



Ministerio del
Medio
Ambiente

Gobierno de Chile

Manual on the Basic Set of Environment Statistics of the FDES 2013



Air Quality Statistics

Topic 1.3.1 of the Basic Set of Environment Statistics of the FDES 2013

Álvaro Shee Smith (ashee@mma.gob.cl)

Ministry of the Environment of Chile

Division of Environmental Information and Economics

Department of Environmental Information

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1. Statistics in topic 1.3.1 Air Quality



| | |
|--|--|
| Component 1: Environmental Conditions and Quality | |
| Sub-component 1.3: Environmental Quality | |
| Topic 1.3.1: Air quality | |
| (Bold Text - Core Set/Tier 1; Regular Text - Tier 2; <i>Italicized Text - Tier 3</i>) | |
| a. | Local air quality |
| | 1. Concentration level of particulate matter (PM₁₀) |
| | 2. Concentration level of particulate matter (PM_{2.5}) |
| | 3. Concentration level of tropospheric ozone (O₃) |
| | 4. Concentration level of carbon monoxide (CO) |
| | 5. Concentration level of sulphur dioxide (SO₂) |
| | 6. Concentration levels of nitrogen oxides (NO_x) |
| | 7. Concentration levels of heavy metals |
| | 8. Concentration levels of non-methane volatile organic compounds (NMVOCs) |
| | 9. <i>Concentration levels of dioxins</i> |
| | 10. <i>Concentration levels of furans</i> |
| | 11. Concentration levels of other pollutants |
| | 12. Number of days when maximum allowable levels were exceeded per year |
| b. | Global atmospheric concentrations of greenhouse gases |
| | 1. Global atmospheric concentration level of carbon dioxide (CO ₂) |
| | 2. Global atmospheric concentration level of methane (CH ₄) |



2. Introduction/Relevance

- This topic includes statistics on the ambient concentration of the most important air pollutants, including suspended solid particles, gases and other relevant pollutants that can have a negative effect on human and ecosystem health.
 - more than 2 million premature deaths attributable to the effects of urban air pollution and indoor air pollution occur every year (WHO).
- Air quality is measured at monitoring stations. Data availability varies according to the country's circumstances.
- National monitoring of air quality is usually limited to urban settlements where polluting activities and the affected population are concentrated.
- This topic provides relevant information for public policy at national/subnational/local and international levels (air quality standards, SDG indicator, OECD GGI, etc.).

3. Definitions and description of the statistics



- General definitions:
 - Air quality
 - Local / Global
 - Concentration
 - Pollution
 - Pollutant:
 - Primary vs Secondary
 - Gaseous vs Particulate, Respirable
 - Scales: Urban, Regional, Hemispheric and global
 - Types of Source



