

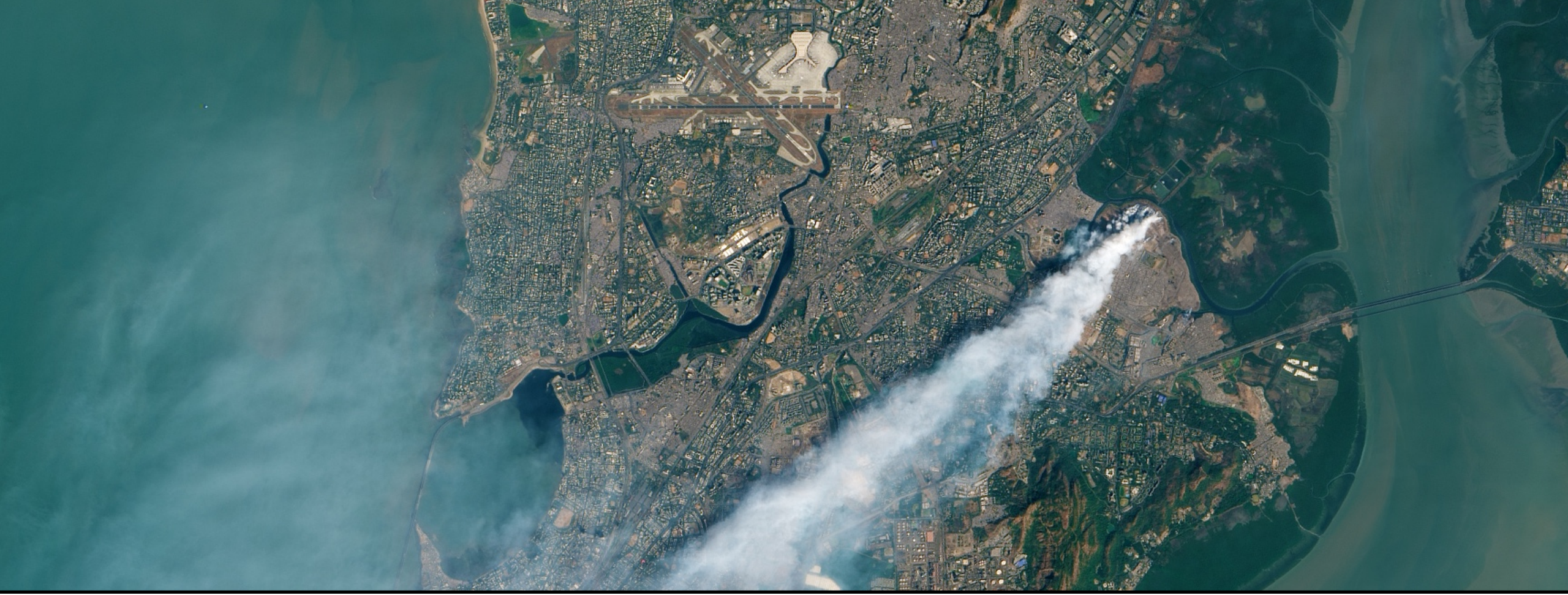


# Satellite Based $PM_{2.5}$ Datasets and Access

Pawan Gupta and Melanie Follette-Cook

Satellite Remote Sensing of Air Quality, 18-19 November 2018





# WHO $PM_{2.5}$ Datasets

# Where to Find and View the Data

## WHO Website – Country Level

### Global Health Observatory (GHO) data

Global Health Observatory data

Data repository

Reports

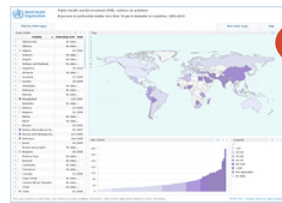
Country statistics

Map gallery

Standards

#### Exposure to ambient air pollution

The mean ambient air pollution of particulate matter with an aerodynamic diameter of 2.5  $\mu\text{m}$  or less (PM<sub>2.5</sub>) in country urban areas ranges from less than 10 to over 100  $\mu\text{g}/\text{m}^3$ . In urban areas, the mean concentration of particulate matter with an aerodynamic diameter of 2.5  $\mu\text{m}$  or less (PM<sub>2.5</sub>) ranges from less than 10 to over 100  $\mu\text{g}/\text{m}^3$ , and from less than 10 to over 200  $\mu\text{g}/\text{m}^3$  for particulate matter with an aerodynamic diameter of 10  $\mu\text{m}$  or less (PM<sub>10</sub>)

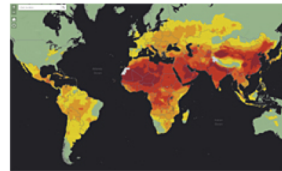


#### Situation at country level

[View interactive map/graph](#)

[View data](#)

[Read more](#)



#### Situation at grid level

[View interactive map](#)

[View data, metadata and detailed methods of estimation](#)



#### Situation at city level

[View full size map \(PM<sub>10</sub>\)](#)

[View full size map \(PM<sub>2.5</sub>\)](#)

[View data](#) | [Read more](#)

[f](#) [t](#) [G+](#) [+](#)

#### More PHE data products

[Maps](#)

[Reports](#)

[Country profiles](#)

[Links](#)

Global Health Observatory (GHO) data > Ambient air pollution

- [http://www.who.int/gho/phe/outdoor\\_air\\_pollution/exposure/en/](http://www.who.int/gho/phe/outdoor_air_pollution/exposure/en/)

Follow this link to download 2014 country level data:

