lime-production	
		2Ax Other-minerals	
	che	2B Chemical-industry	CO ₂ excluding short cycle, CH ₄ , N ₂ O, BC, CO, NH ₃ , NMVOCs, NO _x , OC, SO ₂
		2B2 Chemicals-Nitric-acid	
		2B3 Chemicals-Adipic-acid	
		2D_Chemical-products-manufacture-processing	
iro		2C_Metal-production	CO ₂ excluding short cycle, CH ₄ , BC, CO, NH ₃ , NMVOCs, NO _x , OC, SO ₂
foo_pap		2H_Pulp-and-paper-food-beverage-wood	BC, CO, NMVOCs, NO _x , SO ₂

	nfe	Not in CEDS	CO ₂ _excluding_short_cycle, BC, CO, NO _x , SO ₂
Road transportation (TRO)	tro_res	1A3b Road	BC, OC
	tro_nores	1A3b_Road	CO ₂ _excluding_short_cycle, CO ₂ _organic_cycle, CH ₄ , N ₂ O, BC, CO, NH ₃ , NMVOCs, NO _x , OC, SO ₂
Non-road transportation (TNR)	tnr_other	1A3c Rail	CO ₂ _excluding_short_cycle, CO ₂ _organic_cycle, CH ₄ , N ₂ O, BC, CO, NH ₃ , NMVOCs, NO _x , OC, SO ₂
		1A3eii_Other-transp	
Ships (SHP)	tnr_ship	1A3di Oil Tanker Loading	CO ₂ _excluding_short_cycle, CH ₄ , BC, CO, NMVOCs, NO _x , OC, SO ₂
		1A3dii_Domestic-navigation	
Residential (RCO)	rco	1A4a Commercial-institutional	CO ₂ _excluding_short_cycle, CO ₂ _organic_cycle, CH ₄ , N ₂ O, BC, CO, NH ₃ , NMVOCs, NO _x , OC, SO ₂
		1A4b_Residential	
Fugitives emissions from fuels (FEF)	fff	7A_Fossil-fuel-fires	CO ₂ _excluding_short_cycle, CH ₄ , N ₂ O, BC, CO, NMVOCs, NO _x , OC, SO ₂
	pro	1B1 Fugitive-solid-fuels	CO ₂ _excluding_short_cycle, CH ₄ , N ₂ O, BC, CO, NMVOCs, NO _x , OC, SO ₂
		1B2 Fugitive-petr	
		1B2b Fugitive-NG-distr	
		1B2d Fugitive-other-energy	
Fugitives emissions for methane (FEF_COAL, FEF_GAS, FEF_OIL)	pro_coal pro_oil pro_gas	1B1 Fugitive-solid-fuels	CH ₄
		1B2 Fugitive-petr	
		1B2b Fugitive-NG-distr	
		1B2b Fugitive-NG-prod	
		1B2d Fugitive-other-energy	
Solvents application and production (SLV)	pru_sol	2D Degreasing-Cleaning	CO ₂ _excluding_short_cycle, N ₂ O, NH ₃ , NMVOCs
		2D Other-product-use	
		2D_Paint-application	
Agriculture livestock (AGL)	mnm	3B_Manure-management	CH ₄ , N ₂ O, NH ₃ , NMVOCs, NO _x
	enf	3E_Enteric-fermentation	
Agriculture soils (AGS)	ags	1A4c Agriculture-forestry-fishing	CO ₂ _excluding_short_cycle, CH ₄ , N ₂ O, NH ₃ , NO _x
		3D Rice-Cultivation	
		3D Soil-emissions	
		3I Agriculture-other	
	ide	7BC_Indirect-N2O-non-agricultural-N	

Solid waste and wastewater handling (SWD)	swd_ldf	5A_Solid-waste-disposal	CO ₂ _excluding_short_cycle, CO ₂ _organic_cycle, CH ₄ , N ₂ O, BC, CO, NH ₃ , NMVOCs, NO _x , OC, SO ₂
	swd_inc	5C_Waste-combustion	
		5E_Other-waste-handling	
	wwt	5D_Wastewater-handling	NH ₃ , NMVOCs
Agriculture waste burning (AWB)	awb	Not in CEDS	CH ₄ , N ₂ O, BC, CO, NH ₃ , NMVOCs, NO _x , OC, SO ₂
Indirect emissions from NO_x and NH₃ (DEP)	Ide	7BC_Indirect-N2O-non-agricultural	N ₂ O

Table S2: List of VOCs considered in the inventory and corresponding sectors

Name	Real name	ENE	RCO	TRO	TNR	FEF	SLV	AGR	SHP	SWD
voc1	Alcohols	X	X	X	X	X	X		X	X
voc2	Ethane	X	X	X	X	X	X	X	X	X
voc3	Propane	X	X	X	X	X	X	X	X	X
voc4	Butanes	X	X	X		X	X	X		X
voc5	Pentanes	X	X	X	X	X	X	X	X	X
voc6	Hexanes	X	X	X	X	X	X	X	X	X
voc7	Ethene	X	X	X	X	X	X	X	X	X
voc8	Propene	X	X	X	X	X	X	X	X	X
voc9	Ethyne	X	X	X	X	X	X	X	X	X
voc10	Isoprenes	X	X	X	X	X	X	X	X	X
voc11	Monoterpenes	X	X	X	X		X	X	X	X
voc12	Other alkadienes	X	X	X	X	X	X	X	X	X
voc13	Benzene	X	X	X	X	X	X	X	X	X
voc14	Methylbenzene	X	X	X	X	X	X	X	X	X
voc15	Dimethylbenzenes	X	X	X	X	X	X	X	X	X
voc16	Trimethylbenzenes	X	X	X	X	X	X	X	X	
voc17	Other aromatics	X	X	X	X	X	X	X	X	X
voc18	Esters	X	X	X	X	X	X		X	X
voc19	Ethers	X	X	X	X	X	X	X	X	X
voc20	Chlorinated	X	X	X	X	X	X		X	
voc21	Methanal	X	X	X	X	X	X	X	X	X
voc22	Other alkanals	X	X	X	X	X	X	X	X	X
voc23	Alkanones	X	X	X	X	X	X	X	X	
voc24	Acids	X	X	X	X		X		X	X
voc25	Others	X	X	X	X	X	X	X	X	X

Table S3: Altitude of the 25 levels (center of the altitude level) in CAMS-GLOB-AIR, the emissions from aircraft.

