The PRIMAP-hist national historical emissions time series (1850-2014) (v1.1, updated February 2017)

Recommended citation

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Content

Use of the dataset and full description

Before using the dataset, please read the article describing the methodology, especially the section on uncertainties and the section on limitations of the method and use of the dataset.

Gütschow, J.; Jeffery, L.; Gieseke, R.; Gebel, R.; Stevens, D.; Krapp, M.; Rocha, M. (2016): The PRIMAP-hist national historical emissions time series, Earth Syst. Sci. Data, 8, 571-603, https://doi.org/10.5194/essd-8-571-2016

Please notify us (johannes.guetschow@pik-potsdam.de) if you use the dataset so that we can keep track of how it is used and take that into consideration when updating and improving the dataset.

When using this dataset or one of its updates, please cite the DOI of the precise version of the dataset used and also the data description article which this dataset is supplement to (see above). Please consider also citing the relevant original sources when using the PRIMAP-hist dataset. See the full citations in the References section further below.

Support

If you need support in using the dataset or have any other questions regarding the dataset, please contact johannes.guetschow@pik-potsdam.de.

Abstract

The PRIMAP-hist dataset combines several published datasets to create a comprehensive set of greenhouse gas emission pathways for every country and Kyoto gas covering the years 1850 to 2014, and all UNFCCC (United Nations Framework Convention on Climate Change) member states, as well as most non-UNFCCC territories. The data resolves the main IPCC (Intergovernmental Panel on Climate Change) 1996 categories. For CO_2 from energy and industry, time series for subsectors are available.

The PRIMAP-hist v1.1 dataset is an updated version of

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Please consult the Changelog below for a detailed description of the changes between versions.

Sources

UNFCCC National Communications and National Inventory Reports for developing countries: UNFCCC (2017)

UNFCCC Biennal Update Reports: UNFCCC (2016)

UNFCCC Common Reporting Format (CRF): UNFCCC (2013), UNFCCC (2014)

BP Statistical Review of World Energy: British Petroleum (2016)

CDIAC: Boden et al. (2016)

EDGAR versions 4.2 and 4.2 FT2010:: JRC and PBL (2011), Olivier and Janssens-Maenhout (2012)

FAOSTAT database: Food and Agriculture Organization of the United Nations (2016)

Houghton land use CO_2: Houghton (2008)

RCP historical data: Meinshausen et al. (2011)

EDGAR-HYDE 1.4: Van Aardenne et al. (2001), Olivier and Berdowski (2001),

HYDE land cover data: Klein Goldewijk et al. (2010), Klein Goldewijk et al. (2011)

SAGE Global Potential Vegetation Dataset: Ramankutty and Foley (1999)

FAO Country Boundaries: Food and Agriculture Organization of the United Nations (2015)

Files included in the dataset

PRIMAP-hist_v1.1_06-Mar-2017.csv: With numerical extrapolation of all time series to 2014.

PRIMAP-hist_no_extrapolation_v1.1_06-Mar-2017.csv: Without numerical extrapolation of missing values.

Notes

Emissions from international aviation and shipping are not included in the dataset.

Data format description (columns)

"scenario"

Always "HISTORY".

"country"

ISO 3166 three-letter country codes or custom codes for groups:

Table 1: Additional "country" codes.

Code	Region description
EARTH	Aggregated emissions for all countries.
ANNEXI	Annex-I Parties to the Convention
NONANNEXI	Non-Annex-I Parties to the Convention
AOSIS	Alliance of Small Island States
BASIC	BASIC countries (Brazil, South Africa, India and China)
EU28	European Union
LDC	Least Developed Countries
UMBRELLA	Umbrella Group

"category"

IPCC (Intergovernmental Panel on Climate Change) 1996 categories for emissions

Table 2: Category descriptions using IPCC 1996 terminology.

Category code	Description
CAT0	National Total
CATM0EL	National Total excluding LULUCF
CAT1	Total Energy
CAT1A	Fuel Combustion Activities
CAT1B1	Fugitive Emissions from Solid Fuels
CAT1B2	Fugitive Emissions from Oil and Gas
CAT2	Industrial Processes
CAT2A	Mineral Products
CAT2B	Chemical Industries
CAT2C	Metal Production
CAT2D	Other Production
CAT2G	Other
CAT3	Solvent and Other Product Use
CAT4	Agriculture
CAT5	Land Use, Land Use Change, and Forestry (LULUCF)
CAT6	Waste
CAT7	Other

"entity"

Gas categories using global warming potentials from either Second Assessment Report (SAR) or Assessment Report 4 (AR4).

