World Health Organization

WHO's Urban Ambient Air Pollution database - Update 2016

version 0.2

Data summary

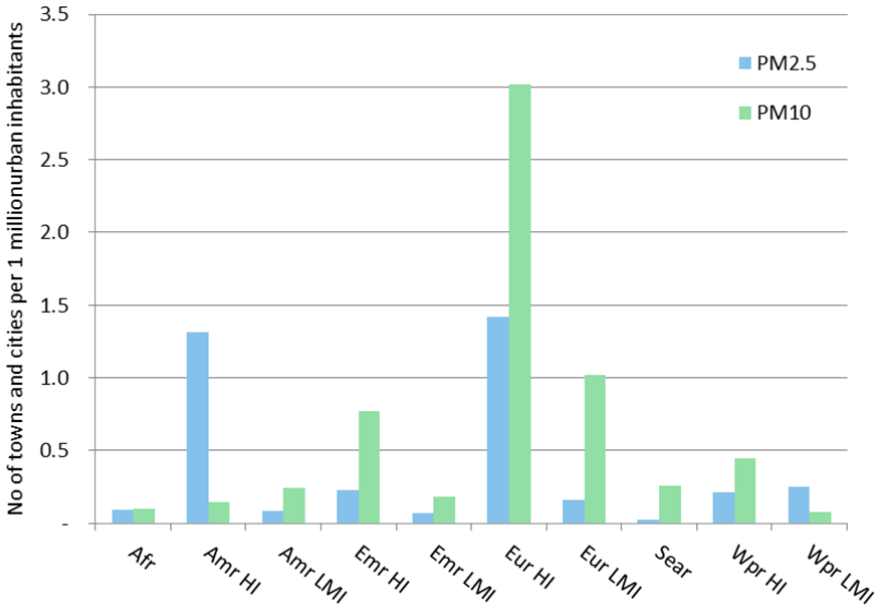
The 2016 version of the database consists mainly of urban air quality data – annual means for PM_{10} and/or $PM_{2.5}$ – covering about 3 000 human settlements in 103 countries for the years 2008-2015. These settlements range in size from a few hundred inhabitants to over 9 million, but are mostly urban in character (see the methods paper for a breakdown by population), and therefore referred to here generally as either "human settlements" or "towns and cities". The regional distribution documented in the database, and the number of settlements with accessible data by urban inhabitants are described in Table 1 and Figure 1, respectively.

Table 1*: Total number of towns and cities in AAP database, 2016 version, by region*

Region	Number of towns and cities	Number of countries	Total number of countries in region
Africa (Sub-Saharan)	39	10	47
America, LMI	102	13	24
America, HI	524	6	11
Eastern Mediterranean, LMI	53	8	15
Eastern Mediterranean, HI	31	6	6
Europe, LMI	166	9	19
Europe, HI	1553	33	34
South-East Asia	175	9	11
Western Pacific, LMI	225	4	21
Western Pacific, HI	109	5	6
World	2 977	103	194

LMI: Low-and middle-income; HI: high-income.

Figure 1: *Number of town and cities with accessible PM_{10} and $PM_{2.5}$ data in 2016 per urban population*