- Formats: csv, Excel, html, XML, etc.
- Can also filter by country and download

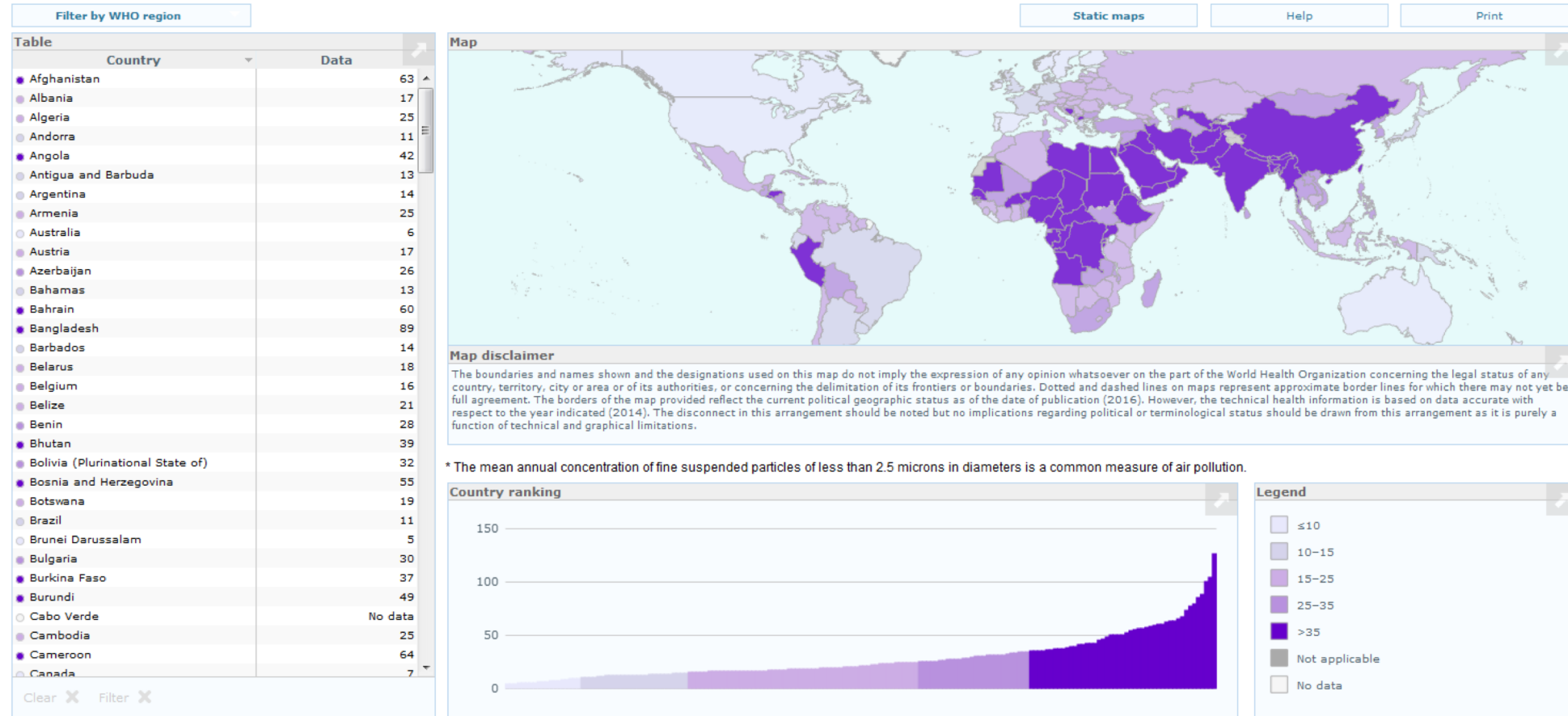


# PM<sub>2.5</sub> at Country Level

[http://gamapserver.who.int/gho/interactive\\_charts/phe/oap\\_exposure/atlas.html](http://gamapserver.who.int/gho/interactive_charts/phe/oap_exposure/atlas.html)



Public Health and Environment (PHE): ambient air pollution  
Annual mean concentrations of fine particulate matter (PM<sub>2.5</sub>) in urban areas (µg/m<sup>3</sup>), 2014\*



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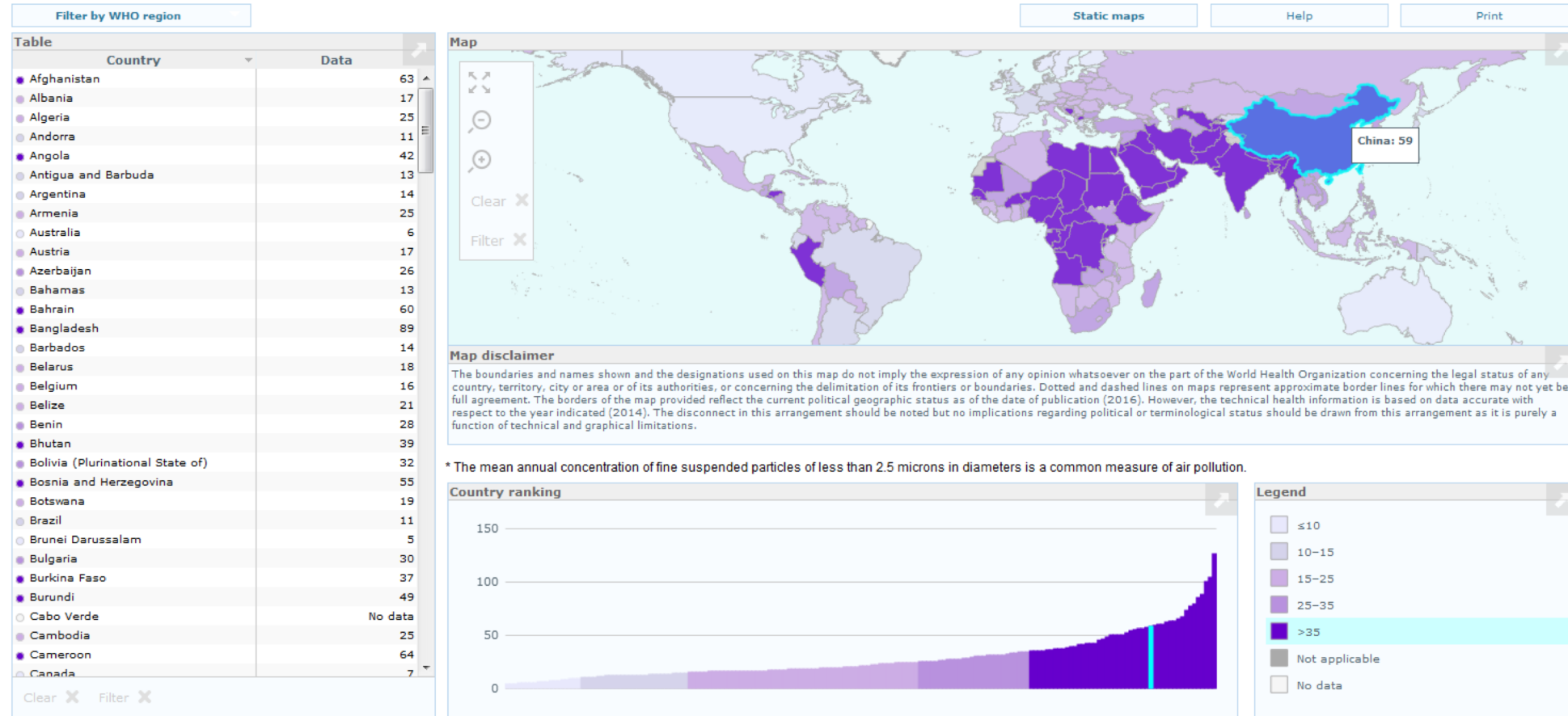


