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# EDGAR v4.3.2 Global Atlas of the three major greenhouse gas emissions for the period 1970–2012

**Greet Janssens-Maenhout et al.**

*Correspondence to:* Greet Janssens-Maenhout (greet.maenhout@ec.europa.eu)

## 1    EDGARv4 geographical data

All countries of the world are taken up in the EDGAR database, except South and North Sudan (grouped together), Liechtenstein (grouped with Switzerland), Monaco (grouped with France), Andorra (grouped with Spain) and Vatican/San Marino (grouped with Italy). The countries are clearly defined with names recognized by the European Commission and present each a Party for the UNFCCC. All countries can be uniquely allocated to one of the three groups that were present at the creation of the UNFCCC: the 24 countries of the OECD in 1990, the 16 countries with Economies in Transition (EIT) (both form the Annex I countries of 1992) and the rest are the non-Annex I countries. Detailed information is not for each country available in the global database and neighbouring countries are assumed to show e.g. similar technologies. As such 24 geographical groups of countries have been defined and are used for e.g. the allocation of the type of vehicles. These 24 groups are also used in IPCC AR6 scenarios run with the IMAGE land-use model. Finally, for the temporal distribution, only three groups of countries are considered, depending on the temperate zone they are located: northern zone, equator and southern zone. All these characteristics of the countries are summarized in Table S1.

**Table S1: List of countries with their ISO_A3 codes and characteristics w.r.t. historical group (24OECD(1990) or 16EIT(1990) or non-Annex I), w.r.t temperate climatic zone (determining the temporal profile) and w.r.t. the geographical 24 groups of neighbouring countries that are assumed to use similar technologies.**

| Name | ISO_A3 code | geographical group | temperate zone | historical group |
|---|---|---|---|---|
| Afghanistan | AFG | 18:_India + | 01:_Northern Temperate Zone | Non-Annex_I |
| Albania | ALB | 12:_Central Europe | 01:_Northern Temperate Zone | Non-Annex_I |
| Algeria | DZA | 07:_Northern_Africa | 01:_Northern Temperate Zone | Non-Annex_I |
| American Samoa | ASM | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Angola | AGO | 10:_Southern_Africa | 02:_Equator | Non-Annex_I |
| Anguilla | AIA | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Antigua and Barbuda | ATG | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Argentina | ARG | 06:_Rest South America | 03:_Southern Temperate Zone | Non-Annex_I |
| Armenia | ARM | 16:_Russia + | 01:_Northern Temperate Zone | Non-Annex_I |
| Aruba | ABW | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Australia | AUS | 24:_Oceania | 03:_Southern Temperate Zone | 24 OECD (1990) |
| Austria | AUT | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Azerbaijan | AZE | 16:_Russia + | 01:_Northern Temperate Zone | Non-Annex_I |
| Bahamas | BHS | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Bahrain | BHR | 17:_Middle_East | 02:_Equator | Non-Annex_I |
| Bangladesh | BGD | 18:_India + | 02:_Equator | Non-Annex_I |
| Barbados | BRB | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Belarus | BLR | 14:_Ukraine + | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Belgium | BEL | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Belize | BLZ | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Benin | BEN | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Bermuda | BMU | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Bhutan | BTN | 18:_India + | 02:_Equator | Non-Annex_I |
| Bolivia | BOL | 06:_Rest South America | 02:_Equator | Non-Annex_I |
| Bosnia and | BIH | 12:_Central Europe | 01:_Northern Temperate Zone | Non-Annex_I |

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|---|---|---|---|---|
| Herzegovina | | | | |
| Botswana | BWA | 10:_Southern_Africa | 02:_Equator | Non-Annex_I |
| Brazil | BRA | 05:_Brazil | 02:_Equator | Non-Annex_I |
| Brunei Darussalam | BRN | 21:_Southeastern Asia | 02:_Equator | Non-Annex_I |
| Bulgaria | BGR | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Burkina Faso | BFA | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Burundi | BDI | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Cambodia | KHM | 21:_Southeastern Asia | 02:_Equator | Non-Annex_I |
| Cameroon | CMR | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Canada | CAN | 01:_Canada | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Cape Verde | CPV | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Cayman Islands | CYM | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Central African Republic | CAF | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Chad | TCD | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Chile | CHL | 06:_Rest South America | 03:_Southern Temperate Zone | Non-Annex_I |
| China (mainland China) | CHN | 20:_China + | 01:_Northern Temperate Zone | Non-Annex_I |
| Colombia | COL | 06:_Rest South America | 02:_Equator | Non-Annex_I |
| Comoros | COM | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Congo | COG | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Congo_the Democratic Republic of the | COD | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Cook Islands | COK | 24:_Oceania | 03:_Southern Temperate Zone | Non-Annex_I |
| Costa Rica | CRI | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Cote d'Ivoire | CIV | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Croatia | HRV | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Cuba | CUB | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Cyprus | CYP | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Czech Republic | CZE | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Denmark | DNK | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Djibouti | DJI | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Dominica | DMA | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Dominican Republic | DOM | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Ecuador | ECU | 06:_Rest South America | 02:_Equator | Non-Annex_I |
| Egypt | EGY | 07:_Northern_Africa | 01:_Northern Temperate Zone | Non-Annex_I |
| El Salvador | SLV | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Equatorial Guinea | GNQ | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Eritrea | ERI | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Estonia | EST | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Ethiopia | ETH | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Falkland Islands (Malvinas) | FLK | 06:_Rest South America | 02:_Equator | Non-Annex_I |
| Faroe Islands (under Danish governance) | FRO | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Fiji | FJI | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Finland | FIN | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| France (including Monaco and Andorra) | FRA | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |

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|---|---|---|---|---|
| French Guiana | GUF | 06:_Rest South America | 02:_Equator | Non-Annex_I |
| French Polynesia | PYF | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Gabon | GAB | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Gambia | GMB | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Georgia | GEO | 16:_Russia + | 01:_Northern Temperate Zone | Non-Annex_I |
| Germany | DEU | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Ghana | GHA | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Gibraltar | GIB | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Greece | GRC | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Greenland (under Danish governance) | GRL | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Grenada | GRD | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Guadeloupe | GLP | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Guam | GUM | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Guatemala | GTM | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Guernsey (under British governance) | GGY | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Guinea | GIN | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Guinea-Bissau | GNB | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Guyana | GUY | 06:_Rest South America | 02:_Equator | Non-Annex_I |
| Haiti | HTI | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Honduras | HND | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Hong Kong (under governance of China) | HKG | 20:_China + | 02:_Equator | Non-Annex_I |
| Hungary | HUN | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Iceland | ISL | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| India | IND | 18:_India + | 02:_Equator | Non-Annex_I |
| Indonesia | IDN | 22:_Indonesia + | 02:_Equator | Non-Annex_I |
| Iran (Islamic Republic of Iran) | IRN | 17:_Middle_East | 01:_Northern Temperate Zone | Non-Annex_I |
| Iraq | IRQ | 17:_Middle_East | 01:_Northern Temperate Zone | Non-Annex_I |
| Ireland | IRL | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Isle of Man (under British governance) | IMN | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Israel | ISR | 17:_Middle_East | 01:_Northern Temperate Zone | Non-Annex_I |
| Italy (including Vatican, San Marino) | ITA | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Jamaica | JAM | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Japan | JPN | 23:_Japan | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Jersey (under British governance) | JEY | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Jordan | JOR | 17:_Middle_East | 01:_Northern Temperate Zone | Non-Annex_I |
| Kazakhstan | KAZ | 15:_Asia-Stan | 01:_Northern Temperate Zone | Non-Annex_I |
| Kenya | KEN | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Kiribati | KIR | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Korea North (Democratic People's Republic of Korea) | PRK | 19:_Korea | 01:_Northern Temperate Zone | Non-Annex_I |
| Korea South (Republic of Korea) | KOR | 19:_Korea | 01:_Northern Temperate Zone | Non-Annex_I |
| Kuwait | KWT | 17:_Middle_East | 01:_Northern Temperate Zone | Non-Annex_I |

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|---|---|---|---|---|
| Kyrgyzstan | KGZ | 15:_Asia-Stan | 01:_Northern Temperate Zone | Non-Annex_I |
| Lao People's Democratic Republic | LAO | 21:_Southeastern Asia | 02:_Equator | Non-Annex_I |
| Latvia | LVA | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Lebanon | LBN | 17:_Middle_East | 01:_Northern Temperate Zone | Non-Annex_I |
| Lesotho | LSO | 10:_Southern_Africa | 02:_Equator | Non-Annex_I |
| Liberia | LBR | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Libyan Arab Jamahiriya | LBY | 07:_Northern_Africa | 01:_Northern Temperate Zone | Non-Annex_I |
| Lithuania | LTU | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Luxembourg | LUX | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Macao (under governance of China) | MAC | 20:_China + | 02:_Equator | Non-Annex_I |
| Macedonia (former Yugoslav Republic of Macedonia) | MKD | 12:_Central Europe | 01:_Northern Temperate Zone | Non-Annex_I |
| Madagascar | MDG | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Malawi | MWI | 10:_Southern_Africa | 02:_Equator | Non-Annex_I |
| Malaysia | MYS | 21:_Southeastern Asia | 02:_Equator | Non-Annex_I |
| Maldives | MDV | 18:_India + | 02:_Equator | Non-Annex_I |
| Mali | MLI | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Malta | MLT | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Marshall Islands | MHL | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Martinique | MTQ | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Mauritania | MRT | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Mauritius | MUS | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Mayotte | MYT | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Mexico | MEX | 03:_Mexico | 02:_Equator | Non-Annex_I |
| Micronesia (Federated States of Micronesia) | FSM | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Moldova (Republic of Moldova) | MDA | 14:_Ukraine + | 01:_Northern Temperate Zone | Non-Annex_I |
| Mongolia | MNG | 20:_China + | 01:_Northern Temperate Zone | Non-Annex_I |
| Montserrat | MSR | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Morocco | MAR | 07:_Northern_Africa | 01:_Northern Temperate Zone | Non-Annex_I |
| Mozambique | MOZ | 10:_Southern_Africa | 02:_Equator | Non-Annex_I |
| Myanmar | MMR | 21:_Southeastern Asia | 02:_Equator | Non-Annex_I |
| Namibia | NAM | 10:_Southern_Africa | 02:_Equator | Non-Annex_I |
| Nauru | NRU | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Nepal | NPL | 18:_India + | 01:_Northern Temperate Zone | Non-Annex_I |
| Netherlands | NLD | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Netherlands Antilles | ANT | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| New Caledonia | NCL | 24:_Oceania | 02:_Equator | Non-Annex_I |
| New Zealand | NZL | 24:_Oceania | 03:_Southern Temperate Zone | 24 OECD (1990) |
| Nicaragua | NIC | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Niger | NER | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Nigeria | NGA | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Niue | NIU | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Norfolk Island (under Australian governance) | NFK | 24:_Oceania | 03:_Southern Temperate Zone | Non-Annex_I |

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|---|---|---|---|---|
| Northern Mariana Islands | MNP | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Norway | NOR | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Oman | OMN | 17:_Middle_East | 02:_Equator | Non-Annex_I |
| Pakistan | PAK | 18:_India + | 01:_Northern Temperate Zone | Non-Annex_I |
| Palau | PLW | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Panama | PAN | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Papua New Guinea | PNG | 22:_Indonesia + | 02:_Equator | Non-Annex_I |
| Paraguay | PRY | 06:_Rest South America | 02:_Equator | Non-Annex_I |
| Peru | PER | 06:_Rest South America | 02:_Equator | Non-Annex_I |
| Philippines | PHL | 21:_Southeastern Asia | 02:_Equator | Non-Annex_I |
| Pitcairn | PCN | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Poland | POL | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Portugal | PRT | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Puerto Rico (under USA governance) | PRI | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Qatar | QAT | 17:_Middle_East | 02:_Equator | Non-Annex_I |
| Reunion | REU | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Romania | ROU | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Russian Federation | RUS | 16:_Russia + | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Rwanda | RWA | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Saint Helena | SHN | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Saint Kitts and Nevis | KNA | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Saint Lucia | LCA | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Saint Pierre and Miquelon (under French governance) | SPM | 02:_USA | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Saint Vincent and the Grenadines | VCT | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Samoa | WSM | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Sao Tome and Principe | STP | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Saudi Arabia | SAU | 17:_Middle_East | 02:_Equator | Non-Annex_I |
| Senegal | SEN | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Serbia and Montenegro (including Kosovo) | SCG | 12:_Central Europe | 01:_Notrhtern Temperate Zone | Non-Annex_I |
| Seychelles | SYC | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Sierra Leone | SLE | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Singapore | SGP | 21:_Southeastern Asia | 02:_Equator | Non-Annex_I |
| Slovakia | SVK | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Slovenia | SVN | 12:_Central Europe | 01:_Northern Temperate Zone | 16 EIT (1990) |
| Solomon Islands | SLB | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Somalia | SOM | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| South Africa | ZAF | 10:_Southern_Africa | 03:_Southern Temperate Zone | Non-Annex_I |
| Spain | ESP | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Sri Lanka | LKA | 18:_India + | 02:_Equator | Non-Annex_I |
| Sudan (North and South Sudan) | SDN | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Suriname | SUR | 06:_Rest South America | 02:_Equator | Non-Annex_I |
| Swaziland | SWZ | 10:_Southern_Africa | 02:_Equator | Non-Annex_I |

