



**11** SUSTAINABLE CITIES  
AND COMMUNITIES



## 11.6.2 Air quality and particulate matter

### Rosstat/UNECE/UNEP/OECD workshop on environment-related SDG indicators

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Environmental Performance and Information Division



### SD objective and target

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- **Objective**
  - Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable
- **Target**
  - Target 11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
- **Indicator**
  - Indicator 11.6.2: Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)
- **Custodian agency**
  - WHO



### Definition

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**The mean annual concentration of fine suspended particles of less than 2.5 microns in diameters (PM2.5)**

**Expressed as the population-weighted average for the urban population in a country, in micrograms per cubic meter [mg/m<sup>3</sup>]**





### Policy relevance and interpretation

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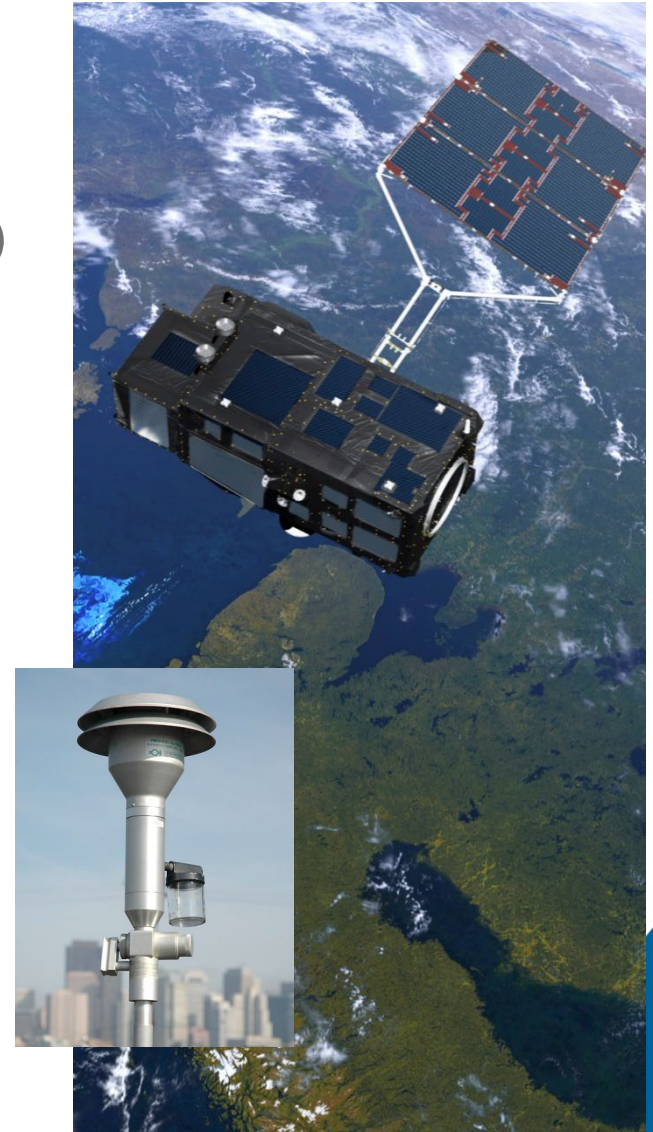
- **Rationale and policy relevance**
  - Fine particulates penetrate deep into the lungs and pose serious risks to health  
→ representative
  - Indicator reflects efforts to improve air quality and results obtained
  - The focus on “population weighted” increases policy relevance
  - Helps address the question whether and to what extent improvements in air quality benefit to people
- **Interpretation**
  - Represents the average annual pollution level to which an average resident in an urban area is exposed to.
  - Provides a representative, though partial view of air pollution issues
  - Can be related to air quality guidelines and targets recommended by WHO
  - Interpretation to account for climatic conditions, socio-demographic patterns, emission sources, geographic location
  - To be complemented with 3.9.1 Mortality rate attributed to air pollution



