NO_x and PM2.5 Measurements With Low Cost Sensors and Reference Monitors at a High Traffic Site in Nairobi, Kenya.

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Exposure to fine particulate matter (PM2.5) and nitrogen oxides (NOx) leads to premature death and other long-term cardiac/pulmonary health consequences, including an average life expectancy of those exposed to PM2.5 decreased by 1 year on continents that lack consistent and adequate air quality monitoring. Although Africa contains the fastest growing population in the world, many sub-Saharan African countries are underserved by air quality monitors that are able to ascertain the extent of pollution levels. Additionally, air quality instruments of a high caliber can cost tens of thousands of dollars, making the distribution of these devices challenging. Low cost sensors (LCSs), which cost between $100-$1000, can potentially close the air pollution data gap when coupled with careful correction and calibration techniques using data-driven methods. Although these low-cost sensors are not as accurate as reference monitors (RMs), side-by-side collocation of LCSs with RMs can provide a means to evaluate sensor performance and develop correction factors. We use a American Ecotech Serinus 40 Analyzer of Nitrogen Oxides colocated next to two Clarity Node-S LCS devices. These have been placed at Kenyatta University City Center campus along Haile Selassie Avenue in Nairobi, Kenya, located in the heart of the Nairobi Central Business District. A PurpleAir PA-II SD was also deployed at U of Nairobi next to a BAM-1020 reference PM2.5 monitor, allowing for performance evaluation and bias correction for two widely used LCS and two major pollutants in Nairobi. We present collocated RM and LCS NOx and PM2.5 data between the months of April and July, 2021. Peaks in NOx occur at (roughly) 6:00am and 7:00pm, likely denoting heavy traffic periods during rush hour. During these times, NO levels are higher than NO2 levels, indicating traffic emissions as the cause of these peaks. There is low correlation between the hourly and daily LCS NO2 levels and RM NO2 levels, leading us to conclude that the alphasense NO2 sensor has relatively little skill. However, the mean

values of NO2 levels are similar (RM = ~16 ppb, LCS = ~13 ppb) over the course of the four observed months, indicating that although the correlation may be poor at short timescales, longer-term averaging (weeks/months) may have little bias. We also report a correlation ($R^2 = 0.22$) between NOx and PM2.5 using the Clarity Node-s sensor, which gives some indication of the contribution of traffic pollution to PM2.5. Lastly, there is a high correlation between high humidity levels and low temperature levels with lower amounts of NO2.