Altitude level	Altitude (km)
1	0.305
2	0.915
3	1.525
4	2.135
5	2.745
6	3.355
7	3.965
8	4.575
9	5.185
10	5.795
11	6.405
12	7.015
13	7.625
14	8.235
15	8.845
16	9.455
17	10.065
18	10.675
19	11.285
20	11.895
21	12.505
22	13.115
23	13.725
24	14.335
25	14.945

- 10 Table S4: This table indicates the global totals for 2 groups of sectors, transportation (sum of road and non-road transportation) and energy + industrial activities (sum of the sectors called power generation, refineries, industrial processes, fugitive and solvents) for the years 2000, 2012 and 2021, as well as the 2000-2012 and 2012-2021 changes.

	Transportation					Energy/industrial				
	2000	2012	2023	Change 2012-2000	Change 2023-2012	2000	2012	2021	Change 2012-2000	Change 2023-2012
CO ₂ (excl)	5,480	6,559	7,276	+20%	+11%	16,525	24,561	25,505	+49%	+4%
CH ₄	0.76	0.90	1.09	+19%	+21%	83.8	113.3	123.6	+35%	+9%
CO	265.5	186.2	162.1	-30%	-13%	95.3	158.0	156.5	+63%	-1%
NO _x	39.2	35.9	32.0	-8%	-11%	27.3	36.1	32.6	+32%	-10%
NMVOCS	29.0	28.5	25.8	-2%	-9%	60.7	78.1	82.2	+29%	+5%
SO ₂	14.9	11.1	3.23	-34%	-70%	75.6	87.0	66.2	+12%	-24%
BC	0.69	0.67	0.53	-3%	-18%	1.35	2.23	1.92	+35%	-14%
OC	0.82	0.76	0.62	-7%	-18%	1.17	2.11	1.81	+80%	-14%
NH ₃	0.49	0.71	0.72	+45%	+1%	1.61	2.12	2.25	+32%	+6%
Benzene	1.5	1.2	0.96	-20%	-20%	2.05	3.02	3.07	+47%	+1%

15

- Table S5: This table indicates the global totals for 2 sectors of groups of sectors, residential and agriculture + waste (livestock, soils, waste burning and waste management) for the years 2000, 2012 and 2021, as well as the 2000-2012 and 2012-2021 changes.

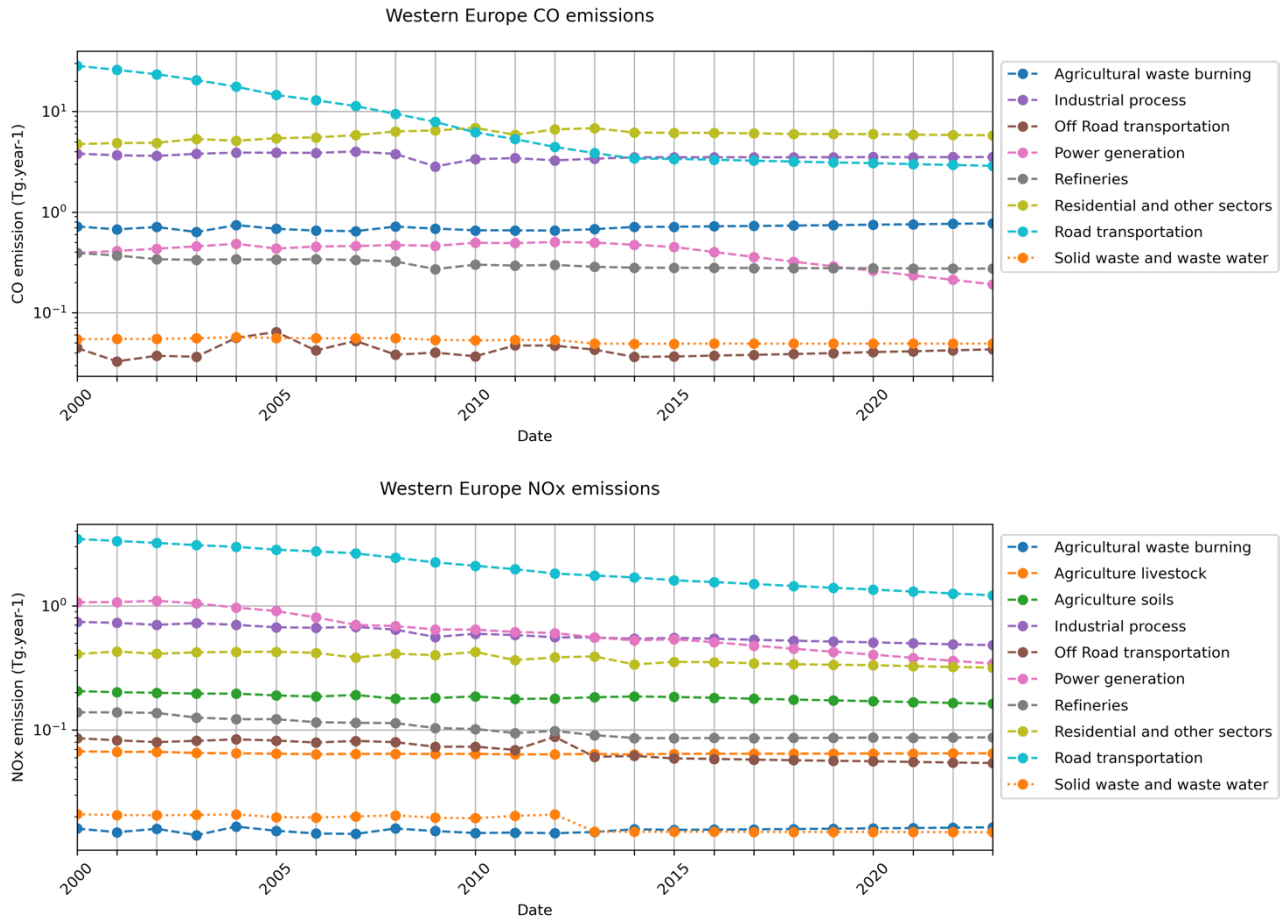
	Residential					Agriculture + waste				
	2000	2012	2023	Change 2012-2000	Change 2023-2012	2000	2012	2021	Change 2012-2000	Change 2023-2012
CO ₂ (excl)	3020	3230	3590	+7%	+11%	11.9	13.0	13.3	+9%	+2%
CH ₄	12.2	12.8	13.1	+5%	+2%	204	231	240	+13%	+4%
CO	158	168	166	+6%	-1%	37.1	50.8	57.4	+37%	+13%
NO _x	3.24	3.53	3.6	+9%	+2%	2.97	3.61	3.76	+21%	+4%
NMVOCS	22.6	24.3	24.1	+7%	-1%	9.46	11.9	12.8	+25%	+8%
SO ₂	7.0	6.7	6.15	-4%	-8%	0.28	0.36	0.38	+28%	+5%
BC	1.49	1.54	1.54	+3%	+0%	0.27	0.36	0.40	+38%	+11%
OC	6.09	6.21	6.07	+2%	-2%	1.86	2.49	2.67	+34%	+7%
NH ₃	3.40	3.72	3.88	+9%	+4%	35.4	42.2	43.8	+19%	+4%
Benzene	0.93	1.02	0.88	+10%	-14%	0.56	0.70	0.69	+25%	-1%

