22 June 2010

Air quality in European cities

2004-2008

ISTAT presents an analysis of air quality[1] in European cities for the 2004-2008 period using data from the European Environment Agency's (EEA) AirBase database.
Elementary data from urban background stations were combined into a single indicator - the average number of times that legally-defined concentration limits were exceeded.
The European Commission sent two advisories asking Italy to prepare an anti-smog plan to counteract the repeated violations that were being registered in air quality limits, especially for PM10.
Two sets of tables are available in Excel format in the Download area: one relates to the first/last 30 cities in the ranking mentioned in the text and the other provides insights on a group of 221 European cities.

Main results

In 2008, the Bulgarian city of Plovdiv ranked first in the classification of the 30 worst cities in terms of air quality, followed by Turin, Brescia, Milan and Sofia (Table 1). At the other end of the scale, the five most virtuous cities were all located in Northern Europe: Tallin in Estonia, Stockholm, Lund and Malmö in Sweden.

With 208 days in 2008, the Bulgarian city of Plovdiv also ranked first for the number of days on which the PM10 (tiny solid particles with a diameter of less than 10 microns and that can be inhaled and enter the upper respiratory tract (nose, pharynx, larynx) limit value of 50 µg/m^3 was exceeded (Table 4).

Turin, however, was the worst European city in terms of the presence of tropospheric Ozone (an important component of *photochemical smog* – harmful for the human respiratory tract, as well as for plants and animals), registering 77 days on which the limit of 120 µg/m^3, the target value for the protection of human health, was exceeded (Table 7).

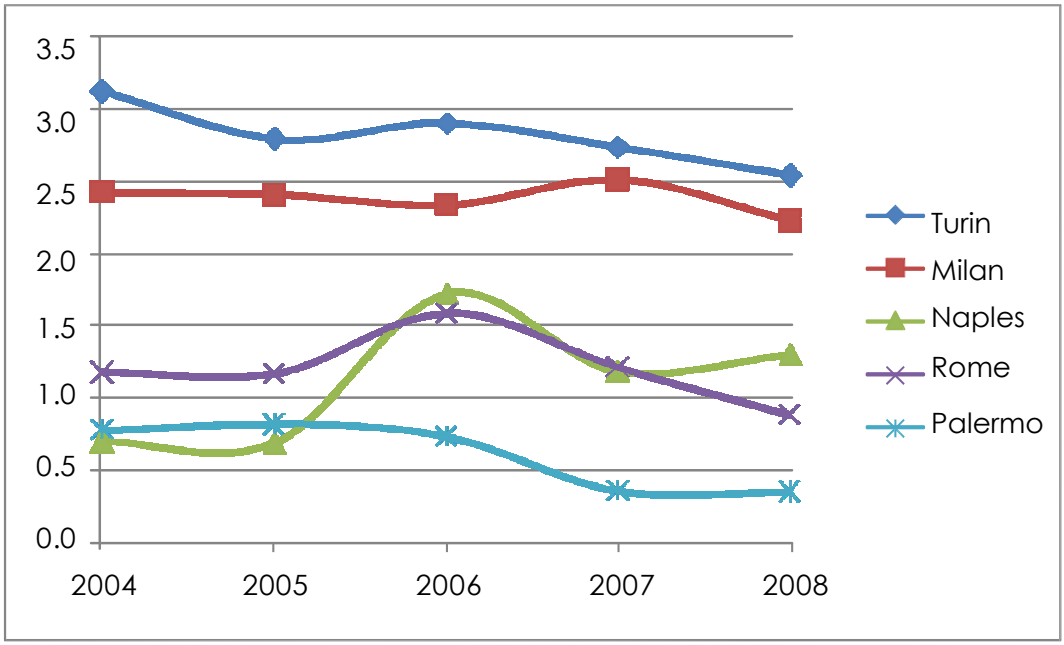
Naples topped the European rankings for the highest annual concentrations of nitrogen dioxide[2] (66.6 µg/m^3, exceeding the 40 µg/m^3 limit value), one of the causes of acid rain that increases the soil acidity and the solubility of various metallic ions, and also contributes to the decay of monuments (Table 10).