3. Definitions and description of the statistics

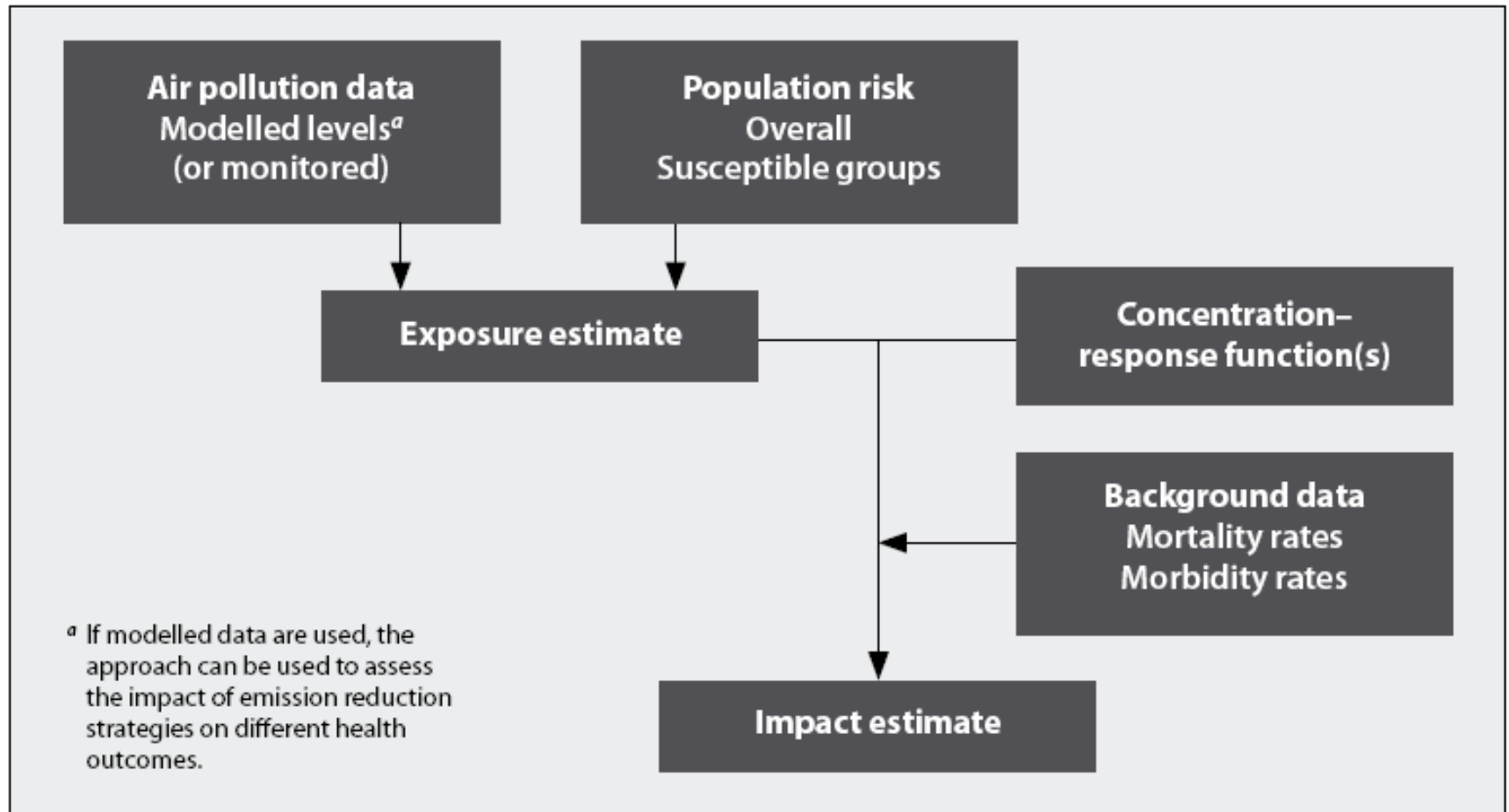


- General definitions:
 - Impacts: population, environment
 - Human Exposure:
 - Source->Emission->Concentrations->Exposure->Dose->Health effects
 - Microenvironments:
 - Indoor vs outdoor
 - Developed vs developing
 - Urban vs rural
 - Different population susceptibility: genetic, socioeconomic status, age, nutrition, gender, chronic diseases
 - Environmental equity
 - Criteria pollutants: PM, O3, CO, SOx, NOx, Pb
 - Standards:
 - Primary (population) and secondary (environment)
 - Latent and saturated areas
 - Health impact assessment



