Documentation for the Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD) with GWR, 1998-2016

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Abstract

The Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD) with GWR, 1998-2016 consist of annual concentrations (micrograms per cubic meter) of ground-level fine particulate matter (PM2.5), with dust and sea-salt removed. This data set combines AOD retrievals from multiple satellite instruments including NASA's Moderate Resolution Imaging Spectroradiometer (MODIS), Multi-angle Imaging SpectroRadiometer (MISR), and the Sea-Viewing Wide Field-of-View Sensor (SeaWiFS). The GEOS-Chem chemical transport model is used to relate this total column measure of aerosol to near-surface PM2.5 concentration. Geographically Weighted Regression (GWR) is used with global ground-based measurements to predict and adjust for the residual PM2.5 bias per grid cell in the initial satellite-derived values. These estimates are primarily intended to aid in large-scale studies. Gridded data sets at 0.01 degrees are provided to allow users to agglomerate data as best meets their particular needs. Data sets are gridded at the finest resolution of the information sources that were incorporated, but do not fully resolve PM2.5 gradients at the gridded resolution due to influence by information sources at coarser resolutions. The data are distributed as GeoTIFF files and are in WGS 84 projection.

Data set citation:

van Donkelaar, A., R. V. Martin, M. Brauer, N. C. Hsu, R. A. Kahn, R. C. Levy, A. Lyapustin, A. M. Sayer, and D. M. Winker. 2018. Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD) with GWR, 1998-2016. Palisades NY: NASA Socioeconomic Data and Applications Center (SEDAC). https://doi.org/10.7927/H4ZK5DQS. Accessed DAY MONTH YEAR.

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We appreciate feedback regarding this data set, such as suggestions, discovery of errors, difficulties in using the data, and format preferences. Please contact:

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Contents

I. Introduction

The Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD) with GWR, 1998-2016 data set utilizes NASA's MODIS, MISR, and SeaWIFS Optical Aerosol Depth (AOD) data to produce a collection of 18 gridded data files for annual concentration (micrograms per cubic meter) of ground-level fine particulate matter (PM2.5) – dust and sea-salt removed – one for each year during 1998-2016, at a spatial resolution of 0.01degrees (i.e., grid cells 1.1 km on a side at the equator). The annual estimates were generated following a geographically weighted regression technique (see van Donkelaar et al., 2016). The grids were developed from the ASCII data files for each year in ArcGIS.

II. Data and Methodology

A detailed description of the methodology is provided in van Donkelaar et al. (2016), which is available in a post-print version on the documentation page (see reference section below). Also, a list of input data is provided in Supporting Information to the journal article available at: http://pubs.acs.org/doi/suppl/10.1021/acs.est.5b05833 (open access).

III. Data Set Description(s)

Data set description:
The PM2.5 grids consist of concentrations (micrograms per cubic meter) of ground-level fine particulate matter (PM2.5) – dust and sea-salt removed – per 0.01 degree grid cells for each of the nineteen years between 1998 and 2016.

Data set web page:
http://sedac.ciesin.columbia.edu/data/set/sdei-global-annual-gwr-pm2-5-modis-misr-seawifs-aod

Data set format:
The data are available in GeoTIFF format as downloadable zip files. Each downloadable is a compressed zip file containing: 1) GeoTIFF for the year, and 2) PDF documentation.

Data set downloads:
sdei-global-annual-gwr-pm2-5-modis-misr-seawifs-aod-YYYY-geotiff.zip

where YYYY are years 1998 through 2016.

IV. How to Use the Data

The raster data are in GeoTIFF format and can be used directly in mapping and geospatial analysis.

V. Potential Use Cases

Prior versions of these data have been used extensively in public health applications, especially in conjunction with population data to estimate exposure levels.

VI. Limitations

The current data set has PM2.5 concentration values excluding dust and sea salt for the benefit of researchers focusing on anthropogenic sources of PM2.5. However, there is higher uncertainty in the PM2.5 values in regions (especially central Asia and northern Africa) with high contributions from mineral dust, mostly a result of sparse ground-based monitoring and challenging conditions for measurement retrieval and simulation. Hence, there are higher degrees of uncertainty in these regions compared to other parts of the world, even after excluding the natural sources.

Note that these estimates are primarily intended to aid in broad area studies. Gridded data sets are provided to allow users to aggregate data to spatial units that suit their needs. Data sets are gridded at the finest resolution of the information sources that were incorporated. These data are not intended for studies examining intra-urban differentials in PM2.5, for example, or other small area research. *In situ* data are more appropriate at those scales.

VII. Acknowledgments

Funding for dissemination of this data set was provided under the NASA contract NNG13HQ04C for the continued operation of the Socioeconomic Data and Applications Center (SEDAC), which is operated by the Center for International Earth Science Information Network (CIESIN) of Columbia University.

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X. Recommended Citation(s)

Data set(s):

van Donkelaar, A., R. V. Martin, M. Brauer, N. C. Hsu, R. A. Kahn, R. C. Levy, A. Lyapustin, A. M. Sayer, and D. M. Winker. 2018. Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD) with GWR, 1998-2016. Palisades NY: NASA Socioeconomic Data and Applications Center (SEDAC). https://doi.org/10.7927/H4ZK5DQS. Accessed DAY MONTH YEAR.

Scientific publication:

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XI. Source Code

No source code is provided.

XII. References

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XIII. Documentation Copyright and License

Appendix 1. Data Revision History

No revisions have been made to this data set. However, it succeeds the data set Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD), v1 (1998−2012).

Appendix 2. Contributing Authors & Documentation Revision History

Revision Date	Contributors	Revisions
March 16, 2018	P. Mondal, T. Chai-Onn, A. de Sherbinin	This document is the 1st instance of documentation.