Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2020-67-RC1, 2020

Atmospheric Measurement Techniques Discussions

Interactive comment on "Application of Low-Cost Fine Particulate Mass Monitors to Convert Satellite Aerosol Optical Depth Measurements to Surface Concentrations in North America and Africa" *by* Carl Malings et al.

Anonymous Referee #1

Received and published: 18 March 2020

The goal of this paper is to assess the conversion of satellite AOD values (not measurements) to surface PM2.5 concentrations by using low cost sensors and regulation grade instruments. Two regions are selected for study – Pittsburg, Pennsylvania and Rwanda, Africa. Most of the discussion is focused on PA. The paper focuses on linear relationship between AOD and PM2.5

The paper tries numerous avenues to assess the suitability of low cost sensors for surface PM2.5 estimations including space-time constraints on regulation versus low cost sensors and various statistical measures.

Most of my comments are for PA since the paper focuses on this region.

The study region is very small 0.7 degrees by 0.7 degrees. The paper definitely needs a map of some sort showing the location of the regulation grade monitors and the location of the low cost sensors since I have no idea how close are far away these sensors are!

The paper never discusses as to how space-time collocation was done for the ground versus satellite data. The results vary depending upon the width of the time and space windows. The paper also does not provide the slope/intercept values for these linear correlations.

The range of annual values in PA was low and the satellite data and the low cost sensors have larger uncertainties in this range and therefore the results may not be robust. Given this backdrop I am not sure how meaningful the PA results are. This is probably the main reason that the correlations are low – Page 11 (Line 325+).

Not sure about the usefulness of an offline approach where only a single conversion factor is used. Why report these values when we know that this is not relevant?

Page 11, Line 319. What is the cloud cover for each site and how does it affect annual average AOD? Given some of the issues mentioned above I am not sure that page 12 (line 24-244) conclusion is acceptable. Also given that the linear correlation has so many problems, using satellite data and ground monitors to assess the linear relationship is fraught with uncertainties.

In summary, I believe that low cost sensors play an important role for PM2.5 research but unless calibration issues and comparisons with ground monitors of regulation grade are made carefully as a function of space, time, meteorology we cannot be sure how useful the data can be for quantitative monitoring, assessment, and research (e.g. epidemiology). It is also not fair to state that (Page 16, line 482) that using the nearest monitor is better than using satellite data because none of the meteorological factors

have been taken into account for estimating PM25 from satellite data.

Minor comments Wang and Christopher, 2003 – Not Wang, 2003 Some of the references are outdated. E.g. Zhang et al 2009 for correlation coefficients. Page 3 : What spatial/temporal scales did Murray et al used

Page 3 : Not all studies find 'anti-correlation' in India. Page 3: Last sentence needs a reference Page 3: The cloud cover problems needs to be addressed and referenced. Christopher & Gupta (2010) Satellite Remote Sensing of Particulate Matter Air Quality: The Cloud-Cover Problem, Journal of the Air & Waste Management Association, 60:5, 596-602, DOI: 10.3155/1047-3289.60.5.596 Page 4: Errors cannot average out and it depends on the range of PM2.5 values and a host of other factors. Section 2.1.1 to 2.1.3 belongs in a Table rather than a few sentences of text Page 5: Line 1 : Here not hare Page 7 says 'as summarized in 2.1.4' but 2.1.4 does not describe calibration in any detail. Erroneous data screening for negative values is easy but doing this manually for the entire low cost network is not possible. Page 6: Line 180-183 says the data are scaled for workdays and non work days. This type of scaling may work for this study but how about other regions? Page 8: The satellite data needs some description with a proper journal reference. Briefly, how was AOD retrieved, what are the uncertainties, how much cloud cover for the analysis, what quality flags were used, etc.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-67, 2020.