3. Definitions and description of the statistics

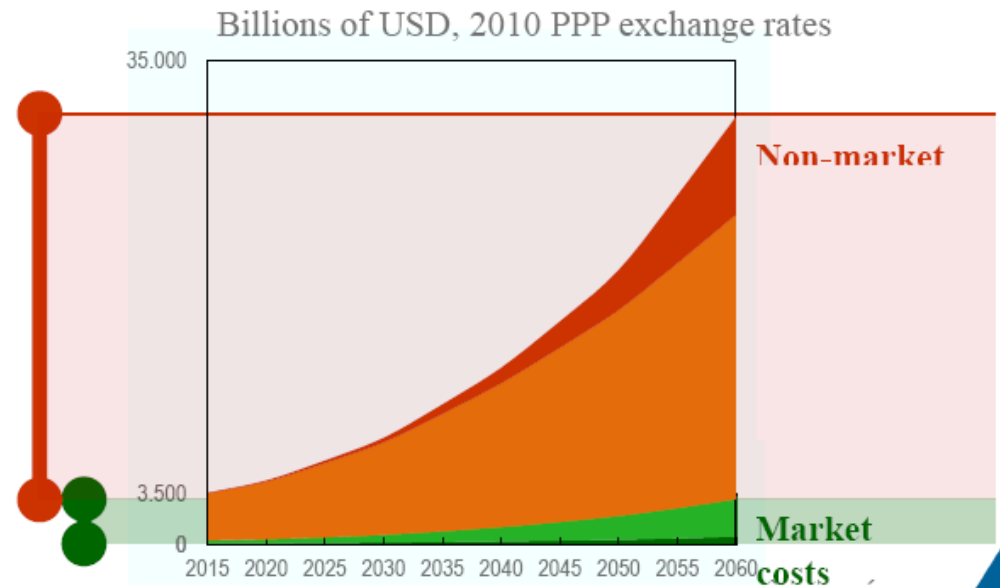
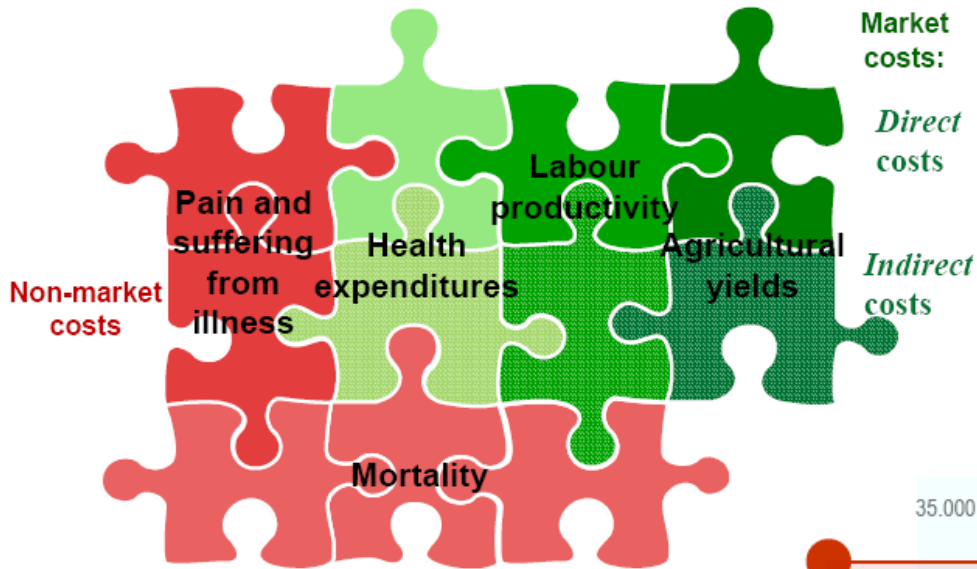
Health impact assessment



Source: WHO

3. Definitions and description of the statistics

Costs of inaction of Air Pollution



Source: OECD (2016), The Economic Consequences of Outdoor Air Pollution



3. Definitions and description of the statistics



- Description of the statistics:
 - Sources for the definitions:
 - WHO Air Quality Guidelines-Global Update 2005, Particulate matter, ozone, nitrogen dioxide and sulfur dioxide.
 - WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global Update 2005, Summary of risk assessment .
 - UNECE Standard Statistical Classification of Ambient Air Quality (1990).
 - European Environment Agency
 - USEPA Air Quality Planning and Standards.
 - World Meteorological Organization (WMO)
 - Agency for toxic substances and diseases (ATSDR)
 - The United Nations Environment Programme (UNEP)
 - Pan American Health Organization
 - Clean Air Institute
 - National Air Quality Legislations
 - Structure for each statistic:
 - General description
 - Statistical description



3. Definitions and description of the statistics



- Description of the statistics, example:
 - **1.3.1.a.1 Concentration level of particulate matter (PM10)**
 - **General description:**
 - Particulate matter," also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.
 - The size of particles is directly linked to their potential for causing health problems. Particles that are 10 micrometers in diameter or smaller generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects.
 - "Inhalable coarse particles," such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter.
 - **Statistical description:**
 - PM10 measurements are reported as average concentrations of mobile 24-hour, daily and annual particulate in the air, expressed in micrograms on cubic meter to normal pressure and temperature $\mu\text{g}/\text{m}^3\text{N}$. Normal temperature and pressure conditions is a standard that allows the comparison of the experimental measures between different sets of data measures. One of the most used standard is the temperature of 293,15 K and a pressure of 1 atm (National Institute of Standards and Technology, NIST).
 - WHO standards:
 - » 20 $\mu\text{g}/\text{m}^3$ annual mean
 - » 50 $\mu\text{g}/\text{m}^3$ 24-hour mean