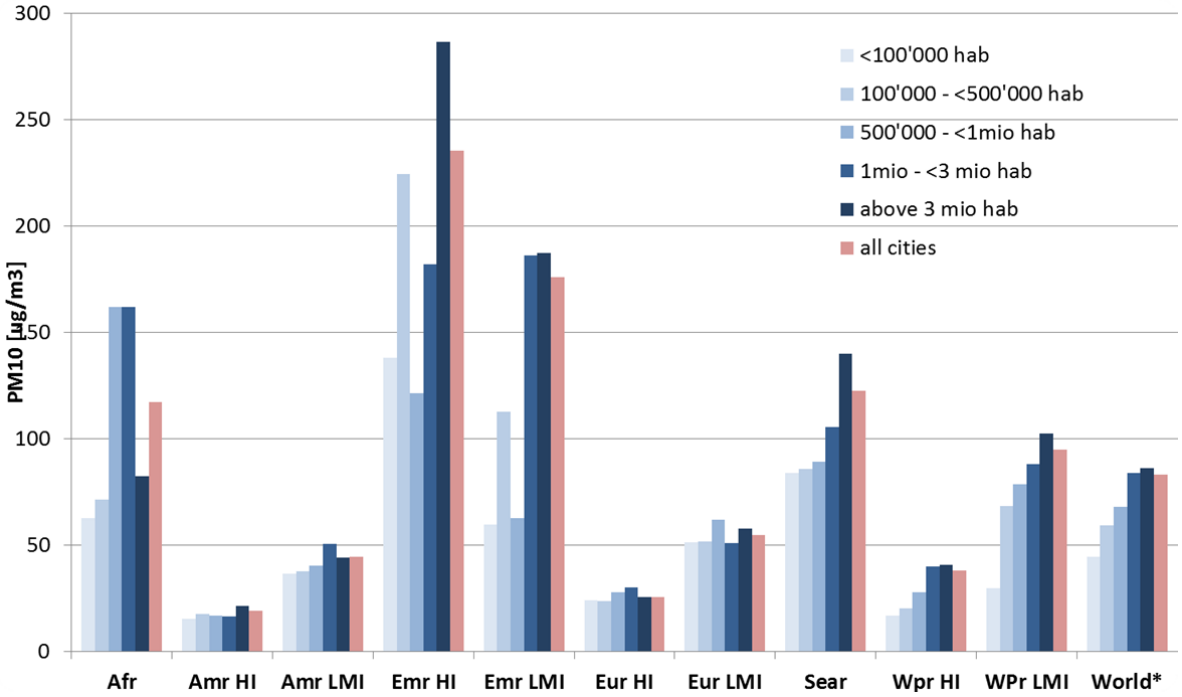


$PM_{10/2.5}$: Fine particulate matter of 10/2.5 microns or less; Afr: Africa; Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMI: Low- and middle-income; HI: high-income.

$PM_{2.5}$ measurements can directly be linked to estimates of health risks, and are therefore of particular interest. PM_{10} measurements first need to be converted to $PM_{2.5}$ in order to do so. In high-income countries, $PM_{2.5}$ measurements are already being widely performed. In low- and middle-income countries, while $PM_{2.5}$ measures still aren't available in many countries but there has been large improvements since the last 3 years: annual mean $PM_{2.5}$ measurements could be accessed in 339 cities, so almost 5 times more than in the 2014 version of the database. Annual mean PM_{10} measurements could be accessed in as many as 586 cities in low and middle income countries. In high-income countries, 1241 cities and towns with $PM_{2.5}$ measures could be accessed, against 1639 cities and towns with PM_{10} measurements.

An overview of PM_{10} levels for the WHO regions and selected cities is presented in Figure 2, 3 and 4.

Figure 2: *PM_{10} levels by region and city size, for available cities and towns latest year in the period 2008-2015.*