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|---|---|---|---|---|
| Sweden | SWE | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Switzerland (including Liechtenstein) | CHE | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Syrian Arab Republic | SYR | 17:_Middle_East | 01:_Northern Temperate Zone | Non-Annex_I |
| Taiwan (under governance of China) | TWN | 20:_China + | 02:_Equator | Non-Annex_I |
| Tajikistan | TJK | 15:_Asia-Stan | 01:_Northern Temperate Zone | Non-Annex_I |
| Tanzania (United Republic of Tanzania) | TZA | 10:_Southern_Africa | 02:_Equator | Non-Annex_I |
| Thailand | THA | 21:_Southeastern Asia | 02:_Equator | Non-Annex_I |
| Timor-Leste | TLS | 21:_Southeastern Asia | 02:_Equator | Non-Annex_I |
| Togo | TGO | 08:_Western_Africa | 02:_Equator | Non-Annex_I |
| Tokelau | TKL | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Tonga | TON | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Trinidad and Tobago | TTO | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Tunisia | TUN | 07:_Northern_Africa | 01:_Northern Temperate Zone | Non-Annex_I |
| Turkey | TUR | 13:_Turkey | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Turkmenistan | TKM | 15:_Asia-Stan | 01:_Northern Temperate Zone | Non-Annex_I |
| Turks and Caicos Islands | TCA | 04:_Rest Central America | 02:_Equator | Non-Annex_I |
| Tuvalu | TUV | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Uganda | UGA | 09:_Eastern_Africa | 02:_Equator | Non-Annex_I |
| Ukraine | UKR | 14:_Ukraine + | 01:_Northern Temperate Zone | 16 EIT (1990) |
| United Arab Emirates | ARE | 17:_Middle_East | 02:_Equator | Non-Annex_I |
| United Kingdom | GBR | 11:_OECD_Europe | 01:_Northern Temperate Zone | 24 OECD (1990) |
| United States | USA | 02:_USA | 01:_Northern Temperate Zone | 24 OECD (1990) |
| Uruguay | URY | 06:_Rest South America | 03:_Southern Temperate Zone | Non-Annex_I |
| Uzbekistan | UZB | 15:_Asia-Stan | 01:_Northern Temperate Zone | Non-Annex_I |
| Vanuatu | VUT | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Venezuela | VEN | 06:_Rest South America | 02:_Equator | Non-Annex_I |
| Viet Nam | VNM | 21:_Southeastern Asia | 02:_Equator | Non-Annex_I |
| Virgin Islands (under British governance) | VGB | 04:_Rest Central America | 02:_Equator | 24 OECD (1990) |
| Virgin Islands (under USA governance) | VIR | 04:_Rest Central America | 02:_Equator | 24 OECD (1990) |
| Wallis and Futuna | WLF | 24:_Oceania | 02:_Equator | Non-Annex_I |
| Western Sahara | ESH | 07:_Northern_Africa | 02:_Equator | Non-Annex_I |
| Yemen | YEM | 17:_Middle_East | 02:_Equator | Non-Annex_I |
| Zambia | ZMB | 10:_Southern_Africa | 02:_Equator | Non-Annex_I |
| Zimbabwe | ZWE | 10:_Southern_Africa | 02:_Equator | Non-Annex_I |

## 2    EDGARv4 human activities

The sector-specific structure of the EDGAR database consists of 26 main sectors (characterized with the first three letter codes), which are further subdivided in subsectors, depending on the type of technology (see Table S3). In addition EDGARv4 uses the same fuel types as IEA and the same livestock and crop types as FAO. The fuel types are for the sake of clarity presented in Table S2 following the main categories of IPCC (2006) guidelines.

5

**Table S2: Different types of fuel (based on IEA definitions), which are grouped in IPCC (2006) guidelines' categories and applied as such in EDGARv4.3.2.**

| Fuel Category | Fuel Description | code | Comment |
|---|---|---|---|
| **SOLID FOSSIL FUELS** | | | *(CO2 long cycle)* |
| Hard coal | Anthracite | ANT | Anthracite |
| Hard coal | Other Bituminous Coal | BTC | Bituminous |
| Hard coal | Coking Coal | CKC | Bituminous |
| Hard coal | Coal Tar | CLT | Coal product *(for non-energy use)* |
| Hard coal | Gas Coke | GCK | Coal product |
| Hard coal | Hard Coal (if no detail) | HDC | |
| Hard coal | Coke Oven Coke | OCK | Coal product |
| Hard coal | Patent Fuel | PAT | Coal product |
| Hard coal | Sub-Bituminous Coal | SBC | Sub-bituminous |
| Brown coal | BKB/Peat Briquettes | BKB | Coal product |
| Brown coal | Brown Coal (if no detail) | BRC | Lignite |
| Brown coal | Lignite/Brown Coal | LGN | Lignite |
| Peat | Peat | PEA | Peat or under Brown coal |
| Solid waste | Municipal Waste (Non-Renew) | MWN | Non-biomass |
| **FOSSIL OIL AND OIL PRODUCTS** | | | |
| Heavy oils | Bitumen | BIT | *for non-energy use* |
| Heavy oils | Crude/NGL/Feedstocks (if no detail) | CNF | Crude subtype |
| Heavy oils | Crude Oil | CRU | |
| Heavy oils | Gas/Diesel Oil | DIE | diesel |
| Heavy oils | Residual Fuel Oil | HFO | |
| Heavy oils | Lubricants | LUB | *for non-energy use* |
| Heavy oils | Other Hydrocarbons | NCR | |
| Heavy oils | Petroleum Coke | PCK | *for non-energy use* |
| Heavy oils | Paraffin Waxes | PWX | *for non-energy use* |
| Heavy oils | Refinery Feedstocks | RFD | Crude subtype |
| Light oils | Additives/Blending Components | ADD | Crude subtype |
| Light oils | Aviation Gasoline | AVG | |
| Light oils | Ethane | ETH | |
| Light oils | Gasoline Type Jet Fuel | GJE | |
| Light oils | Kerosene Type Jet Fuel | JET | |
| Light oils | Liquefied Petroleum Gases (LPG) | LPG | |
| Light oils | Motor Gasoline | MOG | Petrol |
| Light oils | Naphtha | NAP | *for non-energy use* |
| Light oils | Natural Gas Liquids | NGL | Crude subtype |
| Light oils | Kerosene | OKE | |
| Light oils | Non-specified Petroleum Products | OPR | |
| Light oils | White Spirit & SBP | WSP | for NEU |

| | | | |
|---|---|---|---|
| **GASEOUS FOSSIL FUELS** | | | |
| Natural gas | Natural Gas | NGS | |
| Derived gases | Blast Furnace Gas | BFG | Coal product |
| Derived gases | Gas Works Gas | GGS | Coal product |
| Derived gases | Elec/Heat Output from Non-spec. Manuf. Gases | MNG | Miscelaneous fossil fuel product |
| Derived gases | Coke Oven Gas | OGS | Coal product |
| Derived gases | Refinery Gas | RGS | Oil product |
| Derived gases | Oxygen Steel Furnace Gas | SGS | Coal product |
| **BIOMASS FUELS** | | | *(CO2 short cycle)* |
| Solid biomass | Charcoal | CHA | Wood product |
| Solid biomass | Dung | DNG | |
| Solid biomass | Industrial Waste | IWS | Waste |
| Solid biomass | Municipal Waste (Renew) | MWR | Waste |
| Solid biomass | Non-specified Combust. Renewables + Wastes | NSF | |
| Solid biomass | Primary Solid Biomass (non-specified) | SBI | |
| Solid biomass | Vegetal waste | VWS | |
| Solid biomass | Wood | WOD | |
| Liquid biomass | Biodiesel | BDS | |
| Liquid biomass | Biogasoline | BGL | |
| Liquid biomass | Bagasse | BGS | Sugar cane product |
| Liquid biomass | Black Liquor | BLI | Pulp product |
| Liquid biomass | Liquid Biomass | LBI | Bioethanol, biodiesel |
| Liquid biomass | Other Liquid Biofuels | OLB | |
| Gaseous biomass | Biogas | GBI | Landfills, Waste Water Treatment plant, digester |

Table S3: Source categories used in EDGARv4.3.2. These include the main category with all Source/Sink Categories conform with the common reporting format of the IPCC (1996) and IPCC (2006) Guidelines. Note that neither large scale biomass burning nor land-use, land-use change and forestry emissions are included, although we do include agricultural activities (such as livestock and milk production, crop and rice production, agricultural waste burning, field burning, histosols and liming).

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| sector | Sector description | Detail | Detailed desription | IPCC (1996) | IPCC (2006) |
|---|---|---|---|---|---|
| AGS | Agricultural soils | AGS.ANW | Animal Manure Applied to Soils | 4D12 | 3.C.4 |
| AGS | Agricultural soils | AGS.BFL, CHC, CML, CTT, DCK, GTS, HRS, PGS, SHP, SSS, TRK | Pasture, Range and Paddock Manure | 4D2 | 3.C.4 |
| AGS | Agricultural soils | AGS.CRP | Crop Residue | 4D14 | 3.C.4 |
| AGS | Agricultural soils | AGS.HIS | Cultivation of Histosols | 4D15 | 3.C.4 |
| AGS | Agricultural soils | AGS.LMN | CO2 from agricultural lime application | 4D4b | 3.C.2 |
| AGS | Agricultural soils | AGS.NFC | Direct soil emissions | 4D13 | 3.C.4 |
| AGS | Agricultural soils | AGS.NFE | Synthetic Fertilizers | 4D11 | 3.C.4 |
| AGS | Agricultural soils | AGS.RIC | Rice cultivation | 4C | 3.C.7 |

