Supplement of Atmos. Chem. Phys., 18, 15403–15418, 2018
https://doi.org/10.5194/acp-18-15403-2018-supplement

Atmospheric Chemistry and Physics
Open Access
EGU

Supplement of

Airborne particulate matter monitoring in Kenya using calibrated low-cost sensors

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Supplementary Material

Site meteorology

Figure 1d provides the wind rose for the measurement period and Table 1 provides the statistical summary data for the measured meteorological variables during the study period. The wind came predominantly from the northeast with a mean average wind speed of 1.9 m/s. The measurement period was largely dry but there were rain events on the following days: 17th, 19th and 24th February, and 17th and 22nd of March, see grey shaded rectangles in Figure 3. Air mass back trajectory analysis using HYSPLIT confirms that the air masses arriving in Nairobi, during the measurement period, came from the northeast (Stein et al., 2015). It is noted, the Nanyuki rural background field site is located north to northeast of Nairobi and hence is a sensible choice for the measurement of the rural aerosol loading arriving in Nairobi. The temperature and relative humidity time series data from the urban background site is shown in supplementary figure S2.

Table S1 Mean average PM mass concentrations (PM_1, $PM_{2.5}$ and PM_{10}) and daily exceedances of the WHO PM guidelines ($PM_{2.5}$ and PM_{10}) observed at the three measurement sites during the intensive period. [1]WHO guidelines for daily PM_{10} and $PM_{2.5}$ are 50 and 25 μg/m^3, respectively

Measurement location	Measurement days (number)	Average PM_1 mass concentration (μg/m^3)	Average $PM_{2.5}$ mass concentration (μg/m^3)	Average PM_{10} mass concentration (μg/m^3)	% daily $PM_{2.5}$ exceedances[1]	% daily PM_{10} exceedances[1]
Urban background	14	17.1	25.3	62.6	35.7	71.4
Urban roadside	14	33.0	48.2	120.6	100.0	100.0
Rural background	14	11.6	16.6	23.4	21.4	0.0

Table S2 Summary meteorological data for the urban background monitoring site in Nairobi (2nd February – 23rd March 2017)

	Wind speed (m/s)	Pressure (mbar at 1680 m)	Temperature (°C)	Relative humidity (%)
Minimum	0.1	827.3	15.2	15.0
1st Quartile	1.0	831.4	18.9	37.0
Median	1.6	832.4	21.5	51.0
Mean	1.9	832.4	22.1	51.4
3rd Quartile	2.5	833.4	25.2	66.0
Maximum	10.5	836.4	30.7	90.0

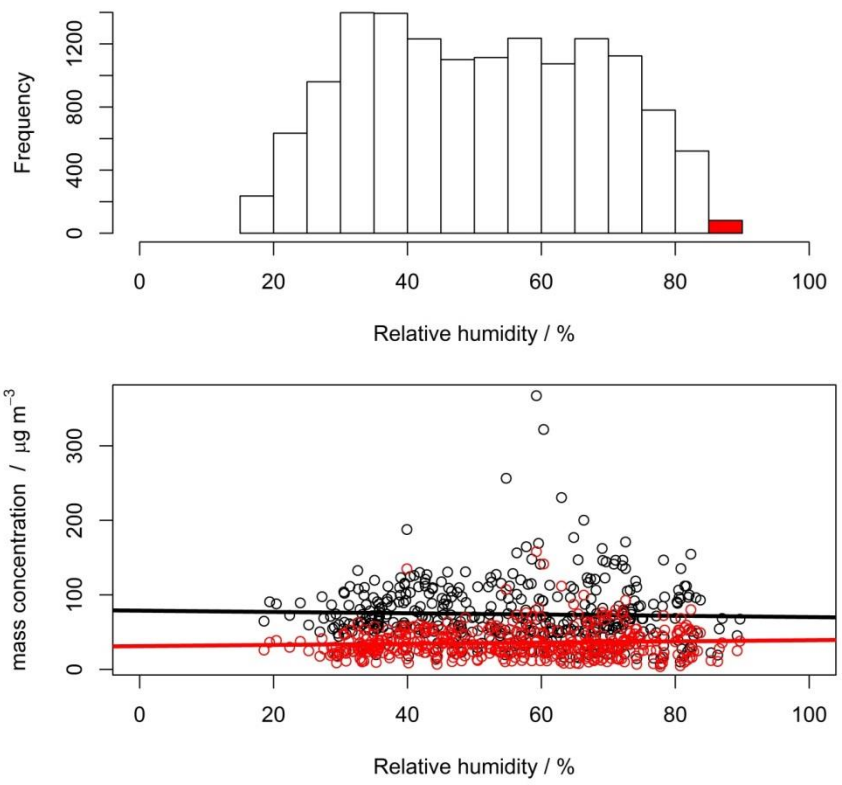

Figure S1. There is no dependence on recorded PM mass concentration upon RH. Top panel – histogram of recorded RH at the urban background site. The data with RH greater than 85% RH is shown in red and represents only 0.84% of the data recorded. Bottom panel – scatter plots of PM_{10} and $PM_{2.5}$ versus RH for the urban background site. Black and red points represent PM10 and PM2.5 data, respectively. Neither site shows any significant dependence of PM concentration upon RH, as expected with respect to Crilley et al. 2018