Air quality in European cities

More than half (17, actually) of the 30 most polluted cities in Europe are Italian. In Plovdiv, which registered the worst air quality of all, the indicator revealed that the concentrations for these three pollutants exceeded legal limits by 2.6 times, on average, during the year 2008. Turin, as already illustrated, ranked second on the list after holding first place in 2004 and 2005. Over the course of the five years being examined here, the value of the summary index for Turin fell from 3.1 in 2004 to 2.7 in 2007, to 2.5 in 2008. The index for Milan held fairly stable and showed a modest improvement in 2008, when prescribed limits were exceeded by 2.2 times (Figure 1).

Palermo registered the best air quality for Italian cities in 2008: the index value was less than unity, which reflects the average values relative to the limits. The value was estimated at 0.3 in this Sicilian city, in fact, down from the value of 0.8 that was recorded in 2004 and 2005 (Figure 1).

Figure 1. Summary air quality indicator for various Italian cities. 2004-2008



The European cities that exhibited the best air quality were Tallin in Estonia, the Swedish cities of Stockholm, Lund and Malmö, and Rostock in Germany. Among the European cities with index values less than 0.2, three (out of 36) are located in the United Kingdom, three (out of 4) in Sweden and two (out of 47) in Germany (Table 2).

Among the capital cities of the 23 European Union countries that were examined, Rome took 181st place in the group of 221, right after Ljubljana. Tallin, Stockholm, Helsinki and Dublin classified in the 10 most virtuous positions. Amsterdam placed 81st, London 108th, Berlin 119th and Paris 127th.

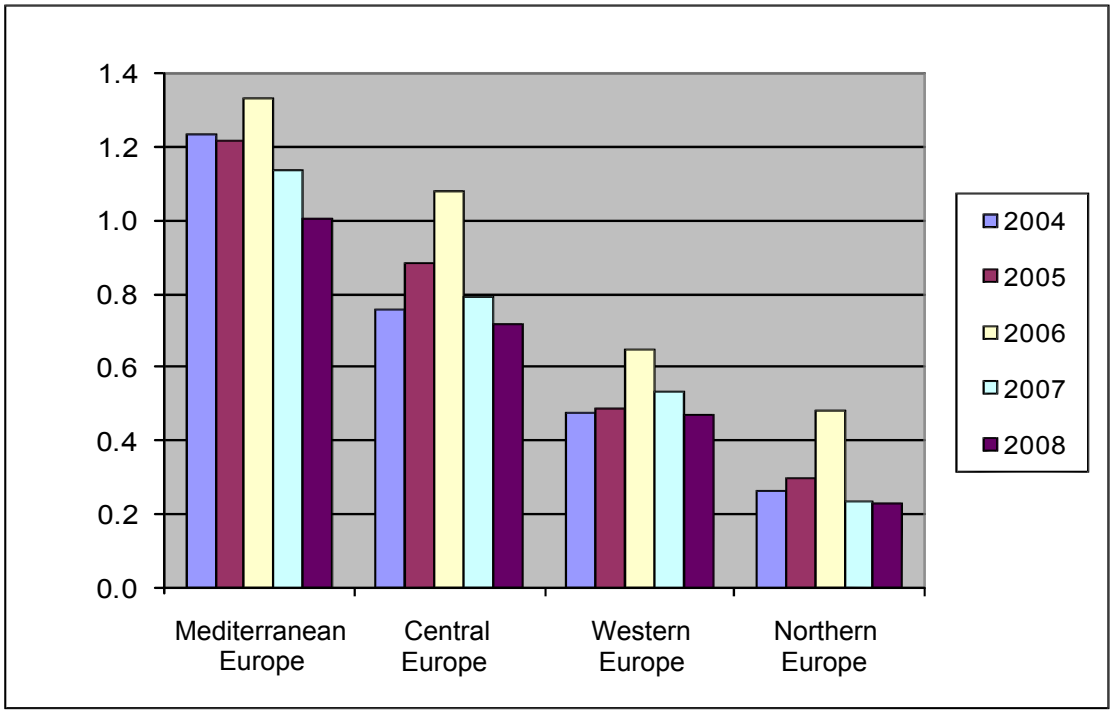
When classified by Country, using the city data employed in this analysis and weighting for population size, Bulgaria had the worst summary air quality index: 2.0 times in excess of the legal parameters. Greece came next with 1.5, followed by Italy with 1.4 and Romania with 1.1 (Table 3). For the most part, the Countries with the best index values are found in Northern Europe: Estonia, Sweden, Finland, Denmark, but also Ireland from the Western Europe macro-region and Portugal from Mediterranean Europe.