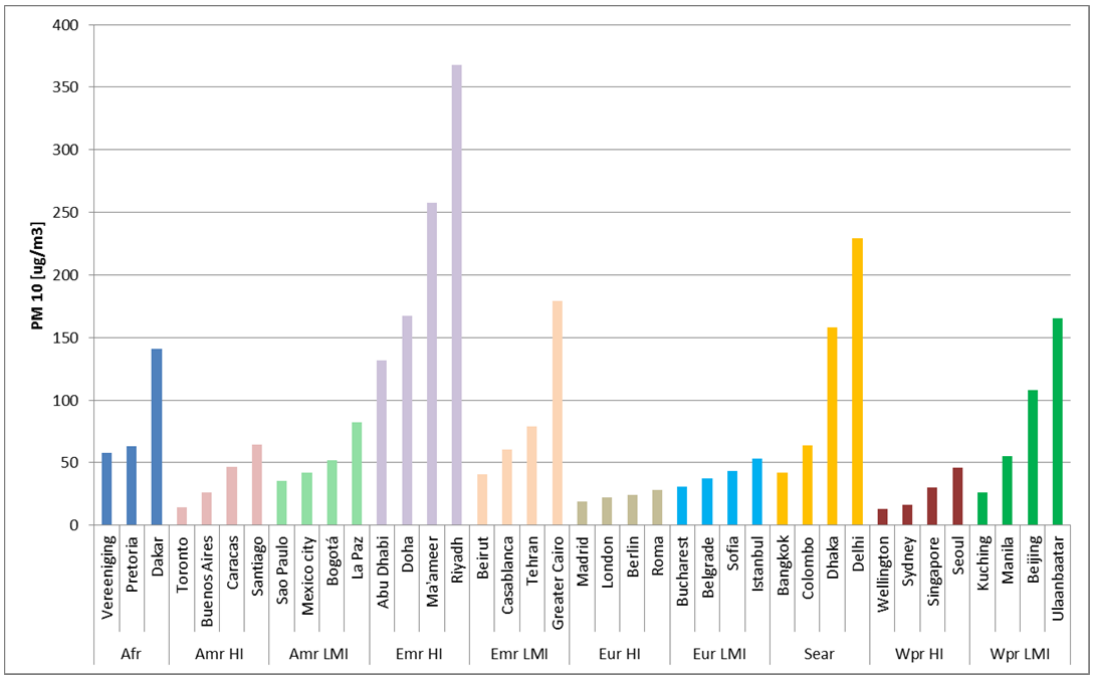


PM_{10}: Fine particulate matter of 10 microns or less; Afr: Africa; Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMI: Low- and middle-income; HI: high-income. PM_{10} values for the world are regional urban population-weighted.

Figure 5 shows the regional and global percentages of the assessed towns and cities with PM measurements experiencing PM_{10} or $PM_{2.5}$ air pollution levels that meet or exceed the WHO Air Quality Guidelines annual mean values of 20 $\mu g/m^3$ (for PM_{10}) and 10 $\mu g/m^3$ (for $PM_{2.5}$)[1]. Globally, according to the currently available data, 16% of the assessed population are exposed to PM_{10} or $PM_{2.5}$ annual mean levels complying with AQG levels. This figures raises to 27% for the interim target 3 (IT-3, 30 $\mu g/m^3$ for PM_{10} and 15 $\mu g/m^3$ for $PM_{2.5}$) of the AQG, 46% for IT-2 (50 $\mu g/m^3$ for PM_{10} and 25 $\mu g/m^3$ for $PM_{2.5}$), and 56% for IT-1 (70 $\mu g/m^3$ for PM_{10} and 35 $\mu g/m^3$ for $PM_{2.5}$).

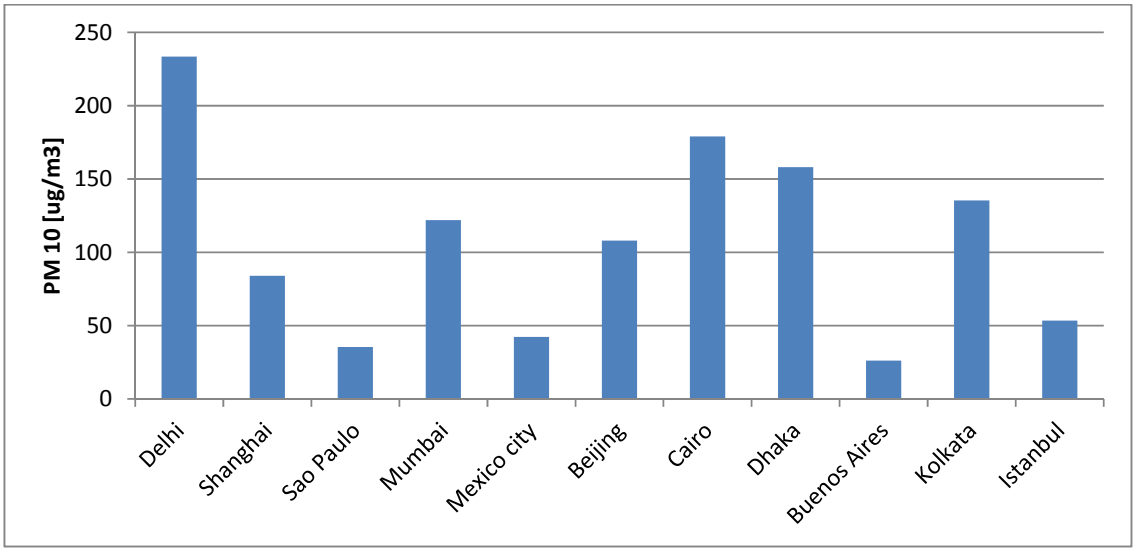
[1] For town and cities with both PM_{10} and $PM2_{2.5}$ values, $PM_{2.5}$ were used.