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| | | | | | |
|---|---|---|---|---|---|
| AGS | Agricultural soils | AGS.TRK | Pasture, Range and Paddock Manure | 4D2 | 3.C.4 |
| AGS | Agricultural soils | AGS.URE | CO2 from urea application | 4D4a | 3.C.3 |
| AWB | Agricultural waste burning | AWB.CRP | Field burning of agric. res.: cereals,pulses, tuber, roots,sugar cane, other | 4F1,2,3,4,5 | 3.C.1.b |
| CHE | Production of chemicals | CHE.AAP | Adipic acid production | 2B3 | 2.B.3 |
| CHE | Production of chemicals | CHE.AMP | Ammonia production (gross CO2) | 2B1g | 2.B.1 |
| CHE | Production of chemicals | CHE.BLK | CO2-ammonia stored in urea | 2B1s | 2.B.8.a |
| CHE | Production of chemicals | CHE.BLK | production of bulk chemiclas (BC,ethylene, styrene, methanol, urea, vinyl chloride, urea) | 2B5 | 2.B.8.a |
| CHE | Production of chemicals | CHE.CLC | Calcium carbide production | 2B4b | 2.B.5 |
| CHE | Production of chemicals | CHE.CLP | Caprolactam production | 2B5f | 2.B.4 |
| CHE | Production of chemicals | CHE.GXA | Glyoxal production | 2B5h1 | 2.B.4 |
| CHE | Production of chemicals | CHE.GXY | Glyoxylic acid production | 2B5h3 | 2.B.4 |
| CHE | Production of chemicals | CHE.NAP | Nitric acid production | 2B2 | 2.B.2 |
| CHE | Production of chemicals | CHE.NFP | Other bulk chemicals production | 2B5g | 2.B.2 |
| CHE | Production of chemicals | CHE.SAP | Other bulk chemicals production | 2B5g | 2.B.4 |
| CHE | Production of chemicals | CHE.SLC | Silicon carbide production | 2B4a | 2.B.5 |
| CHE | Production of chemicals | CHE.SPC | Other bulk chemicals production | 2B5g | 2.B.6 |
| CHE | Production of chemicals | CHE.TTN | Other bulk chemicals production | 2B5g | 2.B.6 |
| ENE | Power industry | ENE.AEL | Electricity Generation (autoproducers) | 1A1a5 | 1.A.1.a.i |
| ENE | Power industry | ENE.AHE | Heat Plants (autoproducers) | 1A1a7 | 1.A.1.a.iii |
| ENE | Power industry | ENE.AHP | Combined Heat and Power gen. (autoprod.) | 1A1a6 | 1.A.1.a.ii |
| ENE | Power industry | ENE.CHP | Public Combined Heat and Power gen. | 1A1a2 | 1.A.1.a.ii |
| ENE | Power industry | ENE.DHE | Public Heat Plants | 1A1a3 | 1.A.1.a.iii |
| ENE | Power industry | ENE.NUC | Public electricity and heat production | 1A1a | 1.A.1.a.i |
| ENE | Power industry | ENE.PEL | Public Electricity Generation | 1A1a1 | 1.A.1.a.i |
| ENE | Power industry | ENE.POW | Public Electricity Generation (own use) | 1A1a4 | 1.A.1.a.i |
| ENE | Power industry | ENE.PUM | Public electricity and heat production | 1A1a | 1.A.1.a.i |
| ENE | Power industry | ENE.PUM | Public Electricity Generation | 1A1a1 | 1.A.1.a.i |
| ENF | Enteric fermentation | ENF.BFL | Buffalo | 4A2 | 3.A.1.b |
| ENF | Enteric fermentation | ENF.CML | Camels and Lamas | 4A5 | 3.A.1.e |
| ENF | Enteric fermentation | ENF.CTT | Dairy cattle | 4A1-d | 3.A.1.a.ii |
| ENF | Enteric fermentation | ENF.CTT | Non-dairy cattle | 4A1-n | 3.A.1.a.ii |
| ENF | Enteric fermentation | ENF.GTS | Goats | 4A4 | 3.A.1.d |
| ENF | Enteric fermentation | ENF.HRS | Horses | 4A6 | 3.A.1.f |
| ENF | Enteric fermentation | ENF.PGS | Swine | 4A8 | 3.A.1.h |
| ENF | Enteric fermentation | ENF.SHP | Sheep | 4A3 | 3.A.1.c |
| ENF | Enteric fermentation | ENF.SSS | Mules and asses | 4A7 | 3.A.1.g |
| FFF | Fossil fuel fires | FFF.COA | Coal fires (underground) | 7A1 | 5.B |
| FFF | Fossil fuel fires | FFF.GSF | Gas fires | 7A3 | 5.B |
| FFF | Fossil fuel fires | FFF.OIL | Oil fires (Kuwait) | 7A2 | 5.B |
| FOO | Production of foods | FOO.BRD | Food and drink production | 2D2 | 2.H.2 |
| FOO | Production of foods | FOO.BRP | Food and drink production | 2D2 | 2.H.2 |

| | | | | | |
|---|---|---|---|---|---|
| FOO | Production of foods | FOO.OTH | Food and drink production | 2D2 | 2.H.2 |
| FOO | Production of foods | FOO.WIN | Food and drink production | 2D2 | 2.H.2 |
| IDE | Indirect emissions | IDE.NH3 | Indirect N2O from NH3 emitted in cat. 1A | 7C1 | 5.A |
| IDE | Indirect emissions | IDE.NH3 | Indirect N2O from NH3 emitted in cat. 2-3 | 7C2 | 5.A |
| IDE | Indirect emissions | IDE.NOX | Indirect N2O from NOx emitted in cat. 1A | 7B1 | 5.A |
| IDE | Indirect emissions | IDE.NOX | Indirect N2O from NOx emitted in cat. 2-3 | 7B2 | 5.A |
| IND | Manufacturing industry | IND.CHE | Chemicals | 1A2c | 1.A.2.c |
| IND | Manufacturing industry | IND.CON | Other industries (stationary) | 1A2f | 1.A.2.k |
| IND | Manufacturing industry | IND.FOO | Food and tobacco | 1A2e | 1.A.2.e |
| IND | Manufacturing industry | IND.INO | Other industries (stationary) | 1A2f | 1.A.2.m |
| IND | Manufacturing industry | IND.IRO | Iron and steel | 1A2a | 1.A.2.a |
| IND | Manufacturing industry | IND.MAC | Other industrial machinary (stationary) | 1A2f | 1.A.2.h |
| IND | Manufacturing industry | IND.MIN | Off-road machinery: mining (diesel) | 1A2f2 | 1.A.2.i |
| IND | Manufacturing industry | IND.NFE | Non-ferrous metals | 1A2b | 1.A.2.b |
| IND | Manufacturing industry | IND.NMM | Other mineral industries (stationary) | 1A2f | 1.A.2.f |
| IND | Manufacturing industry | IND.PAP | Pulp and paper | 1A2d | 1.A.2.d |
| IND | Manufacturing industry | IND.TEQ | Other techn. equip. industries (stationary) | 1A2f | 1.A.2.g |
| IND | Manufacturing industry | IND.TEX | Other textile industries (stationary) | 1A2f | 1.A.2.l |
| IND | Manufacturing industry | IND.WOO | Other wood industries (stationary) | 1A2f | 1.A.2.j |
| IRO | Production of iron and steel | IRO.CSP | Crude steel production total | 2C1a | 2.C.1 |
| IRO | Production of iron and steel | IRO.FEA | Ferroy Alloy production | 2C2 | 2.C.2 |
| IRO | Production of iron and steel | IRO.PIG | Pig iron production | 2C1c | 2.C.1 |
| IRO | Production of iron and steel | IRO.PLT | Pellet production | 2C1e | 2.C.1 |
| IRO | Production of iron and steel | IRO.SNT | Sinter production | 2C1d | 2.C.1 |
| IRO | Production of iron and steel | IRO.STC | Steel casting | 2C1f | 2.C.1 |
| MNM | Manure management | MNM.BFL | Manure Man.: Buffalo (confined) | 4B2 | 3.A.2.b |
| MNM | Manure management | MNM.CHC | Manure Man.: Poultry (confined) | 4B9 | 3.A.2.i |
| MNM | Manure management | MNM.CML | Manure Man.: Camels and llamas (confined) | 4B5 | 3.A.2.e |
| MNM | Manure management | MNM.CTT | Manure Man.: Dairy Cattle (confined) | 4B1-d | 3.A.2.a.ii |
| MNM | Manure management | MNM.CTT | Manure Man.: Non-Dairy Cattle (confined) | 4B1-n | 3.A.2.a.ii |
| MNM | Manure management | MNM.DCK | Manure Man.: Poultry (confined) | 4B9 | 3.A.2.i |
| MNM | Manure management | MNM.GES | Manure Man.: Goats (confined) | 4B4 | 3.A.2.i |
| MNM | Manure management | MNM.GTS | Manure Man.: Goats (confined) | 4B4 | 3.A.2.d |
| MNM | Manure management | MNM.HRS | Manure Man.: Horses (confined) | 4B6 | 3.A.2.f |
| MNM | Manure management | MNM.PGS | Manure Man.: Swine (confined) | 4B8 | 3.A.2.h |
| MNM | Manure management | MNM.SHP | Manure Man.: Sheep (confined) | 4B3 | 3.A.2.c |
| MNM | Manure management | MNM.SSS | Manure Man.: Mules and asses (confined) | 4B7 | 3.A.2.g |
| MNM | Manure management | MNM.TRK | Manure Man.: Poultry (confined) | 4B9 | 3.A.2.i |
| N2O | Indirect N2O emissions | N2O.AGR | Indirect N2O: Atm. Depos. - agricult. (4D) | 4D3a | 3.C.5 |
| N2O | Indirect N2O emissions | N2O.IDR | Indirect N2O from agriculture | 4D3 | 3.C.6 |

| | | | | | |
|---|---|---|---|---|---|
| N2O | Indirect N2O emissions | N2O.IDR | Indirect N2O: Leaching and Run-Off - agri. | 4D3b | 3.C.6 |
| N2O | Indirect N2O emissions | N2O.OTH | Indirect N2O from agriculture | 4D3 | 3.C.5 |
| NEU | Non energy use of fuels | NEU.FEE, IND, TRA | Non-energy use of lubricants/waxes (CO2) | 2G1 | 2.D.2 |
| NEU | Non energy use of fuels | NEU.OTH | Other Non-energy use of fuels (CO2 only) | 2G2 | 2.D.2 |
| NFE | Prod. of non-ferrous metals | NFE.ALP | Aluminium production (primary) | 2C3a | 2.C.3 |
| NFE | Prod. of non-ferrous metals | NFE.ALP | Aluminium production (secondary) | 2C3b | 2.C.3 |
| NFE | Prod. of non-ferrous metals | NFE.ALP | Aluminium foundries: SF6 use | 2C4b | 2.C.3 |
| NFE | Prod. of non-ferrous metals | NFE.AUP | Gold production | 2C5au | 2.C.7 |
| NFE | Prod. of non-ferrous metals | NFE.CUP | Copper production (primary) | 2C5cp | 2.C.7 |
| NFE | Prod. of non-ferrous metals | NFE.CUP | Copper production (secondary) | 2C5cs | 2.C.7 |
| NFE | Prod. of non-ferrous metals | NFE.HGP | Mercury production | 2C5hg | 2.C.7 |
| NFE | Prod. of non-ferrous metals | NFE.MGP | Magnesium foundries: SF6 use | 2C4a | 2.C.4 |
| NFE | Prod. of non-ferrous metals | NFE.MGP | Magnesium production (primary) | 2C5mp | 2.C.4 |
| NFE | Prod. of non-ferrous metals | NFE.MGP | Magnesium production (secondary) | 2C5ms | 2.C.4 |
| NFE | Prod. of non-ferrous metals | NFE.OTH | Other non-ferrous production total | 2C5 | 2.C.7 |
| NFE | Prod. of non-ferrous metals | NFE.OTH | Mercury production | 2C5hg | 2.C.7 |
| NFE | Prod. of non-ferrous metals | NFE.OTH | Molybdenum production | 2C5mo | 2.C.7 |
| NFE | Prod. of non-ferrous metals | NFE.PBP | Lead production (primary) | 2C5lp | 2.C.5 |
| NFE | Prod. of non-ferrous metals | NFE.PBP | Lead production (secondary) | 2C5ls | 2.C.5 |
| NFE | Prod. of non-ferrous metals | NFE.ZNP | Zinc production (primary) | 2C5zp | 2.C.6 |
| NFE | Prod. of non-ferrous metals | NFE.ZNP | Zinc production (secondary) | 2C5zs | 2.C.6 |
| NMM | Prod. non-metallic minerals | NMM.BRK | Other uses of carbonate | 2A7b | 2.A.4.a |
| NMM | Prod. non-metallic minerals | NMM.CMN | Cement production | 2A1 | 2.A.1 |
| NMM | Prod. non-metallic minerals | NMM.CRB | Other uses of carbonate | 2A7b | 2.A.4.a |
| NMM | Prod. non-metallic minerals | NMM.GLS | Glass production | 2A7a | 2.A.3 |
| NMM | Prod. non-metallic minerals | NMM.GPB | Other uses of carbonate | 2A7b | 2.A.3 |
| NMM | Prod. non-metallic minerals | NMM.LMN | Lime production | 2A2 | 2.A.2 |
| NMM | Prod. non-metallic minerals | NMM.LMU | Limestone and Dolomite Use | 2A3 | 2.A.4.d |
| NMM | Prod. non-metallic minerals | NMM.OTH | Other minerals production | 2A7 | 2.A.5 |
| NMM | Prod. non-metallic minerals | NMM.SDS | Soda ash production | 2A4a | 2.A.4.b |
| NMM | Prod. non-metallic minerals | NMM.SDS | Soda ash use | 2A4b | 2.A.4.b |
| PAP | Production of pulp and paper | PAP.PLP | Pulp and paper production | 2D1 | 2.H.1 |
| PAP | Production of pulp and paper | PAP.PPR | Pulp and paper production | 2D1 | 2.H.1 |
| PRO | Fuel production/transmission | PRO.BRC | Brown coal mining | 1B1a3 | 1.B.1.a |
| PRO | Fuel production/transmission | PRO.GAS.NGS | Gas production | 1B2b1 | 1.B.2.b.ii |
| PRO | Fuel production/transmission | PRO.GAS.PIP | Gas transmission | 1B2b3 | 1.B.2.b.ii |
| PRO | Fuel production/transmission | PRO.GAS.DIS | Gas distribution | 1B2b4 | 1.B.2.b.ii |
| PRO | Fuel production/transmission | PRO.HDC | Hard coal mining (gross) | 1B1a1 | 1.B.1.a |
| PRO | Fuel production/transmission | PRO.HDC | Methane recovery from coal mining | 1B1a1r | 1.B.1.a |
| PRO | Fuel production/transmission | PRO.HDC | Abandoned mines | 1B1a2 | 1.B.1.a |
| PRO | Fuel production/transmission | PRO.OIL | Fugitive emissions from oil and gas | 1B2 | 1.B.2.a.ii |
| PRO | Fuel production/transmission | PRO.OIL.OPR | Oil production | 1B2a1 | 1.B.2.a.ii |
| PRO | Fuel production/transmission | PRO.OIL.PIP | Oil transmission | 1B2a2 | 1.B.2.a.ii |