4. International sources and recommendations

4.A Classifications and groupings



- Different classifications of air pollutants
 - Source of generation
 - Local/Global
 - Evolution in the atmosphere
 - gaseous pollutants
 - Particulate matter
 - Criteria pollutants
 - Greenhouse effect
 - ozone layer depletion



4. International sources and recommendations

4.B Reference to international statistical recommendations, frameworks and standards

- International sources:
 - WHO Air Quality Guidelines-Global Update 2005, Particulate matter, ozone, nitrogen dioxide and sulfur dioxide.
 - WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global Update 2005, Summary of risk assessment .
 - UNECE Standard Statistical Classification of Ambient Air Quality (1990).
 - European Environment Agency (environment statistics and indicators)
 - OECD (Air quality statistics and indicators, GGI)
 - USEPA Air Quality Planning and Standards.
 - World Meteorological Organization (WMO)
 - Agency for toxic substances and diseases (ATSDR)
 - The United Nations Environment Programme (UNEP)
 - Pan American Health Organization
 - Clean Air Institute
 - National Air Quality Legislations



4. International sources and recommendations

4.C Sources of global and regional environment statistics and indicators series



- Global and regional:
 - WHO
 - World Bank
 - UNSTAT
 - OECD
 - EUROSTAT
 - EEA
 - ECLAC
 - UNEP
- National:
 - Ministries of the Environment
 - NSOs



5. Transforming data into environment statistics

5.A Data collection and sources of data

- Source type: Monitoring Systems (Air quality monitoring stations) collect time series of pollutants, by hour, day, month, year.
- Institutional partners: Ministry of the Environment, Ministry of Health, Universities, Research Institutions, Private institutions, etc.
- Availability of data:
 - Determining the study objective: diagnosis
 - Design of a sampling plan:
 - Objectives, pollutants
 - Temporal and Spatial considerations
 - Representativeness of data
- Data quality: Data analysis, interpretation and review.



5. Transforming data into environment statistics

5.B Data compilation (procedures and instruments) and transformation into environment statistics series

- Data collection: Monitoring Systems (Air quality monitoring stations)
- Data validation:
 - correct errors in data due to maintenance of equipment, electrical faults or deviations in data without technical support.
 - Useful measures: number of data, central tendency (mean, median, mode), relative position (percentiles), dispersion (range, variance, standard deviation, coefficient of variation, interquartile range) and Association (correlation).
 - Graphics: time series, 2 scales, box.



5. Transforming data into environment statistics

5.B Data compilation (procedures and instruments) and transformation into environment statistics series

- Transformation into statistics:
 - Process the time series to obtain moving averages, daily averages and annual averages, depending on the parameter that is being analyzed. To obtain a representative indicator it is necessary to have a minimum of data (f.e.: not less than 75% of the hourly data).
 - Moving averages are calculated taking the hourly data as many hours backwards needed the moving average.
 - Daily averages correspond to the average of the 24 hourly data recorded on the day.
 - The maximum daily corresponds to the maximum value recorded in the 24 hourly data of the day.



6. Uses and dissemination

6.A Potential presentation/dissemination formats

← → ↻ 🏠 siiia.mma.gob.cl/mma-centralizador-publico/indicador/vistaIndicador.jsf?id=DF9D8C02-B561-ACC4-A7BE-1155A52AD32B

CONCENTRACIONES ANUALES DE MP25 - EVOLUCIÓN DE LOS PROMEDIOS PARA LA RM

Temas: Riesgos para la Salud y Calidad de Vida para la Población - Instrumentos de Gestión - Estado del Medio Ambiente - Cumplimiento Normativo