20

Supplement Figures

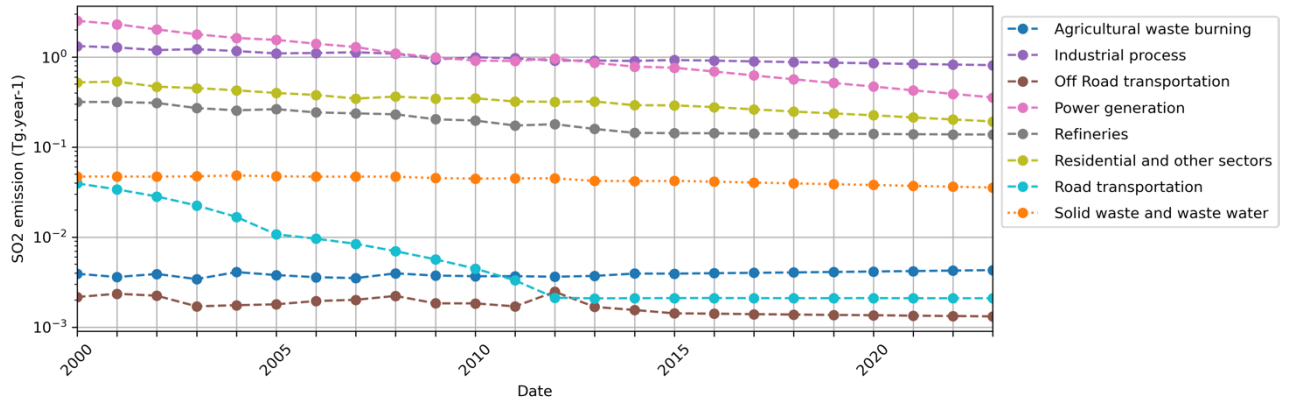
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Figure S1: Changes in the CAMS-GLOB-ANT_v5.3 emissions of CO, NO_x, NMVOCs and SO₂ for the 2000-2023 period in Western Europe. In order to show the emissions for all sectors, a logarithmic scale is used.

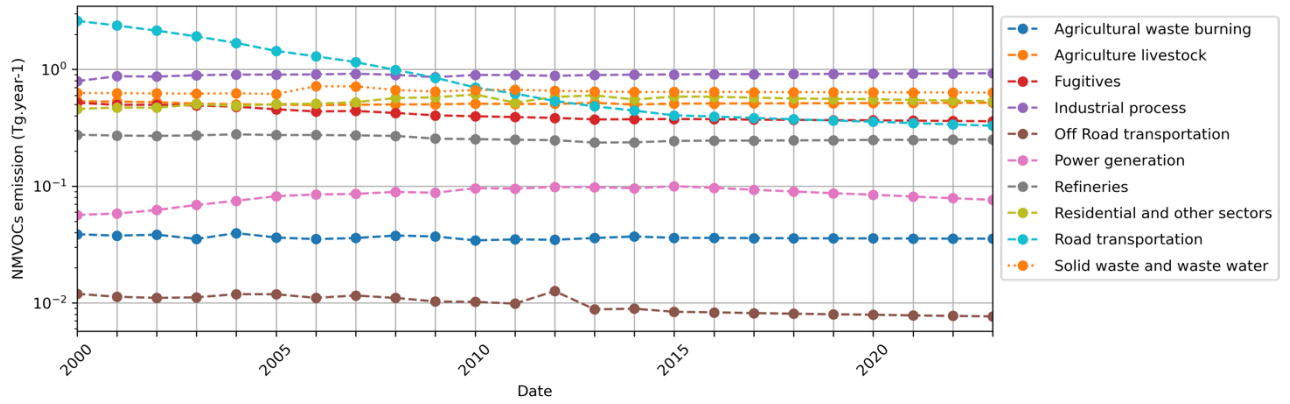


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Western Europe SO2 emissions