# PM<sub>2.5</sub> at Country Level

[http://gamapserver.who.int/gho/interactive\\_charts/phe/oap\\_exposure/atlas.html](http://gamapserver.who.int/gho/interactive_charts/phe/oap_exposure/atlas.html)



Public Health and Environment (PHE): ambient air pollution  
Annual mean concentrations of fine particulate matter (PM<sub>2.5</sub>) in urban areas (µg/m<sup>3</sup>), 2014\*



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# Where to Find and View the Data

## WHO Website – Grid Level

### Global Health Observatory (GHO) data

Global Health Observatory data

Data repository

Reports

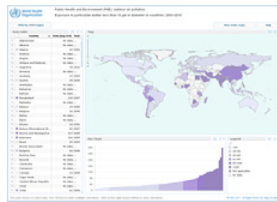
Country statistics

Map gallery

Standards

### Exposure to ambient air pollution

The mean ambient air pollution of particulate matter with an aerodynamic diameter of 2.5  $\mu\text{m}$  or less (PM2.5) in country urban areas ranges from less than 10 to over 100  $\mu\text{g}/\text{m}^3$ . In urban areas, the mean concentration of particulate matter with an aerodynamic diameter of 2.5  $\mu\text{m}$  or less (PM2.5) ranges from less than 10 to over 100  $\mu\text{g}/\text{m}^3$ , and from less than 10 to over 200  $\mu\text{g}/\text{m}^3$  for particulate matter with an aerodynamic diameter of 10  $\mu\text{m}$  or less (PM10)

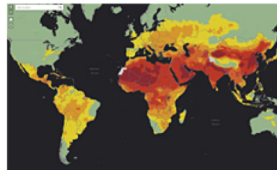


#### Situation at country level

[View interactive map/graph](#)

[View data](#)

[Read more](#)



#### Situation at grid level

[View interactive map](#)

[View data, metadata and detailed methods of estimation](#)



#### Situation at city level

[View full size map \(PM10\)](#)

[View full size map \(PM2.5\)](#)

[View data](#) | [Read more](#)

[Print](#) [Email](#) [Facebook](#) [Twitter](#) [Google+](#) [+](#)

#### More PHE data products

[Maps](#)

[Reports](#)

[Country profiles](#)

[Links](#)

- [http://www.who.int/gho/phe/outdoor\\_air\\_pollution/exposure/en/](http://www.who.int/gho/phe/outdoor_air_pollution/exposure/en/)