| PRO | Fuel production/transmission | PRO.OIL.TK1 | Tanker loading | 1B2a3-l | 1.B.2.a.ii |
|-----|------------------------------|-------------|----------------|---------|------------|
| PRO | Fuel production/transmission | PRO.OIL.TK2 | Tanker oil transport (crude and NGL) | 1B2a4-l | 1.B.2.a.ii |
| PRO | Fuel production/transmission | PRO.OIL.TRK | Transport by oil trucks | 1B2a4-t | 1.B.2.a.ii |
| PRO | Fuel production/transmission | PRO.OIL.VAF | Venting and flaring during oil and gas production | 1B2c | 1.B.2.a.ii |
| PRO | Fuel production/transmission | PRO.PEA | Peat mining | 1B1a4 | 1.B.1.a |
| PRU | Production, use of products | PRU.N2O | Use of N2O as anaesthesia | 3D1 | 2.G.3.b |
| PRU | Production, use of products | PRU.N2O | Use of N2O in aerosol spray cans | 3D3 | 2.G.3.b |
| PRU | Production, use of products | PRU.OTH | Use of other non-specified products | 3D5 | 2.G.3.c |
| RCO | Residential | RCO.AGR | Agriculture and forestry (incl.off-road) | 1A4c1 | 1.A.4.c.i |
| RCO | Residential | RCO.COM | Commercial and public services | 1A4a | 1.A.4.a |
| RCO | Residential | RCO.FSH | Fishing | 1A4c3 | 1.A.4.c.iii |
| RCO | Residential | RCO.OTH | Non-specified other | 1A4d | 1.A.5.b.ii |
| RCO | Residential | RCO.RES | Residential | 1A4b | 1.A.4.b |
| REF | Oil refineries | REF.CMB | Refineries: combustion | 1A1b | 1.A.1.b |
| REF | Oil refineries | REF.EVA | Oil refineries (evaporation) | 1B2a5(e) | 1.B.2.a.iii.4 |
| REF | Oil refineries | REF.INP, OUT | Oil refineries (carbon losses) | 1B2a5(c) | 1.B.2.a.iii.4 |
| SOL | Application of solvents | SOL.CHI | Chemical products | 3C | 2.D.3 |
| SOL | Application of solvents | SOL.DRC | Degreasing and dry cleaning | 3B | 2.D.3 |
| SOL | Application of solvents | SOL.GLA | Other product use (glue & additives) | 3D | 2.D.3 |
| SOL | Application of solvents | SOL.GRA | Other product use (Graphic arts) | 3D | 2.D.3 |
| SOL | Application of solvents | SOL.HHP | Other product use | 3D | 2.D.3 |
| SOL | Application of solvents | SOL.IDG | Degreasing and dry cleaning | 3B | 2.D.3 |
| SOL | Application of solvents | SOL.LTH | Other product use (leather) | 3D | 2.D.3 |
| SOL | Application of solvents | SOL.OTH | Other product use | 3D | 2.D.3 |
| SOL | Application of solvents | SOL.PAI | Solvents in paint | 3A | 2.D.3 |
| SOL | Application of solvents | SOL.PST | Chemical products (pesticides) | 3C | 2.D.3 |
| SOL | Application of solvents | SOL.RBP | Chemical products (rubber) | 3C | 2.D.3 |
| SOL | Application of solvents | SOL.VGO | Other product use (vegetal oil) | 3D | 2.D.3 |
| SWD | Solid waste disposal | SWD.COM | Other waste | 6D | 4.B |
| SWD | Solid waste disposal | SWD.INC.MSW | Waste incineration - uncontrolled MSW burning | 6Cb1 | 4.C.1 |
| SWD | Solid waste disposal | SWD.INC.HOS, SEW, ISW | Waste incineration - non biogenic | 6Cb2 | 4.C.1 |
| SWD | Solid waste disposal | SWD.LDF | Managed waste disposal on land | 6A1 | 4.A.1 |
| SWD | Solid waste disposal | SWD.OTH.HAZ | Waste incineration - hazardous | 6C | 4.C.1 |
| SWD | Solid waste disposal | SWD.OTH | Other waste | 6D | 4.C.1 |
| TNR | Non-road transport | TNR.DAT | Domestic air transport | 1A3a | 1.A.3.a.ii |
| TNR | Non-road transport | TNR.IAT | International air transport | 1C1 | 1.A.3.a.i |
| TNR | Non-road transport | TNR.ILW | Inland shipping | 1A3d | 1.A.3.d.ii |
| TNR | Non-road transport | TNR.OTH | Non-road transport | 1A3e | 1.A.3.e.ii |
| TNR | Non-road transport | TNR.PIP | Non-road transport | 1A3e | 1.A.3.e.i |
| TNR | Non-road transport | TNR.RAI | Non-road transport (rail, etc.) | 1A3c | 1.A.3.c |
| TNR | Non-road transport | TNR.SEA | International marine transport (bunkers) | 1C2 | 1.A.3.d.i |
| TRF | Transformation industry | TRF.EBF | Blast furnaces (pig iron prod.) | 1A1c2 | 1.A.1.c.ii |

| TRF | Transformation industry | TRF.EBK | Other transformation sector (BKB, etc.) | 1A1c5 | 1.A.1.c.ii |
|-----|-------------------------|---------|------------------------------------------|-------|------------|
| TRF | Transformation industry | TRF.EBO | Other transformation sector (BKB, etc.) | 1A1c5 | 1.A.1.c.ii |
| TRF | Transformation industry | TRF.ECH | Fuel comb. charcoal production | 1A1c4 | 1.A.1.c.ii |
| TRF | Transformation industry | TRF.ECK | Fuel combustion coke ovens | 1A1c1 | 1.A.1.c.i |
| TRF | Transformation industry | TRF.EGW | Gas works | 1A1c3 | 1.A.1.c.ii |
| TRF | Transformation industry | TRF.ELN, ELQ, ENO, EOG, EPA | Other transformation sector (BKB, etc.) | 1A1c5 | 1.A.1.c.ii |
| TRF | Transformation industry | TRF.EMI | Off-road machinery: mining (diesel) | 1A5b1 | 1.A.5.b.iii |
| TRF | Transformation industry | TRF.TBN, TBO, TCE, TGL, TLN, TLS, TNO, TPE | Fuel transformation of gaseous fuels (GTL, Blend, (re-)gasif./Liquef.) | 1B2b5 | 1.B.2.b.iii |
| TRF | Transformation industry | TRF.TBF | Blast furnaces | 2C1b | 1.B.1.c |
| TRF | Transformation industry | TRF.TBK, TLQ, TPA | Fuel transformation of solid fuels (BKB Plants, coal liquefaction, patent fuel plants) | 1B1b4 | 1.B.1.c |
| TRF | Transformation industry | TRF.TCH | Fugitive emissions from solid fuels | 1B1 | 1.B.1.c |
| TRF | Transformation industry | TRF.TCK | Fuel transformation coke ovens | 1B1b1 | 1.B.1.c |
| TRF | Transformation industry | TRF.TGW | Fuel transformation in gas works | 1B1b2 | 1.B.2 |
| TRO | Road transport | TRO.EVP | Road transport (evaporation) | 1A3b | 1.A.3.b |
| TRO | Road transport | TRO.ROA | Road transport (mobile combustion) | 1A3b | 1.A.3.b |
| WWT | Waste water | WWT.DOM | Domestic and commercial wastewater | 6B2 | 4.D.1 |
| WWT | Waste water | WWT.IND | Industrial wastewater | 6B1 | 4.D.2 |

## 3 EDGARv4 temporal and spatial distribution

A key proxy dataset is the gridded world population provided by the Center for International Earth Science Information Network (CIESIN, 2005 and updated in 2011) for the years 1990, 1995, 2000, 2005, 2010 and projected to 2015. In-house proxy datasets are developed by dividing the total population into rural and urban. These data are applied in order to cover the country area and population and take into account the fraction of country data in cells with an intersection of the country's borders.

For the agricultural emission sources with diffuse areal distribution, agricultural land use and soil type maps, such as grassland and cropland cover datasets, rice cultivation area and animal density maps from FAO Geonetwork (2011, 2014) and Monfreda et al. (2008) are used. Coastal fishing activities are distributed on the artisanal fishing map of Halpern et al. (2015).

Industrial activities (power plants, oil refineries, mines) are mainly located at the plant location coordinates on the point source grid-maps. Power plant emissions have been distributed according to the CARMAv3.0 (2012) point source distribution making use of the CARMAv3.0 intensity parameter and differentiating three fuel types (coal, gas and oil). CARMA's point sources with low intensity are used to allocate emissions from auto-producing power or heat plants. A specific proxy was developed for the non-metallic minerals production (mainly cement and lime) for the world leading producers of cement (i.e. Brasil, USA, China and India) based on the plant locations and annual throughput of the facility listed by the CEC (2015) for China, Canada and Mexico, EPRTR (2012) v4.2 for Europe and USGS (2016) and IndustryAbout.com (2016) for the rest of the world.

Because of the incompleteness of the list of cement factories (in particular also those with smaller throughput), the country total is not fully distributed over the single reported point sources. Instead annual emission estimates per facility were applied. The difference between the total of the facility emissions and the country total of the given sector is distributed using urban population data. Gas flaring activities are distributed on NOAA's night-time light data (Elvidge et al., 2009) for those areas of Central America, Nigeria and Western Africa, the North Sea region, Middle East and Russia with strong gas flaring activities. For the major coal producers (i.e., China, USA and Southern Africa) the coordinates of coal mines from the World Coal Association (2016) are used to distribute emissions from underground and surface coal mines, also distinguishing between hard and brown coal. Coal mine locations for China have been updated and extended with the data of Liu et al. (2015).

Line sources are exclusively used to describe emissions from the transport sector. Different proxy data layers for three road types worldwide (highways, primary and secondary, residential and commercial roads) obtained from the OpenStreetMap of Geofabrik (2015) are used with different weighting factors for the emission distribution, depending on the type of vehicles circulating on the different types of roads. Similar data from OpenRailwayMap are used for railways.  For inland waterways the maritime traffic lines (for ships and ferries) are composed from the navigable parts of rivers and lakes, using the InlandWaterwaysMap of the US Department of Transport US DoT (2015) for the USA, the UNECE Waterway network (2015) for Europe  and the hydrology map of Lehner et al. (2011) for the rest of the world. Wang et al. (2008) is used for international shipping, updated for the Mediterranean, Black and Baltic Sea with Long Range Identification and Tracking data from the European Maritime Safety Agency, as described in Trombetti et al. (2017). The spatial proxy for the aviation sector is derived from International Civil Aviation Organization (ICAO, 2015) flight information and is specified at three different heights: takeoff/landing, climb-out/descending and cruise (see Fig. S1). ICAO (2015) specifies a typical flight pattern with landing/take-off cycle within few km of the airport, followed by climb-out/descending phase during the first 100 km and the last 100km of a flight and finally the remaining part from 101 km until the last 101 km as the cruise phase. Input data regarding airports and routes used in this approach are taken from Airline Route Mapper of ICAO (2015). Civil supersonic aviation using the Franco-British Concorde between 1976 and 2003 and the Russian Tupolev TU-144 between 1970 and 1983 are also included.

Each of the EDGAR human activities (at subsector level) is uniquely coupled to one temporal profile and one spatial distribution profile. The temporal profiles are given in Table S4a and the spatial profiles in Table S4b. These profiles have been collected, reviewed with our QA/QC procedure and refined over many years. The largest variation is found in the temporal profiles from Asman (1992) for the agricultural sector (Fig. S2a). A smaller modulation in emissions from residential heating is seen in the temporal profiles of Friedrich and Reis (2004), while the modulation of the power generation sector is from Veldt (1992), both updated by Thiruchitampalam (2012). For the monthly distribution of shipping emissions, the profile of Wang et al. (2008) is applied while aviation is distributed with the temporal profile of the AERO2K project of Eyers et al. (2004). Therefore the underlying source of information is given at our best knowledge with the reference in the tables which are a mix of data sources with hyperlinks and literature references.