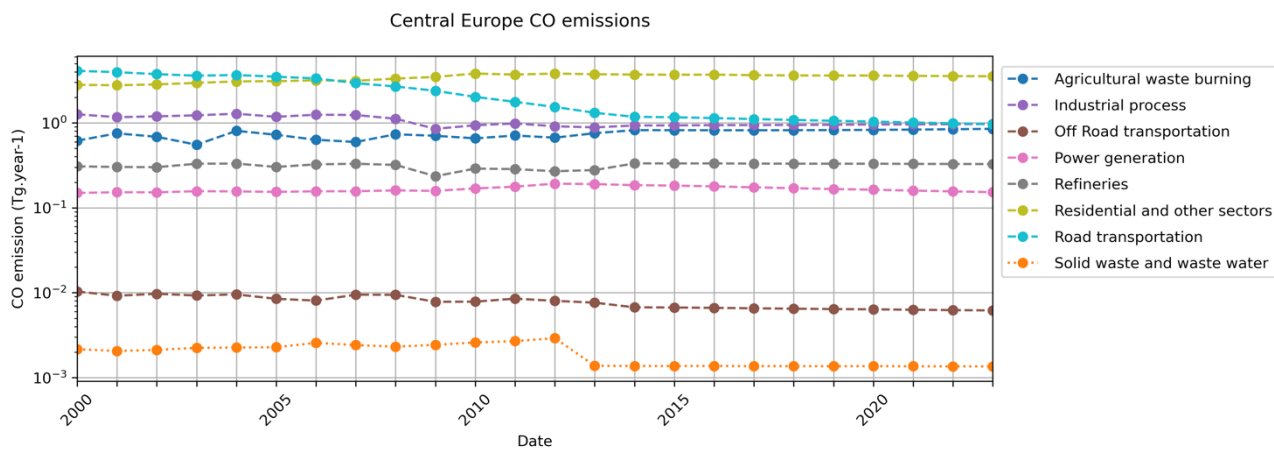
Western Europe NMVOCs emissions



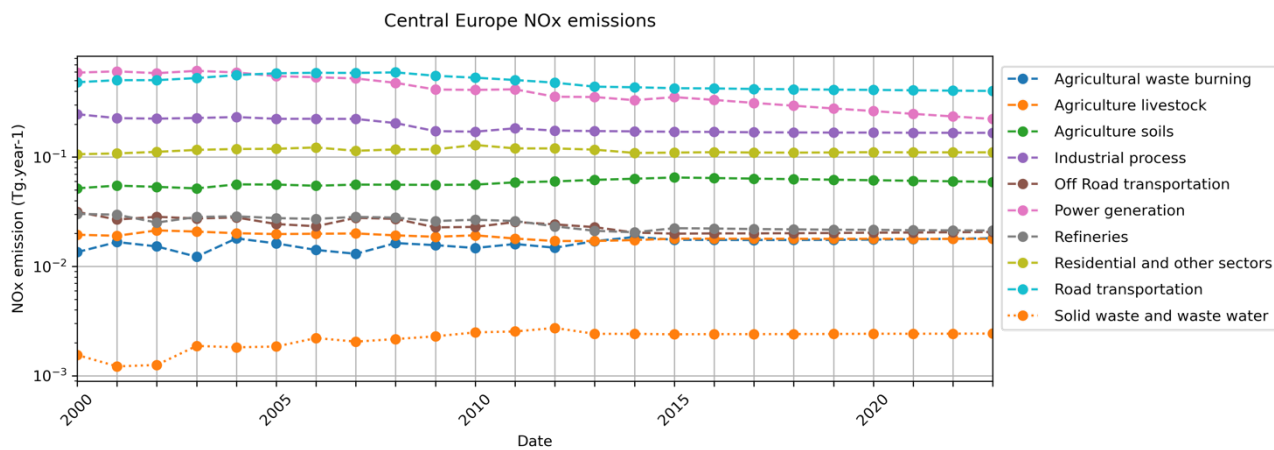
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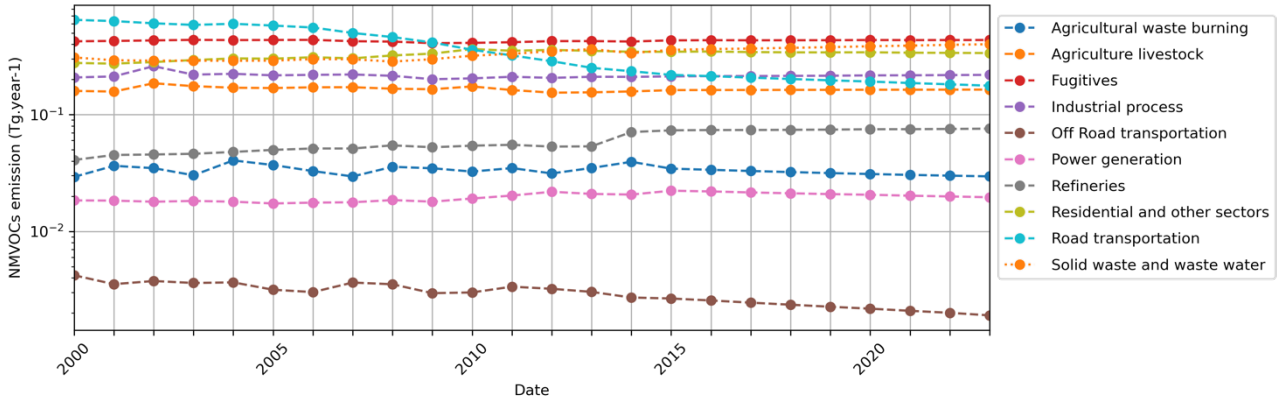
Figure S2: changes in the CAMS-GLOB-ANT_v5.3 emissions of CO, NO_x, NMVOCs and SO₂ for the 2000-2023 period in Central Europe. In order to show the emissions for all sectors, a logarithmic scale is used.



