

**Title:** Using low-cost measurement systems to investigate air quality: a case study in Palapye, Botswana: data repository

**Abstract:** This repository contains processed, quality controlled data used in the manuscript “Using low-cost measurement systems to investigate air quality: a case study in Palapye, Botswana”, which has been accepted by MDP-Atmospheres. The manuscript describes a 5-week field campaign conducted as a partnership between North Carolina A&T, Appalachian State University, Botswana International University of Science and Technology, and Colorado State University.

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**Recommended data citation**

Lassman, W., Pierce, J. R., Bangs, E. J., Sullivan, A. P., Ford, B., Mengistu Tsidu, G., Sherman, J. P., Collett, J. L., Bililign, S. “Using low-cost measurement systems to investigate air quality: a case study in Palapye, Botswana: data repository.” Colorado State University. Libraries, 2020.  
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Please also cite the paper which describes the analysis of these data:

Lassman, W., Pierce, J. R., Bangs, E. J., Sullivan, A. P., Ford, B., Mengistu Tsidu, G., Sherman, J. P., Collett, J. L., Jr., & Bililign, S. (2020). Using Low-Cost Measurement Systems to Investigate Air Quality: A Case Study in Palapye, Botswana. *Atmosphere*, 11(6), 583. <https://doi.org/10.3390/atmos11060583>

**Format of data files:** .csv

**Location where data were collected:** Measurements were conducted at the Botswana International University of Science and Technology campus in Palapye, Botswana.

-22.596190 Lat, 27.123135 Lon.

**Time period during which data were collected:** 2018-06-17—2018-07-16

**File information:**

The repository contains 7 .csv files.

- 1) AOD\_520.csv—contains the aerosol optical depth timeseries for valid times measured from the AMOD sensor. NAN's inserted to indicate cloudy days.
- 2) Bulk\_filter\_concentrations.csv—contains the blank-corrected QC'd estimated atmospheric concentrations derived from filter measurements. Each row is a separate measurement with columns for the date, sampling duration, total mass concentration, and the total masses of black carbon, inorganic aerosol, WSOC aerosol.
- 3) ICinorgs\_atmospheric\_concentrations—same format as Bulk\_filter\_concentrations.csv, but contains speciation of inorganic fraction as determined by ion chromatography.
- 4) MetData—ancillary observations of meteorological data from a met tower on site. First column is local (Central African Time) at hourly time resolution. Variables include:
  - ATMIN, ATMAX (air temp minimum and maximum during measurement period, degrees C)
  - WSMIN, WSMAX (windspeed minimum and maximum during measurement period, m/s)
  - WDAVG (wind direction average, degrees from north)
  - RHMIN, RHMAX (relative humidity, %)
  - BP (barometric pressure, hPa)
  - GHI1HR, GHI24HR, HRSSUN, solar irradiance variables, not used in this study.
- 5) MicroAeth—Hourly observations of black carbon [ $\text{ng}/\text{m}^3$ ]. First column is a time variable, the other column is BC concentrations. Note the frequency of measurements isn't uniform, as the initial samples were done with a timebase of 0.2 seconds. The data used in the study switch to a 5-minute timebase, and this is reflected in the data timestamp.
- 6) Plantower\_timeseries—Hourly observations of  $\text{PM}_{2.5}$  [ $\mu\text{g}/\text{m}^3$ ]. First column is a continuous time variable, the second and third columns are Plantower time-resolved  $\text{PM}_{2.5}$  concentrations, with NAN input for time values where no data is available.
- 7) XRF\_atmospheric\_concentrations—same format as Bulk\_filter\_concentrations.csv, but contains speciation of X-Ray fluorescence results. Due to double-counting between this technique and ion chromatography, these data do not count towards the total mass closure.

## Methods

For detailed description of the post-processing and analytical techniques used to produce these data, refer to the publication describing these data. In brief:

The Aerosol Mass and Optical Depth (AMOD) sampler (Wendt et al., 2019) was used to collect time-integrated samples of  $\text{PM}_{2.5}$  onto Teflon filters, while conducting concurrent time-resolved measurements of surface  $\text{PM}_{2.5}$  using a built-in Plantower sensor, as well as surface-based Aerosol Optical Depth measurements. In addition, time-resolved measurements of black carbon were conducted with an Aethlabs AE51 microAeth.

The filters were weighed pre and post deployment to determine the mass of aerosol collected, and were further characterized with Sootscan<sup>TM</sup>, X-ray fluorescence, and extracted into water and analyzed using ion chromatography and a Sievers Total Organic Carbon analyzer to speciate the  $\text{PM}_{2.5}$ .