### Data sources and reporting mechanisms



- **Data provider**
  - WHO [+OECD]
- **Data sources and measurement method (hybrid)**
  - Based on earth observation data (satellite remote sensing)
  - Combined with chemical air transport models
  - Calibrated with ground monitoring measurements
  - Overlaid with population estimates (population grids)
  - Uses information on topography, local monitoring networks, on measures of specific contributors to air pollution
- **Validation**
  - Data inputs, methods and final estimates are shared with countries prior to publication via WHO official communication channels





### Data sources and reporting mechanisms (2)

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- **Satellite remote sensing**
  - Indirect measures via spectro-radiometers combined with air transport modelling to derive concentration values
  - Broad geographic coverage; high granularity
- **Ground measurements from monitoring networks (WHO)**
  - 3000 cities and localities around the world
  - Official reporting from countries to WHO; via regional networks such as Clean Air Asia and the European Environment Agency
  - Data from UN and other agencies
  - Compiled in the framework of the Global Burden of Disease (GBD) Project
- **Measurement in countries**
  - Use of annual mean concentrations from the ground measurements and the corresponding number of inhabitants to derive the population-weighted exposure
  - 2 methods: spatial interpolation; buffer zones



### Measurement challenges

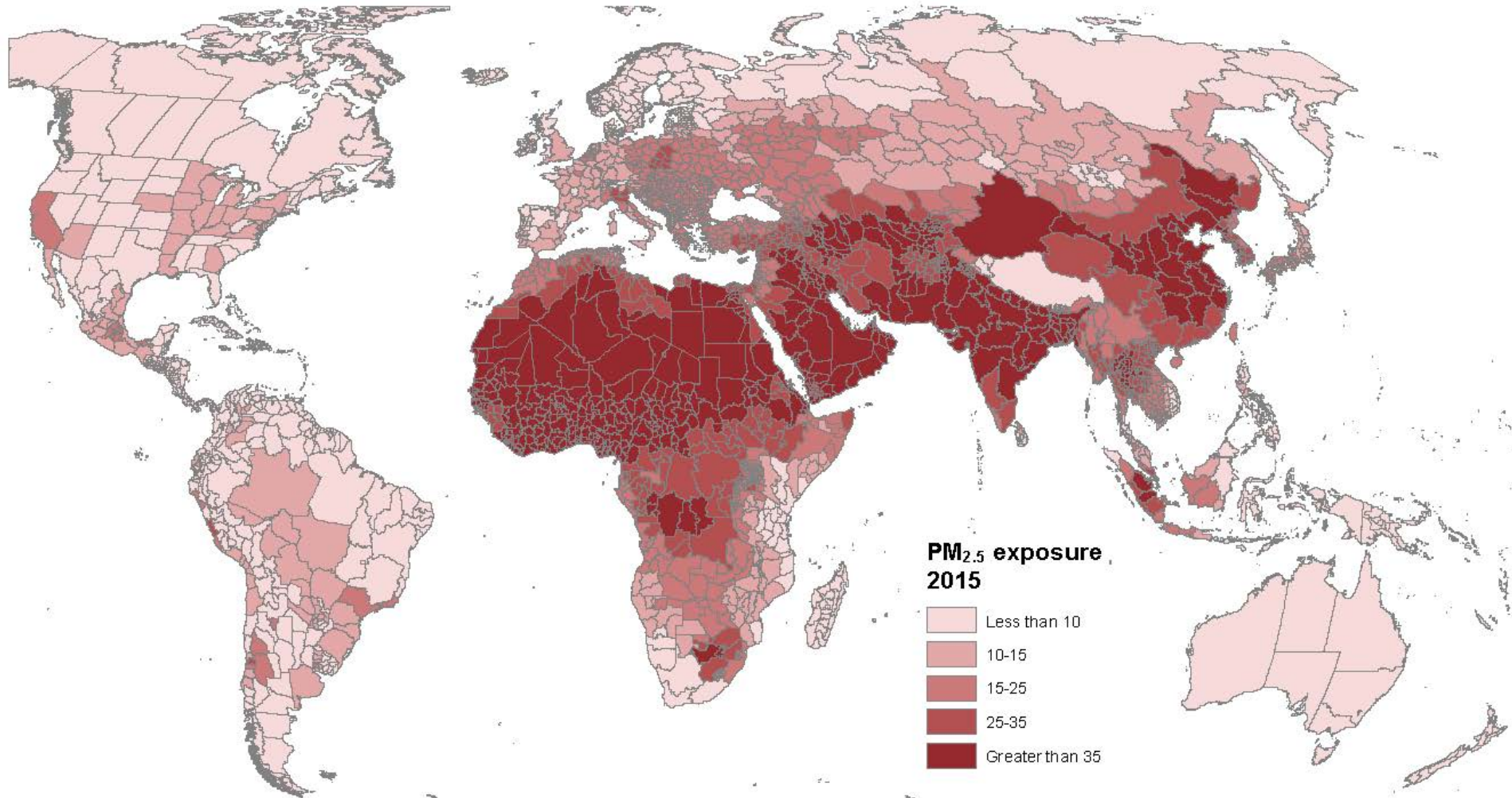
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- **Data availability**
  - Data availability (urban/rural ground monitoring data) generally good for high-income countries; can be relatively poor for some low- and middle income areas
  - Definition of urban/rural may vary by country.
  - International estimates available from the Global Burden of Disease (GBD) project and the OECD
- **Uncertainties/biases**
  - Anthropogenic versus natural sources of particles
  - Pollution from domestic emissions versus pollution from emissions abroad
- **Sources of discrepancies:**
  - Differences between global and national figures: Modelled estimates can differ from concentrations obtained from ground measurements.