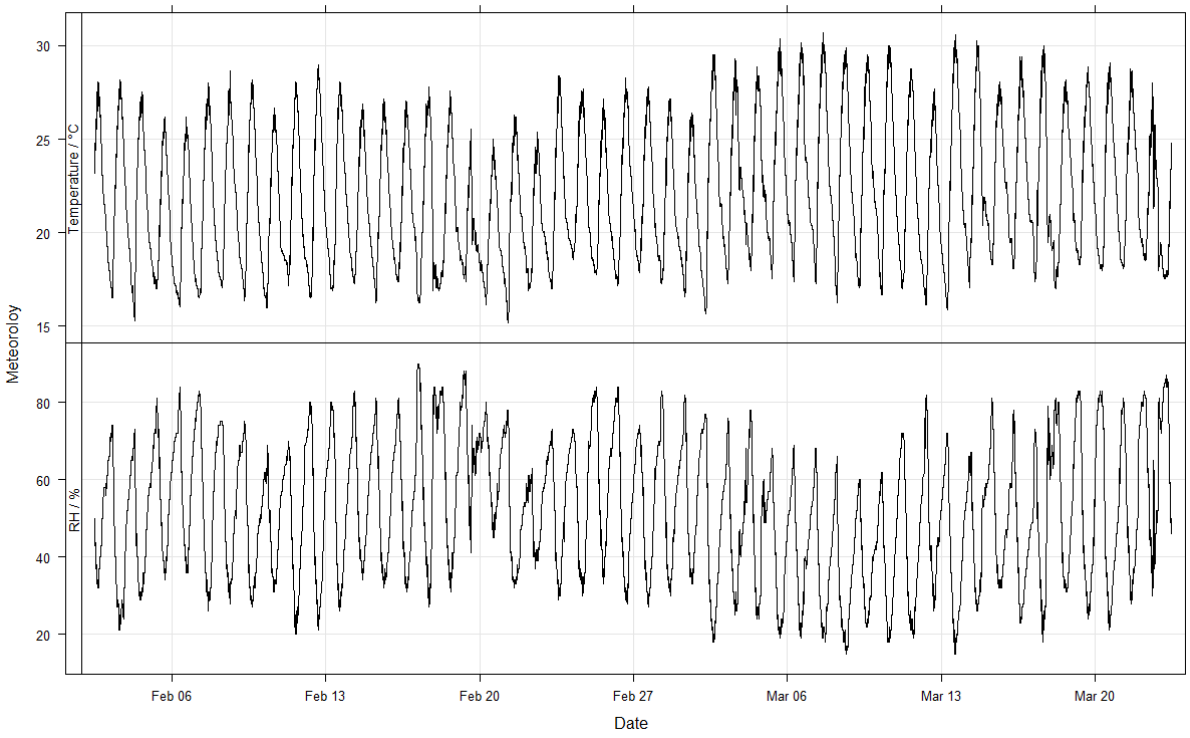

Figure S2. Time series for temperature and relative humidity data collected at the urban background field site in Nairobi.