Lithuania, Germany and the United Kingdom together with Mediterranean France and the Netherlands had index values of less than or equal to 0.5 (Table 3).

At the level of European macro-regions, an analysis of the historical series reveals that the worst air quality levels were found in Mediterranean Europe (E-M), which was followed by the countries of Central Europe (E-C). At the other end of the spectrum, a better situation was found in Western Europe (E-W), and even better in Northern Europe (E-N) (Figure 2).

The year 2008 was the best year for air quality since 2004, while 2006 was the worst year during the five-year period in question (Figure 2).

Figure 2.- Summary air quality indicator by European Macro-Region. 2004-2008



Methodological note

The present analysis considered a total of 221 different European cities, including 23 from Italy: Rome, Milan, Naples, Turin, Palermo, Genoa, Florence, Bologna, Venice, Trento, Perugia, Pescara, Padua, Brescia, Modena, Prato, Parma, Reggio Emilia, Ravenna, Rimini, Bergamo, Forlì and Novara.

The cities belong to 23 of the 27 EU Countries, as indicated in the table.

Each Country was assigned to a one single European Macro-region. French cities were assigned to Western or Mediterranean Macro-Regions, depending on whether they were positioned to the north or the south of 45 degrees latitude.

The population sizes reported in the table reflect the resident population in the observed city relative to the total resident population of the Country in 2004.

The average indicator values for countries and Macro-Regions were obtained by weighting the city data on the basis of the respective 2004 population count.

When data for a specific city were missing, not collected or erroneous for one or more years, values were assigned by applying the average variations observed in at least 3 cities from that Country or Macro-region to the previous or subsequent data value.

The time series was examined for the 2004-2008 period. Data were supplied by the European Environment Agency.

List of observed Countries with the number of cities, population size represented and Macro-region assigned

Country	Abbrev.	City number	Percentage of population represented	Macro-region
Austria	AT	4	26.6	E-C
Belgium	BE	5	21.6	E-W
Bulgaria	BG	4	23.4	E-C
Denmark	DK	3	17.8	E-N
Estonia	EE	1	29.0	E-N
Finland	FI	1	10.8	E-N
France	FR	30	22.9	E-W/E-M (*)
Germany	DE	47	22.8	E-C
Greece	GR	1	7.2	E-M
Ireland	IE	1	11.7	E-W
Italy	IT	23	17.5	E-M
Lithuania	LT	1	16.0	E-N
Netherlands	NL	5	12.9	E-W
Poland	PL	17	19.1	E-C
Portugal	PT	5	10.8	E-M
United Kingdom	GB	36	30.4	E-W
Czech Republic	CZ	4	19.7	E-C
Romania	RO	1	8.9	E-C
Slovakia	SK	2	12.3	E-C
Slovenia	SI	1	13.4	E-M
Spain	ES	22	20.2	E-M
Sweden	SE	4	17.9	E-N
Hungary	HU	3	20.0	E-C
Total		**221**	**20.4**	

(*) French cities: 7 are in the Mediterranean Macro-Region, 23 in the Western.

Data source. The data source was the AirBase database of the European Environment Agency (EEA). As prescribed by resolution 97/101/EC "Establishing a reciprocal exchange of information and data from networks and individual stations measuring ambient air pollution within the Member States," the AirBase European database on air quality is managed by EEA.

Every indicator that was taken into consideration was calculated for the Urban Audit project on the basis of data gathered by (sub)urban background measurement stations located within city administrative boundaries. When multiple stations were present, the number of violation days or the NO_2 mean annual

concentration represent the average of the data collected from different single stations. As established by Eurostat, only those stations that collected at least 75% of the data over the course of the year (therefore for more than 274 days per year) were taken into consideration. The results presented are based on a gap filled data set, obtained from the original Urban Audit data set.

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