Figure 3: *PM_{10} levels for selected[2] cities by region, for the last available year in the period 2011-2015.*



PM_{10}: Fine particulate matter of 10 microns or less; Afr: Africa; Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMI: Low- and middle-income; HI: high-income.

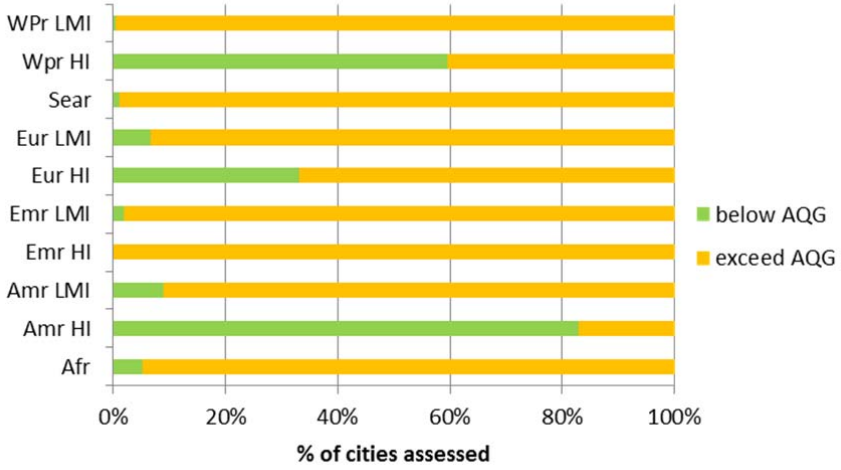
Figure 4: *PM_{10} levels for available mega-cities of more than 14 million habitants for the last available year in the period 2011-2015.*



PM_{10}: Fine particulate matter of 10 microns or less.

[2] Selection criteria: for year of measurement 2011 or more recent, the largest city for each country within a region (or two cities for one country if only 2 countries available in the region. City size ranges from 140'000 to 26 million habitants.

Figure 5: *Annual mean PM of the assessed town and cities compared to the WHO Air Quality Guidelines (AQG)*[a]



Afr: Africa; Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMI: Low- and middle-income; HI: high-income; AQG: WHO Air Quality Guidelines.

[a] Annual mean PM10: 20 μg/m^3; Annual mean PM2.5: 10 μg/m^3.

Comparison of urban air pollution levels in recent years

A total of 795 towns and cities in 67 countries were selected for a more refined comparison of $PM_{2.5}$ (where available), or PM_{10} values over a period of 5 or more years. (Table 2). The selection was made according to the following criteria: these urban areas have either measured $PM_{2.5}$ or PM_{10} values in the three databases, and cover a period of 3 years or more; or these areas are represented in the data that was collected in 2011, 2014 or 2016 and cover a period of 4 years or more.

The 2011 version of the database contains data for 2010 or earlier, and the 2014 version for 2012 or earlier. To compare levels of air pollution for the equivalent of a five-year period (e.g. 2008 -2013) for cities included in the above-described selection, a linear regression was made. A regional summary is presented by WHO region and income groups (Table 3). Globally, annual PM levels are estimated to have increased by 8% during the recent five-year period in the assessed cities (Note: the global increase figure is weighted by the regional urban population).