Table 3: Gas categories and used global warming potential

Code	Description
CH4	Methane
CO2	Carbon Dioxide
FGASES	Fluorinated Gases (SAR)
FGASESAR4	Fluorinated Gases (AR4)
HFCS	Hydrofluorocarbons (SAR)
HFCSAR4	Hydrofluorocarbons (AR4)
KYOTOGHG	Kyoto greenhouse gases (SAR)
KYOTOGHGAR4	Kyoto greenhouse gases (AR4)
N2O	Nitrous Oxide
PFCS	Perflurocarbons (SAR)
PFCSAR4	Perflurocarbons (AR4)
SF6	Sulfur Hexafluoride

"unit"

Unit is either Gg or $GgCO_2eq$ (CO_2-equivalent according to the global warming potential used).

Remaining columns

Years from 1850-2014.

Changelog

v1.1 (March 2017)

The v1.1 release contains mostly bug fixes. To keep the dataset up to date we also included some updated data sources. The methodology remained unchanged apart from the minor changes described below.

Changes in PRIMAP-hist source creation

- South Sudan now has individual data for some sectors. For these sectors, South Sudan is treated as any other country during the source creation while timeseries for other sectors and gases are downscaled from Sudan data.
- Sources with scarce data points for several countries (BUR2015, UNFCCC2017) are now interpolated before the creation of the PRIMAP-hist dataset such that the linear regression used to match lower priority data sources can be computed. Before the last data point was used directly.

Changes in data sources and preprocessing

Input source updates

- FAOSTAT data has been updated to the January 2017 version.
  - The last data year is now 2014 for all categories except for forest land emissions where it is 2015. However, for the PRIMAP-hist dataset we use the aggregate land use time series which has 2014 as the last data point.
  - There are significant changes in historical emissions for several countries.
    - Land use data for several countries is very different from the 2015 version of FAOSTAT data.

    * Manure management CH_4 and N_2O emissions for a lot of (mostly developed) countries were adjusted down by a large margin. This is not a general adjustment though, as some countries' emissions were adjusted upwards, while others remained unchanged.
    * For some economies in transition, pre-1990 emissions are higher than in the 2015 FAOSTAT data.
- CDIAC fossil CO_2 data has been updated to the 2016 release
- BP fossil CO_2 data has been updated to the 2016 release
- UNFCCC detailed by party data has been updated to January 2017
  - Data has not changed much compared to the version used for PRIMAP-hist v1.0
  - For Kazakhstan, HFCs and PFCs data for the years 1990 and 1991 with very high emissions were removed from the UNFCCC data repository. In consequence Kazakhstan's historical (pre-1992) emissions for HFCs and PFCs are much lower in v1.1 than in v1.0.

Changes in processing

- FAOSTAT
  - In version 1.0 negative data were removed from the FAOSTAT dataset during processing. This has been fixed. It only affected land use CO_2. Where data were negative for part of the time series they were replaced by zero while time series completely consisting of negative data were discarded such that Houghton data was used.
  - In v1.0 single subcategories were linearly extrapolated during category aggregation such that time series for all categories covered the same time frame. When the linear extrpolation lead to emission estimates of these subcategories to increase backwards in time, the linear regression was replaced with a linear path to zero emissions in the first year with data (1961). In v1.1 this has been changed such that in those cases a constant extrapolation is used instead of a linear extrapolation to zero. This affects emission estimates from "Field burning of agricultural residues" (IPCC1996 category 4F) and to a lesser extent subsectors of the "Agricultural soils" sector (IPCC1996 category 4D). CH_4 and N_2O emissions are affected. Only a few countries are affected by the change.
- CDIAC
  - A bug in the downscaling of regions to countries was fixed. This affected Indonesia (though not concerning the growth rates used in the PRIMAP-hist dataset, just the absolute values), Timor-Leste, Latvia and Estonia (cement only), and Palau prior to 1992.
  - Downscaling of Italy and San Marino as a region to individual countries now uses EDGAR emissions from appropriate sectors instead of GDP data.
- UNFCCC
  - A bug in the routine that read the csv files exported from the UNFCCC website lead to omitting the second block in the non-standard csv files. This bug has been fixed. Consequently some countries now have one to three additional data points added at the end of the time series.
  - Data for Viet Nam and Peru are now contained in the UNFCCC dataset with enough data to meet our minimum requirements. UNFCCC data for these two countries is therefore included in PRIMAP-hist v1.1.