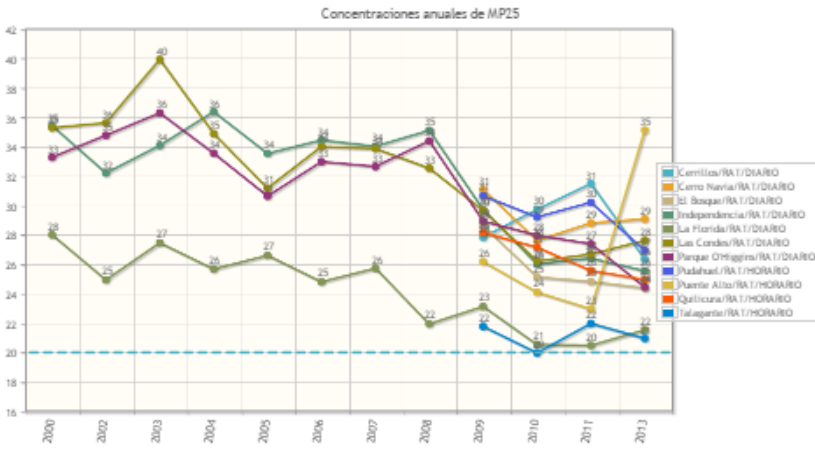
← VOLVER

GRÁFICO TABLA MAPA

EXPORTAR GRÁFICO

Desagregación: - Evolución de los promedios para la

Tipo de gráfica: Concentraciones anuales de MP25 Desde: 2000 Hasta: 2013



- Autor:** Ministerio del Medio Ambiente
- Descripción:** Muestra las concentraciones promedio anual de Material Particulado 2,5, para estaciones de monitoreo del país, según último año disponible que cumple con los criterios mínimos para el cálculo anual.
- Descripción de las variables:** Las concentraciones anuales de MP2,5 se calculan según norma D.S. N°12/2011 del Ministerio del Medio Ambiente, de la siguiente manera: • Se obtienen las mediciones horarias de concentraciones de MP2,5 en el aire, en estaciones de monitoreo con representatividad poblacional. • A partir de las mediciones horarias se calcula el promedio diario. Se considera válido el promedio diario si por lo menos tiene 18 horas medidas en el día. • A partir de los promedios diarios válidos se calculan los promedios mensuales. Se considera válido el promedio mensual si por lo menos tiene el 75% de los promedios diarios válidos en el mes. • Con los promedios mensuales se calcula el promedio anual. Para que el promedio anual sea válido se necesita un mínimo de 9 meses válidos. En el caso de tener 9 o 10 meses válidos se completan los meses faltantes con el máximo de los últimos 12 meses válidos al mes faltante, hasta obtener 11 meses válidos. Luego con los 11 meses válidos se calcula el promedio anual. En el caso de tener 11 meses válidos se calcula el promedio anual con esos 11 meses.
- Unidad de medida:** microgramos por metro cúbico (µg/m³)
- Fuentes:** Sistema Nacional de Calidad del Aire (SINCA), Ministerio del Medio Ambiente (MMA)
- Fecha:** 2014-03-06



Indicadores y Estadísticas Ambientales



CONCENTRACIONES ANUALES DE MP25 - EVOLUCIÓN DEL PERCENTIL 98 Y PROMEDIO PARA LA RM

Temas: Riesgos para la Salud y Calidad de Vida para la Población - Estado del Medio Ambiente - Cumplimiento Normativo - Estadísticas e indicadores

