Trends of air quality in a fast growing Sub-Saharan African city: Nairobi, Kenya

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Keywords: PAH, PM_X, Urban aerosol, Black carbon, Mineral dust

Introduction

One of the most pronounced consequences of urbanization is the rapid deterioration of urban air quality. Poor air quality has been associated with several negative effects on human health, climate and ecosystems. The apparent fast urbanization calls for improved understanding of the processes leading to the production and deposition of major air pollutants in the urban aerosol. This is of particular importance in developing countries where air quality policies seldom exist and when they do they are rarely informed with respect to locally collected air quality data. Nairobi, the capital city of Kenya, is one such city where air quality policies are still in their infancy. Formulation and implementation of informed mitigation policies for sustainable improvement and maintenance of clean air there is need to understand pollutant quantities and sources including their temporal and spatial characteristics. In this study we have summarized selected air quality studies carried out in Nairobi over the period 2002-2010. They were mainly focused on particulate matter (PM) speciation and were driven by the available instrumentation and funding. PM is known to be a major air pollutant with adverse effects on human health, climate and ecosystems.

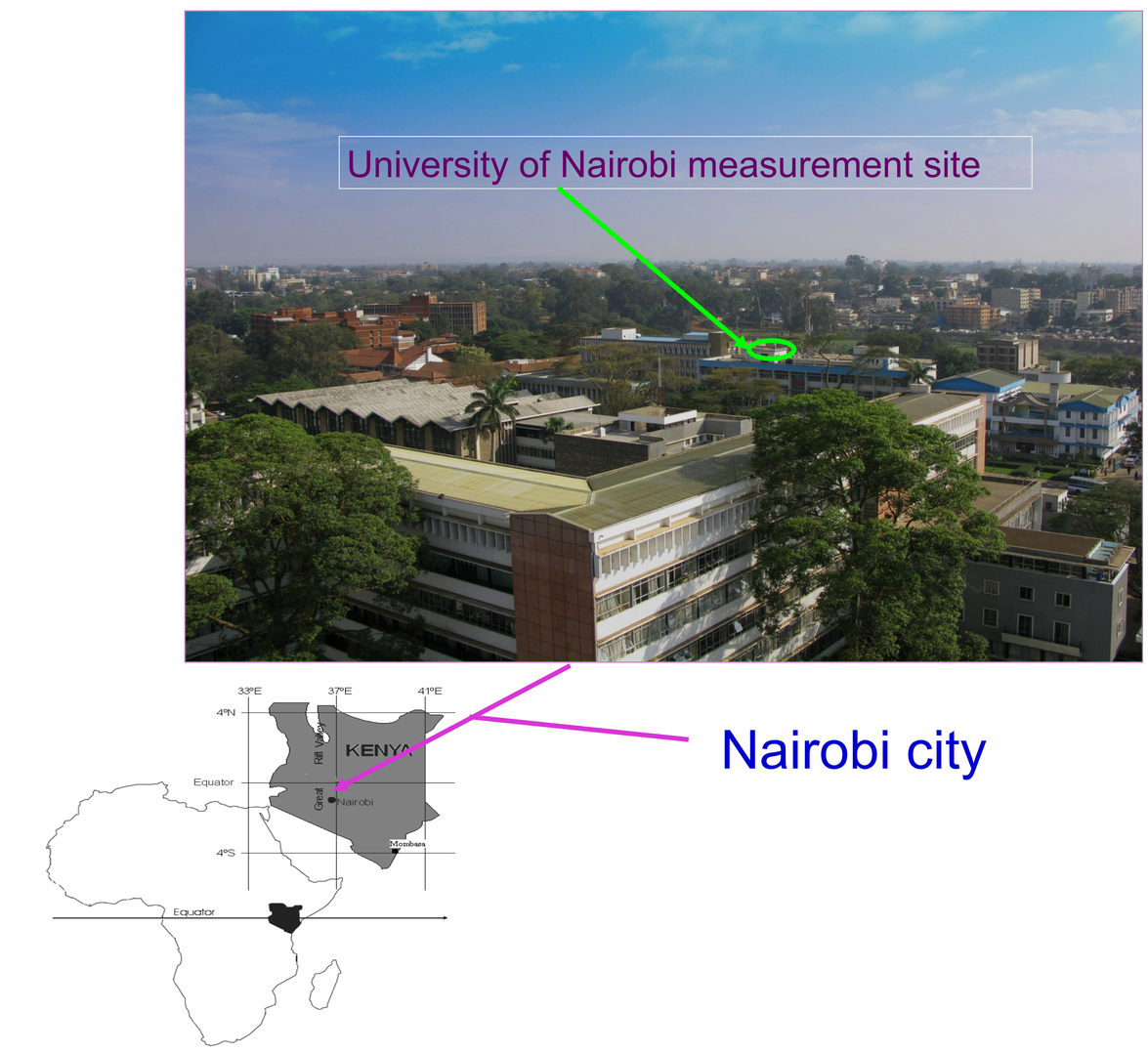

Figure 1. Map showing the geographical location of Nairobi in Kenya and the main sampling site at University of Nairobi.

Species Studies

Table 1 shows a summary of some of the studies, which have been carried out in Nairobi between 2002-2010 including the employed sampling and analytical instrumentation. These studies were mostly for a short period of time and therefore the evaluated samples were a small number due to funding availability and accessibility to instrumentation. However, they have achieved a great deal in informing the policy makers and interested development partners air pollution levels were far above global contention that developing South was not as polluted as the developed north. When opportunities arose research collaborators in the north provided the missing analytical methods in Kenya like the analysis of hydrocarbons and black carbon, and gravimetric facilities. Heavy metal speciation were specifically designed for source identification besides evaluating levels of those known to be harmful to human health, especially Pb.

Acknowledgement

