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Comparative analysis of atmospheric concentration measurements of PM10 particles, nitrogen oxides and ozone in the Mediterranean urban areas of Athens and Thessaloniki, Greece.

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The two major urban areas in Greece, Athens and Thessaloniki, encounter air pollution problems during the last decades due to the high pollutant emission density and the poor ventilation caused by the local topography, especially for Athens. An additional factor is the high level of solar irradiation leading to the formation of secondary photochemical pollutants like ozone. At present, the most serious air pollution problems in both urban areas are related to the ozone exceedances of target values of ozone but also to the violations of the EU standards of atmospheric PM10 particles, which are quite frequently recorded. More than half of the population in Greece lives in these two large urban centers and their significant urban emissions are expected to influence the surrounding areas in northern and southern Greece, for Thessaloniki and Athens respectively.

For the assessment of the suspended particulate pollution levels in these two major urban areas of Greece, the atmospheric concentration measurements of the PM10 atmospheric particles in Athens and Thessaloniki, have been analyzed in parallel with the corresponding measurements of nitrogen oxides and ozone during the four year period 2001-2004, in the framework of the EU funded project HEREPLUS (Health Risk from Environmental Pollution Levels in Urban Systems). In each urban area, two air pollution monitoring stations with different site characteristics (central urban, peripheral) have been examined. The data analysis was mainly focused on the parallel examination of the seasonal variation of the mean monthly values and the diurnal variation of hourly values. The variation of the concentration patterns during the cold and the warm semester of the year as well as during upwind or downwind conditions at the peripheral stations of both urban areas have been also examined. The highest PM10 hourly values appear in the central urban stations during the cold semester of the year and during the morning hours. It also comes out that the PM10 variation characteristics exhibit similar features with the corresponding variation patterns observed for primary urban pollutants i.e. nitrogen oxides, like the existence of the sharp morning and the evening peaks at the central urban stations. On the other hand though, they exhibit also characteristics encountered in secondary photochemical pollutants i.e. ozone, like the broad mid-day peak at the peripheral stations as well as the existence of relatively high rural background levels around both urban areas. The PM10 concentration levels at the peripheral stations of Athens and Thessaloniki but also the estimated rural background levels are in the 25-35 μg/m3 range. These rural background PM10 levels are in agreement with measurements reported at a rural background site in Central Greece but also with other measurements in the Aegean Sea region. These rural levels are considered as significant regarding the EU air quality standards and should be taken into account in the formulation of the local pollution abatement strategies as they cover about the half of the average PM10 levels measured at the central urban stations of both examined urban areas.