World Health Organization

WHO ambient (outdoor) air quality database
Summary results, update 2018

version 6 April 2018

The database covers more than 4000 human settlements ranging in size from a less than a one hundred to more than 10 million inhabitants. Most of these are urban areas of more than 15 000 inhabitants or more, hence this database is often referred to it as a "urban air quality data base". However more than 25% of settlements in the database are smaller than 16 000 residents, and a limited proportion (mostly in Europe) includes settlements of less than 1500 inhabitants. These settlements may however also be located in proximity to larger urban agglomeration.

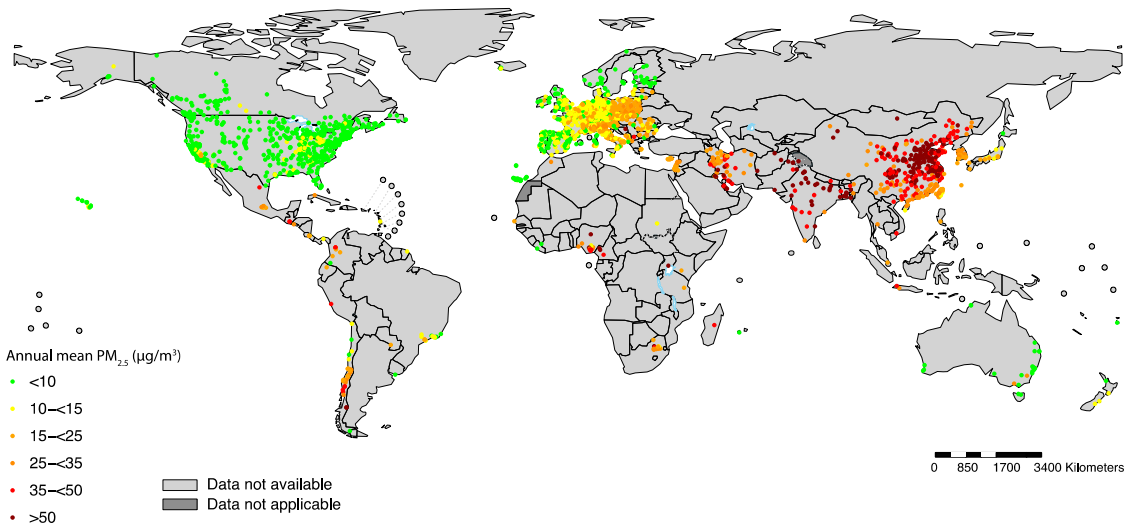
Table 1. Ambient air pollution database: Proportion of settlements by population size.

Percentage of observations	**Settlement size**
0%	0
5%	1'318
10%	3'523
25%	15'397
41%	37'061
50%	56'919
75%	259'592
90%	941'007
95%	1'883'287
99%	7'327'618
Mean settlement size	**460'294**
Number of settlements	**4'387**

Data Availability

The 2018 version of the WHO ambient (outdoor) air quality database consists mainly of urban air quality data annual means for PM_{10} and/or $PM_{2.5}$, covering more than 4000 human settlements in 108 countries for the years from 2010 to 2016. These settlements range in size from less than a hundred inhabitants to over 10 million, but are mostly urban in character (see table 1), and therefore referred to generally as either human settlements or towns and cities. The data was retrieved at monitoring station level, and further aggregated at city level.

Figure 1: Location of the monitoring stations and $PM_{2.5}$ concentration in more than 4000 human settlements, 2010-2016