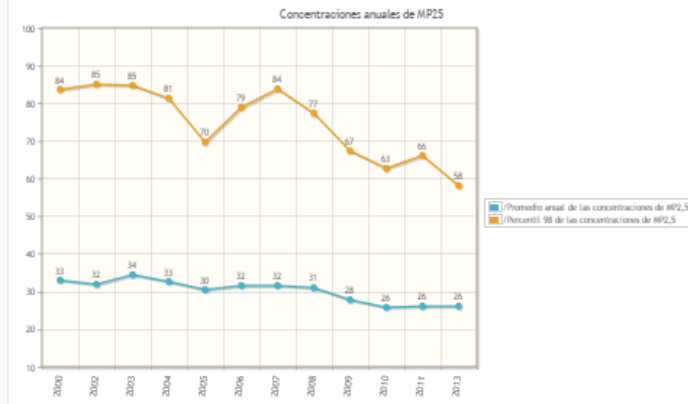
← VOLVER

GRÁFICO TABLA MAPA

EXPORTAR GRÁFICO

Desagregación: - Evolución del percentil 98 y prome

Tipo de gráfica: Concentraciones anuales de MP25 Desde: 2000 Hasta: 2013



- Autor:** Ministerio del Medio Ambiente
- Descripción:** Muestra las concentraciones promedio anual de Material Particulado 2,5, para estaciones de monitoreo del país, según último año disponible que cumple con los criterios mínimos para el cálculo anual.
- Descripción de las variables:** Las concentraciones anuales de MP2,5 se calculan según norma D.S. N°12/2011 del Ministerio del Medio Ambiente, de la siguiente manera: • Se obtienen las mediciones horarias de concentraciones de MP2,5 en el aire, en estaciones de monitoreo con representatividad poblacional. • A partir de las mediciones horarias se calcula el promedio diario. Se considera válido el promedio diario si por lo menos tiene 18 horas medidas en el día. • A partir de los promedios diarios válidos se calculan los promedios mensuales. Se considera válido el promedio mensual si por lo menos tiene el 75% de los promedios diarios válidos en el mes. • Con los promedios mensuales se calcula el promedio anual. Para que el promedio anual sea válido se necesita un mínimo de 9 meses válidos. En el caso de tener 9 o 10 meses válidos se completan los meses faltantes con el máximo de los últimos 12 meses válidos al mes faltante, hasta obtener 11 meses válidos. Luego con los 11 meses válidos se calcula el promedio anual. En el caso de tener 11 meses válidos se calcula el promedio anual con esos 11 meses.
- Unidad de medida:** Microgramos por metro cúbico (µg/m³)
- Fuentes:** Sistema Nacional de Calidad del Aire (SINCA), Ministerio del Medio Ambiente (MMA)

Source: Ministry of the Environment of Chile, www.sinia.cl

6. Uses and dissemination

6.A Potential presentation/dissemination formats

SINiA Indicadores y Estadísticas Ambientales

CALIDAD DEL AIRE - CONCENTRACIÓN DE MP2,5. AÑO 2015.

Temas: Riesgos para la Salud y Calidad de Vida para la Población - Estado del Medio Ambiente

GRÁFICO TABLA MAPA EXPORTAR GRÁFICO Desagregación: Concentración de MP2,5. Año 2015.

Tipo de gráfico: Calidad del Aire - Concentración MP2,5 a

Calidad del Aire - Concentración MP2,5 a nivel nacional. año 2015.

Regiones y estratos de monitoreo de calidad del aire

Concentración (µg/m³)

2015

- Autor:** Ministerio del Medio Ambiente
- Descripción:** Muestra las concentraciones promedio anual de Material Particulado 2,5, por las estaciones de monitoreo del país, según último año disponible que cumple con los criterios mínimos para el cálculo anual.
- Descripción de las variables:** Las concentraciones anuales de MP 2,5 se calculan según norma D.S. N°12/2011 del Ministerio del Medio Ambiente, de la siguiente manera:
 - Se obtienen las mediciones horarias de concentraciones de MP 2,5 en el aire en estaciones de monitoreo con representatividad poblacional.
 - A partir de las mediciones horarias se calcula el promedio diario. Se considera válido el promedio si por lo menos tiene 18 horas medidas en el día.
 - A partir de los promedios diarios válidos se calculan los promedios mensuales. Se considera válido el promedio mensual si por lo menos tiene el 75% de los promedios diarios válidos en el mes.
 - Con los promedios mensuales se calcula el promedio anual. Para que el promedio anual sea válido se necesita un mínimo de 9 meses válidos. En el caso de tener 9 ó 10 meses válidos se completan los meses faltantes con el máximo de los últimos 12 meses válidos al mes faltante, hasta obtener 11 meses válidos. Luego con los 11 meses válidos se calcula el promedio anual. En el caso de tener 11 meses válidos se calcula el promedio anual con esos 11 meses.
- Unidad de medida:** µg/m³N
- Fuentes:** Sistema Nacional de Calidad del Aire (SINCA)
- Fecha:** 2016-09-27

SINiA Indicadores y Estadísticas Ambientales

EPISODIOS CRITICOS POR MP 2.5 EN LA REGIÓN METROPOLITANA. 2000 - 2015.

Temas: Riesgos para la Salud y Calidad de Vida para la Población

GRÁFICO TABLA MAPA EXPORTAR GRÁFICO Desagregación: por MP 2,5 en la Región Metropolitana.

