

Historical Emissions For CMIP6 (v 2.0)

Contacts

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Overview

Data for CMIP6 are being provided as part of on-going research efforts to improve historical emissions data. We first describe core datasets that we are committed to providing for use by atmospheric chemistry models to produce historical concentration fields. Potential refinements to this data that may be possible by this time will be described separately.

Data Overview

Anthropogenic Reactive Gas Emissions

- 0.5° gridded emissions of SO₂, NO_x, NH₃, CH₄, CO, NMVOC, BC, OC using spatial distributions from EDGAR 4.2 and 4.3 for each aggregate sector (see list below). Higher resolutions will be available if requested.
- Aggregated emissions by region and sector
- Years: 1750 – 1970 (at 5 year intervals), then annually until 2014

Methodology: Emissions by sector will be updated from largely similar sources as used in Lamarque et al. (2010) (e.g., country submissions to UNFCCC, similar data directly from countries, and research estimates such as EDGAR and REAS), but done in a manner to produce consistent trends using the newly developed Community Emissions Data System (CEDS, see below). The main focus for the CMIP6 data product will be to provide consistent trends over the last 4+ decades using data from the same source for any given country. Discontinuities between newer data and previous Lamarque et al. (2010) data will be resolved in favor of the newer data (which may alter pre-industrial values as well). Data will be compiled at the level of country and sector, and mapped to a spatial grid, likely using the same algorithms as in Lamarque et al. (2010).

Emissions will be extended to 2014 using preliminary fuel consumption data from BP, assuming the same sectoral consumption pattern by fuel for each country using methodologies similar to those in Klimont et al. (2013) and projections of trends in emission factors.

The CMIP6 dataset will also include:

- Gridded VOC's speciated to 23 species and groups using methodologies drawn from TNO and HTAPv2.
- An auxiliary dataset providing emissions from solid biofuel combustion (for potential use in speciation and aerosol size schemes)
- Monthly seasonality using estimates drawn from the ECLIPSE dataset.

Fossil Carbon Dioxide

- Fossil fuel + cement emissions by country and fuel 1751– 2014 (annual)
- 1° gridded emissions of fossil CO₂, from 1751 – 2014 (monthly resolution 1950 – present), likely downscaled to 0.5° using an appropriate proxy
- CO₂ by RCP sector for at least 1971-2014

Methodology: CDIAC CO₂ emissions will form basis of this data set, along with gridded emissions (Andres et al., 1996). Emissions by sector on a country level will be approximated by scaling CDIAC country totals by sectoral CO₂ emissions proxies derived from the CEDS emission data system (see below). Note that the gridded emissions provided in this product may not be completely compatible at the grid-cell level with the reactive gas emissions provided due to different spatial proxy data used. Consistent gridded data sets for CO₂ and reactive species are planned for a later date.

Open Burning (savanna, forest, deforestation, agricultural, peat)

A large group of collaborators are producing a composite dataset for open burning emissions (Contact: Guido van der Werf [guido.vander.werf@vu.nl]). Over the “GFED era” (1997-2014) the data are an updated version of GFED with (at least) monthly resolution. For the pre-GFED era (1750-1996) a variety of methods will be used to extrapolate using various proxy time series.

Emission Sectors For Gridded Anthropogenic Emissions

The sectoral distribution for follow the RCP categories (Lamarque et al. 2010).

AGR	Non-combustion agricultural sector
ENE	Energy Production and Conversion (including fugitive)
IND	Industrial combustion and processes
RCO	Residential and Commercial Buildings, and Other
SLV	Solvents
TRA	Surface Transportation (Road, Rail, Domestic Shipping)
SHP	International Shipping
WST	Waste handling (solid and liquid)

AVI Aviation

(Aviation is gridded separately so as to provide emission by height.)

** Note that there is one change from the RCP sector definitions. We have used the abbreviation RCO for Residential and Commercial Buildings, and Other to clarify the definition of this sector.

Gridding Methodology

Emissions from the CEDS are aggregated to a set of 12 intermediate sectors that correspond to the available EDGAR emission grids. Emissions are mapped to a spatial grid within each country (with fractional allocation in cells that overlap between multiple countries) using the EDGAR spatial distribution within that country. To the extent EDGAR grids vary over 1970 through 2010 those changes in spatial distribution will be reflected. Between 1970 and 1900 the spatial distribution in most sectors is gradually changed to reflect historical population distributions from Hyde.

Background: CEDS

The anthropogenic reactive gas and aerosol precursor emissions data are being produced as a first data product from the CEDS (Community Emissions Data System) project. CEDS aims to produce annually updated global emission inventories, with consistent emissions and driver data, over the entire industrial period, with consistent estimates of uncertainty. The data product produced for CMIP6 will focus on the recent decades, with more refined data products to follow, with improved sectoral, regional, and sub-regional gridding, improved consistency over time and space, improved estimates of emission seasonality, and estimates of emission uncertainty. The CEDS data and data system will be released as open source software.

References

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