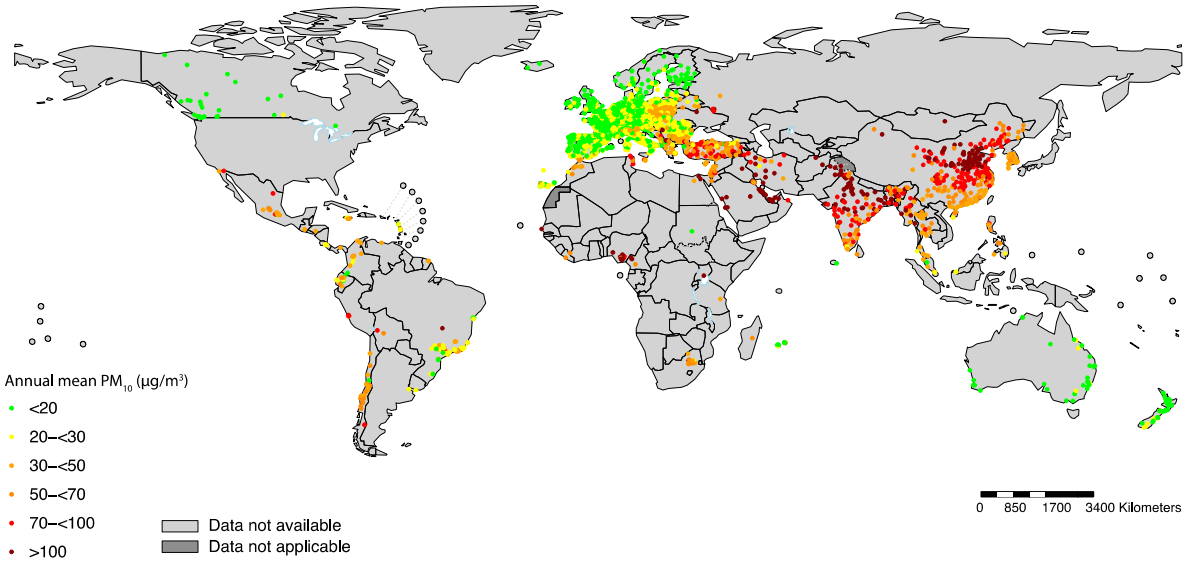
$PM_{2.5}$: Fine particulate matter of a diameter of 2.5 microns or less.

Figure 1 and Figure 2 feature the coverage of the ground measurements of $PM_{2.5}$ and PM_{10} respectively, which are still not homogeneously distributed around the globe. A higher concentration of ground measurements is generally found in high and middle income countries, in Europe and North America, India and China.

The regional distribution documented in the database, and the number of settlements with accessible data by urban inhabitants are described in Table 2 and Figure 3, respectively.

$PM_{2.5}$ measurements can directly be used to estimate health impact, and are therefore of particular interest. When $PM_{2.5}$ measurements are not available, PM_{10} measurements need to be converted to $PM_{2.5}$. In high income countries, $PM_{2.5}$ measurements are already being widely performed. In many low and middle income countries, while $PM_{2.5}$ measures are still not available, there has been large improvements over the last years.

Figure 2 Location of the monitoring stations and PM_{10} concentration in more than 4000 human settlements, 2010-2016.



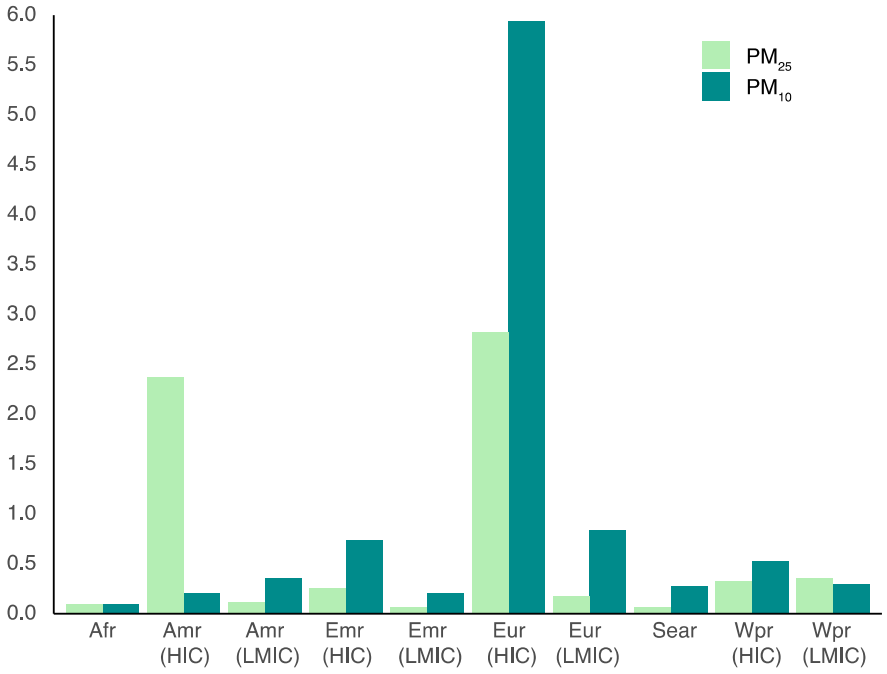
PM_{10}: Fine particulate matter of a diameter of 10 microns or less.

