Aeronautics and Space Administration
Earth Science Data Information and
Center (GES DISC)

README Document for MERRA-2 Country-Level Surface PM2.5 Monthly Mean Products - Version 1

Last Revised August 31, 2023

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Revision History

Revision Date	Changes	Author
February 21, 2022	version 1.0	Suhung Shen
August 31, 2023	Links to the updated File specification in section 1.1	Suhung Shen

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1.0 Introduction

This document provides basic information for accessing MERRA-2 Country-Level Surface $PM_{2.5}$ Monthly Mean Products version 1.

This dataset consists of one data collection, **M2_TMAX_PM25_1**, which is a value-added product derived from the MERRA-2 aerosol monthly product M2TMNXAER_5.12.4 (or tavgM_2d_aer_Nx). The surface concentration of fine particulate matter ($PM_{2.5}$) is calculated as the sum of individual aerosol components (organic carbon, black carbon, sulfate, sea salt, and dust) (Buchard et al., 2017) and is recast from the native MERRA-2 model grid. This data collection includes separate files for country-level (and territories) $PM_{2.5}$ surface concentrations with and without population weighting applied.

1.1 Dataset Description

The algorithm and more information about this dataset are documented in the File Specification at https://gmao.gsfc.nasa.gov/pubs/docs/Keller1487.pdf

1.2 Data Citation

To cite the data in publications with the data DOI:

*Global Modeling and Assimilation Office (GMAO) (2021), MERRA-2 avgM_2d_pm25_admin0, 2d, Single-Level, Country-Level Surface PM2.5 Monthly Mean Products V1, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: **[Data Access Date]**, doi:10.5067/FY616726UXSR*

1.3 Quality Issues

A mask file is used for geopolitical boundaries of countries and territories. Due to artifacts in how the masking is applied, $PM_{2.5}$ values may appear as zero (0) for some small islands.

2.0 Data Organization

This product consists of one data collection:

ShortName: M2_TMAX_PM25
LongName: avgM_2d_pm25_admin0, 2d, Single-Level, Country-Level Surface $PM_{2.5}$ Monthly Mean Products
Version: 1
Data DOI: 10.5067/FY616726UXSR

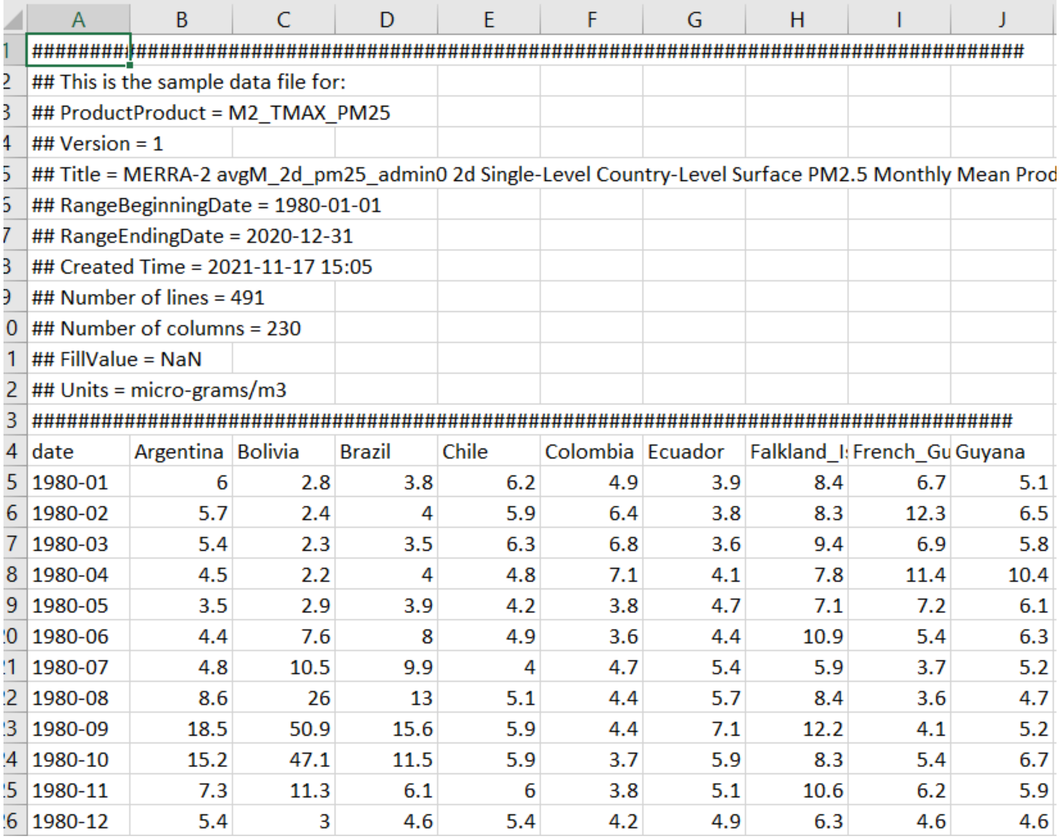
2.1 Data File structure

This product consists of five files, including two data files in csv format and three ancillary files in netCDF format. The data files are:

MERRA2.avgM_2d_pm25_admin0x.v01.19800101-20201231.csv
MERRA2.avgM_2d_pm25_admin0x_pw.v01.19800101-20201231.csv

They are monthly mean $PM_{2.5}$ surface concentration averaged at country level without weighting and weighted with population, respectively.

