

AeroCom–II ACCMIP AeroCom Emission Dataset

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AEROCOM – II , ACCMIP AeroCom Emission Files

The AeroCom-II ACCMIP emission dataset comprises anthropogenic and biomass burning emissions of 7 selected species (BC, OC, CO, CH₄, NH₃, SO₂, NO_x for the years 1850 and 1980 to 2010. In the dataset, aircraft emissions are stored in a separate file because of their 3D nature.

a) Anthropogenic and biomass burning emissions excluding aircraft

Filename: *accmip_emissions_aeroCom_{YEAR}.0.5x0.5.nc*

The anthropogenic and biomass burning emission files contain all emission sector variables except aircraft emissions. The sector variables are defined in **Tab. 1**. Each sector has a given code number which can be used to extract individual sectors.

a) Aircraft emissions

Filename: *accmip_aircraft_emissions_aeroCom_{YEAR}.0.5x0.5.nc*

Aircraft emissions are given in 25 vertical levels, resolved in km. Only BC and NO_x emissions are available.

Code	Abbreviation	Description
1	ene	Energy production and distribution
2	ind	Industry (combustion and non-combustion)
3	tra	Land transport
4	dom	Residential and commercial combustion
5	slv	Solvent production and use
6	agr	Agricultural production
7	awb	Agricultural waste burning on fields
8	wst	Waste treatment and disposal
9	shp	Maritime transport
10	air	Aviation
11	for	Open vegetation fires in forests
12	gra	Open vegetation fires in savanna and grasslands

Tab. 1: ACCMIP emission sector variables. The sector variable names are constructed as follows: *emiss_{SECTOR_ABBREVIATION}_{SPECIES_ABBREVIATION}*. The AeroCom ACCMIP emission dataset comprises the species carbon monoxide (CO), methane (CH₄), ammonia (NH₃), sulfur dioxide (SO₂), particulate

elemental carbon (BC), particulate organic carbon (OC), nitric oxides (NO_x as NO) with the following species abbreviation: co, ch4, nh3, so2, bc, oc, nox.

Ancillary data

a) Grid area

Filename: *gridarea.aerocom.0.5x0.5.nc*

The grid area file provides the grid area of each 0.5deg horizontal grid cell in m² assuming an earth radius of 6371000 meters.

b) Region mask

Filename: *image24_regions_0.5x0.5.nc*

The region mask file provides a mask for the IMAGE 24 regions as described in <http://themasites.pbl.nl/en/themasites/image/background/regions/index.html>. This mask was used in the construction of the ACCMIP dataset. The following numeric code numbers are attributed to each IMAGE 24 region:

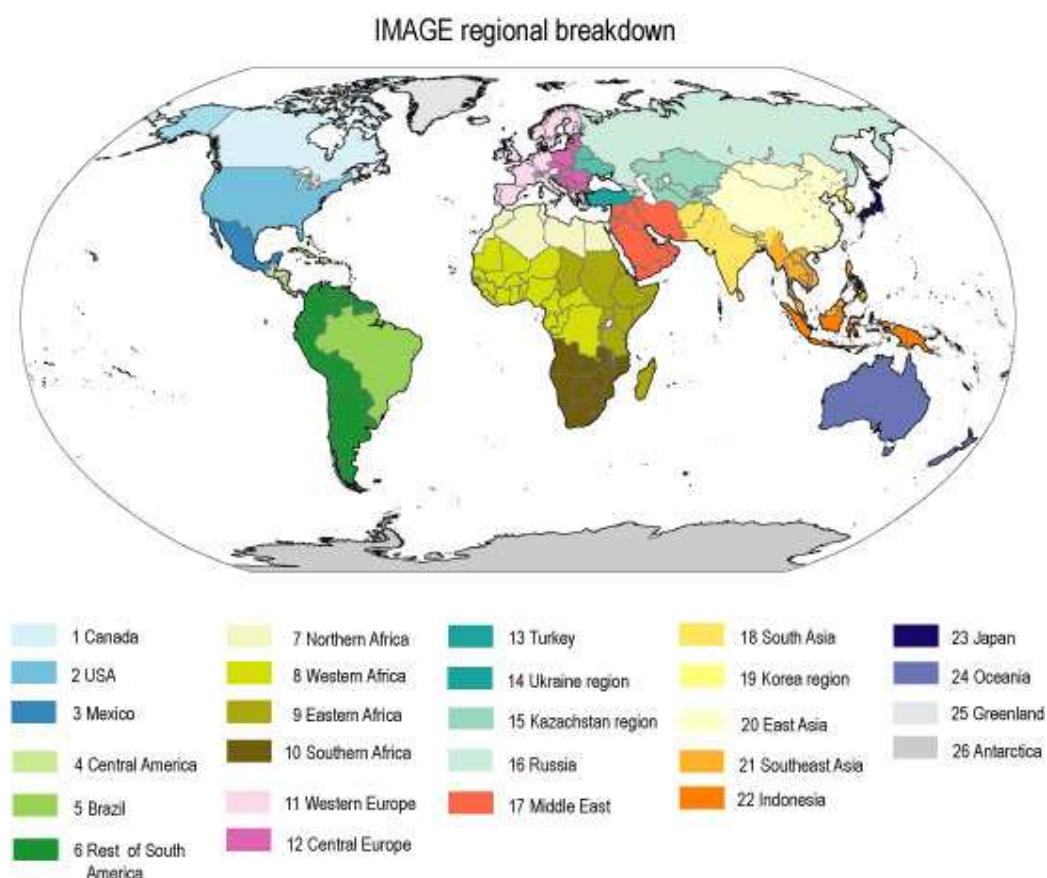


Fig. 1: Map showing IMAGE 24 region definition (http://themasites.pbl.nl/images/image_regio_tcm61-32751.jpg, last visited July 20, 2011). The netCDF version of the region mask does not contain Greenland and Antarctica (codes 25 and 26).

c) Sectoral global totals

Filename: *sectorised_summary_accmip-maccity_aerocom.xls*

This excel table provides summary statistics of annual global total emissions for each species and sector in Gg per year.

d) GFED3.1 and GFED2 biomass burning emission data for comparison

GFED2 biomass burning emission data are available as monthly and 8-day totals for the years 1997 to 2008. The original data with a horizontal resolution of 1 degree can be downloaded from <http://www.falw.vu/~gwerf/GFED/GFED2/>.

GFED3.1 biomass burning emission data are available as monthly totals for the years 1997 to 2009. The original data with a horizontal resolution of 0.5 degree can be downloaded from <http://www.falw.vu/~gwerf/GFED/GFED3/emissions/>.

d) GFASv1 biomass burning emission data for comparison

The MACC GFAS (Global Fire Assimilation) system provides near-real time daily fire emission estimates at 0.5 degree horizontal resolution. Archived emission estimates are available back to January 2003. The data are available via http://macc.icg.kfa-juelich.de:50080/access?catalog=http://macc.icg.kfa-juelich.de:58080/MACC_wildfire.

Emission Data Description

(extracted from global attributes in the metadata of each netCDF file)

Conventions = CF-1.5

title = ACCMIP-MACCity AeroCom Emissions

institution = Dataset created by Forschungszentrum Juelich GmbH (Research Center Juelich), IEK-8, Germany

source = This ACCMIP-MACCity AeroCom emission dataset has been prepared from the ACCMIP (Atmospheric Chemistry and Climate Model Intercomparison Project) historical emission dataset described in Lamarque et al. (2010) and the so-called RCP8.5 (Representative Concentration Pathways) future emission scenario described in Riahi et al. (2007).

The ACCMIP dataset provides 0.5 degree horizontally gridded emission estimates for 10 anthropogenic sectors and 2 biomass burning categories for the years 1850 to 2000 as decadal monthly means. The dataset represents a best guess emission estimate constructed from a harmonised combination of existing regional and global inventories. RCP emission estimates for the decades 2000 to 2100 (with an additional estimate for 2005) were developed as projections starting from the decade 2000 ACCMIP emissions.