Table 2: Total number of cities and countries in AAP database, 2018 version, by region.

Region	Number of settlements	Number of countries with data	Total number of countries in region
Africa (Sub-Saharan) (LMIC)	41	10	47
Americas (HIC)	760	4	11
Americas (LMIC)	170	16	24
Eastern Mediterranean (HIC)	33	6	6
Eastern Mediterranean (LMIC)	98	9	15
Europe (HIC)	2392	31	34
Europe (LMIC)	234	12	19
South-East Asia (LMIC)	198	9	11
Western Pacific (HIC)	125	5	6
Western Pacific (LMIC)	336	6	21
Global	***4387***	***108***	***194***

AAP: Ambient air pollution database; LMIC: Low and middle-income countries; HIC: high-income countries.

Figure 3: Number of towns and cities with accessible PM_{10} and $PM_{2.5}$ data in 2018 per urban population (in millions).



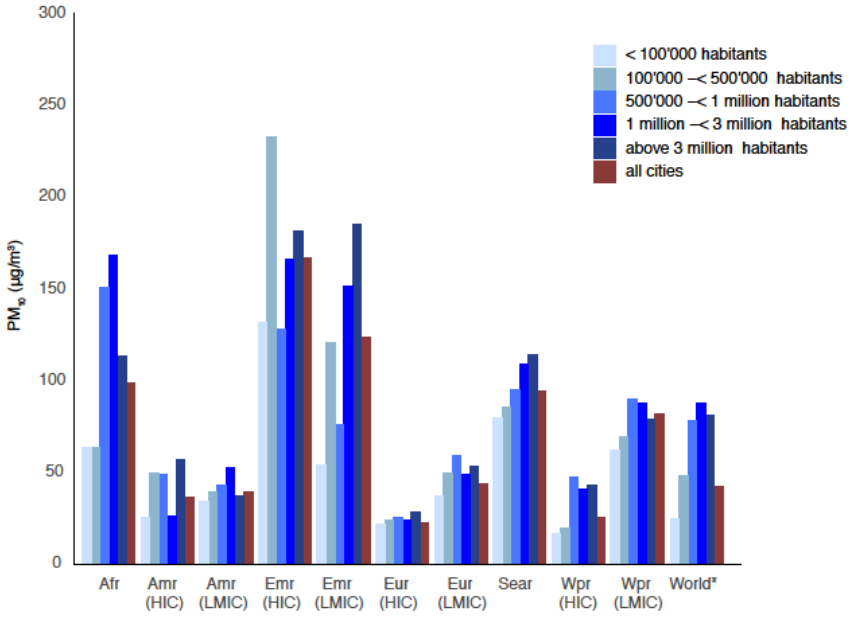
$PM_{10/2.5}$: Fine particulate matter of diameter of 10/2.5 microns or less; Afr: Africa; Amr: Americas; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMIC: low and middle-income countries; HIC: high-income countries.

In the 2018 version of the database, annual mean $PM_{2.5}$ were compiled at monitoring station level, as much as possible, for about 9690 stations. About 51% of them were urban, 10% rural, 32% not specified, and the remaining either industrial, traffic or background. Annual mean $PM_{2.5}$ could be accessed in 1902 cities for high income countries and 566 cities for low and middle income countries, hence almost 50% increase since 2016. The annual mean PM_{10} measurements could be accessed in 925 cities in low and middle income countries, and 2460 cities in high income countries, reflecting an increase of more than 50%.