Global Health Observatory (GHO) data > Ambient air pollution



# Data Integration Model for Air Quality (DIMAQ)

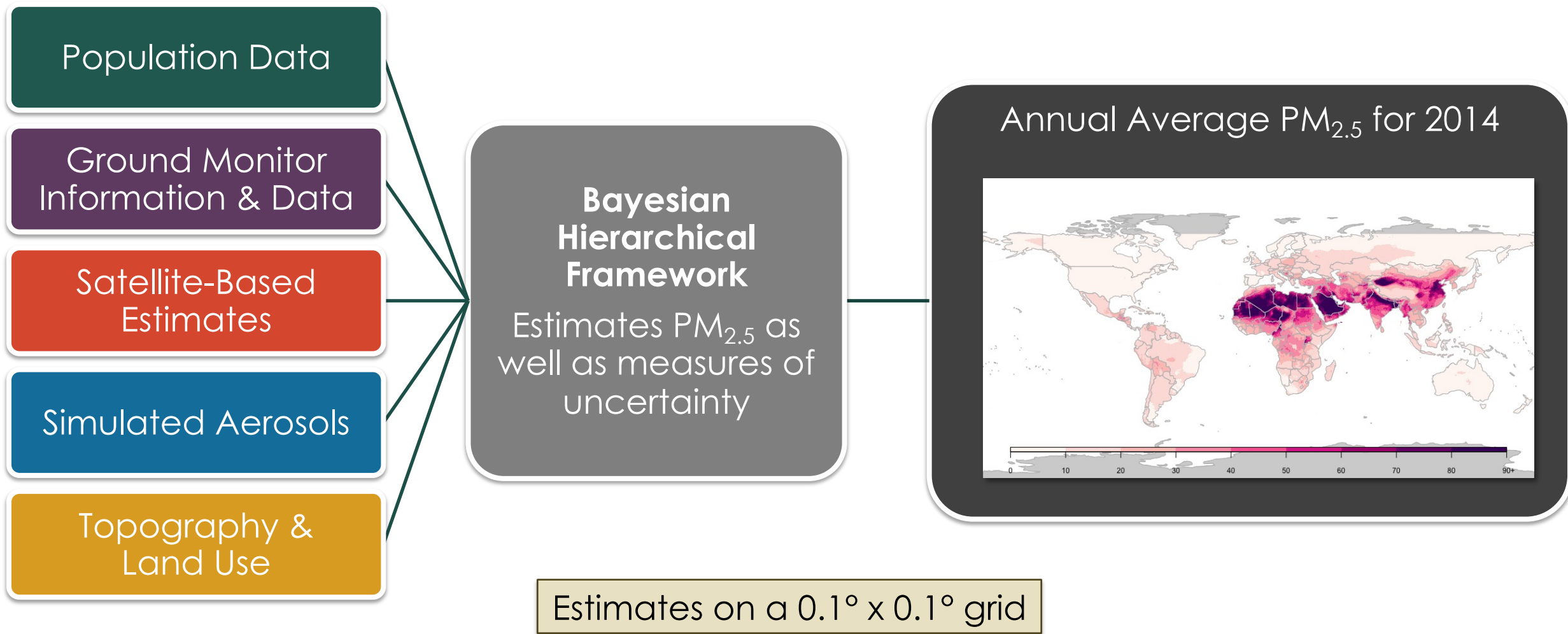


Image Credit (Right): Shaddick, et al. (2018), Figure 7 (top)



# PM<sub>2.5</sub> at Grid Level

<http://www.who.int/airpollution/data/modelled-estimates/en/>

The screenshot shows the WHO website page for 'Modelled Global Ambient Air Pollution estimates'. On the left, a navigation menu includes 'Air pollution', 'Ambient air pollution', 'Household air pollution', 'Maps & databases', 'Guidelines', 'Publications', and 'News and events'. An arrow points from the 'Maps & databases' link to the word 'Maps' written below it. The main content area has a title 'Modelled Global Ambient Air Pollution estimates' and a sub-header 'The latest DIMAQ data (2016)'. Below this, there are several links: 'Global ambient air pollution map', 'DIMAQ database, 2016 data' (a .csv file), 'Meta-data file for DIMAQ 2016' (an .xlsx file), 'Detailed methods for DIMAQ 2016', and 'Further information on the implementation of DIMAQ and the 2016 estimates of PM2.5'. To the right of the main content, there are social media icons and a 'Related links' section with two links: 'Ambient air pollution: A global assessment of exposure and burden of disease' and 'More on ambient air pollution'.