45



Central Europe NMVOCs emissions



Central Europe SO2 emissions

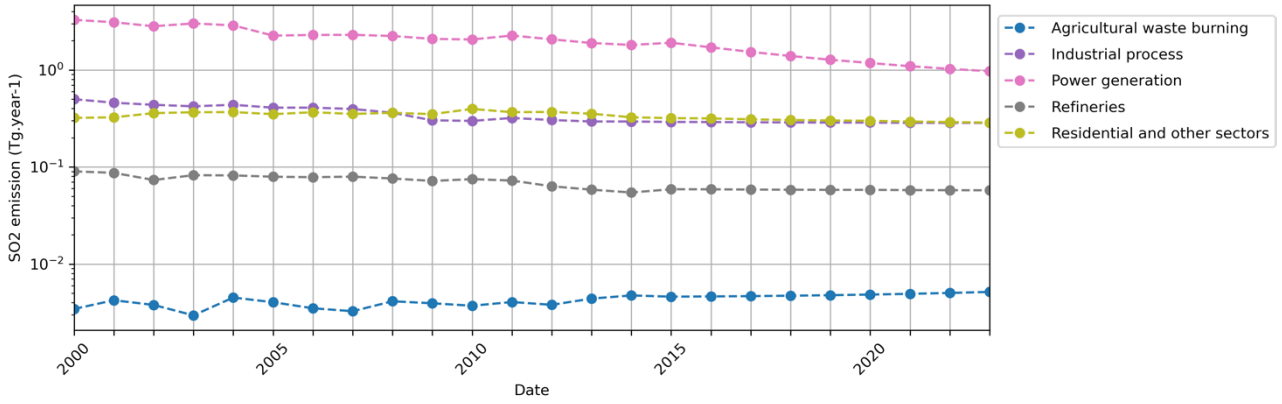
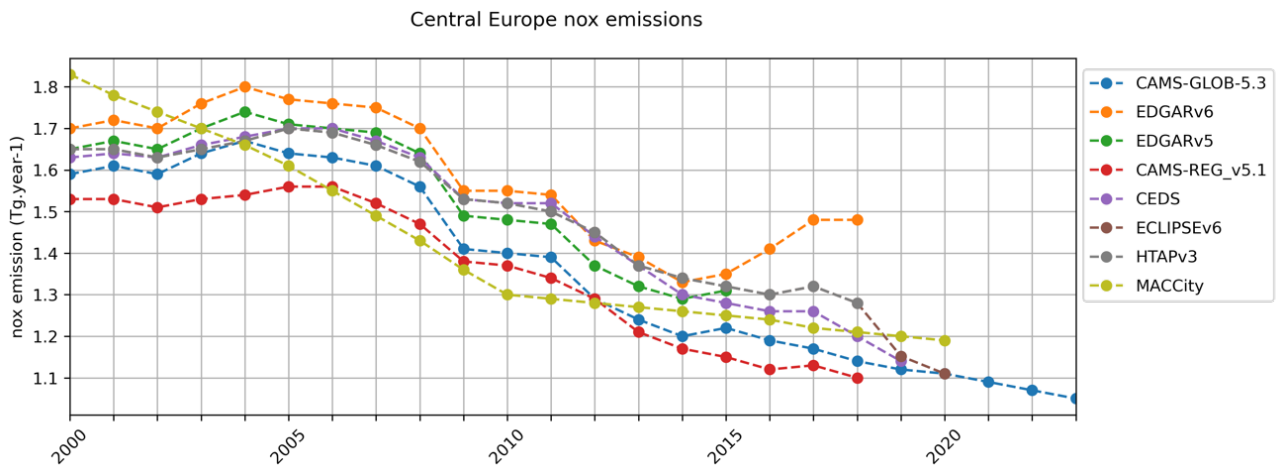
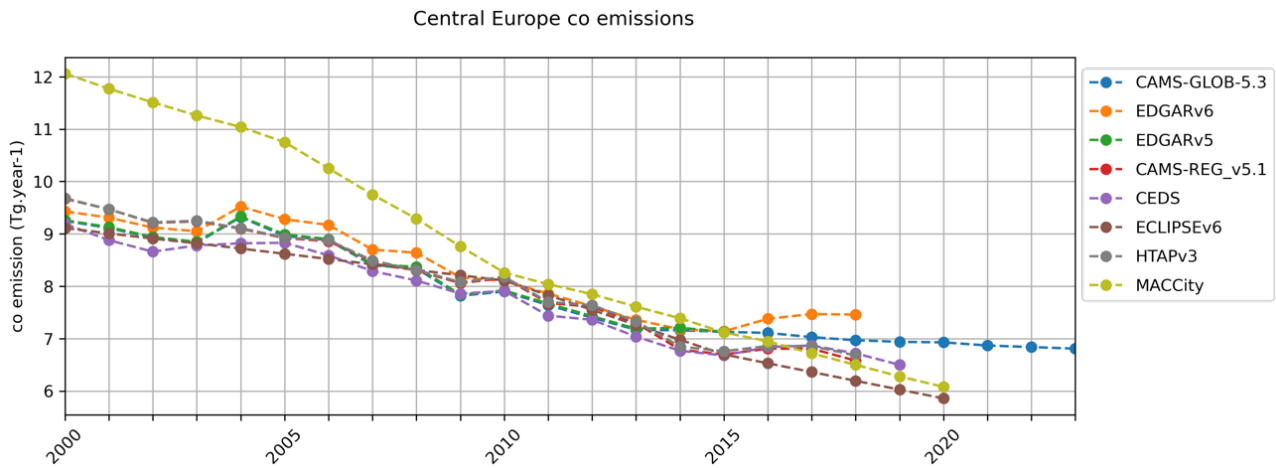
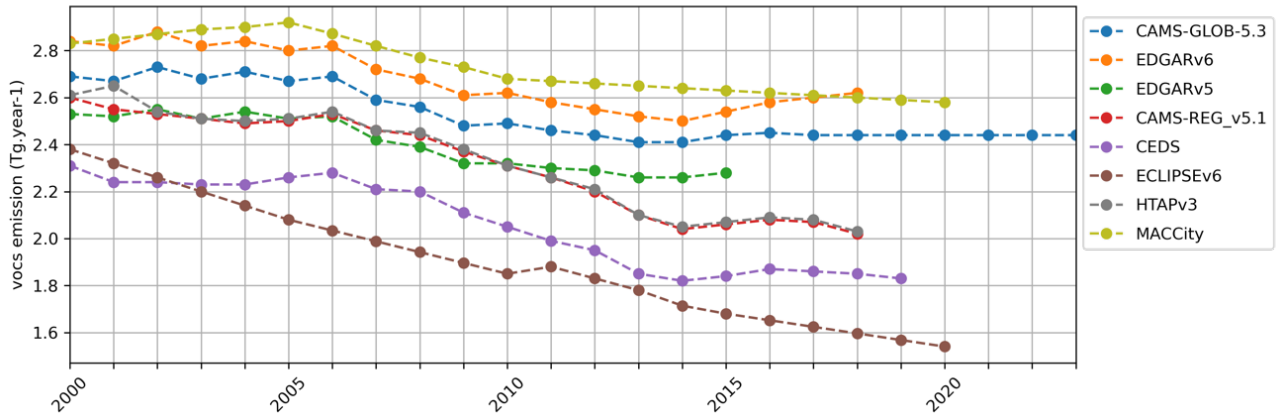


Figure S3: Comparisons of the CAMS-GLOB-ANT_v5.3 emissions with other global datasets and the CAMS-REG_V5.1 inventory for Central Europe.