## Population exposure to air pollution (PM2.5)

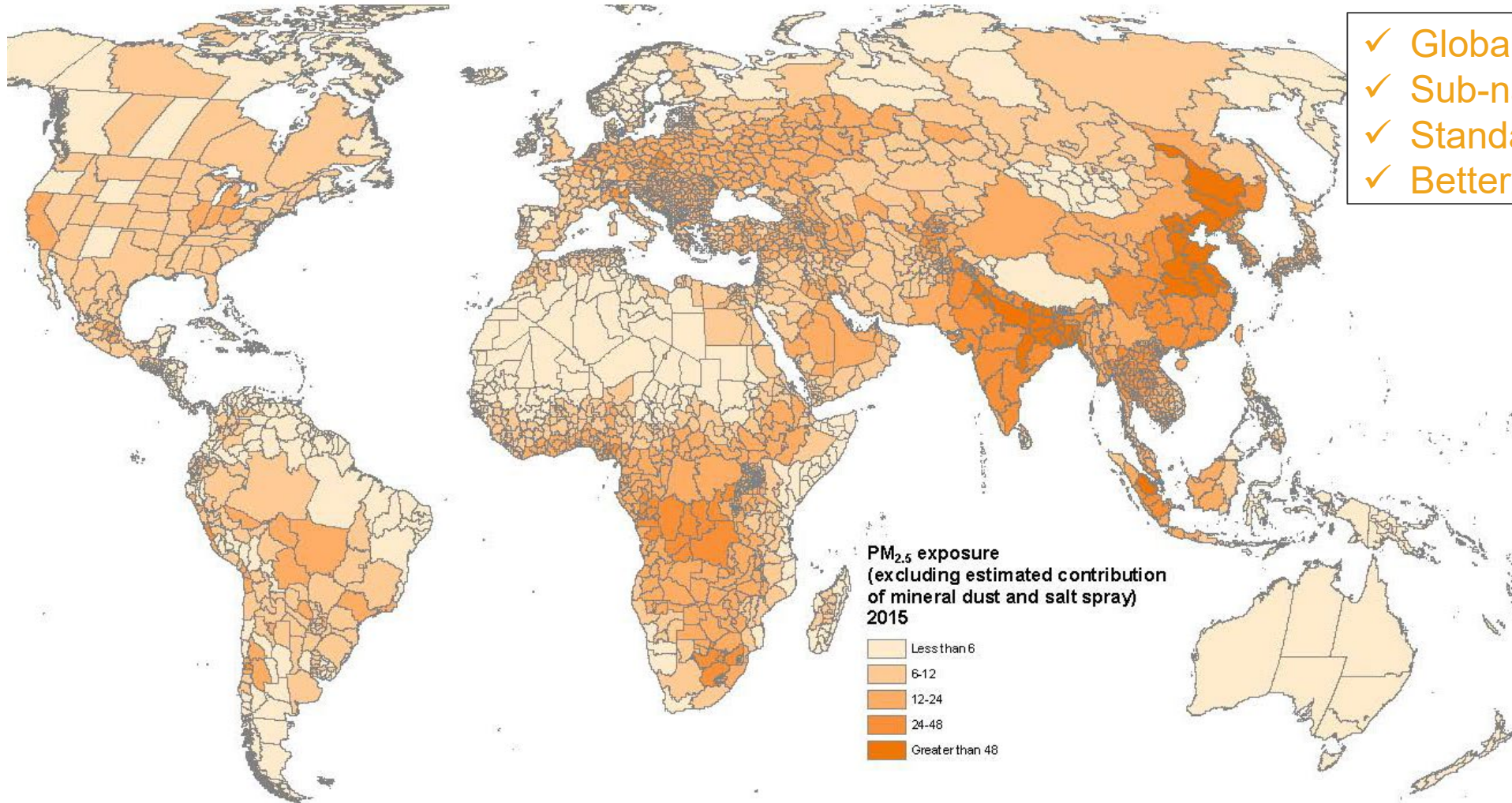


Note: Population exposure to outdoor concentrations of fine particulate matter (PM<sub>2.5</sub>), annual mean in 2015. OECD calculations based on van Donkelaar et al. (2016), For further details, see ENV/EPOC/WPEI(2015)5/FINAL and Green Growth Indicators 2017 (forthcoming).





## Population exposure to air pollution (PM2.5)



- ✓ Global coverage
- ✓ Sub-national detail
- ✓ Standardised methodology
- ✓ Better consistency over time

Note: Population exposure to outdoor concentrations of fine particulate matter (PM<sub>2.5</sub>), annual mean in 2015. OECD calculations based on van Donkelaar et al. (2016). For further details, see ENV/EPOC/WPEI(2015)5/FINAL and Green Growth Indicators 2017 (forthcoming).



### Links and references

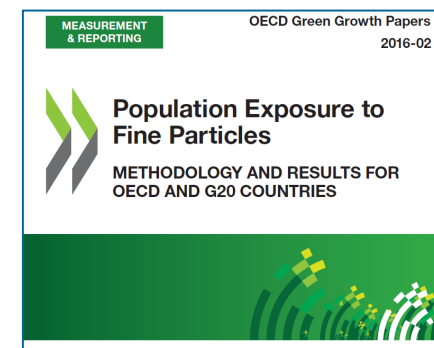


- **WHO**

- [www.who.int/gho/phe](http://www.who.int/gho/phe)
- WHO (2016a). Ambient air pollution: a global assessment of exposure and burden of disease, WHO Geneva.
- WHO (2016b). WHO Urban ambient air quality database, WHO Geneva.

- **Other**

- Shaddick G et al (2016). Data Integration Model for Air Quality: A Hierarchical Approach to the Global Estimation of Exposures to Ambient Air Pollution. Royal Statistical Society, <https://arxiv.org/abs/1609.00141>.
- Shaddick G et al (2018). Data Integration for the Assessment of Population Exposure to Ambient Air Pollution for Global Burden of Disease Assessment, <https://pubs.acs.org/doi/10.1021/acs.est.8b02864>
- OECD (2016). Population exposure to fine particles. Green Growth Working Paper
- OECD database "Exposure to PM2.5 fine particles", <https://doi.org/10.1787/75bcac8d-en>





**Thank you!**