1. Introduction

This document gives information for gridded datasets of Regional Emission inventory in ASia (REAS) **version 3.2.1** that present monthly gridded emissions for each sub-sector. See Kurokawa and Ohara (2020) for basic methodology, results, and other information about REASv3.2. **Note that documents describing differences between REASv3.2 and REASv3.2.1 are available in the REAS Data Download Site/Data Sets (https://www.nies.go.jp/REAS/).**

2. Directories and file names

All gridded data are tarred and zipped (with gzip) as XXX_YYYY_GRID.tar.gz. Directories and files are created by unpacking the files as follows:

- Species except for NMVOC

```
XXX/
    YYYY/
        REASv3.2.1_XXX_ZZZZZZ_YYYY_0.25x0.25
```

- NMVOC

```
NMV/
    YYYY/
        SC/
            REASv3.2.1_NMV_SC_ZZZZZZ_YYYY_0.25x0.25
```

XXX: Species codes
SC: NMVOC species codes
YYYY: Years
ZZZZZZ: Sector categories codes
* See next pages for definition of each code.

(1) XXX: Species codes

Species codes	Species
SO2	Sulfur dioxide
NOX	Nitrogen oxides (as NO_2)
CO_	Carbon monoxide
NMV	Non-methane volatile organic compounds
PM10_	PM_{10}
PM2.5	$PM_{2.5}$
BC_	Black carbon
OC_	Organic carbon
NH3	Ammonia
CO2	Carbon dioxide

(2) SC: NMVOC species codes

NMVOC species codes	Species
01	Ethane
02	Propane
03	Butanes
04	Pentanes
05	Other Alkanes
06	Ethylene
07	Propene
08	Terminal Alkenes
09	Internal Alkenes
10	Acetylene
11	Benzene
12	Toluene
13	Xylenes
14	Other Aromatics
15	Formaldehyde
16	Other Aldehyde
17	Ketones
18	Halocarbons
19	Others
20	Total

(3) ZZZZZZ: Sector categories codes

(3)-1. SO_2, NO_x, CO, PM_{10}, $PM_{2.5}$, BC, and OC

Sector categories codes	Sector categories
POWER_PLANTS_POINT	Power and heat plants as point sources
POWER_PLANTS_NON-POINT	Power and heat plants as non-point sources
INDUSTRY	Industry (emissions both from fuel combustion and industrial processes)
ROAD_TRANSPORT	Road transport (cars, buses, trucks, motor cycles, and other on-road vehicles)
OTHER_TRANSPORT	Railway, and other off-road transports (navigation is not included)
DOMESTIC	Residential, commerce and public services, agricultural equipment, and others (fishing is not included)
TOTAL	Total

(3)-2. CO_2

Sector categories codes	Sector categories
EXCL-BF-POWER_PLANTS_POINT	Power and heat plants as point sources Note: no data from biofuel combustion
EXCL-BF-POWER_PLANTS_NON-POINT	Power and heat plants as non-point sources excluding contribution from biofuel combustion
BF-POWER_PLANTS_NON-POINT	Power and heat plants as non-point sources from biofuel combustion
EXCL-BF-INDUSTRY	Industry (emissions both from fuel combustion and industrial processes) excluding contribution from biofuel combustion
BF-INDUSTRY	Industry (emissions both from fuel combustion and industrial processes) from biofuel combustion
EXCL-BF-ROAD_TRANSPORT	Road transport (cars, buses, trucks, motor cycles, and other on-road vehicles) Note: no data from biofuel combustion
EXCL-BF-OTHER_TRANSPORT	Railway, and other off-road transports (navigation is not included) Note: no data from biofuel combustion
EXCL-BF-DOMESTIC	Residential, commerce and public services, agricultural equipment, and others (fishing is not included) excluding contribution from biofuel combustion
BF-DOMESTIC	Residential, commerce and public services, agricultural equipment, and others (fishing is not included) from biofuel combustion
EXCL-BF-TOTAL	Total excluding contribution from biofuel combustion
BF-TOTAL	Total from biofuel combustion

(3)-3. NH_3

Sector categories codes	Sector categories
POWER_PLANTS_POINT	Power and heat plants as point sources
POWER_PLANTS_NON-POINT	Power and heat plants as non-point sources
INDUSTRY	Industry (emissions both from fuel combustion and industrial processes)
ROAD_TRANSPORT	Road transport (cars, buses, trucks, motor cycles, and other on-road vehicles)
OTHER_TRANSPORT	Railway, and other off-road transports (navigation is not included)
DOMESTIC	Residential, commerce and public services, agricultural equipment, and others (fishing is not included)
FERTILIZER	Fertilizer application
MANURE_MANAGEMENT	Manure management of livestock
MISC	Human respiration and perspiration, latrines, and others (For NH_3)
TOTAL	Total

(3)-4. NMVOC

Sector categories codes	Sector categories
POWER_PLANTS_POINT	Power and heat plants as point sources
POWER_PLANTS_NON-POINT	Power and heat plants as non-point sources
INDUSTRY	Industry (emissions both from fuel combustion and industrial processes)
ROAD_TRANSPORT	Road transport (cars, buses, trucks, motor cycles, and other on-road vehicles)
OTHER_TRANSPORT	Railway, and other off-road transports (navigation is not included)
DOMESTIC	Residential, commerce and public services, agricultural equipment, and others (fishing is not included)
EXTRACTION	Extraction and handling of fossil fuels (For NMVOC)
SOLVENTS	Solvent use (including paint use)
WASTE	Waste treatment (both solid and water waste)
TOTAL	Total

3. Information to read files

All gridded data are text files and their data format is common. Points to read gridded data sets are as follows:

- First 9 lines are for header information and following lines are for monthly emissions in each grid cell from January to December. (Leap and non-leap year are considered for emissions in February.)

- Spatial resolution is 0.25 degree by 0.25 degree except for POWER_PLANTS_POINT. Longitude and latitude of data other than POWER_PLANTS_POINT mean lower left (southwest) corner of grid cells. Longitude and latitude of data for POWER_PLANTS_POINT mean place for each Longitude and latitude for power plants.

- Unit of NO_x emissions is NO_2 ton per month.

Ex.
9
NOX emissions on 0.25 degree by 0.25 degree grid
REASv3.2.1_NOX_INDUSTRY_2015_0.25x0.25
NOX[tNO2/mon],2015,monthly,0.25 degree by 0.25 degree
Industry
min : 0.3657752E-05 max : 0.9886187E+04 sum : 0.1196985E+08
Format:2F8.2,12E14.7(longitude, latitude, monthly emission value from JAN-DEC)
* Longitude and latitude are at lower left (southwest) corner of grid cell
Contact: kurokawa@acap.asia
122.50 53.75 0.1869279E-02 0.1686743E-02 0.1874487E-02 0.1837720E-02 0.1907437E-02 0.1861237E-02 0.1896056E-02 0.1903824E-02 0.1859230E-02 0.1906834E-02 0.1844891E-02 0.1898297E-02
122.75 53.75 0.2563582E-01 0.2313247E-01 0.2570725E-01 0.2520302E-01 0.2615914E-01 0.2552553E-01 0.2600305E-01 0.2610958E-01 0.2549800E-01 0.2615086E-01 0.2530136E-01 0.2603377E-01
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References

Kurokawa, J. and Ohara, T.: Long-term historical trends in air pollutant emissions in Asia: Regional Emission inventory in ASia (REAS) version 3, Atmos. Chem. Phys., 20, 12761–12793, https://doi.org/10.5194/acp-20-12761-2020, 2020.