The European Air Quality Index

The European Air Quality Index allows users to understand more about air quality where they live, work or travel. Displaying up-to-date information for Europe, users can gain insights into the air quality in individual countries, regions and cities.

The Index is based on concentration values for up to five key pollutants, including:

- particulate matter (PM_{10});
- fine particulate matter ($PM_{2.5}$);
- ozone (O_3);
- nitrogen dioxide (NO_2);
- sulphur dioxide (SO2).

It reflects the potential impact of air quality on health, driven by the pollutant for which concentrations are poorest due to associated health impacts.

The index is calculated hourly for more than 3.500 air quality monitoring stations across Europe, using a combination of up-to-date data reported by EEA member countries (not formally verified by countries) and forecast of the air quality level as provided by Copernicus Atmospheric Monitoring Service (CAMS).

By default, the air quality index depicts the situation 3 hours ago. Users can then select any hour in the preceding 48 hours and view forecast values for the following 24 hours.

The user can filter the selection by country and by station type. Stations are classified in relation to the predominant emission sources: traffic, industry and background (where the pollution level is dominated neither by traffic nor by industry). The user can view all stations, traffic stations only or non-traffic stations only (i.e. industrial and background stations).

European Union legislation sets air quality standards for both short-term (hourly or daily) and long-term (annual) air quality levels. Standards for long-term levels are stricter than for short-term levels, since serious health effects may occur from long-term exposure to pollutants.

The Index indicates the short-term air quality situation. It does not reflect the long-term (annual) air quality situation, which may differ significantly.

The air quality index is not a tool for checking compliance with air quality standards and cannot be used for this purpose.

Methodology

The Index uses 'up-to-date' air quality data officially reported every hour by EEA member countries, complemented where necessary by modelled air quality data from the European Union's Copernicus Atmosphere Monitoring Service (CAMS).

Concentrations values for up to five key pollutants determine the index level that reflects air quality at each monitoring station. The index corresponds to the poorest level for any of five pollutants, according to the table shown below.

Circles and dots on the map represent the locations of air quality monitoring stations. The colours reflect air quality at the given hour at that station.

Calculating the index for traffic stations

When calculating the index for traffic stations we only use data for NO_2 and PM (either $PM_{2.5}$, PM_{10} or both). This is because SO_2 concentrations can be high in localized areas and distort the picture of local air quality, while ozone levels are normally very low at traffic stations.

Calculating the index for industrial and background stations

At industrial and background stations, the index is calculated for those stations with data (either measured or modelled) for at least the three pollutants NO_2, O_3 and PM (either $PM_{2.5}$, PM_{10} or both).

Stations missing data for certain pollutants

To avoid leaving out stations that do not report data for all pollutants or for which missing data cannot be gap-filled, the index is calculated for all monitoring stations with data for at least one pollutant. Those stations that do not report data or for which data cannot be gap-filled for the minimum pollutants for that station type are depicted as semi-transparent circles , indicating that the index is not calculated with the minimum range of pollutants. The station is coloured as grey unless the index is poor or worse, when the current index colour is used.

Grey dots indicate stations for which no data have been reported to allow the index to be calculated.

Averaging time for pollutants

For NO_2, O_3 and SO_2, hourly concentrations are fed into the calculation of the index.

For PM_{10} and $PM_{2.5}$, the 24-hour running means for the past 24 hours are fed into the calculation of the index. A 24-hour running mean will be calculated if there are values for at least 18 out of the 24 hours.

Missing data and gap filling

When data is not reported for a given hour, values are approximated, or 'gap-filled' using CAMS modelled air quality data. In such cases, it is marked with an asterisk.

The method used for gap-filling depends on the pollutant.

- For NO_2, $PM_{2.5}$ and PM_{10} we use the difference method.
- For O_3 we use the multiplicative method.
- No gap filling is performed for SO_2

Difference method: The value is approximated by taking the CAMS modelled value and adding or subtracting a correction difference. This correction is the average difference between previously measured values and the CAMS modelled value for the same hour for at least three of the four previous days.

Multiplicative method: The value is approximated by taking the CAMS modelled value, and applying a correction factor. This correction is the average ratio between the previously measured values and the CAMS modelled values for the same hour for at least three of the four previous days.

In cases where there are no measured values for the same hour over three of the four previous days, the value for the given pollutant is not calculated.