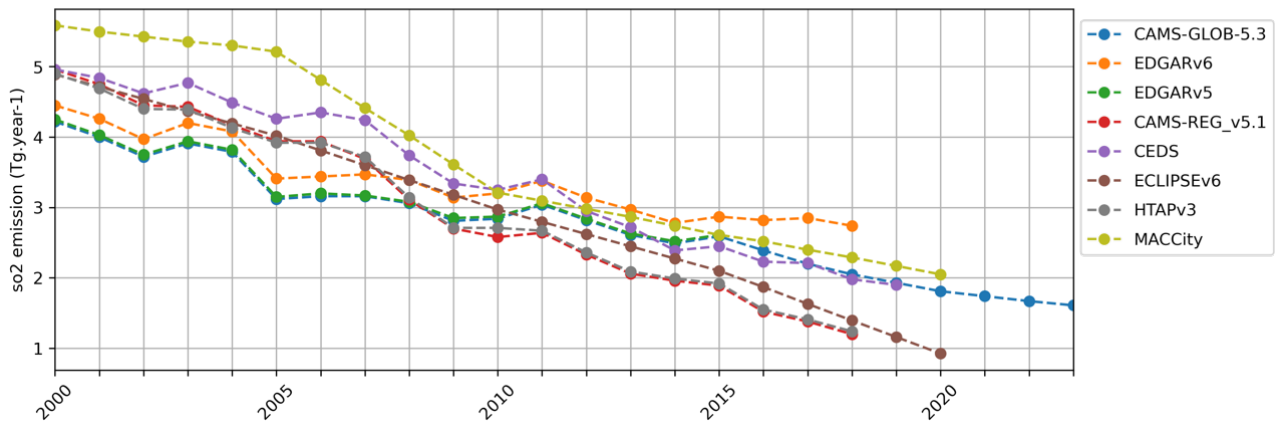


Central Europe vocs emissions



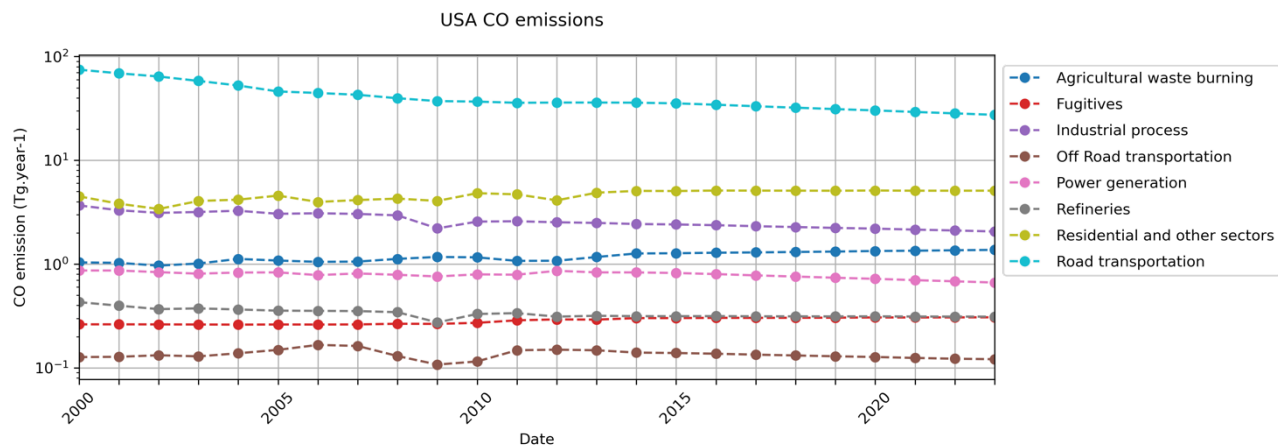
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Central Europe so2 emissions

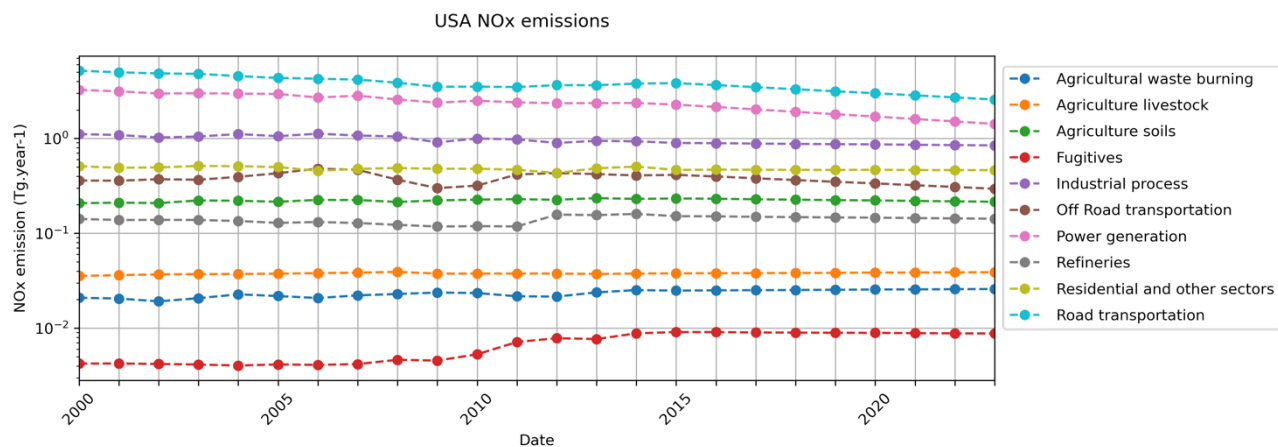


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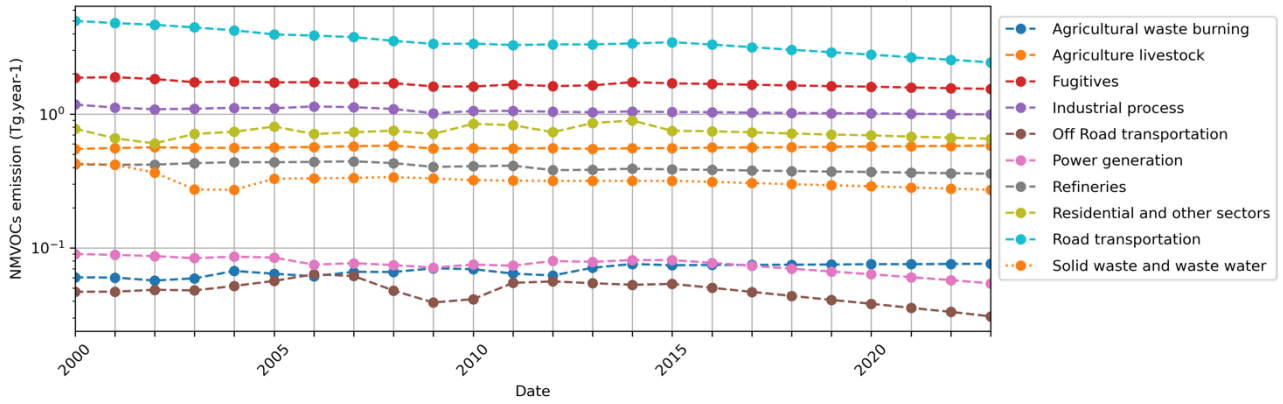
Figure S4: changes in the CAMS-GLOB-ANT_v5.3 emissions of CO, NO_x, NMVOCs and SO₂ for the 2000-2023 period in the USA. In order to show the emissions for all sectors, a logarithmic scale is used.



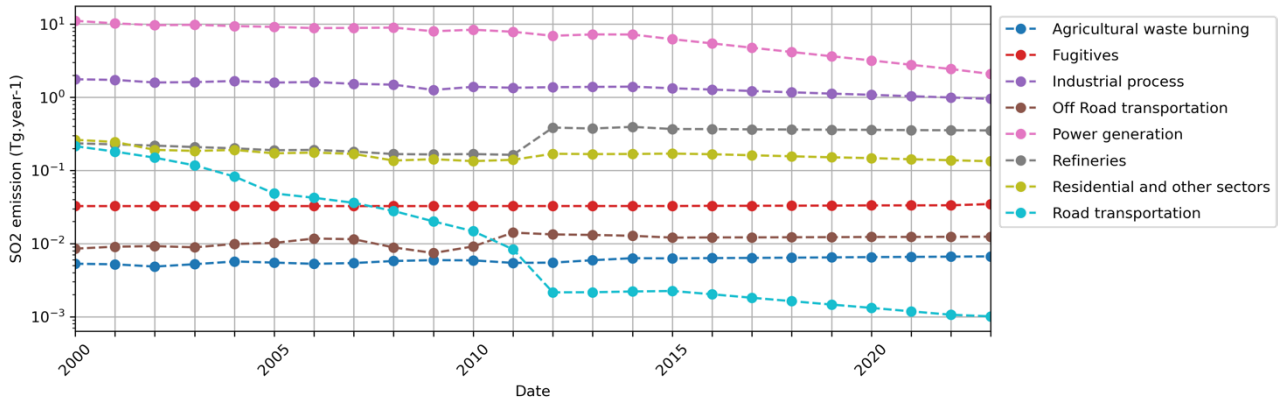
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USA NMVOCs emissions