Table 2: *Number of cities included for the $PM_{2.5}$ and PM_{10} comparison over a 5-year period, by region.*

Region	Number of town and cities	Number of countries
Africa (Sub-Saharan)[1]	2	2
America, LMI	13	7
America, HI	343	6
Eastern Mediterranean, LMI	16	6
Eastern Mediterranean, HI	6	2
Europe, LMI	32	5
Europe, HI	277	30
South-East Asia	53	5
Western Pacific, LMI	33	2
Western Pacific, HI	21	3
World	796	68

LMI: Low- and middle-income countries; HI: High-income.

[1] Region with less than 5 cities were not included in the analysis, due to lack of representativeness.

Table 3: Trend in $PM_{2.5}$ or *PM_{10} based on cities available in several versions of the database, by region*[1].

Region	Trend over the mean period 2008-2013[2]
Africa (Sub-Saharan)	NA
America, LMI	→
America, HI	↘
Eastern Mediterranean, LMI	↗
Eastern Mediterranean, HI	↗
Europe, LMI	↘
Europe, HI	↘
South-East Asia	↗
Western Pacific, LMI	↗
Western Pacific, HI	↘
World[3]	↗

[1] Criteria for inclusion: cities with measured PM2.5 or PM10 values in the three database versions covering a period of 3 years or more, or in two versions and covering a period of 4 years or more.

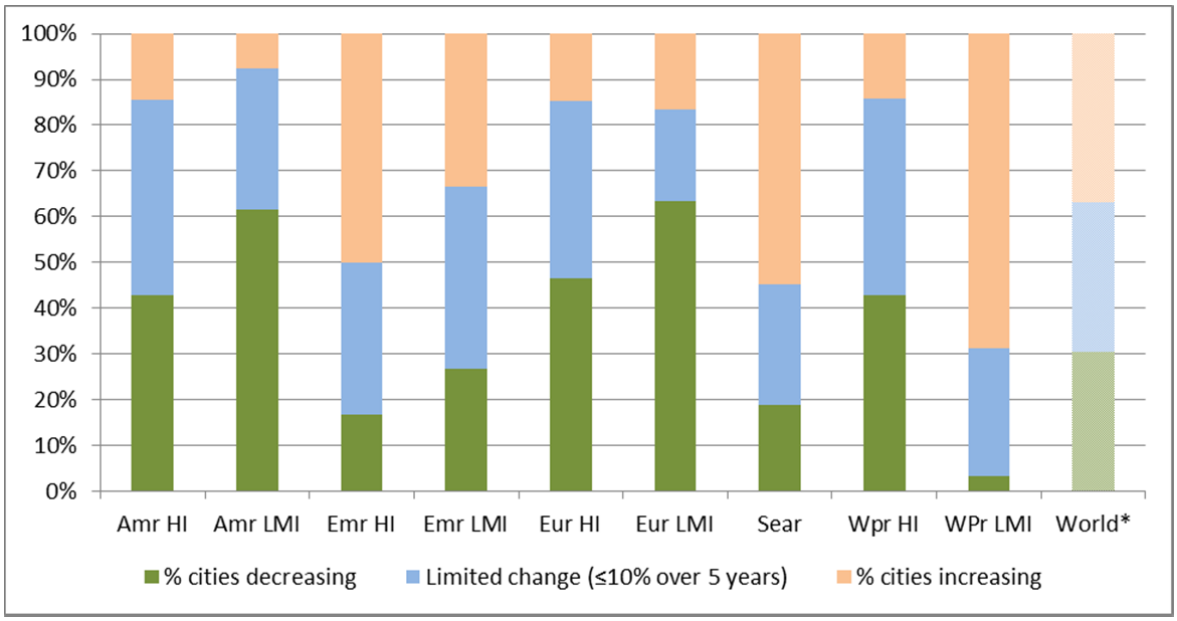
[2] → : No more than 5% change over the five-year period; ↘ : More than 5% decrease over the five-year period; ↗ : More than 5% increase over the five-year period.

[3] The mean for the World is based on weighting by regional urban population.