Data Summary

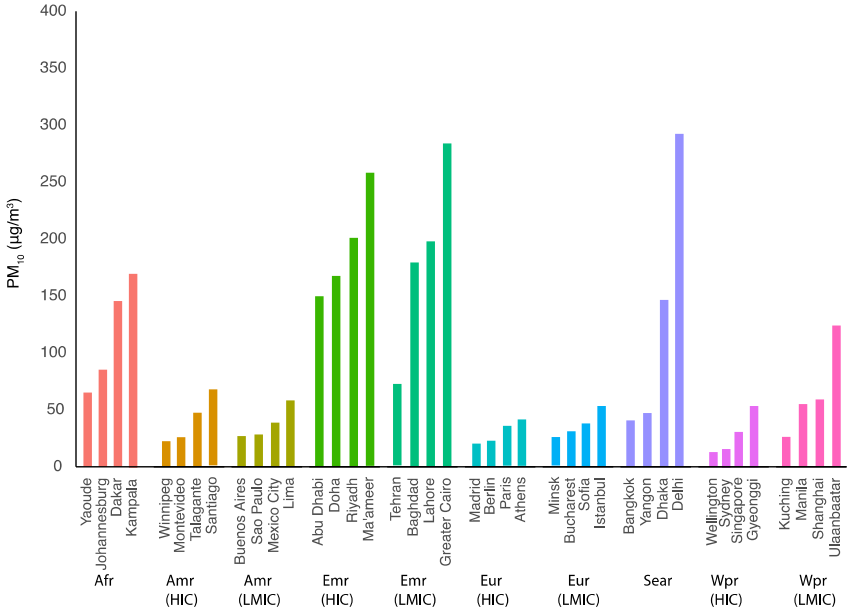
The database can be consulted on the WHO website at : www.who.int/airpollution/data. An overview of PM_{10} and $PM_{2.5}$ levels for the WHO regions and selected cities is presented in Figure 4, 5, 6 and 7.

Figure 4: PM_{10} levels by region and city size, for available cities and towns in the latest year in the period 2010- 2016.



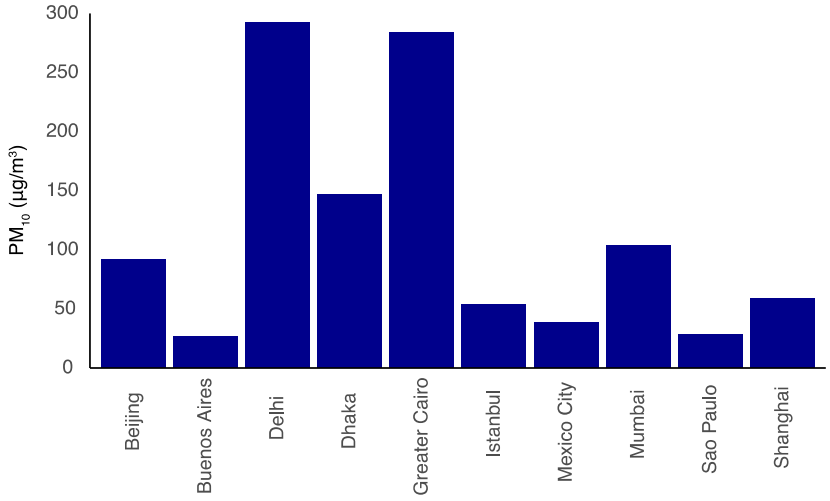
PM_{10}: Particulate matter of 10 microns or less: Afr: Africa; Amr: Americas; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMIC: low and middle-income countries; HIC: high-income countries.PM_{10} values for the world are regional-urban population-weighted.*

Figure 5: PM_{10} levels for selected cities by region, for the last available year in the period 2010-2016.



PM_{10}: Particulate matter of 10 microns or less: Afr: Africa; Amr: Americas; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMIC: low and middle-income countries; HIC: high-income countries. [1] Selection criteria: For the latest year of measurement for each city included in the database, the largest for each country within a region was selected. City size ranges from 192'900 to 26 million habitants

Figure 6: PM_{10} levels for available mega-cities of more than 14 million habitants for the last available year in the period 2010-2016.