USA SO2 emissions

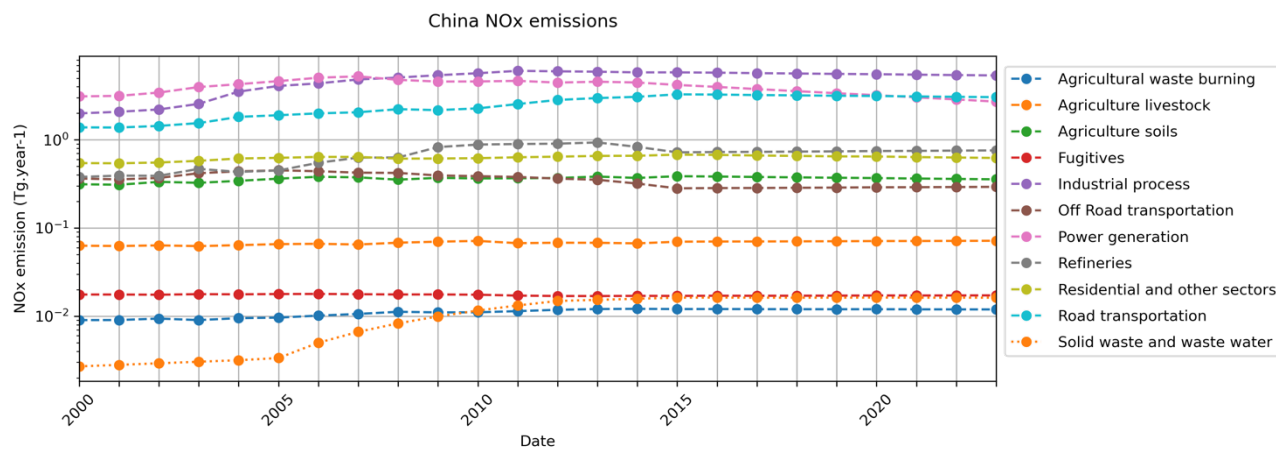
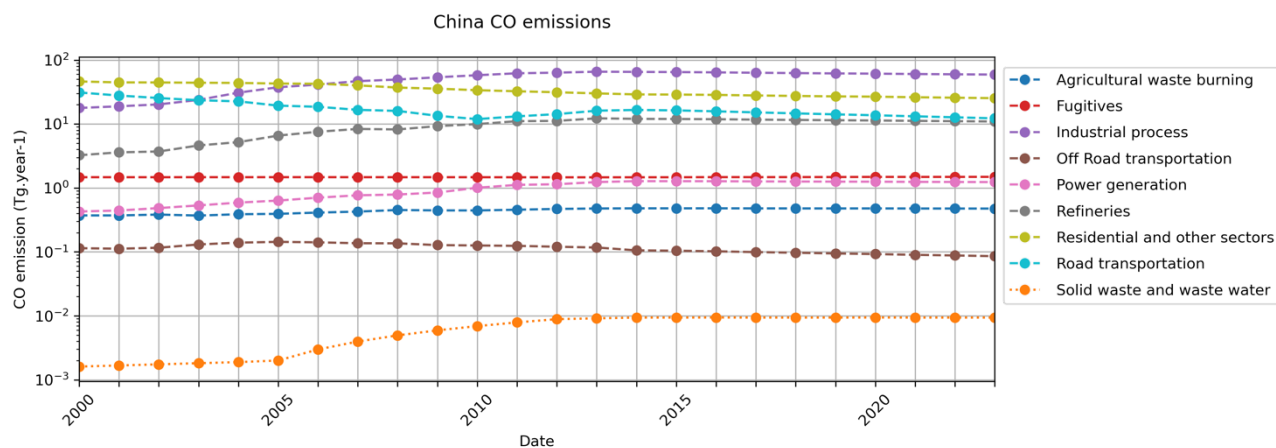


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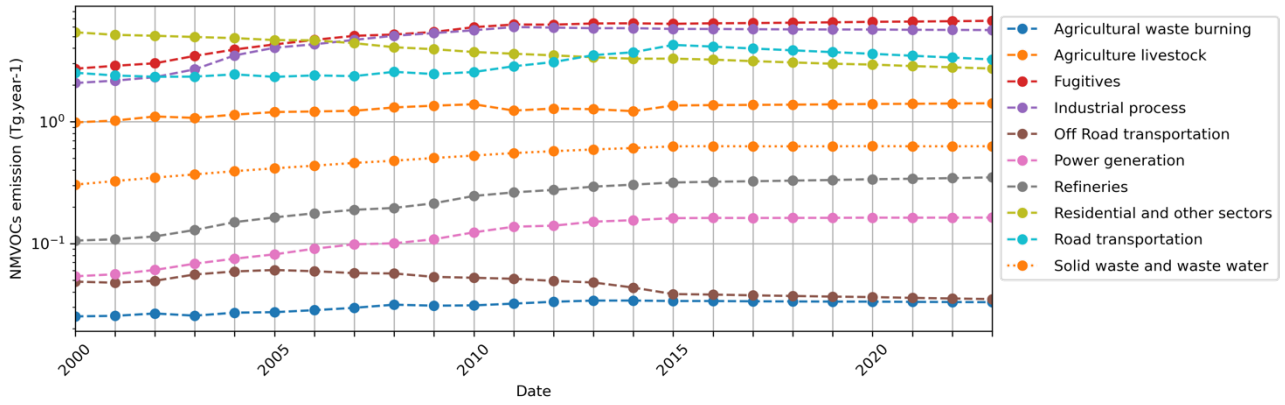
Figure S5: changes in the CAMS-GLOB-ANT_v5.3 emissions of CO, NO_x, NMVOCs and SO₂ for the 2000-2023 period in China. In order to show the emissions for all sectors, a logarithmic scale is used.