**Table S4a – List of temporal profiles to which the human activities are allocated in EDGARv4.3.2 for monthly distribution. The data source provides the literature reference, in which these underlying proxies are described.**

| Geographical zone | Sector | Subsector | Temporal profile: data source | Temporal profile: data reference |
|---|---|---|---|---|
| **Northern temperate zone** | **energy** | Power industry | based on LOTOS | Veldt (1992), Builtjes (1992) |
| | **Waste** | solid waste and waste water | Constant | |
| | **fuel production & use** | Mining | Constant | |
| | | non-energy use of fuels | Constant | |
| | | Refineries | Constant | |
| | **process industry** | Metal | Constant | |
| | | Chemical | Constant | |
| | | manufacturing and other | Constant | |
| | **Solvents** | production & application | German data for paint, ink, glue of 90s | Friedrich (2000) |
| | **Residential** | gaseous fuel use | based on GENEMIS and LOTOS | Lenhart & Friedrich (1995) |
| | | solid fuel use | based on GENEMIS | Lenhart & Friedrich (1995) |
| | **Transport** | Ground | national data of the Netherlands, UK and USA | Friedrich (2000) |
| | | Shipping | Inland and international | Wang et al. (2008) |
| | | domestic & int. Aviation | AERO2K | Eyers et al. (2004) |
| | **Agriculture** | agricultural soils | based on agricultural model | Asman (1992) |
| | | agricultural waste burning | based on agricultural model | Asman (1992) |
| | | enteric fermentation | based on agricultural model | Asman (1992) |
| | | manure management | based on agricultural model | Asman (1992) |
| **Equator** | **all** | | Constant | |
| | **transport** | Ground | national data of the Netherlands, UK and USA | Friedrich (2000) |
| | | Shipping | Inland and international | Wang et al. (2008) |
| | | Aviation | AERO2K | Eyers et al. (2004) |
| **Southern temperate zone** | **all** | idem Northern temperate zone but shifted with 6 months | | cfr. references above |

**Table S4b – List of spatial proxy data that are in EDGARv4.3.2 applied to spatially distribute the national totals. The reference provides either the literature reference or the hyperlink where these underlying data can be found. All these spatial proxy datasets are modified to fit within the gridding algorithm of EDGARv4.3.2 and often combine different sources when no global coverage was obtained with the proxy data.**

| Main sector | Sector name | Spatial proxy specificity | Spatial proxy data source | Spatial proxy data reference |
|---|---|---|---|---|
| AGS | Agricultural soils | livestock: buffaloes, cattles, chickens, ducks, goats, pigs, poultry, sheeps | http://livestock.geo-wiki.org/ and with for buffaloes: http://www.fao.org/AG/AGAInfo/resources/en/glw/GLW_dens.html | FAO Geonetwork (2014) |
| | | 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 agricultural land and crop type mask | Ramankutty et al. (2008) |
| | | Histosols | FAO histosol map | FAO Geonetwork, 2007 |
| | | Grassland | CORINE GLC (2000) | 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 agricultural land and crop type mask | Ramankutty agricultural land and crop type mask |
| | | Grassland | CORINE GLC (2000) | Global Land Cover map JRC (2000) |
| CHE | Production of chemicals | adipic acid, ammonia, caprolactam, glyoxal, nitric acid, sulfuric acid | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR gridding manual (2013) |
| | | Urban population | In-house EDGAR proxy based on CIESIN GWPv3 population and settlements map (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ | CIESIN (2011) |
| ENE | Power industry | Power plants: public and auto-producers, distinguished per fuel type (coal, gas, oil) | CARMAv3.0 (2012) for 2004, 2009 and future, with few corrections (http://carma.org/) and local data for China and Russia | CARMAv3.0 (2012) |
| ENF | Enteric fermentation | Animals: buffaloes, cattles, goats, pigs, sheeps | http://livestock.geo-wiki.org/ and with for buffaloes: http://www.fao.org/AG/AGAInfo/resources/en/glw/GLW_dens.html | FAO Geonetwork (2014) |
| | | Grassland | CORINE GLC (2000) | Global Land Cover map JRC (2000) |
| FOO | Production of foods | Urban population | In-house EDGAR proxy based on CIESIN GWPv3 population and settlements map (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ | CIESIN (2011) |
| FFF | Fossil Fuel Fires | coal fires | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |
| | | gas flaring | NOAA-NDGC (2015) VIIRS data https://www.ngdc.noaa.gov/eog/viirs.html | NOAA-NDGC (2015); Elvidge et al. (2016) |

| | | | | |
|---|---|---|---|---|
| **IND** | **Combustion for manufacturing industry** | Cement | Combining USGS point souce data (http://mrdata.usgs.gov/mineral-operations/) and EPRTRv4.2 data (http://prtr.ec.europa.eu) (for Europe) and CEC data (http://takingstock.cec.org/) | USGS (2014); E-PRTR (2012); CEC (2015) |
| | | Chemical | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |
| | | Mining | In-house EDGAR proxy based on USGS (https://mrdata.usgs.gov/mrds/) | USGS (2014) |
| | | Paper | Combining EPRTRv4.2 dataset (http://prtr.ec.europa.eu) and CEC data (http://takingstock.cec.org/) | E-PRTR (2012); CEC (2015) |
| | | Steel | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |
| | | Urban population | In-house EDGAR proxy based on CIESIN GWPv3 population and settlements maps (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ | CIESIN (2011) |
| **IRO** | **Iron/ steel production** | Blast furnace, Basic oxygen furnace, Open hearth furnace, Crude steel,Electric furnace, Sinter, Steel | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |
| **MNM** | **Manure management** | Animals: buffaloes, cattles, chickens, ducks, goats, pigs, poultry, sheeps | http://livestock.geo-wiki.org/ and with for buffaloes: http://www.fao.org/AG/AGAInfo/resources/en/glw/GLW_dens.html | FAO Geonetwork (2014) |
| | | Grassland | CORINE GLC (2000) | Global Land Cover map JRC (2000) |
| **NEU** | **Non energy use of fuels** | Urban population | In-house EDGAR proxy based on CIESIN GWPv3 population and settlements maps (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ | CIESIN (2011) |
| **NFE** | **Non-ferrous metals production** | Aluminum production (primary and secondary) | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |
| | | Copper production (primary and secondary) | USGS copper production data (https://mrdata.usgs.gov/mrds/) | USGS (2014) |
| | | Magnesium production (primary and secondary) | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |
| | | Lead production (primary and secondary) | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |
| | | Zinc production (primary and secondary) | In-house EDGAR proxy based on USGS (https://mrdata.usgs.gov/mrds/) | USGS (2014) |
| | | Urban population | In-house EDGAR proxy based on CIESIN GWPv3 population and settlements maps (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ | CIESIN (2011) |
| **NMM** | **Non-metallic minerals production** | Cement | Combining USGS cement data (http://mrdata.usgs.gov/mineral-operations/) and EPRTRv4.2 data (http://prtr.ec.europa.eu) and CEC data (http://takingstock.cec.org/) | USGS (2014); E-PRTR (2012); CEC (2015) |

| | | | | |
|---|---|---|---|---|
| | | Lime | Combining USGS cement data (http://mrdata.usgs.gov/mineral-operations/) and EPRTRv4.2 data (http://prtr.ec.europa.eu) and CEC data (http://takingstock.cec.org/) | USGS (2014); E-PRTR (2012); CEC (2015) |
| | | Urban population | In-house EDGAR proxy based on CIESIN GWPv3 population and settlements maps (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ | CIESIN (2011) |
| **PAP** | **Production of pulp and paper** | Paper | Combining paper production data of EPRTRv4.2 (http://prtr.ec.europa.eu) and CEC data (http://takingstock.cec.org/) (gapfilled with urban population) | E-PRTR (2012); CEC (2015) |
| **PRO** | **Fuel exploitation** | Coal mining: brown and hard coal | Combining USGS coal mines (https://www.usgs.gov/) and EPRTRv4.2 for European mines (http://prtr.ec.europa.eu) and Global Energy Observatory ( http://globalenergyobservatory.org) and China coal mine data from Liu et al. (2015) | USGS (2014); E-PRTRv4.2 (2012); Liu et al. (2015) |
| | | gas flaring | NOAA-NDGC (2015) VIIRS data https://www.ngdc.noaa.gov/eog/viirs.html | NOAA-NDGC (2015); Elvidge et al. (2016) |
| | | Gas pipelines transmission | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |
| | | oil pipelines | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |
| | | oil terminals | In-house EDGAR proxy based on World Port Index (PUB 150) (http://msi.nga.mil/MSISiteContent/StaticFiles/NAV_PUBS/WPI/Pub150bk.pdf) gapfilled with urban population | World Port (2015) |
| | | shipping tankers | In-house EDGAR proxy based on LRIT and Wang et al. (2007) | Trombetti et al. (2017); Wang et al. (2007) |
| | | Population | In-house EDGAR proxy based on CIESIN GWPv3 population map (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ | CIESIN (2011) |
| | | Roads: commercial heavy duty, residential | In-house EDGAR proxy based on OpenStreetMap (2015), distinguishing 4 different road type classes | Geofabrik (2015) |
| **PRU** | **Production and use of other products** | Urban population | In-house EDGAR proxy based on CIESIN GWPv3 population and settlements map (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ | CIESIN (2011) |
| **RCO** | **Energy for buildings** | Fishing | In-house EDGAR proxy based on KNB data repository | Halpern et al. (2015) |
| | | Rural population, urban population | In-house EDGAR proxy based on CIESIN GWPv3 population and settlements map (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ (rural pop.= total pop. –urban pop.) | CIESIN (2011) |

| | | | | |
|---|---|---|---|---|
| **REF_TRF** | **Oil refineries and Transformation industry** | Coke | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |
| | | gas flaring | NOAA-NDGC (2015) VIIRS data https://www.ngdc.noaa.gov/eog/viirs.html | NOAA-NDGC (2015); Elvidge et al. (2016) |
| | | Iron Blast furnace | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |
| | | Mining | In-house EDGAR proxy based on USGS (https://mrdata.usgs.gov/mrds/) | USGS (2014) |
| | | oil refineries | In-house EDGAR proxy with E-PRTRv4.2 for Europe, USGS (https://mrdata.usgs.gov/mrds/), | E-PRTR (2012); USGS (2014); |
| | | oil terminals | In-house EDGAR proxy based on World Port Index (PUB 150) (http://msi.nga.mil/MSISiteContent/StaticFiles/NAV_PUBS/WPI/Pub150bk.pdf) | World Port (2015) |
| | | Residential Roads | In-house EDGAR proxy based on OpenStreetMap (2015), distinguishing 4 different road type classes | Geofabrik (2015) |
| | | Urban population | In-house EDGAR proxy based on CIESIN GWPv3 population and settlements map (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ | CIESIN (2011) |
| **SOL** | **Application of solvents** | Urban population, rural population | In-house EDGAR proxy based on CIESIN GWPv3 population and settlements map (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ (rural pop.= total pop. –urban pop.) | CIESIN (2011) |
| **SWD_INC** | **Solid waste incineration** | Solid waste incineration | In-house EDGAR proxy based on EPRTRv4.2 European incinerators (http://prtr.ec.europa.eu) (gapfilled with urban population) | E-PRTR (2012) |
| **SWD_LDF** | **Solid waste landfills** | Solid waste landfills | In-house EDGAR proxy based on EPRTRv4.2 European landfills (http://prtr.ec.europa.eu) and CEC (http://takingstock.cec.org/) (gapfilled with urban population) | E-PRTR (2012); CEC (2015) |
| **TNR_AIR** | **Aviation** | Domestic and international aviation, distinguished at 4 different height levels for climb-out/descending, cruise, supersonic and take-off/landing | In-house EDGAR proxy based on Airline Route Mapper (http://arm.64hosts.com/) | ICAO (2015) |
| **TNR_Other** | **Rail, pipelines, off-road** | Residential Roads | In-house EDGAR proxy based on OpenStreetMap (2015), distinguishing 4 different road type classes | Geofabrik (2015) |
| | | Railways | In-house EDGAR proxy based on OpenRailMap | Geofabrik (2015) |
| **TNR_Ship** | **Ships** | Shipping: cargo, passengers, tankers | In-house EDGAR proxy based on LRIT and Wang et al. (2007) | Trombetti et al. (2017); Wang et al. (2007) |
| | | inland waterways | In-house EDGAR proxy | Janssens-Maenhout et al., EDGAR grid. manual (2013) |

| | | | | |
|---|---|---|---|---|
| **TRO** | Road transportation | Roads: commercial heavy and light duty, residential | In-house EDGAR proxy based on OpenStreetMap (2015), distinguishing 4 different road type classes | Geofabrik (2015) |
| **WWT** | Waste water handling | Waste water treatment | In-house EDGAR proxy based on EPRTR WWT plants in Europe (http://prtr.ec.europa.eu) and CEC (http://takingstock.cec.org/) | E-PRTR (2012); CEC (2015) |
| | | Urban population, rural population | In-house EDGAR proxy based on CIESIN GWPv3 population and settlements map (5 year timesteps from 1990 onwards) http://sedac.ciesin.columbia.edu/ (rural pop.= total pop. –urban pop.) | CIESIN (2011) |

The distribution of the country totals for a given sector over the different grid cells of the country occurs, where needed, with technology-specific and timedependent proxy data $f_{ij}$ (in formula (2)):

- For road transport, technology-dependence is highly important, to reflect the traffic of passenger cars but no heavy duty vehicles on residential roads, but both on highways. The OpenstreetMap has been downloaded for all parts of the globe with the 4 different types of roads. For each vehicle type in EDGARv4 (motorcycles, mopeds, passenger cars, light duty vehicles, heavy duty vehicles and busses) a proxy dataset is composed with the appropriate roads (max. 4 out of the 4) on which the given type of vehicles are mainly running. The proxy data does not vary over time, but the shares of the different vehicles do vary over time and as such a time variation is obtained in the road transport emissions distribution.

