Summer and winter time aerosol levels at an urban Mediterranean environment: Impacts of biomass burning.

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The mass concentration, composition, physical and chemical properties (e.g., extent of oxidation of organic particulate matter) can vary significantly during the year. Patras is coastal urban area with around 200,000 inhabitants, located in western Greece, with light industry. Local traffic has been long assumed to be the major local aerosol source. Due to the high photochemical intensity throughout year but especially during the summer, significant production of secondary aerosol mass is expected.

Winter and summertime intensive measurements have been carried out to investigate the differences on the levels, sources, and chemical processing of ambient particles in this urban area of the Eastern Mediterranean. Aerosol mass, chemical composition and hygroscopicity were monitored during the summer by combining a High Resolution Aerosol Mass Spectrometer (HR-AMS), a Scanning Mobility Particle Sizer (SMPS), a Scanning Flow CCN Counter (SFCA, Moore and Nenes, 2009), a Hygroscopic Tandem Differential Mobility Analyzer (HTDMA). 24-hour filter samples were analyzed for the determination of Organic Carbon (OC), Elemental Carbon (EC) and Water Soluble Organic Carbon (WSOC). The summer measurements took place from 8 to 27 June 2012. Winter-time sampling included day (8:00-18:00) and night (18:00-8:00) filter collection. The winter measurements were carried out from 10 of January until 10 of February of 2013.

Significant differences in the submicron aerosol levels were observed between summer and winter. The $PM_{0.5}$ concentrations are shown at Figure 1. Higher concentrations and variability were observed during the winter period. The mean concentration of $PM_{0.5}$ during the winter intensive campaign was 17.8±16.2 μg m^{-3} and 5.2±2.3 μg m^{-3} for the corresponding period during the summer. The low summertime concentrations are partially due to lower pollutant emissions in Greece due to the financial crisis. The very high levels during the winter are due to high biomass burning emissions from both fireplaces and also agricultural burning of olive tree branches (Kostenidou et al., 2013). These do cause high concentrations of PM and the corresponding gas-phase pollutants during specific periods and days. For example, the PM usually started increasing at around 18:00, reaching a peak at 23:00 and returning to lower levels by 3:00. This variation is consistent with the increased use of fireplaces for home heating. The low mixing heights during the winter also help enhance the pollutant concentrations.

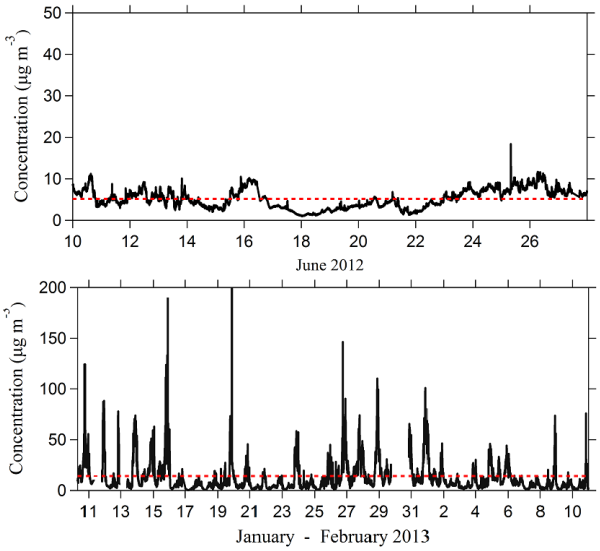

Figure 1. Summer (upper curve) and winter (lower curve) levels of $PM_{0.5}$ aerosol. Dashed lines show the average concentration for the corresponding sampling period.

Differences in the diurnal profiles and variation for the different periods will be discussed and the hygroscopicity of the aerosols will be inspected for the two sampling periods.

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References

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