LMI: Low- and middle-income countries; HI: High-income; NA: Not available. Results are based on 795 cities and are to be interpreted with caution, as 1) cities included might not ensure representativeness, 2) yearly variations due for example to climatic changes can be important and 3) a 5-year comparison does not necessarily represent trends, in particular when changes are limited.

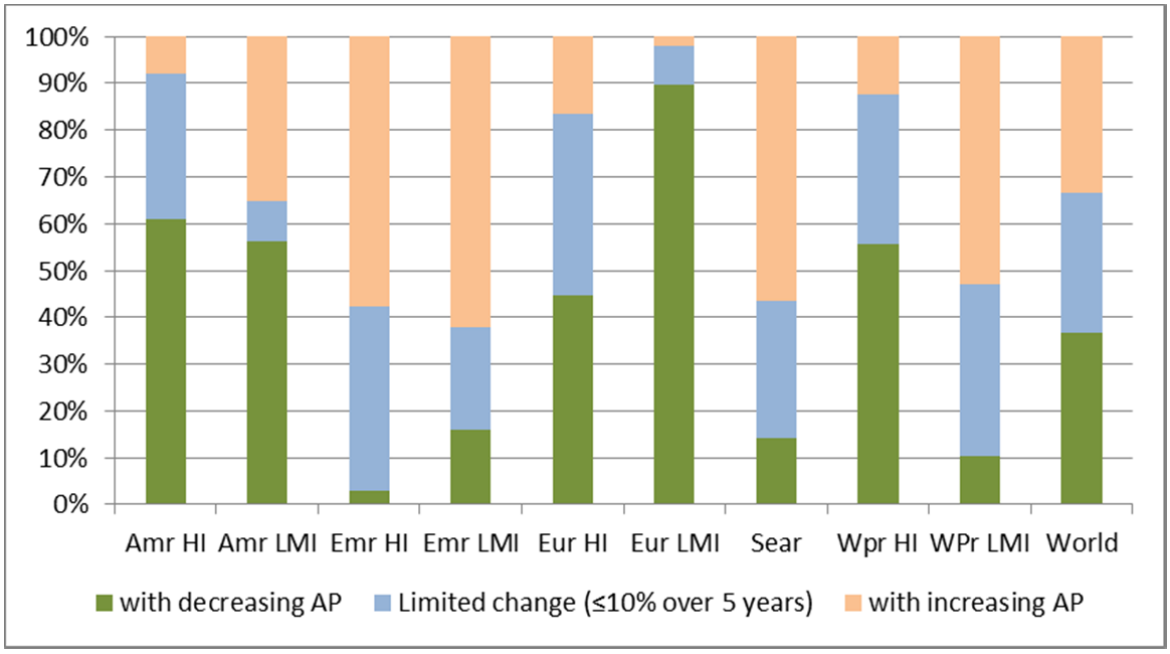
Figure 6 shows the percentage of towns and cities with decreasing levels of annual mean PM2.5 or PM_{10} (in green), increasing levels (in light orange), and levels with changes of ≤10% over a 5-year period (in blue), by region. The variation in population living in cities with increasing or decreasing population levels is represented in Figure 7.

Figure 6: *Percentage of cities with increasing and decreasing PM2.5 or PM_{10} annual means, by region*



Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia, Wpr: Western Pacific; LMI: Low- and middle-income; HI: high-income. *The world figure is regional population-weighted.

Figure 7: *Percentage of city population experiencing increasing and decreasing PM2.5 or PM_{10} annual means, by region.*



Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia, Wpr: Western Pacific; LMI: Low- and middle-income; HI: high-income.

Limitations

The presented comparison of air pollution levels has a number of limitations:

- PM2.5 or, when not available, PM_{10} values were used for the comparison, which may have influenced the results;
- The period of comparison is relatively short. Yearly variations may for example be influenced by the weather and data within a five-year period may not be sufficient to reflect a longer term trend. A longer time period of comparison would be required to confirm any trends.
- The sampling locations may have changed within the period of comparison, and a variation in annual mean PM levels of a city may reflect different sampling locations rather than a trend. Measurement locations are however reasonably stable over time.

For further information, please contact:
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