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Gaseous Pollutants and PM_{10} Trends From Monitoring Networks in Bari Province: PCA and APCS Applications on a Two Years and Half Data Set

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Abstract

The trends of PM_{10}, CO, NO_x, Benzene and Toluene collected, from January 2005 to May 2007, in six stations of monitoring networks of Bari Municipality and Province, are shown.

The Absolute Principal Component Scores model has been applied to data collected. The model identified three recurrent sources, associated with vehicular traffic and particulate transport, covering over 90% of variance.

Introduction

The inhalation of air polluted with PM_{10} (particulate matter of aerodynamic size <10 μm in diameter) and or irritant gases such as NO_2 and SO_2 is associated with both short-term and long term health effects, most of which impact on respiratory and cardiovascular system [1]. For this reason the knowledge of chemical composition and sources of air polluted is demanded in any program aimed at controlling the levels of pollutants in order to evaluate and reduce their impact on human health. From this point of view the source apportionment models are very useful [2,3].

The present paper deals with bihourly data of PM_{10}, CO, NO_x, Benzene and Toluene collected in six monitoring sites of Bari territory from January 2005 to May 2007; the daily and night trends for CO, PM10, Benzene and Toluene collected will be shown. A receptor model is applied to bihourly data collected. The main aim of this paper is to provide a clear illustration of how large datasets from monitoring stations can give information about the number and nature of the pollutant sources, and to suggest an estimate of the contribution of the traffic source to PM_{10} concentration level.

Materials & Methods

In this paper some sites of Bari and its province monitoring network stations have been selected as representative sites of the investigated area. In Bari, the selected monitoring stations are located in residential area (viale King), in urban area (viale Archimede) and in a suburban area (S. Nicola sport stadium). In province of Bari, the three selected stations are located in the urban and residential areas of the following towns: Altamura (67000 inhabitants) located at 47 Km south-westwards from Bari, Andria (98000 in.) at 55 Km northwards from Bari and Monopoli (50000 in.) a costal town at 40 Km southwards from Bari. Each station is provided with automatic analysers of CO, PM_{10}, NO_x, Benzene and Toluene [4]. The receptor model used in this paper is described in Bruno et al. 2008 [4].

Results

Observing figure 1, shown as example, CO concentrations (but the same can be observed for the other parameters) show different trends between night and day values, whit day mean values bigger than night ones (the percentage ratio between daily mean-nigh mean and daily mean is 53%).

Considering the PM_{10} night and day mean concentrations it's possible to note that they don't show a clear difference between day and night. In fact the ratio for PM_{10} is 16%.

The different behaviour between PM_{10} and the other parameters (NOx, CO, Benzene, Toluene) can be considered common to the whole area investigated. Moreover the PM_{10} amount monitored in this area presents a common contribution also among monitoring stations located at 70 km far each other and PM_{10} concentrations monitored in the this area do not show a seasonal trend [5].

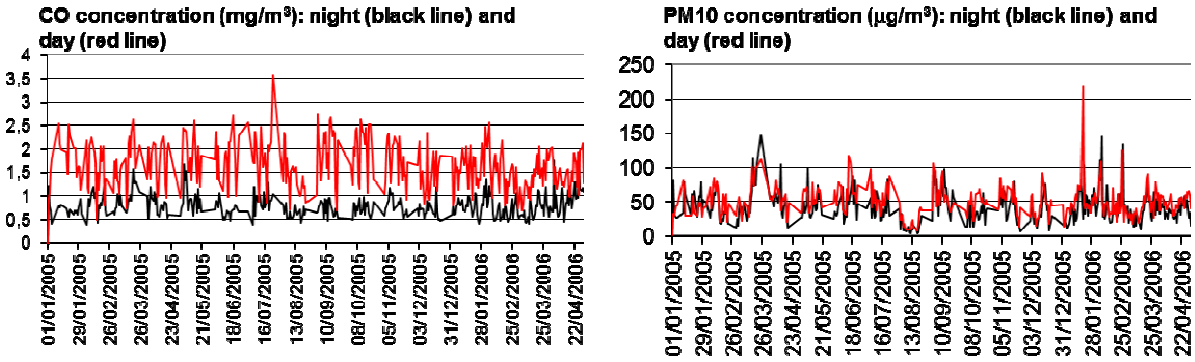

Fig. 1; CO and PM_{10} trends comparing day and night periods for the data collected in Viale Archimede (Bari) from January 2005 and April 2006

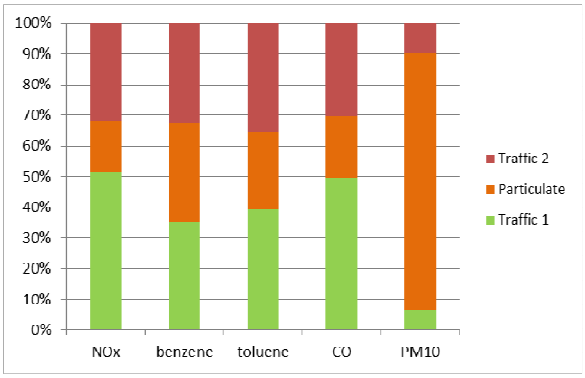

Fig.2; percentage of parameters distribution in the three sources: Traffic 1, Traffic 2 and Particulate

The APCS model allowed to identify three pollutant's sources; moreover we found that over 95% of the mass of PM_{10} is attributed to the source called "Particulate" (in consideration of the importance of such parameter for this source). The other two sources are differently characterized by NO_x, Benzene, Toluene, CO and a little contribution of PM_{10}. Fig.2 is referred to the mean values of the six sites. Coefficients of correlation of the three sources among the six sites will be shown.

Conclusions

By using a long time data set obtained by monitoring networks of Bari Municipality and Provinces it's been possible to pointed out a different constant trend between PM_{10} and other parameters like NOx, CO, Benzene, Toluene. The application of receptor models allowed to point out a contribution of a source of particulate (named Particulate) that explains the 95% of the total PM_{10} mass. This source allowed to better understand the peculiarity of the PM_{10} amount and behaviour in the investigated area. Moreover the information obtained suggests that new air quality indicators have to be identified, as respect the PM_{10} concentrations, in order to have more clear suggestions of pollutants sources.

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