- For power plants, no technology-dependence is available in the proxy datasets, but fuel- and time-dependence, given by the CARMAv3.0 datasets (2004, 2007, future). After a standard QA/QC screening with gapfilling of missing (0,0) plant coordinates, correcting inverted (lon,lat) coordinates and adding some additional points for Russia, the proxy data were used for 2004 (covering the period up to 2005), for 2007 (covering the period 2006-2010) and for future (covering the period 2011-2012). With the given carbon-intensity, a differentiation between coal, oil and gas power plants could be made, so that the distribution of the power plant emissions can be done while keeping the fuel characteristics. The capacity is used to vary the strength of the point sources relatively within the same fuel category. For larger countries (e.g. USA) with a non-uniform distribution of coal power plants, this was considered a significant improvement. There is a high uncertainty inusing the capacity for the actual strength of the point source. However, plant information data is sensitive and the CARMAv3.0 provides the desired input for a global picture.
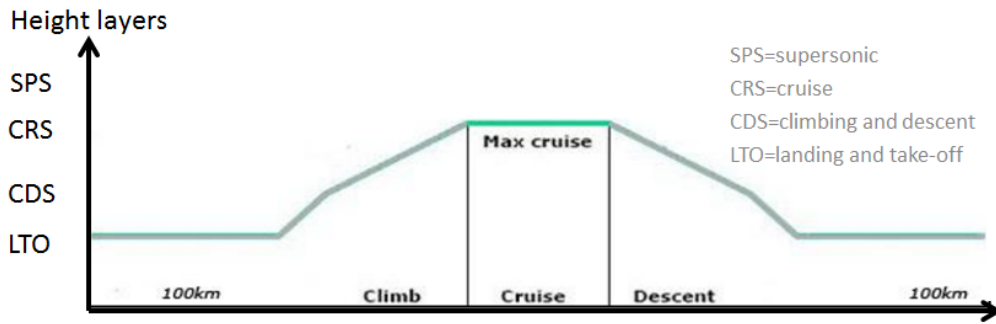
**Figure S1 – EDGAR approach to distribute emissions from aviation over 4 different altitude ranges.**
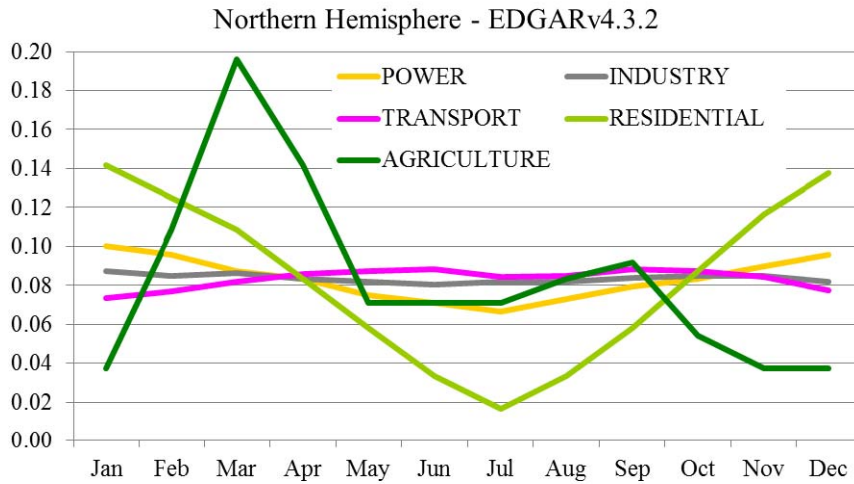


5    **Figure S2 – a. Proxy data used in EDGARv4.3.2 to temporally distribute the annual emissions over 12 months.**
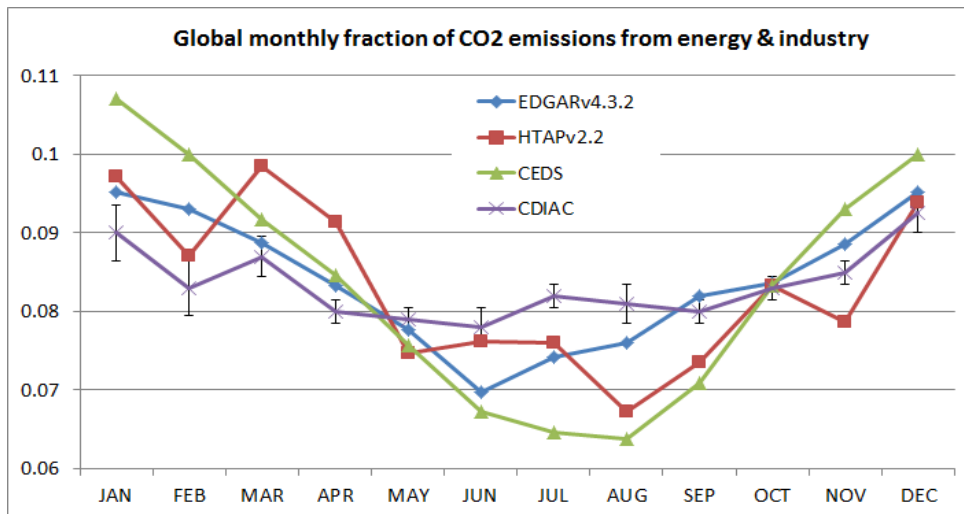
**Fig. S2b: Comparison of the monthly fractions of CO2 emissions from energy and industry applied by EDGARv4.3.2, with those derived by Andres et al. (2011) for CDIAC, Hoesly et al. (2018) for CEDS and Janssens-Maenhout et al. (2015) for HTAPv2.2.**

5    **4    Comparison of EDGARv4.3.2 to previous versions v4.2 and v4.1**

Compared to former versions of the EDGAR database (e.g. EDGARv4.2, http://edgar.jrc.ec.europa.eu/overview.php?v=42), some emission factors have been updated, mostly for CH4 on coal mining and N2O on agricultural soils. This explains the differences in the comparison of the different EDGAR versions in Fig. S3.



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| Agriculture | 2005 | Tg N2O/yr | share | σ |
|---|---|---|---|---|
| Agricultural soils | AGS | 4.26E+00 | 59.6% | 2.6% |
| Crop waste burning | AWB | 3.92E-02 | 0.5% | 1.0% |
| Manure Management | MNM | 3.14E-01 | 4.39% | 1.4% |
| Non-Agriculture | 2005 | Pg CO2/yr | share | σ |
| Chemicals | CHE | 7.12E-01 | 0.55% | 1.0% |
| Energy | ENE | 2.07E-01 | 9.94% | 14.9% |
| Fossil fuel fires | FFF | 7.53E-04 | 0.01% | 0.0% |
| Indirect emissions | IDE | 5.51E-01 | 7.70% | 11.8% |
| Manufacturing | IND | 6.69E-02 | 0.93% | 28.5% |
| fossil fuel production | PRO | 3.35E-03 | 0.05% | 23.6% |
| products use | PRU | 8.10E-02 | 1.1% | 6.5% |
| Housing | RCO | 2.53E-01 | 3.5% | 5.2% |
| Refineries | REF | 2.22E-03 | 0.0% | 1.4% |
| Solid waste | SWD | 1.40E-02 | 0.2% | 29.8% |
| Non-road transport | TNR | 7.81E-02 | 1.1% | 1.8% |
| Fuel transformation | TRF | 1.32E-02 | 0.2% | 28.1% |
| Road transport | TRO | 2.39E-01 | 3.3% | 0.6% |
| Wastewater | WWT | 3.19E-01 | 4.5% | 1.7% |

**Figure S3: Comparison of v4.3.2 with previous EDGARversions (v4.2 and v4.1) for CO$_2$ (a), CH$_4$ (b) and N$_2$O (c)**

The largest improvement of the gridmaps is due to the significant update of the proxy data (see Table S4) to localise better the non-diffusive emissions. The importance of point and line source data has been also confirmed by Oda et al. (2018), which calls for further observation-based verification. Table S5 shows the difference between v4.2 and v4.3.2 proxy datasets and illustrates the more prominent use of line and point sources where data is available. The examples below illustrate how user feedback helped to enhance the spatial proxy:

- A more appropriate representation of the road transportation activity with the 4 types of road in v4.3.2 (versus the generic „roads x population" proxy in v4.2) for the transport by passenger cars was obtained, by representing better the volume traffic well, not only in Europe (as analysed by Thiruchitampalam, 2012) but also in the USA with sufficient weight the city connections (contrary to v4.2 as observed by Gately et al., 2017). The new proxy data also works on a different road pattern for China and other developing regions, where road density and urban areas have a completely different pattern from the ones of industrialized countries.

- The power plants proxy from CARMA v3.0 yield a better and more appropriate representation of the power and heat generation activity, of which we did not only update the large power plant locations splitup by fuel type (coal, oil, gas) but we now included also the autoproducers and small scale electricity and heat production plants. In addition, the QA/QC procedures do not only check the completeness of the proxies but also the plausibility of the values for plant facilities with their capacity.

- Improvement of the spatial distribution of the fossil fuel production emissions in EDGARv4.2 was shown to be necessary for USA by Maasakkers et al. (2016) and for China by Saunois et al. (2017) and addressed accordingly by extending the dataset with extra point sources for the extraction and mining sites.

**Table S5 – Improvement of the spatial proxy data from EDGARv4.2 to EDGAR v4.3.2: indicating those sectors that were considerably improved for the spatial distribution of the sectoral emission totals per country.**

| EDGAR sector | Sector description | Gridmaps v4.2 | Gridmaps v4.3.2 |
|---|---|---|---|
| | | | |

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| | | 114 maps | 297 maps (also sometimes changing over the 42 yr time period) |
|---|---|---|---|
| **Total** | | 114 maps | 297 maps (also sometimes changing over the 42 yr time period) |
| **AGS/ ENF/ MNM** | **Agriculture** | Per type of animal: FAOgeonetwork (2007) | Per type of animal: FAOgeonetwork (2014) |
| | | Per type of crop: FAOgeonetwork (2007) | Per type of crop: FAOgeonetwork (2014) |
| **CHE/ IRO/ NFE** | **Production of chemicals** | In-house EDGAR proxy, gapfilled with **population** as default | In-house EDGAR proxy per type of non-ferrous metal or per type of chemical product, improved with **point source data** from EPRTRv4.2 for Europe, USGS for the rest of the world, gapfilled with **urban population** as default |
| **NMM** | **Cement** | In-house EDGAR proxy, gapfilled with **population** as default | In-house EDGAR proxy, improved **with point source data** from EPRTRv4.2 (2012) for Europe, and CEC (2015) for the rest of the world with global cement shares per province for China and with **urban population** as default |
| **ENE** | **Power industry** | 53981 Power plants (public + autoproducers) from CARMA (2007) without distinction for fuel type | 68931 Power plants (public + autoproducers) from CARMAv3.0 (2012), distinguished per fuel type and with correction for missing or inverted coordinates and additions for China and Russia |
| **PRO** | **Fuel exploitation** | In-house EDGAR proxy, with distinction per fuel type and surface and ground mining of brown and hard coal. | In-house EDGAR proxy per fuel type, improved for coal mining with **point source data** from EPRTRv4.2 (2012) for Europe, and Liu et al. (2015) for China |
| **REF** | **Oil refineries** | In house EDGAR proxy, with gas flaring from **DMSP (Elvidge, 2009),** and gapfilling with **population** as default | In-house EDGAR proxy, improved **with point source data** from EPRTRv4.2 (2012) for Europe, USGS (2014), gas flaring from **NOAA-NDGC (2015),** oil terminals from World Port (2015), gapfilled with **rural population** |
| **SWD** | **Landfills and waste incinerators** | In-house EDGAR proxy, gapfilled with population | In-house EDGAR proxy, improved **with point source data** from EPRTRv4.2 for Europe, gapfilled with **urban population** |
| **TNR_ Aviation** | **Aviation** | In-house EDGAR proxy with distinction between take-off/landing, climb-out/descend, cruise, supersonic based on **AERO2K** dataset (Eyers et al. 2004) | In-house EDGAR proxy with distinction between take-off/landing, climb-out/descend, cruise, supersonic based on **Airline Route Mapper** (http://arm.64hosts.com/) |
| **TNR_ Ship** | **Shipping** | EDGAR proxy based on Wang et al. (2008) | In-house EDGAR proxy based on Wang et al. (2008) improved with **LRIT** information (Trombetti, 2017) for European seas |
| **TRO** | **Road transport** | Convolution of **roads** of OpenstreetMap **(2008)** and the **population** map for all vehicles except trucks; roads of OpenstreetMap (2008) for trucks | New OpenStreetMap **(2015) with distinction between 4 different road type classes**, used differently for the different types of vehicles (trucks, passenger cars, busses, twowheelers) |
| **WWT** | **Waste water handling** | Total population for developed countries, urban population for developing countries | EDGAR proxy improved with point source data from EPRTRv4.2 (2012) and CEC (2015), gapfilled with urban population |

