Meteorological impacts in the modification of PM_{10} concentration levels in the urban area of Volos, Greece

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Keywords: PM_{10}; Saharan dust events; Volos; Greece.
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Volos, a coastal medium-sized city in the region of Thessaly extended along the northern part of the Pagassitikos Gulf at the eastern seaboard of Central Greece, is among the cities which suffer from the air pollution in Greece. The case of Volos is an interesting example, where in the last decades the urbanization and the increased industrialization have resulted in the degradation of the air quality within the area, triggering health impacts. Meteorological factors play an important role in the air pollution development, while the complex topography of Volos exacerbates air pollution episodes.

In this study, the relationships between PM_{10} (particulate matter with diameter less than 10 μm) and meteorological parameters such as wind speed, relative humidity and air temperature have been analyzed from 2005 to 2009 on the basis of 24-hour continuous measurements. According to the results obtained from the multiple linear regression analysis, there is a strong relation between meteorological parameters and the particulate matter (Table 1) concentrations in Volos city. More specifically, the PM_{10} concentrations remain above the European Union (EU) limit values (Figure 1) for the whole part of the examined period (2005-2009) and this can be attributed to anthropogenic (industry and car traffic) and natural sources (Saharan episodes) of particulate pollution. The percentage of the total variance of PM_{10} concentrations explained by a single meteorological parameter for the cold period gets up to 10.6% (r^2) whereas, for the 5-year period, up to 6.8%. On the contrary, for the warm period it appears that the percentage of the total variance of PM_{10} concentrations explained by a single meteorological parameter gets up to only 2.5%.

Table 1. Pearson's correlation coefficients between the mean daily PM_{10} concentrations (μg/m^3) and the three meteorological parameters. Statistically significant values (at the 99% confidence level) are presented in bold.

Period	WS (m/s)	T (°C)	RH (%)
2005-2007	**-0.260**	**-0.184**	**-0.213**
Cold	**-0.326**	-0.092	**0.243**
Warm	**-0.159**	0.107	-0.078

Moreover, the calculation of the 72-hour air mass back trajectories during (eight) Saharan dust events, took place within the examined period, was carried out by applying the HYSPLIT 4 model of Air Resources Laboratory of NOAA for three different levels: 500, 1500 and 4000 m (a.m.s.l.). It is worthy to remark the high PM_{10} values observed, indicating the contribution of such natural events in exacerbating the air quality in the area of Volos.

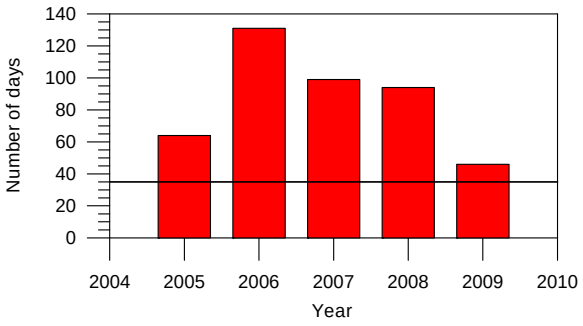

Figure 1. Temporal evolution of annual exceedances of mean daily PM_{10} concentrations at the city of Volos (2005-2009; the horizontal line indicates EU limit).

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