Tipo de gráfico: Episodios críticos por MP2,5 en la Región Desde: 2000 Hasta: 2015

Episodios críticos por MP 2,5 en la Región Metropolitana

N° de episodios

Alerta Pre-emergencia Emergencia

- Autor:** Ministerio del Medio Ambiente
- Descripción:** Indicador que mide la evolución de los episodios críticos declarados por material particulado 2,5 (MP2,5) en la Región Metropolitana.
- Descripción de las variables:** Los episodios críticos por concentración de MP 2,5, se clasifican en Alertas (concentraciones entre 80-100 µg/m³), pre-emergencia (concentraciones entre 110-169 µg/m³) y emergencia (concentraciones entre 170 µg/m³ o superior)
- Unidad de medida:** µg/m³N
- Fuentes:** Ministerio del Medio Ambiente
- Fecha:** 2016-09-25

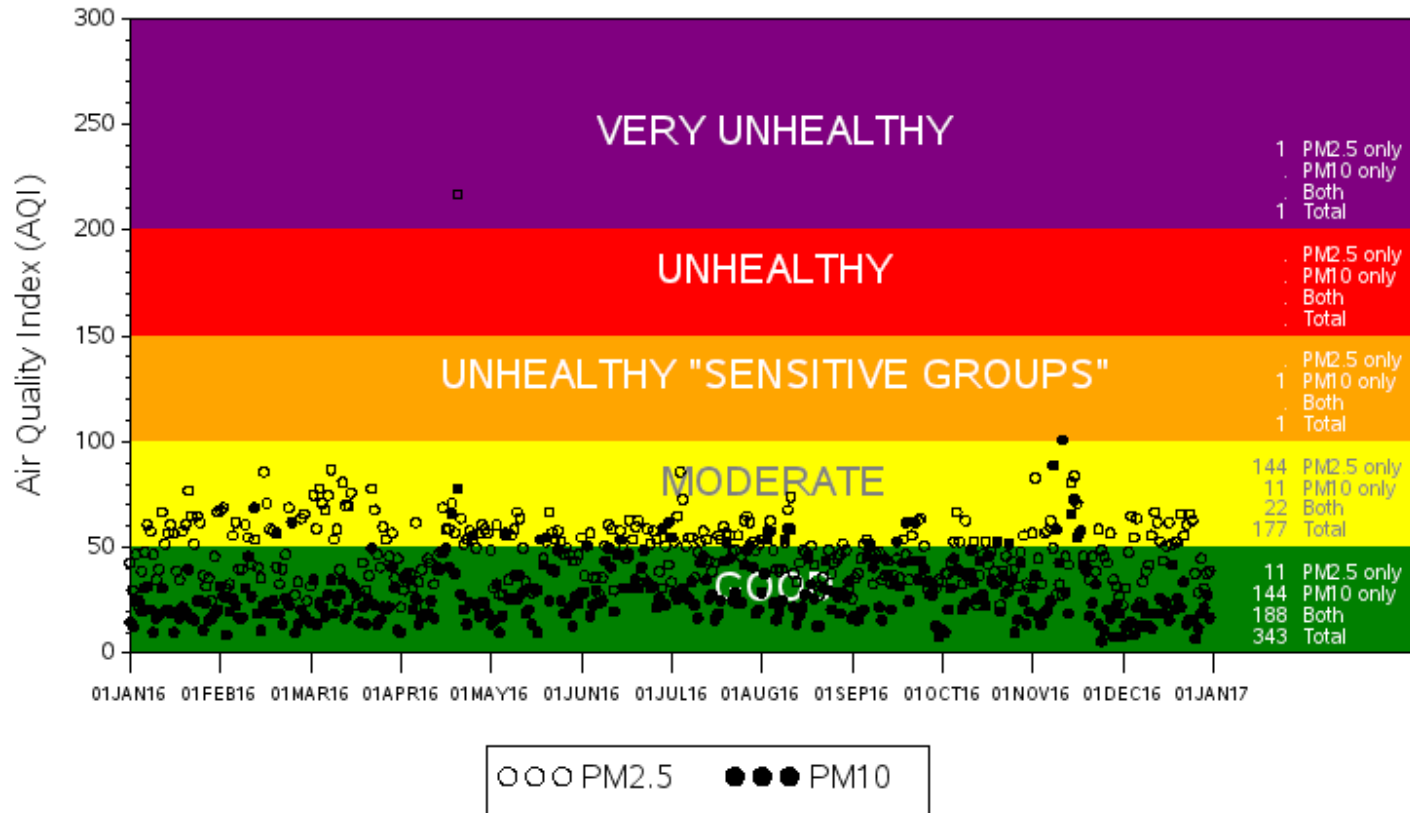
Source: Ministry of the Environment of Chile, www.sinia.cl