The yearly ACCMIP-MACCity AeroCom emissions (i.e. years 1850, 1980 to 2010) were calculated from linear time interpolation of ACCMIP and RCP85 data downloadable from ftp://ftp-ippc.fz-juelich.de/pub/emissions/gridded_netcdf/decadal/ with the exception of biomass burning emissions of the years 1980 to 2008. The latter are taken from the ACCMIP-MACCity biomass burning emission dataset which contains monthly mean emissions with explicit interannual variability and which is the original data used to construct the decadal mean ACCMIP biomass burning emissions. More details on the ACCMIP-MACCity biomass burning emission dataset is given in the comment.

The ACCMIP-MACCity AeroCom emission data have the same number of sector variables (in total 11 sector variables excluding aircraft emissions) for each species and each year. In order to achieve this, sector variables missing in the original ACCMIP dataset (e.g. NH₃ emissions for the waste sector variable `emiss_waste`) are set to zero. Due to their 3D nature, aircraft emission data are stored in a separate file.

comment = Here we provide some additional remarks on the ACCMIP-MACCity biomass burning emission data.

The methodology and the original data sources used to construct these data are described in Lamarque et al. (2010).

The ACCMIP-MACCity biomass burning emission dataset for the years 1997 to 2008 has been prepared from the GFEDv2 inventory (Global Fire Emissions Database, Version 2), described in van der Werf et al. (2006), while the years 1980 to 1996 have been prepared from the RETRO wildland fire emission inventory (version 2), described in Schultz et al. 2008.

Both inventories provide monthly mean gridded global data on the amount of biomass burned by forest (tropical and extratropical) and savannah fires and derived emission estimates. The ACCMIP-MACCity biomass burning emissions were calculated from the monthly biomass burned estimates by applying fuel-type specific emission factors from Andreae and Merlet (2001, with updates until 2008), a biomass carbon content of 45% and the GFEDv2 predominant vegetation cover map. Emissions from burning of peat soils are also explicitly taking into account. The parameterisation is described in Lamarque et al. (2010). Information on the fractional distribution of peat soils is taken from the FAO (2003) WRB Map of World Soil Resources. Peat-fire specific emission factors published by Christian et al. (2003) are applied, which, for species such as CO, NH₃, CH₄ and SO₂ yield distinctively higher emissions per unit mass biomass burned than forest or savannah fires. On the other hand, the peat-fire emission factors for e.g. BC, OC and NO_x are lower. The inclusion of peat fires

may thus lead to significant regional differences in the estimated emission when compared to the original GFEDv2 or RETROv2 inventory.

For the compilation of the ACCMIP-MACCity biomass burning emissions inventory, the original spatiotemporal patterns of biomass carbon burned in the RETRO inventory have been improved (redistributed) in the RETRO regions Contig. USA, C-America, S-America, NH Africa, SH Africa, India, Continent. Southeastasia and Australia. A monthly fire climatology derived from the GFEDv2 data (mean over years 1997 to 2006) was used to redistribute in space and time the regional annual total carbon emissions of each of these regions. For the RETRO region Siberia and Mongolia, the redistribution was done using combined information from the GFEDv2 monthly climatology and monthly Fire Danger Index (FDI) maps for the period. The original spatiotemporal carbon emission patterns of Alaska, Canada, Europe and Indonesia remained unchanged.

Given the above-described approach, the ACCMIP-MACCity AeroCom biomass burning emission dataset has two discontinuities: one between 1996 and 1997 and another one between 2008 and 2009. This is because the spatiotemporal pattern of fire emissions in the period 1997 to 2008 is derived from satellite observations of actual fires (GFEDv2 inventory) while the patterns before 1997 (modified RETRO inventory) and after 2008 (linear time interpolation of the RCP8.5 inventory) are derived from fire climatologies.

references =

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- history** =2011-07-19: modified data format to make it CF-compliant and added metadata, Angelika Heil
- 2011-05-11: time-interpolation of ACCMIP and RCP8.5 data by Angelika Heil
- 2008-11-11: creation of ACCMIP-MACCity biomass burning data by Angelika Heil
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