

Title: Regional PM air quality studies in Northern and Western Africa

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Abstract

Particulate matter (PM), especially PM₁₀ and PM_{2.5}, has profound implications for climate change, human health, and ecosystem sustainability. A thorough understanding of the composition and sources of the organic and inorganic compounds present in PM is required to develop effective pollution control policies. Urban areas in Northern and Western Africa, such as Fez, Morocco, and Lagos, Nigeria, are experiencing increasing levels of air pollution due to rapid urbanization, industrialization, and increased vehicular traffic. These developments pose significant risks to public health and require immediate attention to air quality management in these regions. While many studies have explored particulate pollution in various global contexts, few research studies have focused on the organic composition and distribution of PM sources in Africa. This study aims to address this gap by identifying the primary sources of PM₁₀ and PM_{2.5} pollutants in these cities and assessing their potential health implications. Using various analytical techniques, this study analyzes PM₁₀ and PM_{2.5} samples collected in urban and residential areas of Fez, Morocco, and Lagos, Nigeria. The results indicate that the PM₁₀ mass in Fez ranged between 37 and 107 $\mu\text{g m}^{-3}$. Traffic emissions were identified as the major source of PM₁₀ in Fez, contributing 30% of PM mass, especially from diesel engines, as suggested by the diagnostic ratios approach. Moreover, biomass burning contributes up to 14% of total PM, mainly from local anthropogenic activities, as suggested by polar plots. In Lagos, higher PM_{2.5} levels (up to 56 $\mu\text{g m}^{-3}$) were linked to air masses arriving from industrial regions, demonstrating the role of regional transport in increasing local air pollution. Furthermore, PM_{2.5} pollution was predominantly from petrogenic activities, particularly gasoline and diesel engine emissions, with n-alkane concentrations found in Lagos, ranging from 1.8 to 146.6 ng m^{-3} and representing 0.2% of total PM_{2.5} mass. Accordingly, this study highlights vehicular emissions as a key source of PM pollution in Fez and Lagos and provides recommendations for targeted air quality initiatives in Northern and Western Africa.