



An emission inventory available for hindcasts from 1980 - 2007

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Aircraft emissions



- 3-d gridded fuel burned [kg/d] is available for each month from 01/1976 to 12/2007
- Based on gridded burned fuel data from NASA's AEAP project for 1976, 1984, 1992, 1999, and a projection for 2015
- Contains both scheduled and non-scheduled (military, charter, general aviation) air traffic
- Horizontal resolution is 1x1
- Provided on 25 pressure altitude levels
- Regridded to 1.25x1 and 2.5x2 on 55 hybrid levels (GEOS-4 grid)

Recommendations:

- EI of 0.8 for SO₂ (0.8 g SO₂/kg fuel)
- height dependent EI for BC; OC=1/3 BC; all hydrophilic
- NCREGRID tool for regridding

Emissions from international ship traffic



- Amount of BC, OC, SO₂, and SO₄ [kg/y] available for each year from 1979 to 2007
- Based on estimates of total SO₂ and PM emissions of Veronika Eyring for 1970, 1980, 1995, and 2001, and a projection for 2020.
- These numbers were used to scale gridded SO₂ emissions from the EDGAR 32FT2000 database for 2000 (<http://www.mnp.nl/edgar>)
- Horizontal resolution is 1x1 (1.25x1 and 2.5x2 also available)
- Currently only emitted into the lowest model level in GOCART
- 80% of BC and 50% of OC emitted as hydrophobic, the rest hydrophilic

Anthropogenic emissions

(excluding BB, aircraft and international ship traffic)

- Amount of BC [Gg/y], OC [Gg/y], and SO₂ [kg/y] available for each year from 1980-2006
- Based on:
 - Gridded BC and OC emissions for 1996 from Tami Bond
 - Gridded SO₂ emissions for 2000 are from the EDGAR 32FT2000 database.
 - The gridded files were extended to an annual trend by scaling with regional BC, OC, and SO₂ emission numbers for 17 regions for each year from 1980 – 2006, provided by David Streets
- Horizontal resolution is 1x1 (and 1.25x1, 2.5x2)
- Biofuel and non-international ship traffic is included

Anthropogenic emissions (2)

- Currently emitted only into first model level in GOCART
- Seasonal variation over Europe applied for SO₂ within the model
- 5% of SO₂ directly emitted as SO₄ over Europe, 3% elsewhere
- Assuming 80% of BC and 50% of OC emitted as hydrophobic, the rest hydrophilic

Volcanic emissions



- Volcanic SO₂ emissions [kt/d] available for every day from 01/01/1979 to 31/12/2007
- Several hundred volcanoes included per day
- Plume height [m a.s.l.] also included
- Longitude, latitude, and elevation provided for each volcano
- Based on:
 - Global Volcanism Program database
 - TOMS and OMI observations
 - COSPEC measurements (including continuously erupting volcanoes from Andres & Kasgnoc)
 - Non-eruptive degassing rates included

Volcanic emissions (2)



- We evenly distribute the SO_2 among the model levels located in the top 1/3 of the eruption plume
- Non-eruptive SO_2 is placed in the level which contains the crater elevation

Biomass burning emissions



- Available for every month from 01/1979 to 12/2007
- Quantity provided is the dry mass burned in kg/m²/month
- Based on:
 - For 1997-2007, we use the Global Fire Emission Dataset (GFED) version 2
 - SO₂, BC, and OC for 1980 – 1996 derived from a scaled version of a total dry mass burned inventory from Bryan Duncan (TOMS AI)
 - Scaling factors determined from the overlapping period 1997-2000 by adjusting the Duncan dataset to GFEDv2Quantity provided is the dry mass burned in kg/m²/month

Biomass burning emissions (2)



- We use the following emission factors:
 - 1.12×10^{-3} to convert dry mass [kg] to SO₂ [kg]
 - 0.001 kgC/kg dry mass for BC
 - OC = 8 x BC
- We distribute the BB emissions evenly among the model levels located within the boundary layer; alternatives currently being investigated ...
- 80% of BC and 50% of OC emitted as hydrophobic, the rest hydrophilic