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95

China NMVOCs emissions



China SO2 emissions

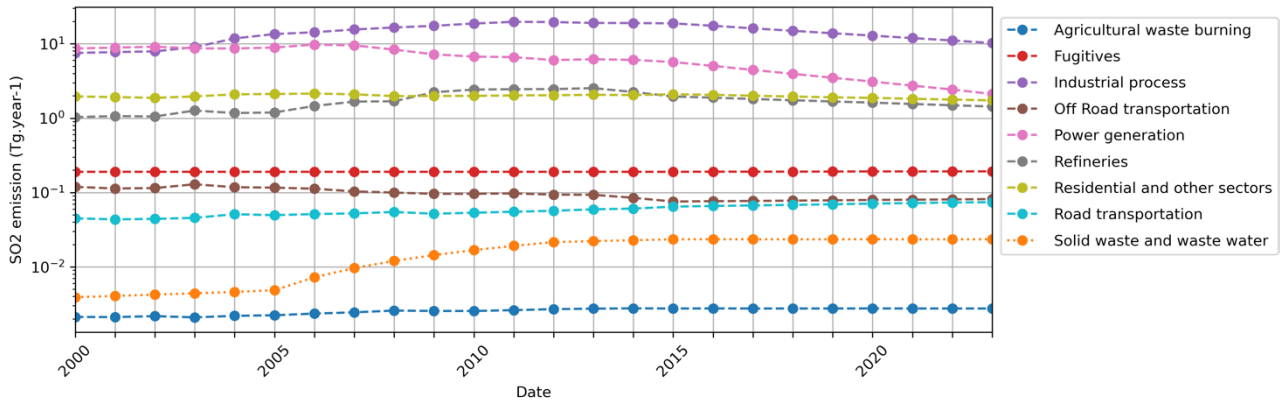
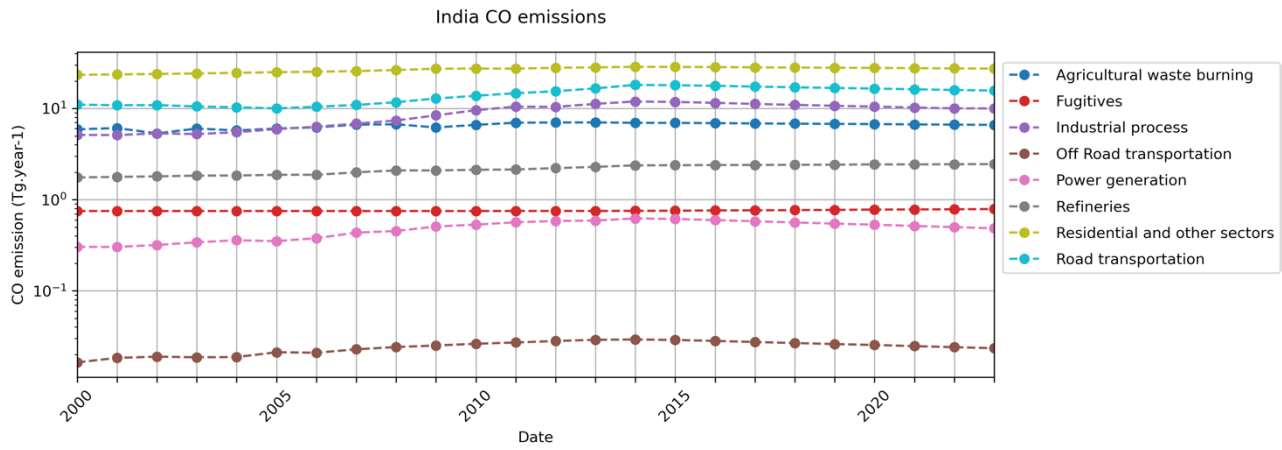
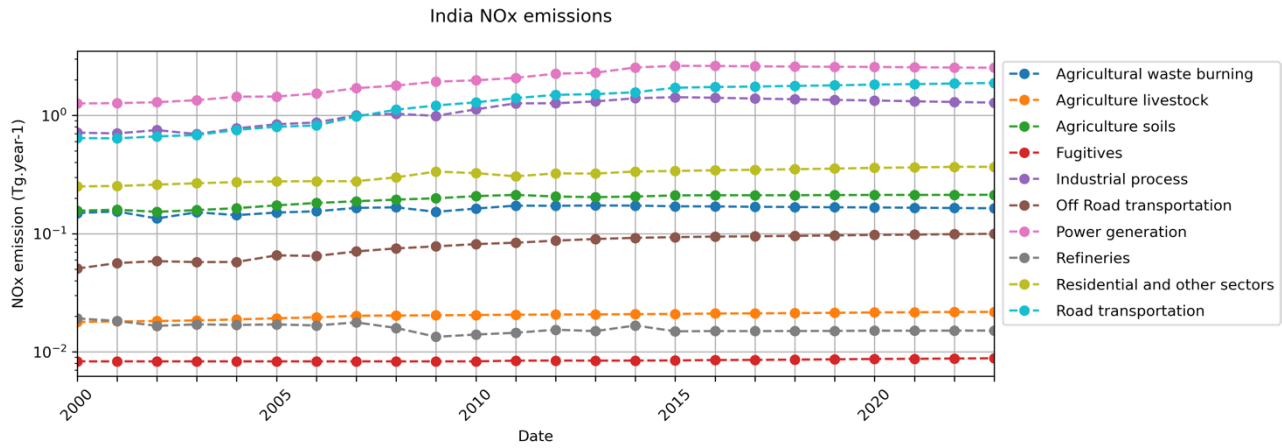


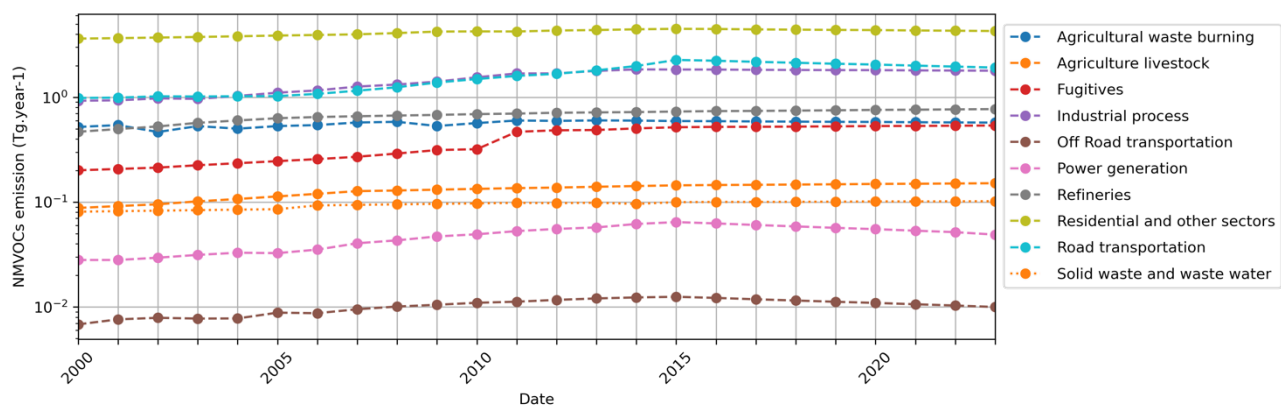
Figure S6: changes in the CAMS-GLOB-ANT_v5.3 emissions of CO, NO_x, NMVOCs and SO₂ for the
 105 2000-2023 period in India. In order to show the emissions for all sectors, a logarithmic scale is used.



110



India NMVOCs emissions



115

India SO2 emissions