Further bug fixes

- In v1.0 a few countries were missing in the downscaled Houghton data. Some countries are still not available as they are missing in the country mask used to convert the gridded vegetation data to countries. For details see Section Known problems below.
- In some cases the Composite Source Generator removed the first or last data point of a time series. This bug has been fixed.

Known problems

- For Mauritius, the first data point for CH_4 for different sectors in the UNFCCC 2017 dataset is very low compared to the other data points. This influences the final dataset.

- For Micronesia, the last data point for CH_4 and N_2O from the agricultural sector (and all subsectors) is very low. This influences the final dataset.
- For Saint Kitts and Newis, N_2O emissions from the agricultural sector in the last years are much higher than the rest of the data. This influences the final dataset.
- There is no CH_4 and N_2O land use data for Egypt, Grenada, Haiti, and Singapore in PRIMAP-hist v1.1. The only available data source is FAO, which has only zero values in its current version and is thus not used for the PRIMAP-hist source.
- The (former) Netherlands Antilles are not included in the country mask used for Houghton (2008) downscaling thus there is no Houghton (2008) based data.
- The country mask used in the downscaling of Houghton (2008) data treats Taiwan as a part of China and thus does not deliver data for Taiwan. As none of the data sources used for PRIMAP-hist has land use data for Taiwan we have no option to downscale Taiwan from China.
- Due to the additional year in FAO (2014) some developed countries have very low land use CH_4 emissions in 2014 compared to the period with CRF data. This will be solved in the next revision of PRIMAP-hist where CRF2015 and CRF2016 will be used. A number of possible reasons account for the differences between FAO and CRF data, which likely differ between countries. Land-use CH4 emissions are dominantly from biomass burning. The FAO (Food and Agriculture Organization of the United Nations (2016)) calculate non-CO2 from biomass burning using the tier 1 methodology of IPCC 2006 guidelines (IPCC (2006)) and activity data from GFED4 (Giglio et al. (2017)). National inventories (CRF2014) are often based on country specific emissions factors and data for burned areas. The national inventories may also exclude natural disturbances and have different definitions than FAO for managed land areas. Land use N_2O emissions are subject to similar differences in data.
- UNFCCC data for Ecuador (aggregate sectors and gases) is much higher than third party data, but only covers a few years. The resulting time series is thus discontinuous.

Noteworthy changes

- Aruba: historical CO_2 emissions are lower than in v1.0 because CDIAC emissions have been adjusted downwards for the years prior to 1998.
- Australia, Belize, Botswana, Guinea-Bissau, Namibia, Papua New Guinea, Zimbabwe, Mongolia: changes in CH_4 and/or N_2O emissions due to the change in extrapolation of FAO data for subsectors of the agricultural sector.
- Bosnia and Herzegovina: pre-1990 CDIAC data has changed leading to higher pre-1990 CO_2 emissions in PRIMAP-hist.
- Eritrea: historical CO_2 emissions are higher than in v1.0 because CDIAC emissions have been adjusted upwards for the years prior to 1998.
- Federated States of Micronesia and Saint Helena, Ascension, and Tristan da Cunha: emissions have increased due to an increase in FAO agricultural CH_4 and N_2O emissions.
- India: energy related CO_2 is lower starting in 1977 due to changes in CDIAC data.
- Palau, Timor-Leste: higher historical emissions due to the bugfix in CDIAC downscaling.
- Peru: the UNFCCC data that is now used as the first priority source differs from the third party sources used in PRIMAP-histy v1.0.
- San Marino: changes in historical emissions due to the changed key data for downscaling of San Marino from Italy in CDIAC.
- Sudan, South Sudan: the availability of data for South Sudan changed the time series from the previous time series which were based on downscaling using population data.
- Vanuatu had zero CO_2 emissions before 1960 in PRIMAP-hist v1.0 because CDIAC2015 had zero data for a few years before 1960. Now the data is non-zero as these data points are not contained in CDIAC2016.
- For several countries data for the last two years has changed as additional data points from updated CDIAC, FAOSTAT, UNFCCC, and BP data replace extrapolated data.
- Land use data for the period of 1991 - 2014 has changed for several countries. The first reason is that we now use Houghton data for all years where they are available and not obtained through extrapolation (see Section 2.4.1 of the data description paper). The second reason is that the FAO data changed massively.

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