## 5 Resulting trends for $CO_2$, $CH_4$ and $N_2O$ per country group

In addition to the GHG trends for the three major regions in Fig. 4, the figures S4a, S4b and S4c present the three GHG separately for the same regions and countries: (i) non-Annex I countries with China, India, Brazil and Rest of non-Annex I countries, (ii) 24OECD90 countries with USA, EU15 and the remaining 8 OECD countries of 1990, (iii) 16EIT90 countries with Russia, EU13 and the remaining 2 newly independent Eurasian states. While

Fig. S4a shows a similar trend as Fig. 4, this is not the case for Fig. S4b and S4c, where e.g. non-Annex I countries with significant agricultural activities and relative large uncertainties are important.
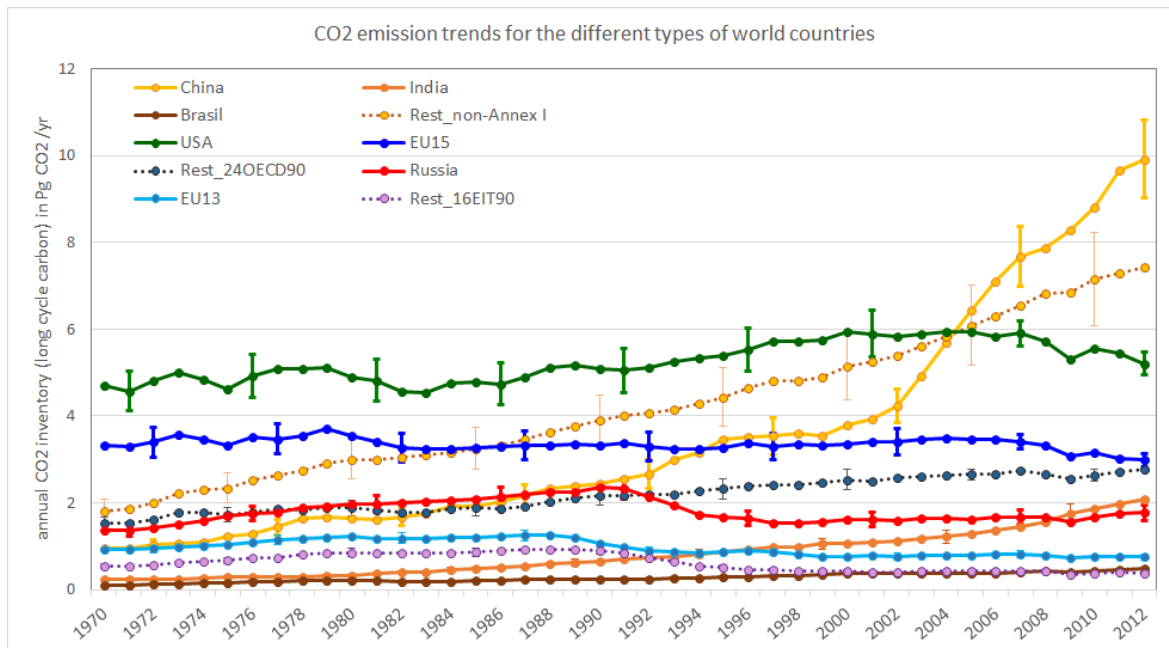


5    **Figure S4a: Annual CO₂ time series 1970-2012 of EDGARv4.3.2 with periodic error bar indication for the different types of countries with top emitters: China, India, Brasil, USA, EU-15, EU13, Russia and the rest of the non-Annex I countries, the rest of the OECD countries and the rest of the Eurasian states.**
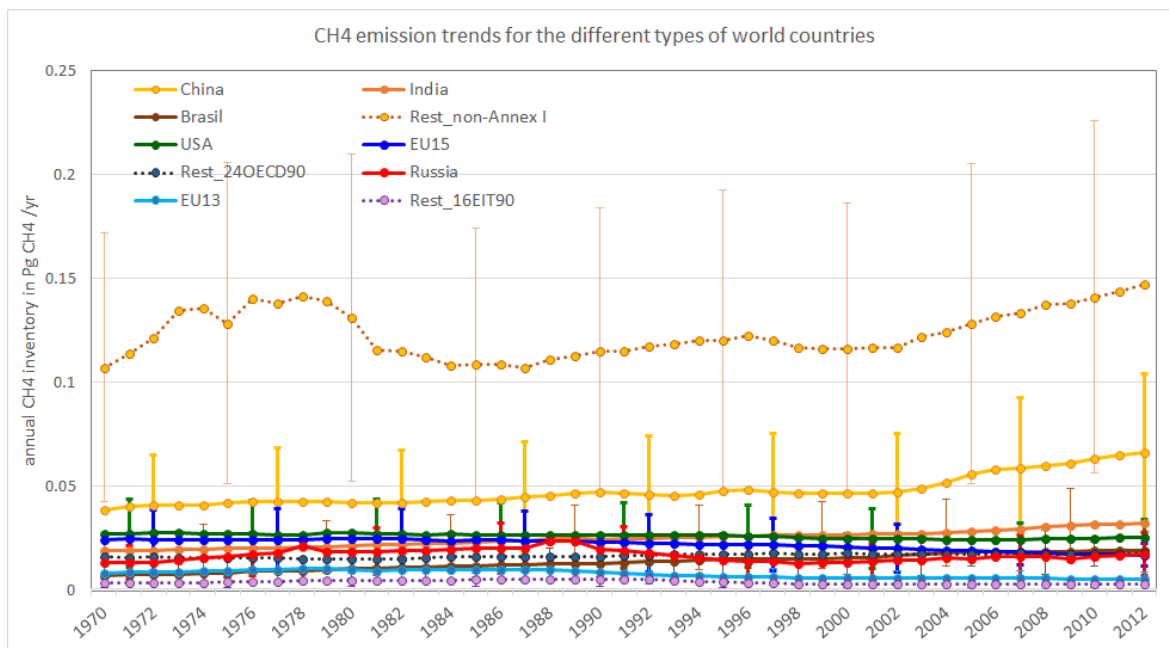


10   **Figure S4b: Annual CH₄ time series 1970-2012 of EDGARv4.3.2 with periodic error bar indication for the different types of countries with top emitters: China, India, Brasil, USA, EU-15, EU13, Russia and the rest of the non-Annex I countries, the rest of the OECD countries and the rest of the Eurasian states.**
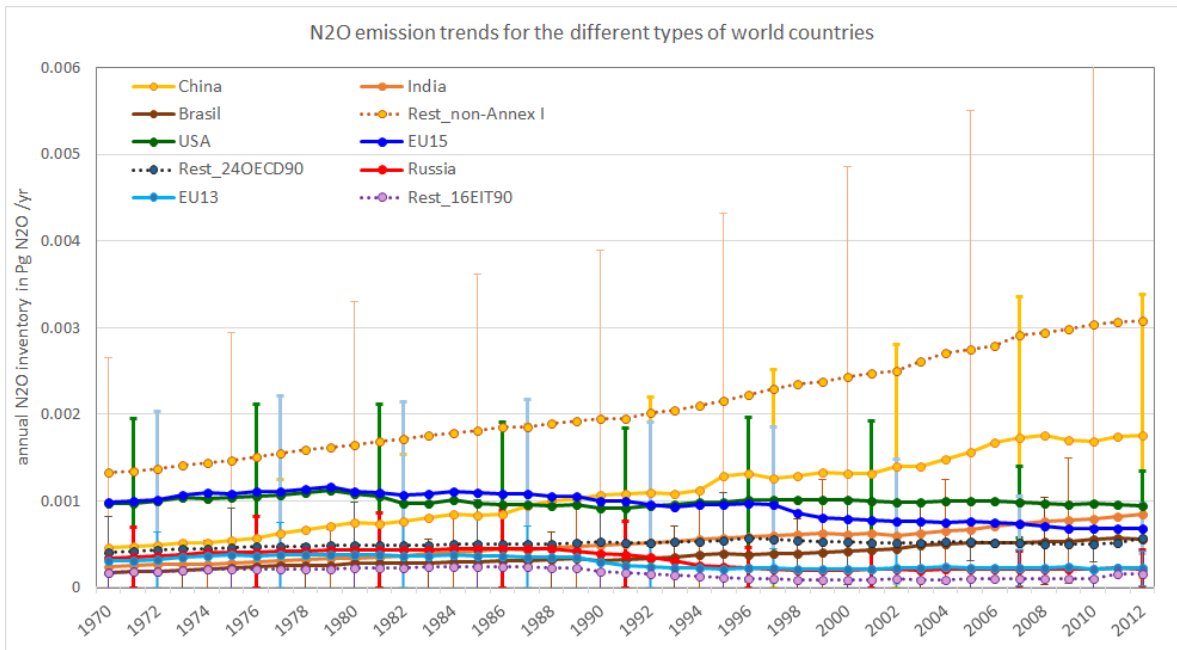
**Figure S4c: Annual N$_2$O time series 1970-2012 of EDGARv4.3.2 with periodic error bar indication for the different types of countries with top emitters: China, India, Brasil, USA, EU-15, EU13, Russia and the rest of the non-Annex I countries, the rest of the OECD countries and the rest of the Eurasian states.**

5

## 6    Resulting grid-maps of CO$_2$ - addition

The grid-maps of CO$_2$ presented in Fig. 9, 10 and 11 include both the short- and long-cycle carbon. For the buildings and road transport sector, it is interesting to look at the emissions difference for the long- and short-cycle carbon CO$_2$ separately. Figures S5a and S5b present the buildings sector for the long-cycle carbon CO$_2$ (from the combustion of fossil fuel) and respectively the short-cycle carbon CO$_2$ (from combustion of biofuel such as wood, wood waste, vegetal waste, dung, which are important for e.g. India). While the combustion of fossil fuel increased in Asia (India and China) considerably, the consumption of biofuel in the residential sector is partially decreasing, particularly in highly populated areas. Figures S5c and S5d present the transport sector for the long-cycle carbon CO$_2$ (mainly from combustion of diesel, petrol, gas) and the short-cycle carbon CO$_2$ respectively (from combustion of biodiesel and biogasoline). The trend of increasing fuel consumption for road transport is almost globally strongly present for the fossil fuel, while the biofuel consumption in road transport remains limited so far (except for Brasil).
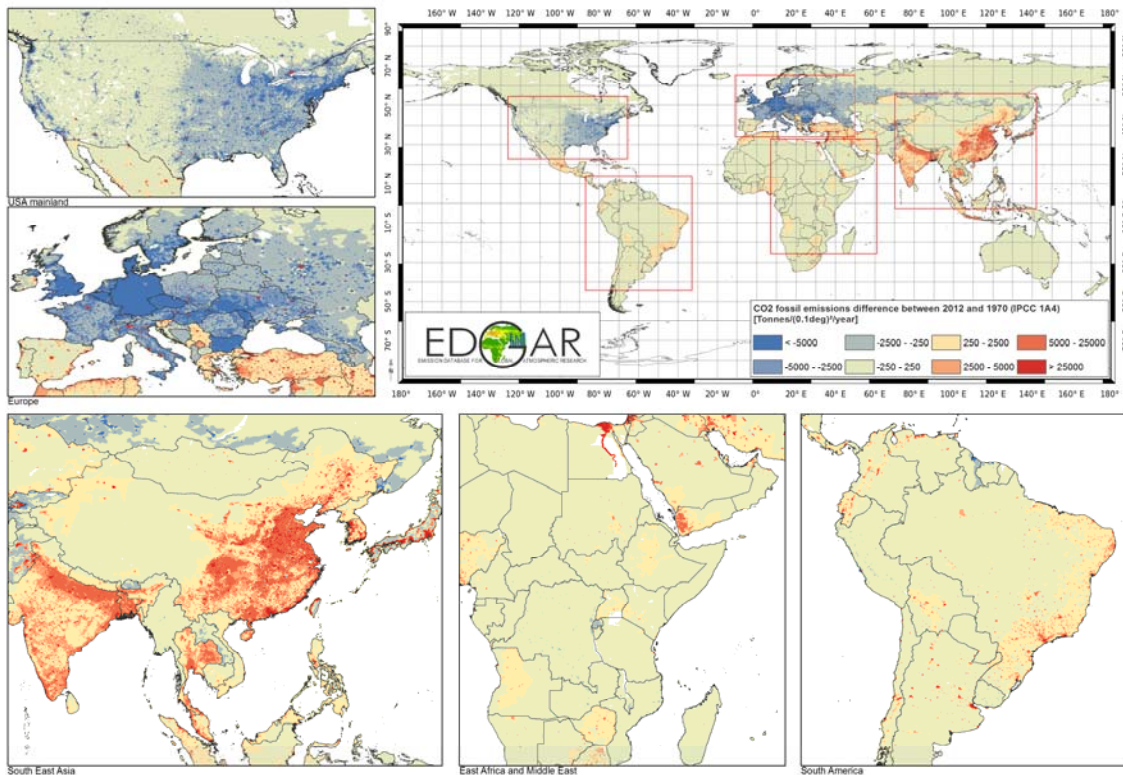