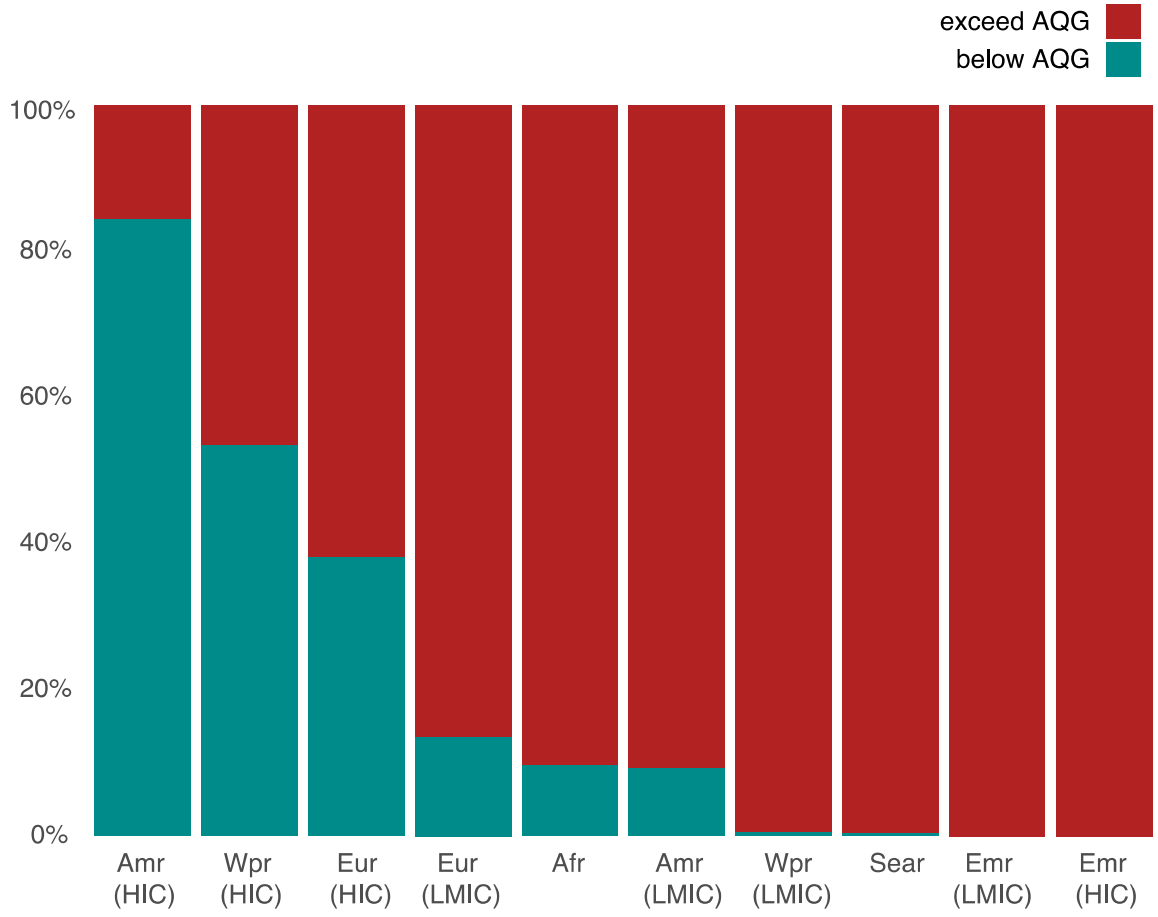


PM_{10}: Particulate matter of 10 microns or less: Afr: Africa; Amr: Americas; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMIC: low and middle-income countries; HIC: high-income countries

Compliance with Air Quality Guidelines

Figure 7 shows the regional 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 (AQG), i.e. annual mean values of 20 µg/m^3 for PM_{10} and 10 µg/m^3 for $PM_{2.5}$.[4] Globally, according to the currently available data, only 18% of the assessed population is exposed to PM_{10} or $PM_{2.5}$ annual mean levels complying with AQG levels. This increases to 31 % for the interim target 3 (i.e. IT-3: 30 µg/m^3 for PM_{10} and 15 µg/m^3 for $PM_{2.5}$) of the AQG, 50% for interim target 2 (i.e. IT-3: 50 µg/m^3 for PM_{10} and 25 µg/m^3 for $PM_{2.5}$) of the AQG, and 63% for interim target 1 (i.e. IT-3: 70 µg/m^3 for PM_{10} and 35 µg/m^3 for $PM_{2.5}$) of the AQG.

