Anthropogenic and biomass burning emissions for AeroCom III

1. Anthropogenic emissions
a) 1750-2014:
- Source: Community Emission Data System (CEDS) for CMIP6. Available at: https://esgf-node.llnl.gov/search/input4mips/
- Spatial resolution: 0.5° (finer resolution up to 0.1° can be generated on request)
- Temporal resolution: Monthly
- Data format: netcdf, with 50-years per data file
- Bulk emissions (BC, OC, SO_2, NO_x, NH_3, CO, NMVOC, CO_2, CH_4):
  - 8 sectors: sector_ids = "0: Agriculture; 1: Energy; 2: Industrial; 3: Transportation; 4: Residential, Commercial, Other; 5: Solvents production and application; 6: Waste; 7: International Shipping"
  - Filename: [em_species]-em-anthro_input4MIPs_emissions_CMIP_CEDS-2017-05-18_gn_YYYY01-ZZZZ12.nc (where YYYY is the starting year contained in this file, and ZZZZ is the ending year)
- Aircraft emissions (BC, OC, SO_2, NO_x, NH_3, CO, NMVOC, CO_2, CH_4):
  - 25 vertical layers
  - Filename: [em_species]-em-AIR-anthro_input4MIPs_emissions_CMIP_CEDS-2017-05-18_gn_YYYY01-ZZZZ12.nc
- Reference: Hoesly, R. M., Smith, S. J., Feng, L., Klimont, Z., Janssens-Maenhout, G., Pitkanen, T., Seibert, J. J., Vu, L., Andres, R. J., Bolt, R. M., Bond, T. C., Dawidowski, L., Kholod, N., Kurokawa, J.-I., Li, M., Liu, L., Lu, Z., Moura, M. C. P., O'Rourke, P. R., and Zhang, Q.: Historical (1750–2014) anthropogenic emissions of reactive gases and aerosols from the Community Emissions Data System (CEDS), Geosci. Model Dev., 11, 369-408, https://doi.org/10.5194/gmd-11-369-2018, 2018.

b) after 2014:
- Recommended: using the 2014 emission for the years beyond 2014 until the updated CEDS emissions become available.

2. Biomass burning emissions
a) 1850-2015:
- Source: BB for CMIP6. Available at: https://esgf-node.llnl.gov/search/input4mips/
- Spatial resolution: 0.25° x 0.25°
- Temporal resolution: Monthly
- Emitted species: aerosol (BC, OC) and aerosol precursor and reactive compounds (SO_2, N_2O, NO_x, NH_3, CH_4, CO, NMVOC, H_2)
- NMVOC consists of the sum of: C_2H_6, CH_3OH, C_2H_5OH, C_3H_8, C_2H_2, C_2H_4, C_3H_6, C_5H_8, $C_{10}H_{16}$, C_7H_8, C_6H_6, C_8H_{10}, Toluene_lump, Higher_Alkenes, Higher_Alkanes, CH_2O, C_2H_4O, C_3H_6O, C_2H_6S, HCN, HCOOH, CH_3COOH, MEK, CH_3COCHO, $HOCH_2CHO$. These NMVOCs are also provided separately
- Data format: netcdf, 185001-201512 in a data file
- Filename: [em_species]-em-biomassburning_input4MIPs_emissions_CMIP_V-2017-05-18_gn_YYYY01-ZZZZ12.nc (where YYYY is the starting year contained in this file, and ZZZZ is the ending year)

- Reference: van Marle, M. J. E., Kloster, S., Magi, B. I., Marlon, J. R., Daniau, A.-L., Field, R. D., Arneth, A., Forrest, M., Hantson, S., Kehrwald, N. M., Knorr, W., Lasslop, G., Li, F., Mangeon, S., Yue, C., Kaiser, J. W., and van der Werf, G. R.: Historic global biomass burning emissions for CMIP6 (BB4CMIP) based on merging satellite observations with proxies and fire models (1750–2015), Geosci. Model Dev., 10, 3329-3357, https://doi.org/10.5194/gmd-10-3329-2017, 2017.

b) For model experiments that need emissions after 2015 (or between 2003 and beyond 2015):
- Two options of biomass burning emissions based on the MODIS fire radiative power are publicly available:
- Global Fire Assimilation System (GFAS) (2003 to current, near real time):
  - Source: ECMWF. Available at https://apps.ecmwf.int/datasets/data/cams-gfas/ (sign in/sign up required)
  - Spatial resolution (version G1.2): 0.1° x 0.1°
  - Temporal resolution: Daily
  - Reference: Kaiser, J. W., Heil, A., Andreae, M. O., Benedetti, A., Chubarova, N., Jones, L., Morcrette, J.-J., Razinger, M., Schultz, M. G., Suttie, M., and van der Werf, G. R. (2012). Biomass burning emissions estimated with a global fire assimilation system based on observed fire radiative power. BG, 9:527-554.
- Fire Energetics and Emissions Research (FEER) (2003 to Janurary 2018):
  - Source: NASA GSFC. Available at https://feer.gsfc.nasa.gov/data/emissions/.
  - Spatial resolution (version G1.2): 0.1° x 0.1°
  - Temporal resolution: Daily and monthly
  - Reference: Ichoku, C., and Ellison, L. (2014). Global top-down smoke-aerosol emissions estimation using satellite fire radiative power measurements. Atmospheric Chemistry and Physics, 14(13), 6643–6667. doi:10.5194/acp-14-6643-2014.