Regridding emissions

Surface and external forcing (3D) emissions provided to the model have to be on the horizontal grid that is used for the simulations before running the model. Conservative regridding within CESM2 is not available at this point. CAM-chem and WACCM will conservatively regrid vertically on to the model levels.

Available emissions inventories are described on the Available Input Datasets page and the CAM-chem wiki. Additional explanation of the NCL and Fortran regridding tools described below are in this presentation.

Python regridding

A python regridding function is described on the CAM-chem python resources site.

Regrid CAMS global anthropogenic emissions

Two scripts are required to create emissions files ready for use in CESM from original CAMS (Copernicus Atmosphere Monitoring Service) files. Original global CAMS emissions of 0.1x0.1 resolution between 2000-2019 have been downloaded to /glade/p/acom/acom-climate/tilmes/emis/download/. Additiona l emissions for the year 2020 will follow as soon as they become available. The processing of CAMS emissions to irregular grids is done in 2 steps with scripts from: https://github.com/NCAR/IPT/tree/master/Emissions/CAMS_Anthropogenic.

1. Regridding the original emissions to the desired irregular grid. This is performed using: **Regrid_fv2se_cams_anthro.ncl.** This program has to be edited if using new resolutions; change the following variables: outgrid, dstPath, and dstGridName for the new grid.
2. Map to CESM chemistry scheme: **rename_cams_anthro_se.ncl.** If used for different resolutions, the following fields have to be adjusted: dir_inp, dir_out, resolution.

Regrid CMIP6 anthropogenic and biomass burning emissions

Two scripts, available at https://github.com/NCAR/IPT/tree/master/Emissions/CMIP, are required to create emissions files ready for use in CESM from original CMIP6 (0.5 degree resolution) files.

1. The first step is to conservatively regrid the original CMIP6 emissions to the desired grid. The NCL script **Regrid_fv2se_cmip6_main.ncl** uses ESMF utilities and reads a file with grid information and weights for the destination grid. Options can bet set for which years to grid to the new files. This may take up to 24 hours, depending on the grid and number of years, so should be submitted as job on casper (regrid_main). The main script calls several other scripts to regrid separately anthropogenic emissions, biomass burning emissions, biogenic emissions, aircraft emissions, and continuously outgassing volcanoes.
2. The second step is to transform the regridded emissions into the chemical species needed in CESM (CAM, CAM-chem or WACCM). After the regridding has been performed, as described in Step 1, the emission fields are mapped to CESM chemical species, using: **rename_and_convert _cmip_hist.ncl**. The user needs to only edit the location of the regridded emissions and the output directory. The script loops through anthropogenic emissions, biomass burning emissions and aircraft emissions. It is best to run each sector separately because of the time it takes to complete them. A slurm script (script_rename) is available to run this as a batch job.

Regrid QFED biomass burning emissions

QFED (Quick Fire Emissions Dataset) emissions files are distributed by NASA Goddard/GMAO. Daily emissions are available at 0.25x0.3125 or 0.1x0.1 degree horizontal resolution. An ncl script (regrid_fv2se_qfed_bb.ncl) is available at https://github.com/NCAR/IPT to regrid these emissions to spectral element resolution. Emissions files for several resolutions are at: /glade/campaign/acom/acom-weather/MUSICA/emissions/.

Grid FINN biomass burning emissions

A fortran program for gridding fire emissions from the Fire INventory from NCAR (FINN) versions 1.5 and 2.2 to regular lat-lon (FV) or unstructured (SE, SE-RR) grids is described on the Grid FINN page.

Grid U.S. EPA (NEI) anthropogenic emissions

A fortran program reads the complex collection of EPA emissions files and creates gridded files for use in CESM2: https://github.com/NCAR/IPT/tree /master/Emissions/EPA_Anthropgenic/ANTHRO_EPA_CAMSE.

Further documentation is provided in the anthro_emis readme.