2014 & 2016 Data sets

← .csv file with gridded PM<sub>2.5</sub> estimates

← Meta-data for PM<sub>2.5</sub> estimates

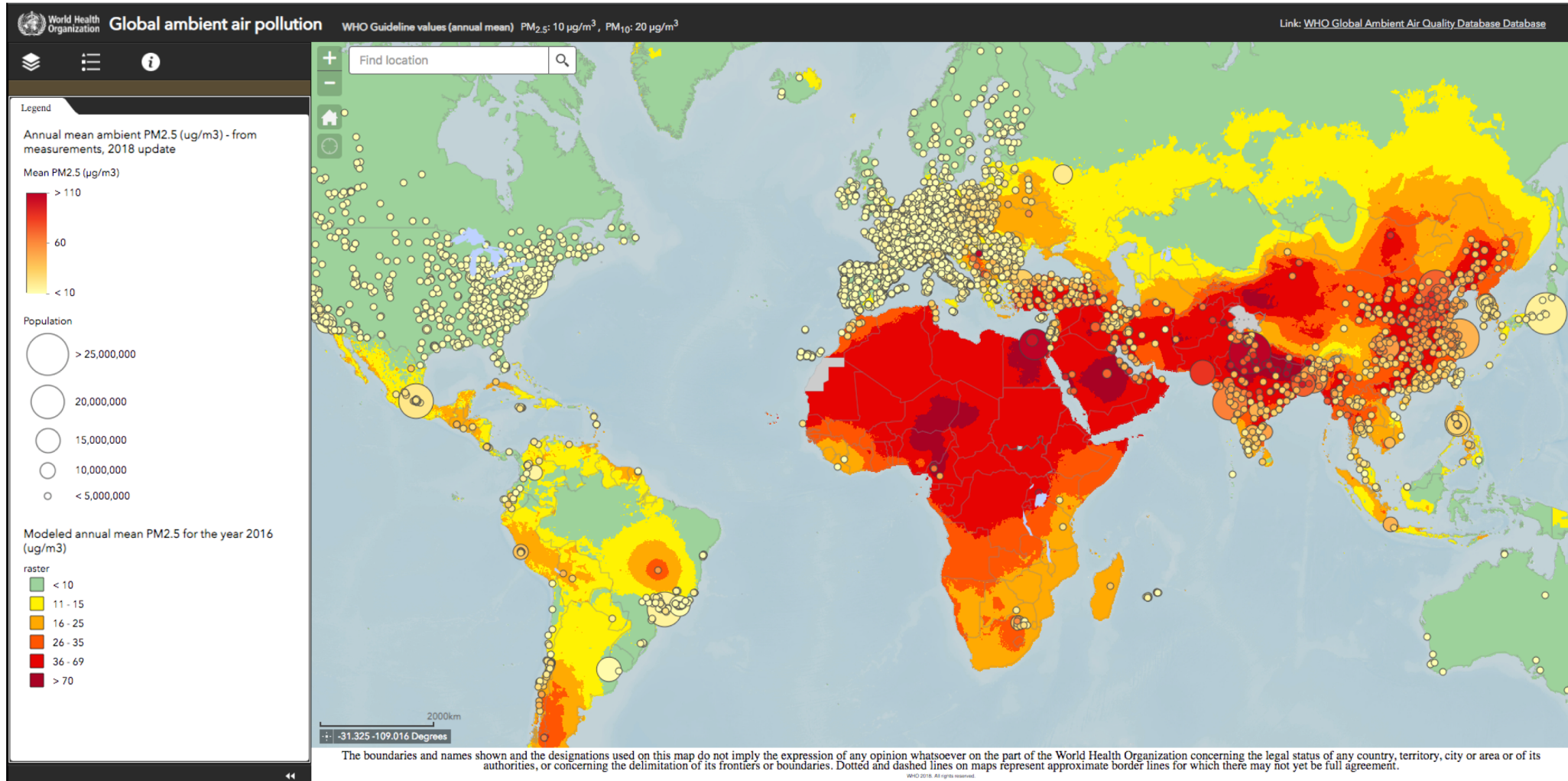
← Link to Shaddick et al. paper





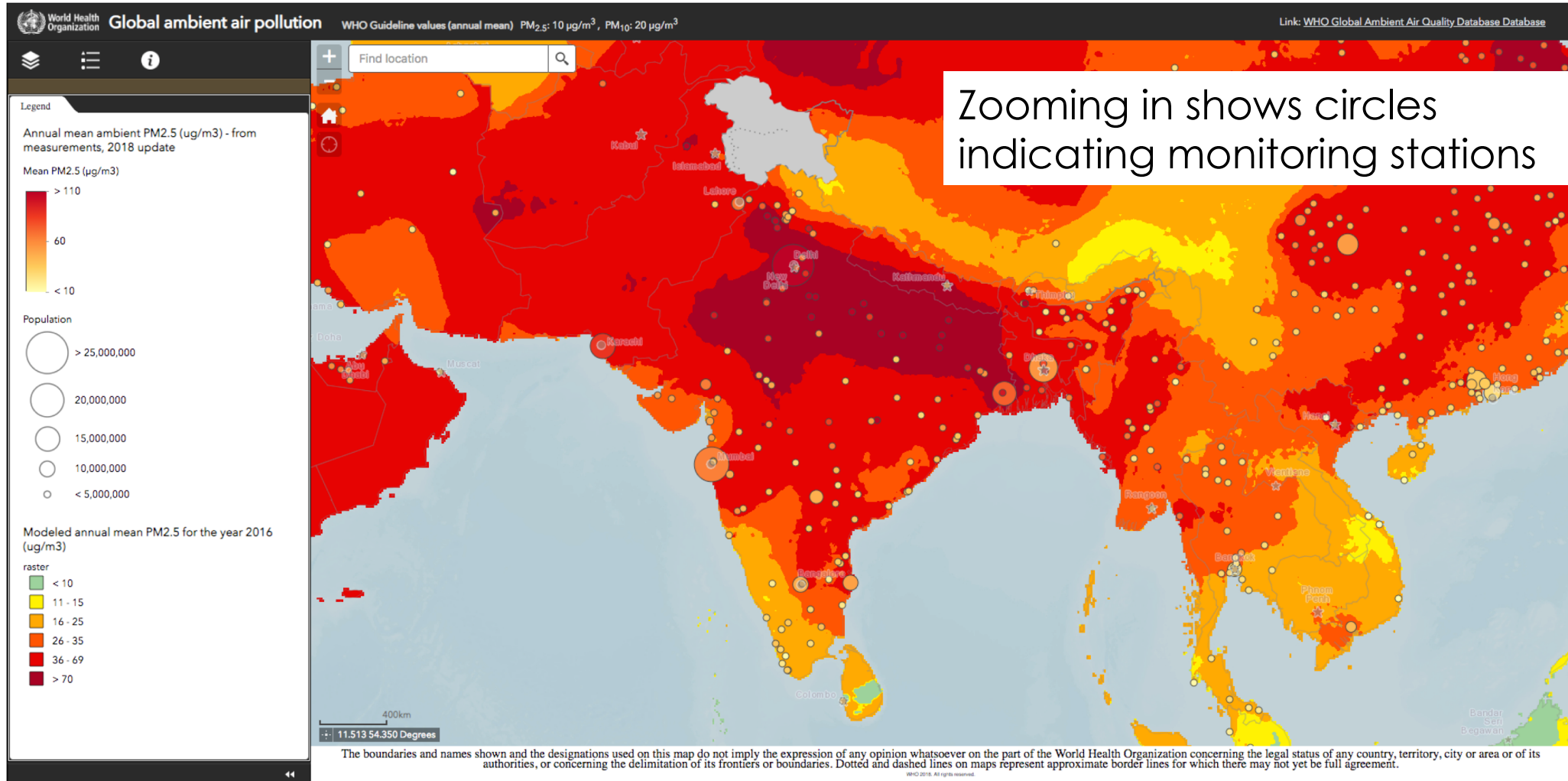
# PM<sub>2.5</sub> at Grid Level

<http://maps.who.int/airpollution/>



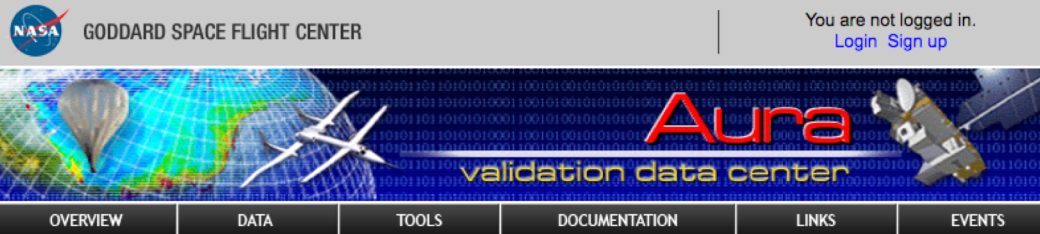
# PM<sub>2.5</sub> at Grid Level

<http://maps.who.int/airpollution/>



# WHO PM<sub>2.5</sub> Gridded Data by Country

[https://avdc.gsfc.nasa.gov/pub/tmp/WHO\\_PM25\\_2014\\_COUNTRY\\_DATA/](https://avdc.gsfc.nasa.gov/pub/tmp/WHO_PM25_2014_COUNTRY_DATA/)



NASA GODDARD SPACE FLIGHT CENTER | You are not logged in. [Login](#) [Sign up](#)