We acknowledge the support by International Science Programme, Sweden, United States Environmental Agency (USEPA), North Carolina and Center for Sustainable Urban Development, New York.

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Discussions

The study reports implicated vehicular emissions and mineral dust as contributing most pollutants, especially diesel powered and poorly maintained vehicles. The concentration levels of evaluated PAH was comparable to those observed in megacities and in polluted northern cities. Near ground level (2 -7 m above ground level) black carbon and mineral dust showed high correlations that followed the traffic intensities in the city which is normally high in the morning and evening, and low in midday hours. At elevated sampling sites ≥10 m the observed concentrations and wind system considerations implied a regional influence on Nairobi pollutants. Comparison with size segregated PM_{10} concentrations measured before 2005 revealed a trend of deteriorating air quality in Nairobi which is understandable in the midst of increasing on-road vehicles, traffic jam persistence and increasing urban population which dictate the increase of on-road public transport.

Table 1: Tabulation of some of the the studies carried out between 2003 and 2010 in Nairobi city, Kenya

Study year	Species monitored	Instrumentation
2002-2004	BC, PM_{10}, $PM_{10-2.5}$, $PM_{2.5}$ and elemental contents	Size segregating Dichotomous Impactor, Energy Dispersive X-Ray Fluorescence (EDXRF) and Black Smoke Detector
2006 - 2008	PAHs, $PM_{(<35)}$, OC, EC, BC, PM_{10}, $PM_{10-2.5}$, $PM_{2.5}$, and elemental contents	High-Volume sampler and Thermal Desorption Gas Chromatography-Mass Spectrometer, Dichotomous Impactor, EDXRF and Black Smoke Detector
2005	PM_2, $PM_{(10-2)}$, NO, NO_2, CO and elemental content	Gent sampler with a stack filter unit, NOx Chemiluminescence Analyzer, Infrared Analyzer, Dichotomous Impactor, EDXRF
2010	$PM_{2.5}$, CO, Fe, Ca, K, Mn and Ti	Optical particle counter (Grimm1.108), EDXRF
2007-2010	BC, PM_{10}, $PM_{10-2.5}$, $PM_{2.5}$ and elemental contents	Dichotomous Impactor, Cyclone particle Samplers, Black Smoke Detector and EDXRF

Conclusions

Air quality in Nairobi is heavily impacted by traffic and mineral dust and the pollutant concentrations are increasing. However, air quality situation is not fully understood and long period studies, designed to capture seasonal variations, are necessary. The best for the required knowledge of air pollution in Nairobi is continuous monitoring.

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