Figure 7: Annual mean particulate matter concentration of the assessed towns and cities, compared to the WHO Air Quality Guidelines [a].



Afr: Africa; Amr: Americas; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMIC: low and middle-income countries; HIC: high-income countries; AQG: WHO Air Quality Guidelines.

[a] Annual mean PM_{10}: 20 µg/m^3; Annual mean $PM_{2.5}$: 10 µg/m^3

[4]For towns and cities with both PM_{10} and $PM_{2.5}$ values, $PM_{2.5}$ values were used.

Comparison of air pollution levels in recent years

A total of 1269 towns and cities in 75 countries were selected for a more refined comparison of PM_{25} (where available), or PM_{10} values over a period of 6 years or more (Table 3). The selection was made according to the following criteria: cities or towns with measured PM_{25} or PM_{10} values for at least three different years for the same pollutant in the period 2008-2016, covering a period of four years or more, or for at least two different years and covering a period of five years or more.

The comparison of the air pollution levels over multiple years within the sample of cities selected suggests that air pollution from particulate matter is approximately stable over the past years, on a global scale. Air pollution levels remained on average steady around the globe, using a cut-off of 10% change within the 2010-2016 period, with some regions, like the Americas and Europe decreasing.

A complete trend analysis would need to take into account additional important factors, e.g. changes in meteorology, city type etc., and account for the heterogeneity of ground measurements data compiled in this database, in space and time. It is therefore very difficult to infer general trends on regional levels, especially for those regions in which data has become available only in the last few years.

Table 3 Number of cities included for the $PM_{2.5}$ and PM_{10} comparison over a six year period (2010-2016), by region.