The csv format file consists of header line information and a data table containing $PM_{2.5}$ data at country-level as shown in Figure 1.



	A	B	C	D	E	F	G	H	I	J
1	#########	##								
2	## This is the sample data file for:									
3	## ProductProduct = M2_TMAX_PM25									
4	## Version = 1									
5	## Title = MERRA-2 avgM_2d_pm25_admin0 2d Single-Level Country-Level Surface PM2.5 Monthly Mean Prod									
6	## RangeBeginningDate = 1980-01-01									
7	## RangeEndingDate = 2020-12-31									
8	## Created Time = 2021-11-17 15:05									
9	## Number of lines = 491									
0	## Number of columns = 230									
1	## FillValue = NaN									
2	## Units = micro-grams/m3									
3	##									
4	date	Argentina	Bolivia	Brazil	Chile	Colombia	Ecuador	Falkland_I:	French_Gu	Guyana
5	1980-01	6	2.8	3.8	6.2	4.9	3.9	8.4	6.7	5.1
6	1980-02	5.7	2.4	4	5.9	6.4	3.8	8.3	12.3	6.5
7	1980-03	5.4	2.3	3.5	6.3	6.8	3.6	9.4	6.9	5.8
8	1980-04	4.5	2.2	4	4.8	7.1	4.1	7.8	11.4	10.4
9	1980-05	3.5	2.9	3.9	4.2	3.8	4.7	7.1	7.2	6.1
0	1980-06	4.4	7.6	8	4.9	3.6	4.4	10.9	5.4	6.3
1	1980-07	4.8	10.5	9.9	4	4.7	5.4	5.9	3.7	5.2
2	1980-08	8.6	26	13	5.1	4.4	5.7	8.4	3.6	4.7
3	1980-09	18.5	50.9	15.6	5.9	4.4	7.1	12.2	4.1	5.2
4	1980-10	15.2	47.1	11.5	5.9	3.7	5.9	8.3	5.4	6.7
5	1980-11	7.3	11.3	6.1	6	3.8	5.1	10.6	6.2	5.9
6	1980-12	5.4	3	4.6	5.4	4.2	4.9	6.3	4.6	4.6

Figure 1: Subset of the file MERRA2.avgM_2d_pm25_admin0x.v01.19800101-20201231.csv

2.2 Ancillary data file structure

This dataset consists of three ancillary files in netCDF format.

mask_worldCountries_MERRA2.nc
mask_worldPopulation_MERRA2.nc
mask_UScounty_MERRA2.nc

The first two mask files are on the MERRA-2 grid for world countries and world population, respectively. They are used for generating the $PM_{2.5}$ data as shown in the python tutorial. The third mask file is on the MERRA-2 grid for US counties, which may be used for generating the $PM_{2.5}$ data at US county level by replacing the world country mask file in the tutorial.

3.0 Data Access

3.1 Direct access

https://goldsmr4.gesdisc.eosdis.nasa.gov/data/MERRA2_CLIM/M2_TMAX_PM25.1/

3.2 Dataset landing page

The dataset landing page consists of the links of data access, product summary, documentation, and references, which can be found by clicking the following the data doi link:
data doi:10.5067/FY616726UXSR

Or searching the product name **M2_TMAX_PM25.1** from GES DISC.

4.0 GES DISC Data Services

4.1 Contact information

If you need assistance or wish to report a problem:

Email: gsfc-help-disc@lists.nasa.gov
Voice: 301-614-5224
Fax: 301-614-5268
Address:
Goddard Earth Sciences Data and Information Services Center
NASA Goddard Space Flight Center
Code 610.2 Greenbelt, MD 20771 USA

4.2 Online helps

The GES DISC website contains many informative articles under the "How To Section", "FAQ" (frequently asked questions), "News", "Glossary", and "Help". A sample of relevant articles includes:

Earthdata Login for Data Access

How to remotely access MERRA-2 with Python3 and calculate monthly average surface PM2.5 for world countries

5.0 Acknowledgments

The authors would like to thank Assaf Anyamba, Melanie Follette Cook, and Mariel Friberg at NASA Goddard Space Flight Center and Diana Yeung at Johns Hopkins Bloomberg School of Public Health for useful discussions facilitated through the NASA Goddard Air Quality & Health Group. The authors would like to thank Kanan Patel (Science Systems and Applications, Inc. intern) for a segment of code that was adapted into the python tutorial.