**Figure S5a: Difference between 2012 and 1970 in long-cycle carbon CO$_2$ emissions from the buildings sector (combustion of fossil fuel for heating, cooling and equiping buildings, including also lighting and cooking).**
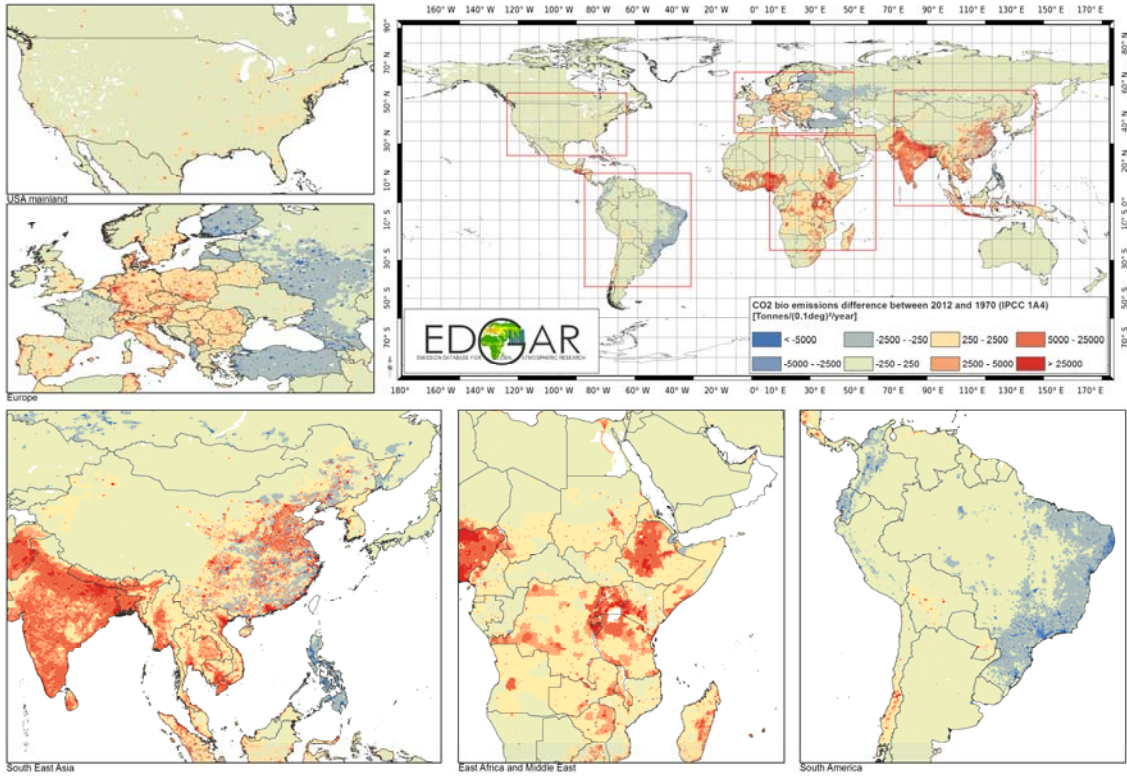
**Figure S5b: Difference between 2012 and 1970 in short-cycle carbon CO$_2$ emissions from the buildings sector (combustion of biofuel, vegetal waste, wood waste, dung, wood for heating and cooking).**



5
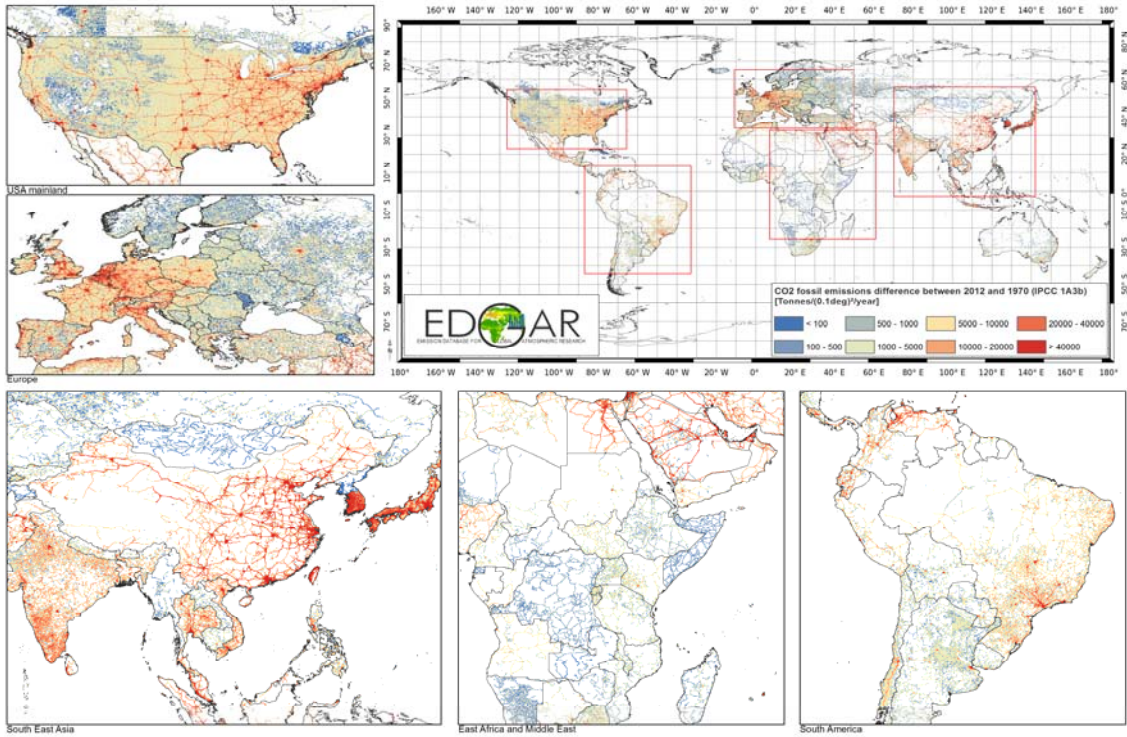
**Figure S5c: Difference between 2012 and 1970 in long-cycle carbon CO$_2$ emissions from the transport sector (consumption of diesel, petrol, gas by vehicles for road transport).**
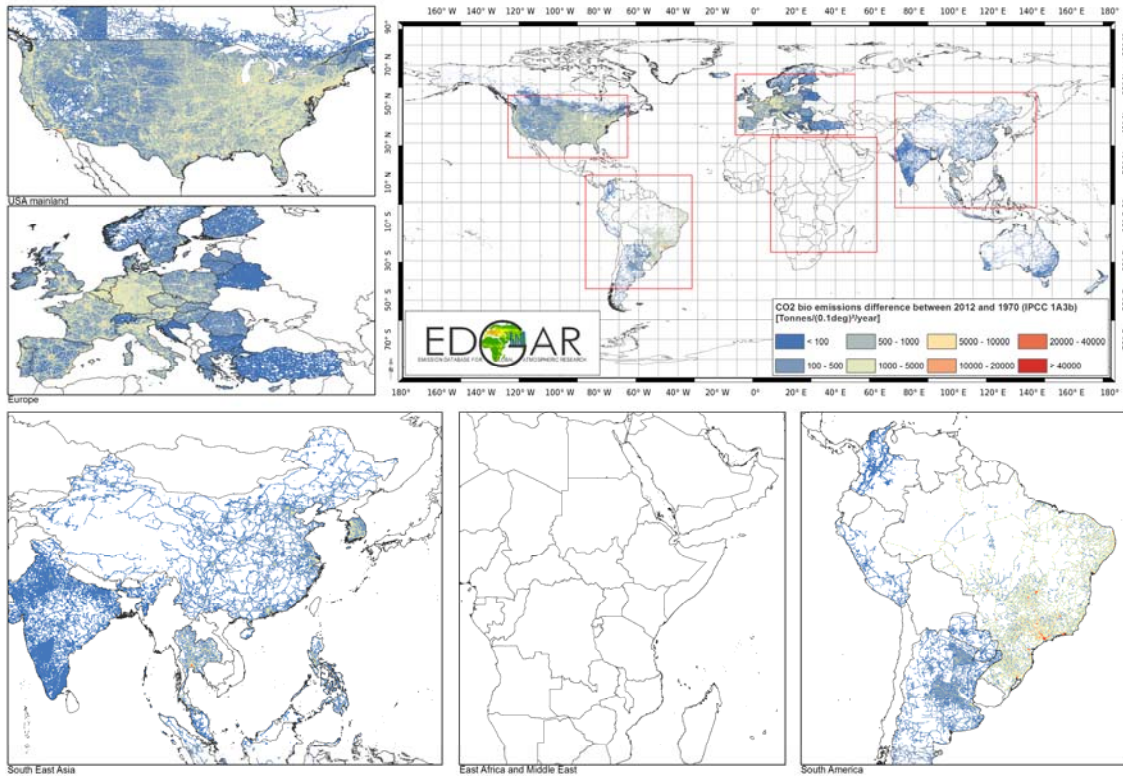
**Figure S5d: Difference between 2012 and 1970 in short-cycle carbon CO$_2$ emissions from the transport sector (consumption of biodiesel or biogasoline in vehicles).**

The sensitivity of the spatial distribution in the gridmaps is not negligible and subject to investigation in the H2020 project CHE. However, the atmospheric modeling community has been using EDGARv4, as shown in Table S5 and feedback has been taken up in the v4.3.2 version.

**Table S5 – Non-exhaustive list of examples of EDGARv4 uptake by the atmospheric modeling community.**

| EDGAR version | Greenhouse Gas | Reference |
|---|---|---|
| EDGARv4.0 | CH$_4$ | Beck et al. (2012) ; Monteil et al. (2011) |
| EDGAR v4.1 (EC-JRC/PBL, 2010) | CH$_4$, N$_2$O | Montzka et al. (2011) |
| EDGARv4.2 (EC-JRC/PBL, 2012) | CO$_2$ | Agusti-Panareda et al. (2014); Liu et al. (2015); Schneising et al. (2013), Gately & Hutyra (2017), Oda et al. (2018) |
| | CH$_4$ | Alexe et al. (2015); Buchwitz et al. (2017); Bergamaschi et al. (2015); Houweling et al. (2014) ; Jacob et al. (2016) ; Kirschke et al. (2013); Massart et al. (2014) ; Miller et al. (2013), Maasakkers et al. (2016) |
| | N$_2$O | Bergamaschi et al. (2015) |

| EDGARv4.2FT2010<br>EC-JRC/PBL (2013) | $CO_2$ | Liu et al. (2017) ; Pandey et al. (2016), Oda et al. (2018) |
|---|---|---|
| | $CH_4$ | Henne et al. (2016) ; Janardanan et al. (2017); Pandey et al. (2016) ; Röckmann et al. (2016) ; Thompson et al. (2017) ; Turner et al. (2016) ; Wunch et al. (2018) ; Yu et al. (2017) |
| EDGARv4.2FT-InGOS<br>Janssens-Maenhout et al. (2014) | $CH_4$, $N_2O$ | Bergamaschi et al. (2018) |
| EDGARv4.3.1<br>EC-JRC/PBL (2016) | $CO_2$ | Boschetti et al. (2018) ; Vardag et al. (2015) |
| EDGAR v4.3.2<br>Janssens-Maenhout et al. (2018) | $CO_2$ | Le Quéré et al. (2018) |

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