The contribution from natural sources to aerosol primary emissions and gaseous aerosol precursors over urban areas

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Abstract

The objective of this work was to estimate the contribution from natural sources to PM primary emissions and their precursors over the Athens and Thessaloniki Metropolitan Areas (AMA and TMA, respectively). The focus of the analysis was on the seasonal and inter-annual variation of natural sources' contribution to total emissions over the area during the period 2000-2010. Therefore, emission inventories for $PM_{2.5}$,$PM_{2.5-10}$ and NMVOCs, precursor to PM, from natural sources (vegetation, sea surface and wind erosion of soil) were constructed and compared to anthropogenic emissions in the areas. The contribution of gaseous pollutants to aerosol formation was calculated according to the methodology of de Leeuw (2002). According to the above methodology emissions of each precursor gas can be weighted to account for potential secondary aerosol formation. The weighting factors account for the fraction of emissions of pollutant changing into aerosol and the molecular weight difference. Emissions of each pollutant are multiplied by the aerosol formation potential and results are reported in PM_{10} equivalents. It was found that the contribution of natural sources to total particles was significant, especially in the case of coarse particles (~94% in AMA; ~82% in TMA). In particular, the average contribution from the sea surface to the total particulate pollution over the AMA and TMA during the decade was approximately 34% and 10% for $PM_{2.5}$, respectively, while it was approximately 65% and 47% for $PM_{2.5-10}$. Windblown dust accounted for a relatively high fraction of total PM emissions in AMA and TMA (~25%). There was no significant seasonal variation observed in the contribution of natural PM emissions to total PM emissions. In addition BVOCs emissions accounted for approximately 36% and 68% of total VOCs emitted from the AMA and TMA, respectively. The contribution of BVOCs to total NMVOCs emissions was increased during the summer period due to the enhanced solar radiation and temperature as well as the elimination of central heating emissions. The decadal averaged share of primary PM and gaseous precursors to secondary aerosol formation from natural sources to total equivalent PM mass in the areas was approximately 36% in AMA and more than 15% in TMA..

Keywords: Natural sources; BVOCs; Emission inventory; secondary aerosols

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