Forecast index

Forecast values are shown as transparent circles. Circles are coloured as grey if the minimum number of required pollutants, depending on the type of station, could not be forecast and the forecast index is good, fair or moderate.

To calculate the forecast values for the following 24 hours, CAMS modelled air quality data are used and corrected using the gap-filling methods described above. No forecast values are provided for SO_2.

Bands of concentrations and index levels

The bands are based on the relative risks associated to short-term exposure to $PM_{2.5}$, O_3 and NO_2, as defined by the World Health Organization in its report on the Health Risks of Air Pollution in Europe project (HRAPIE project report).

The relative risk of exposure to $PM_{2.5}$ is taken as basis for driving the index, specifically the increase in the risk of mortality per 10 µg/m³ increase in the daily mean concentration of $PM_{2.5}$.

Assuming linearity across the relative risks functions for O_3 and NO_2, we calculate the concentrations of these pollutants that pose an equivalent relative risk to a 10 µg/m³ increase in the daily mean of $PM_{2.5}$.

For PM_{10} concentrations, a constant ratio between PM_{10} and $PM_{2.5}$ of 1:2 is assumed, in line with the World Health Organization´s air quality guidelines for Europe.

For SO_2, the bands reflect the limit values set under the EU Air Quality Directive.

Pollutant	Index level (based on pollutant concentrations in µg/m3)					
	Good	Fair	Moderate	Poor	Very poor	Extremely poor
Particles less than 2.5 µm ($PM_{2.5}$)	0-10	10-20	20-25	25-50	50-75	75-800
Particles less than 10 µm (PM_{10})	0-20	20-40	40-50	50-100	100-150	150-1200
Nitrogen dioxide (NO_2)	0-40	40-90	90-120	120-230	230-340	340-1000
Ozone (O_3)	0-50	50-100	100-130	130-240	240-380	380-800
Sulphur dioxide (SO_2)	0-100	100-200	200-350	350-500	500-750	750-1250

Air quality measurements that exceed the maximum values in the 'extremely poor' category are not taken into account for the index calculation, since these values are typically found to be erroneous.

Health messages

The index bands are complemented by health related messages that provide recommendations for both the general population and sensitive populations. The latter includes both adults and children with respiratory problems and adults with heart conditions.

AQ index	General population	Sensitive populations
Good	The air quality is good. Enjoy your usual outdoor activities.	The air quality is good. Enjoy your usual outdoor activities.
	Enjoy your usual outdoor activities	Enjoy your usual outdoor activities
Moderate	Enjoy your usual outdoor activities	Consider reducing intense outdoor activities, if you experience symptoms.
	Consider reducing intense activities outdoors, if you experience symptoms such as sore eyes, a cough or sore throat	Consider reducing physical activities, particularly outdoors, especially if you experience symptoms.
	Consider reducing intense activities outdoors, if you experience symptoms such as sore eyes, a cough or sore throat	Reduce physical activities, particularly outdoors, especially if you experience symptoms.
	Reduce physical activities outdoors.	Avoid physical activities outdoors.

Additional information

When clicking on a station on the map, a pop-up window appears with the following additional information:

1. The name of the station and the air quality index at that station and hour.

2. A “View station” option, that provides the location of the station using © Google Maps.

3. A “Show details” option, with a summary of the station information; the air quality index and the associated health advice for the general population and sensitive populations; links to information on air pollution for the country where the station is located and to the webpage of the administration in charge of reporting the concentrations for that station and two graphs.

The values indicated when hovering over the horizontal pizza-diagrams show the hourly AQ Index, the hourly concentrations for NO_2, O_3 and SO_2, and the 24-hour running means for PM measured at the station or gap-filled over the last 7 days. An asterisk next to a value indicates that the value has been gap-filled

The pie chart indicates the number of days that feel under each Index band over the past 365 days. The highest hourly Index level in a day determines the daily Index level taken into account.

Further information

The European Environment Agency publishes a range of information on air quality:

- Air pollution web page
- Air quality live: Up-to-date air quality measurement
- Key air quality statistics for the main air pollutants: map viewer
- 'Air Quality in Europe' – latest report
- Air pollution country profiles

The European Air Quality Index was developed jointly by the European Commission's Directorate General for Environment and the European Environment Agency to inform citizens and public authorities about the recent air quality status across Europe.