**Aura**  
validation data center

OVERVIEW DATA TOOLS DOCUMENTATION LINKS EVENTS

## OVERVIEW/HOME

Name	Last modified	Size
Parent Directory		-
Afghanistan_AFG_2014_WHO_PM25.csv	15-Feb-2017 10:32	220K
Albania_ALB_2014_WHO_PM25.csv	15-Feb-2017 10:32	11K
Algeria_DZA_2014_WHO_PM25.csv	15-Feb-2017 10:32	760K
Andorra_AND_2014_WHO_PM25.csv	15-Feb-2017 10:32	386
Angola_AGO_2014_WHO_PM25.csv	15-Feb-2017 10:32	375K
AntiguaandBarbuda_ATG_2014_WHO_PM25.csv	15-Feb-2017 10:32	761
Argentina_ARG_2014_WHO_PM25.csv	15-Feb-2017 10:32	1.0M
Armenia_ARM_2014_WHO_PM25.csv	15-Feb-2017 10:32	11K
Australia_AUS_2014_WHO_PM25.csv	15-Feb-2017 10:32	2.5M
Austria_AUT_2014_WHO_PM25.csv	15-Feb-2017 10:32	35K
Azerbaijan_AZE_2014_WHO_PM25.csv	15-Feb-2017 10:32	32K
Bahamas_BHS_2014_WHO_PM25.csv	15-Feb-2017 10:32	4.5K
Bahrain_BHR_2014_WHO_PM25.csv	15-Feb-2017 10:32	350
Bangladesh_BGD_2014_WHO_PM25.csv	15-Feb-2017 10:32	44K
Barbados_BRB_2014_WHO_PM25.csv	15-Feb-2017 10:32	317
Belarus_BLR_2014_WHO_PM25.csv	15-Feb-2017 10:32	99K
Belgium_BEL_2014_WHO_PM25.csv	15-Feb-2017 10:32	14K
Belize_BLZ_2014_WHO_PM25.csv	15-Feb-2017 10:32	6.8K
Benin_BEN_2014_WHO_PM25.csv	15-Feb-2017 10:32	34K
Bhutan_BTN_2014_WHO_PM25.csv	15-Feb-2017 10:32	13K
Bolivia,PlurinationalStateof_BOL_2014_WHO_PM25.csv	15-Feb-2017 10:32	342K
BosniaandHerzegovina_BIH_2014_WHO_PM25.csv	15-Feb-2017 10:32	21K
Botswana_BWA_2014_WHO_PM25.csv	15-Feb-2017 10:32	183K
Brazil_BRA_2014_WHO_PM25.csv	15-Feb-2017 10:32	2.6M
BruneiDarussalam_BRN_2014_WHO_PM25.csv	15-Feb-2017 10:32	1.9K



# Where to Find and View the Data

WHO Website City Level: [http://www.who.int/gho/phe/outdoor\\_air\\_pollution/exposure/en/](http://www.who.int/gho/phe/outdoor_air_pollution/exposure/en/)

The screenshot shows the WHO GHO data page for 'Exposure to ambient air pollution'. It features a navigation menu on the left with links for 'Global Health Observatory data', 'Data repository', 'Reports', 'Country statistics', 'Map gallery', and 'Standards'. The main content area is titled 'Global Health Observatory (GHO) data' and 'Exposure to ambient air pollution'. It includes a descriptive paragraph about PM2.5 and PM10 concentrations, a world map with a data table, and three sections: 'Situation at country level', 'Situation at grid level', and 'Situation at city level'. The 'Situation at city level' section contains links to download full-size maps for PM10 (778kb) and PM2.5 (699kb) as PDFs, and links to 'View data' and 'Read more'. A 'More PHE data products' sidebar on the right lists 'Maps', 'Reports', 'Country profiles', and 'Links'. Social media icons for print, email, Facebook, Twitter, and Google+ are also present.

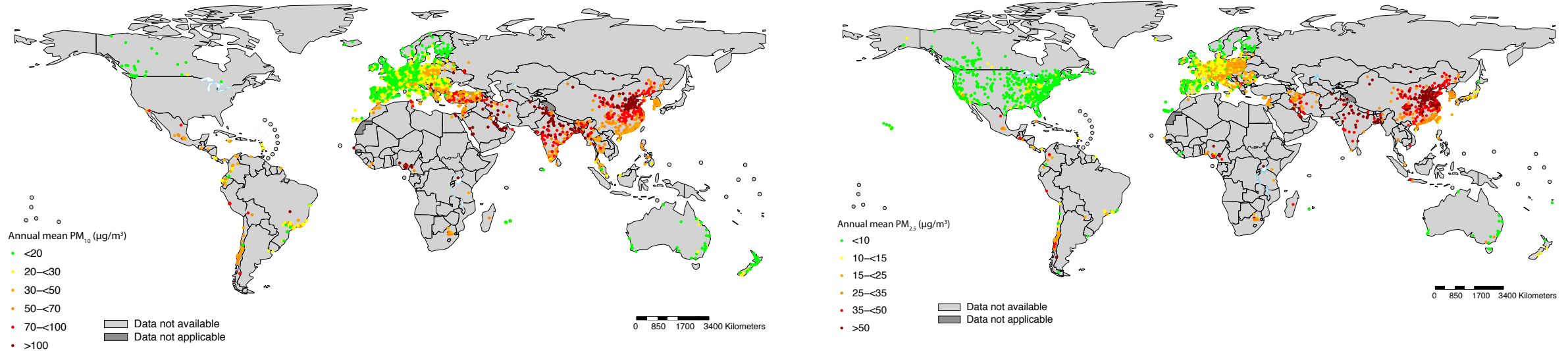
Maps of city level PM<sub>10</sub> and PM<sub>2.5</sub>

.csv file with city level annual means



# PM<sub>2.5</sub> at City Level

[http://www.who.int/gho/phe/outdoor\\_air\\_pollution/exposure/en/](http://www.who.int/gho/phe/outdoor_air_pollution/exposure/en/)