6. Uses and dissemination

6.A Potential presentation/dissemination formats



Daily PM2.5 and PM10 AQI Values in 2016
Chicago-Naperville-Elgin, IL-IN-WI



Source: U.S. EPA AirData <<https://www.epa.gov/air-data>>



6. Uses and dissemination

6.A Potential presentation/dissemination formats

Air Quality Health Index

The screenshot shows the Air Quality Health Index (AQHI) website for Hong Kong. The header includes the logo and navigation links. The main content area is divided into several sections:

- HIGHLIGHTS:** Current AQHI: General Stations 5 to 6, Roadside Stations 6. Forecast of Health Risk Maximums.
- FORECAST of Health Risk:** A table showing the forecast for 23-03-2015, Today A.M., and Today P.M. for General and Roadside Stations.
- Air Quality Health Index:** A table showing the AQHI for various monitoring stations on 23-03-2015 at 08:00.
- Remark:** A box containing three notes about the data source, the purpose of the AQHI, and the procedure for data suspension.

| 23-03-2015 | Today A.M. | Today P.M. |
|-------------------|-----------------|-----------------|
| General Stations | Low to Moderate | Low to Moderate |
| Roadside Stations | Low to Moderate | Low to High |

| 08:00 23-03-2015 | AQHI | Health Risk |
|--------------------------|------|-------------|
| General Stations | | |
| Central/Western | 6 | Moderate |
| Eastern | 5 | Moderate |
| Kwun Tong | 6 | Moderate |
| Sham Shui Po | 5 | Moderate |
| Kwai Chung | 6 | Moderate |
| Tsuen Wan | 5 | Moderate |
| Yuen Long | 5 | Moderate |
| Tuen Mun | 5 | Moderate |
| Tung Chung | 6 | Moderate |
| Tai Po | 5 | Moderate |
| Sha Tin | 6 | Moderate |
| Tap Mun | 6 | Moderate |
| Roadside Stations | | |
| Causeway Bay | 6 | Moderate |
| Central | 6 | Moderate |
| Mong Kok | 6 | Moderate |

Remark:

- The AQHI information is based on raw data taken directly from EPD's Air Quality Monitoring Network.
- The hourly reported AQHI is for short term health risk communication; for health risks of long-term exposure of the air quality, please refer to *Annual Air Quality Index (Annual AQI)*.
- In case of station or equipment suspension due to maintenance, the data collection for calculation of AQHI at station will be affected, the data of a most similar station will then be adopted. Such AQHI will be shown in *italics*.

Source: Environmental Protection Department of Hong Kong
<http://www.aqhi.gov.hk/en.html>



6. Uses and dissemination

6.B Commonly used indicators that incorporate this statistic

- Concentrations of air pollutants: mean, percentile, maximum, etc
- Excedence of air quality limit values (standard)
- Air Quality Index
- Population exposure to air pollution
- SDG Indicator : 11.6.2 - Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)
- OECD Green Growth Indicators:Exposure to air pollution:
 - Mean population exposure to PM2.5 (Micrograms per cubic metre)
 - Percentage of population exposed to more than 10 micrograms/m³ (Percentage)
 - Percentage of population exposed to more than 35 micrograms/m³ (Percentage)



6. Uses and dissemination

6.C SEEA accounts/tables that use this statistic

- The SEEA Central Framework doesn't include air quality accounts (concentrations). But it includes emissions to the air (different FDES topic).
- The SEEA Experimental Ecosystem Accounting includes air filtration (clean air) and sequestering of carbon as ecosystem services.

Table 3.2 Physical flows of ecosystem services for an EAU

| | Type of LCEU | | | | |
|---------------------------------------|--|--|--|-------------------------------|-----|
| | Forest tree cover | Agricultural land* | Urban and associated developed areas | Open Wetlands | ... |
| Type of ecosystem services (by CICES) | | | | | |
| Provisioning services | e.g. tonnes of timber | e.g. tonnes of wheat | | | |
| Regulating services | e.g. tonnes of CO ₂ stored/released | e.g. tonnes of CO ₂ stored/released | e.g. tonnes of CO ₂ stored/released | e.g. tonnes of P absorbed | |
| Cultural services | e.g. number of visitors/hikers | | e.g. hectares of parkland | e.g. hectares of duck habitat | |

* Medium to large fields rainfed herbaceous cropland



Thank you

Gracias

Álvaro Shee Smith (ashee@mma.gob.cl)
Ministry of the Environment of Chile
Division of Environmental Information and Economics
Department of Environmental Information
3 May 2017