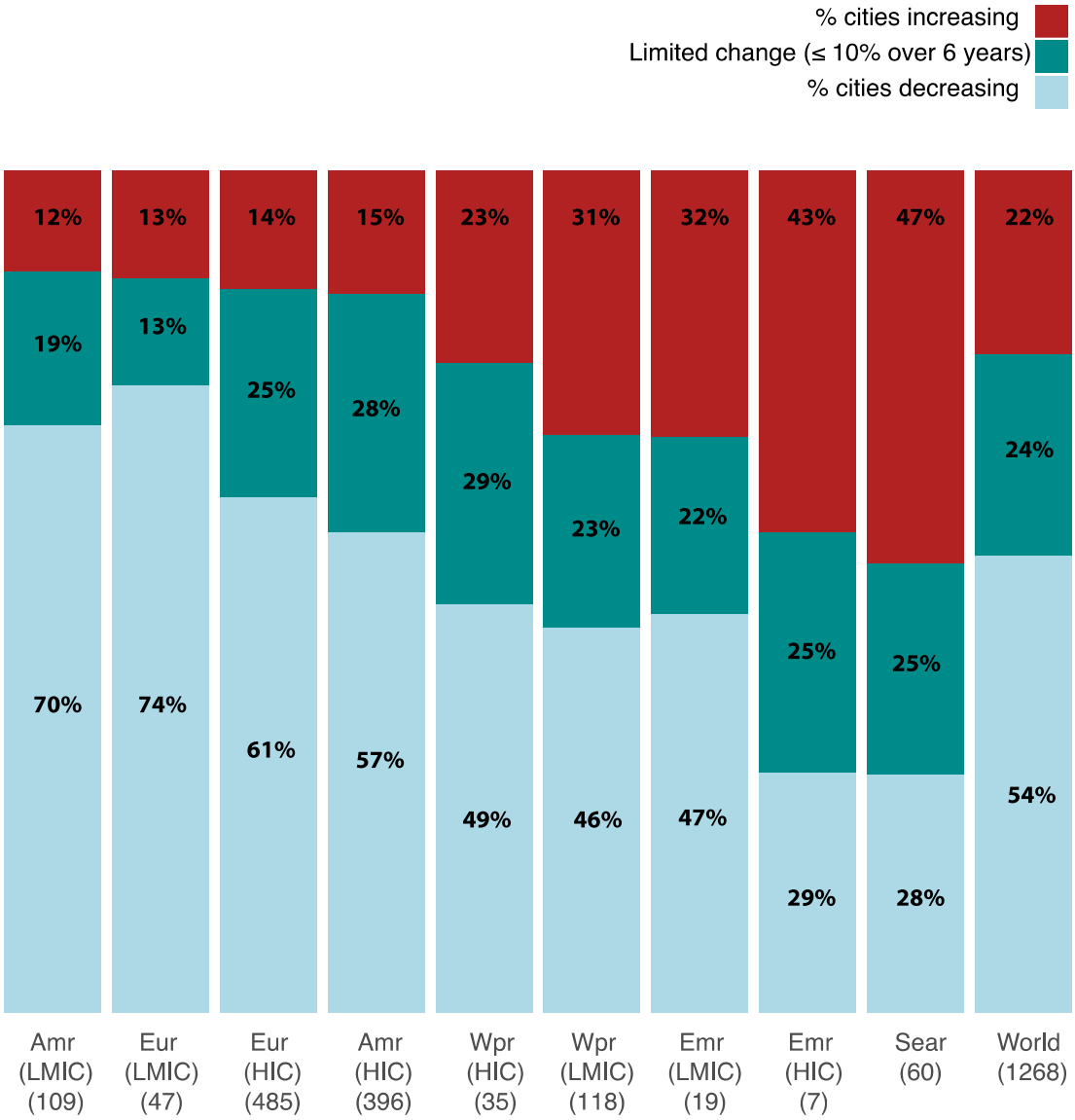
LMIC: low and middle-income countries; HIC: high-income countries.

Region	Number of town and cities	Number of countries
Africa (Sub-Saharan) (LMIC)[1]	3	3
Americas (HIC)	396	4
Americas (LMIC)	109	13
Eastern Mediterranean (HIC)	7	2
Eastern Mediterranean (LMIC)	19	6
Europe (HIC)	485	29
Europe (LMIC)	47	7
South-East Asia (LMIC)	61	5
Western Pacific (HIC)	35	3
Western Pacific (LMIC)	118	3
Global	1271	75

[1]Regions with less than five cities were not included in the analysis, due to poor representation.

Figure 8 shows the percentage of towns and cities with decreasing levels of annual mean $PM_{2.5}$ or PM_{10} (in light green), increasing levels (in red) and levels with changes of ≤ 10% over a 6-year period (in dark green).

Figure 8: Percentage of cities with increasing and decreasing PM2.5 or PM10 annual means over a six-year period (2010-2016), by region.



Afr: Africa; Amr: Americas; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia; Wpr: Western Pacific; LMIC: low and middle-income countries; HIC: high-income countries; The world figure is regional population-weighted. Criteria for inclusion: cities with measured $PM_{2.5}$ or PM_{10} values for at least three different years for the same pollutant in the period 2010-2016, covering a period of four years or more, or for at least two different years and covering a period of five years or more. Results are based on 1268 cities and towns and are to be interpreted with caution, as: a) cities included might not ensure representativeness; b) yearly variations due for example to climatic changes can be important; c) a six-year comparison does not necessarily represent trends, in particular when changes are limited, and d) heterogeneity of the data is important.

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

- When PM2.5 were not available , converted PM10 values were used for the comparison
- The period of comparison is relatively short. Yearly variations may for example be influenced by the weather and data within a 6-year period and may not be sufficient to reflect a longer term trend. 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. Measurements are however stable over time
- Data available for some regions are abundant in some cases and scarce in others.

For more information : www.who.int/airpollution/data

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