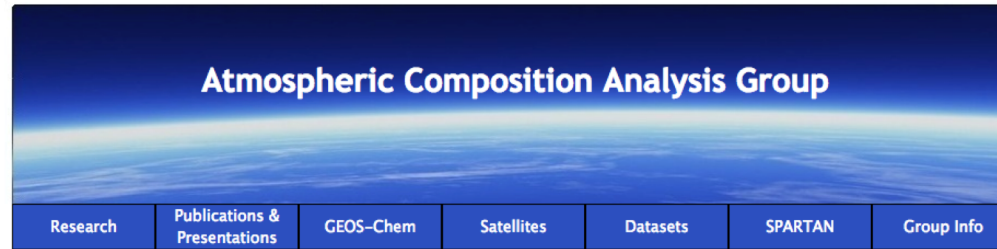




# Long Term Time Series

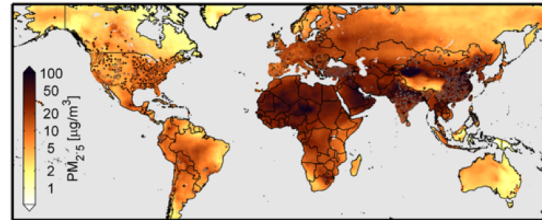
# Satellite-Derived Surface PM<sub>2.5</sub> Datasets

[http://fizz.phys.dal.ca/~atmos/martin/?page\\_id=140](http://fizz.phys.dal.ca/~atmos/martin/?page_id=140)



## Surface PM<sub>2.5</sub>

Global Estimates (V4.GL.02 / V4.GL.02.NoGWR):



We estimate ground-level fine particulate matter (PM<sub>2.5</sub>) by combining Aerosol Optical Depth (AOD) retrievals from the NASA MODIS, MISR, and SeaWiFS instruments with the GEOS-Chem chemical transport model, and subsequently calibrated to global ground-based observations of PM<sub>2.5</sub> using Geographically Weighted Regression (GWR) as detailed in the below reference.

### References:

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, **Global Estimates of Fine Particulate Matter using a Combined Geophysical-Statistical Method with Information from Satellites, Models, and Monitors**, *Environ. Sci. Technol.*, doi: 10.1021/acs.est.5b05833, 2016. [\[Link\]](#)

Estimates prior to 2008 incorporate temporal information from:

Boys, B.L., Martin, R.V., van Donkelaar, A., MacDonell, R., Hsu, N.C., Cooper, M.J., Yantosca, R.M., Lu, Z., Streets, D.G., Zhang, Q., Wang, S., **Fifteen-year global time series of satellite-derived fine particulate matter**, *Environ. Sci. Technol.*, 10.1021/es502113p, 2014. [\[Link\]](#)

van Donkelaar, A., R. V. Martin, M. Brauer and B. L. Boys, **Global fine particulate matter concentrations from satellite for long-term exposure assessment**, *Environmental Health Perspectives*, 123, 135-143, DOI:10.1289/ehp.1408646, 2015. [\[Link\]](#)

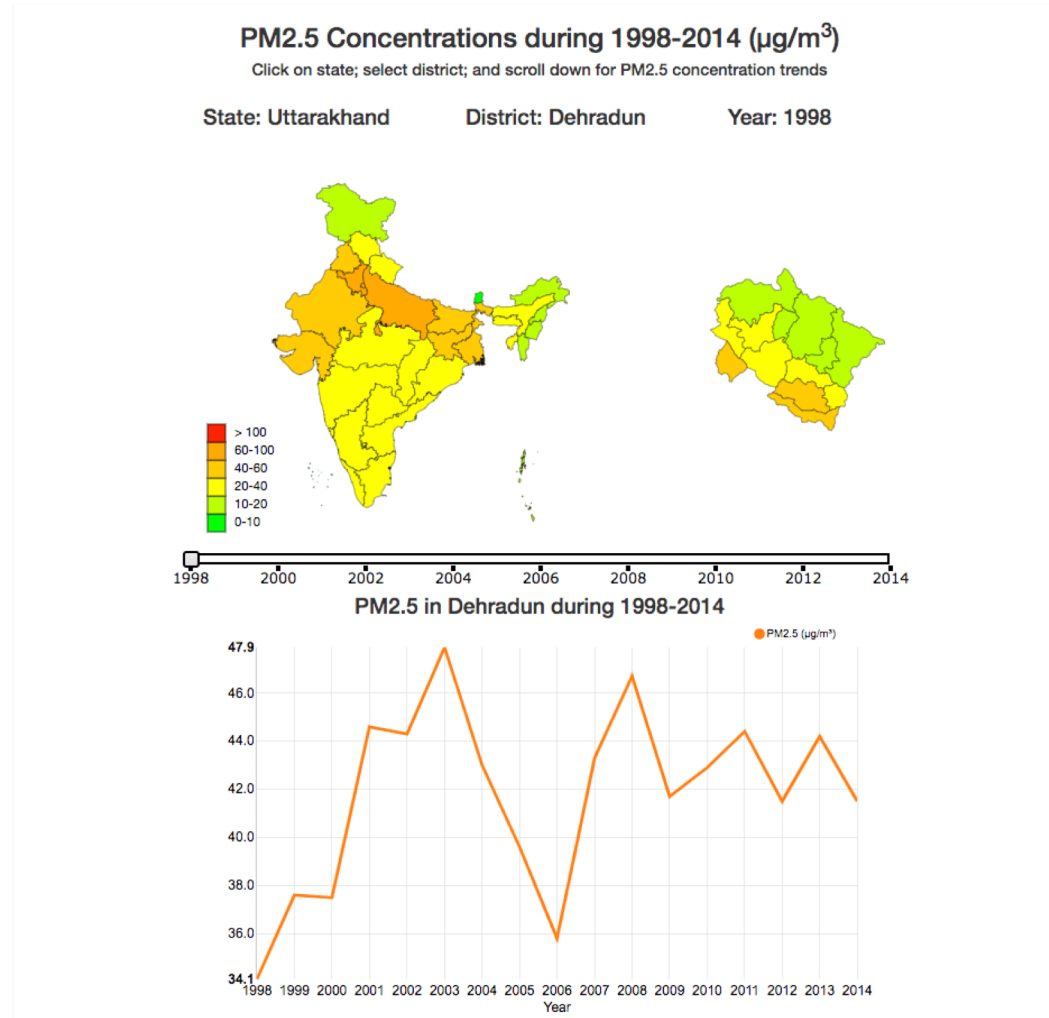
### Scientific Datasets:

Global resolved datasets are provided in ArcGIS-compatible NetCDF [.nc] or zipped ASCII [.asc.zip] file. Note that the unzipped ASCII files can be cumbersome. Gridded files use the WGS84 projection. Corresponding files for Google Earth are also provided [.kmz]. Country means are also provided in a comma separated ASCII (.csv) format. Dust and Sea-Salt Removed PM<sub>2.5</sub> estimates apply simulated compositional information to our full-composition values, following van Donkelaar et al., EHP, 2015. Other extractions can often be produced upon request. Please contact Aaron van Donkelaar (Aaron.van.Donkelaar@dal.ca) for further information.



# India: Model and Satellite-Derived PM<sub>2.5</sub>

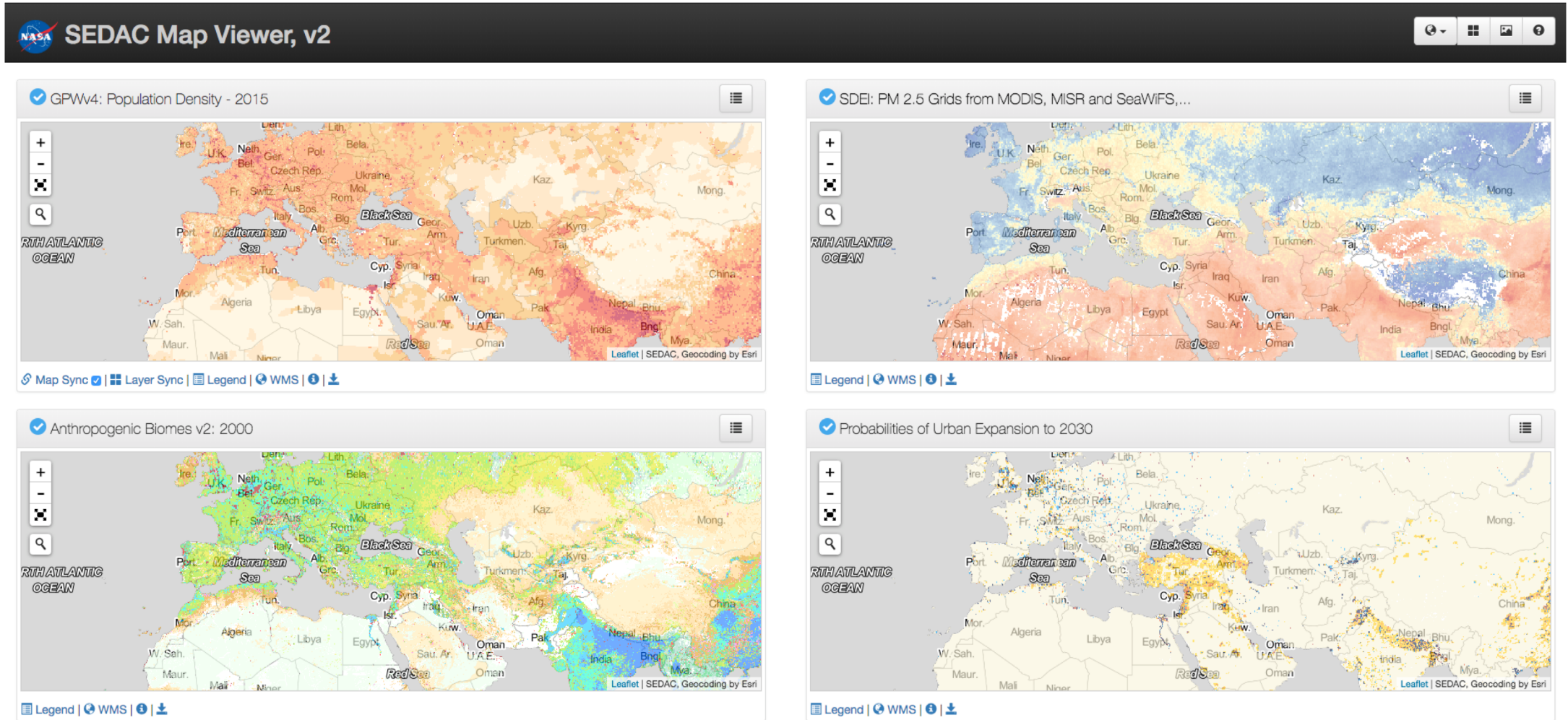
<http://www.urbanemissions.info/india-air-quality/india-satpm25/>





# Socioeconomic Data & Applications Center (SEDAC)

<http://sedac.ciesin.columbia.edu/mapping/viewer/#>



# State of Global Air

<https://www.stateofglobalair.org>

STATE OF GLOBAL AIR /2018

HOW CLEAN IS YOUR AIR?    IMPACT ON YOUR HEALTH    EXPLORE THE DATA    READ THE REPORT    WHAT'S NEW

HEI    IHME

## STATE OF GLOBAL AIR /2018

**NEW FOR 2018**    Your source for the latest global, regional, and country-specific data on air quality and health.

### How clean is the air you breathe?

Nearly 95% of the world's population live in areas where fine particle levels exceed global air quality guidelines. **NEW for 2018** — Data on exposures to household air pollution!

### What is the impact on your health?

Air pollution is linked to illness and early death and is the sixth leading risk factor globally. Household air pollution is the eighth leading risk factor!

### Explore the interactive data.

Explore your country's air and health using this unique site. View maps, compare trends, and download data. **NEW for 2018** — Data on household air pollution and health!

### Read the report.

View the latest analysis of air quality and health findings meant for citizens, policy makers, journalists, and scientists. **NEW for 2018** — The role of household air pollution!