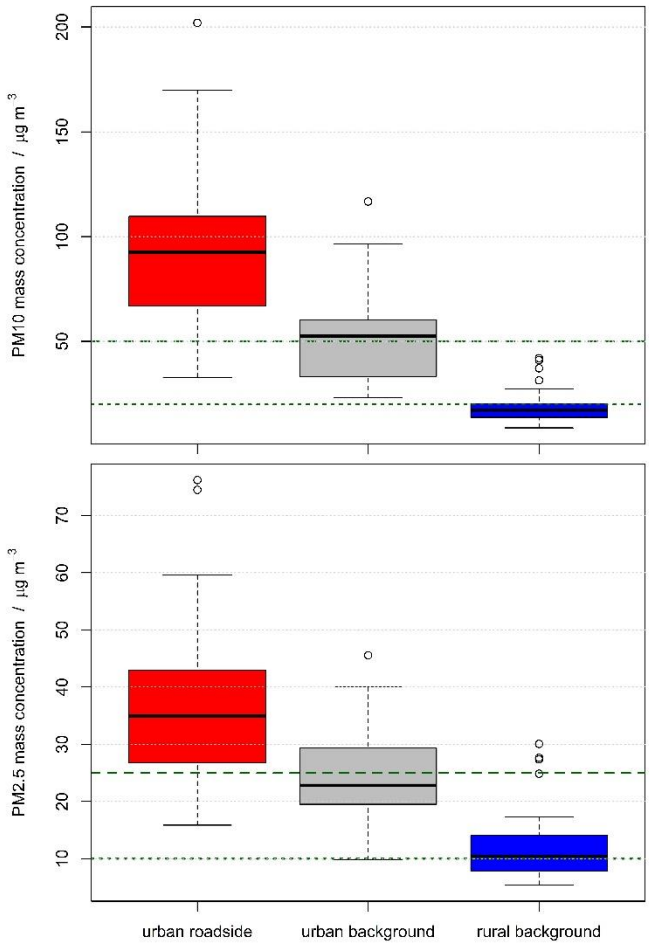

Figure S3 Box and whisker plots of the daily averaged $PM_{2.5}$ and PM_{10} mass concentrations measured at the three sites. The green dashed and dotted lines represents the WHO recommended annual and daily limits, respectively

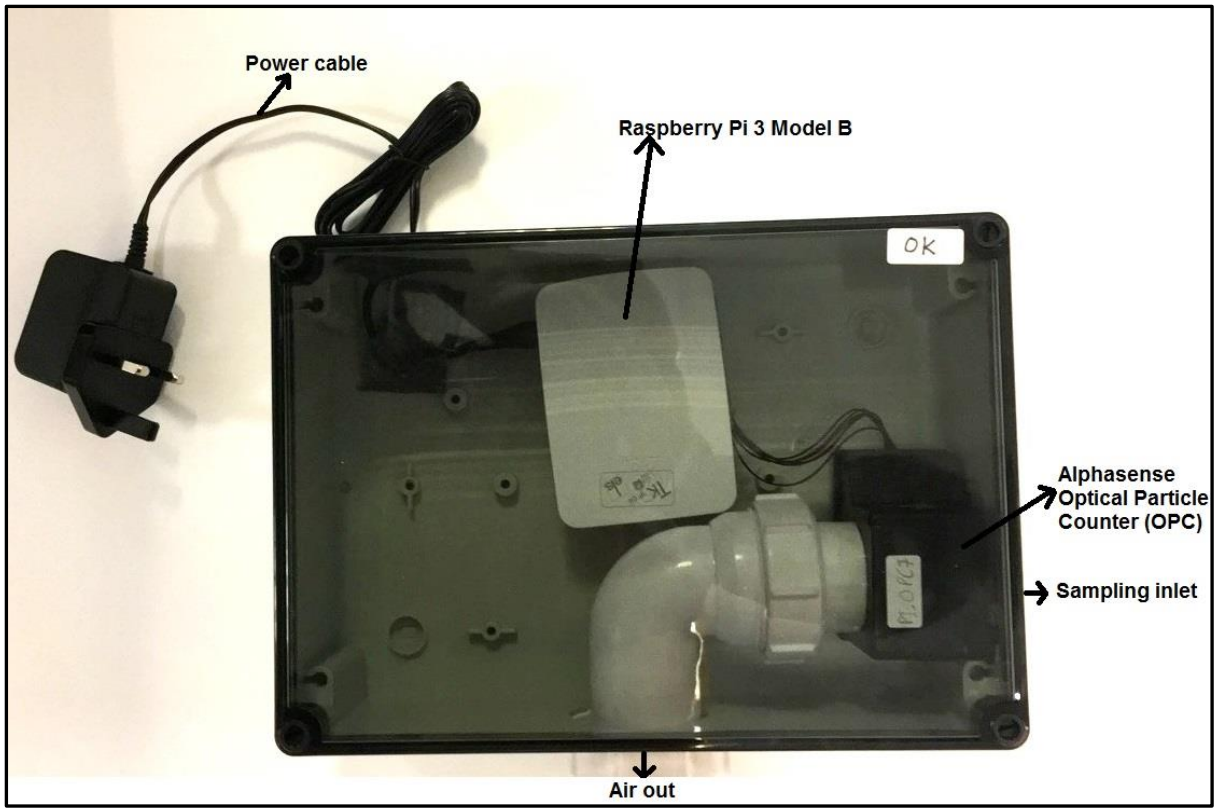

Figure S4 Labelled photograph of key components of low cost PM monitor.