**Ceilometer Comparisons and what their data says about Backscatter and PBL in Baltimore, Maryland and Beltsville, Maryland**

Wambugu Kironji*
University of Maryland—Baltimore County, Catonsville, Maryland

Comparing backscatter data between two Lufft CHM 15k ceilometer lidar systems--specifically the lidars used at the University of Maryland--Baltimore County (UMBC) and at Howard University--Beltsville Campus (HUBV) can be done using the programming language Python's capabilities for graphing, numerical analysis and ability to read netCDF. The purpose of using python is to create easily interpret-able visualizations of the readings from and differences between the backscatter. It is important to check for differences to see if it is necessary to have both of these lidar systems in the same network. Viewing the differences might also give more insight on some of the physical phenomenon occurring at these two locations--as one is in an urban environment (UMBC) and the other in a more rural environment that is forested and has higher amounts of plant life (HUBV). For the most part these two locations should have mostly similar readings due to their closeness in proximity (physical distance) but that one of the locations will be slightly dominant. This could be due to mechanical or software issues: differences in backscatter calculation algorithms, laser quality. Another reason could be physical differences in these environments: differences in planetary boundary layer (PBL) height due to differences in heat absorption, location-specific producers of aerosols (a factor that is local to one area but not the other).

It is important to compare backscatter data in order to see differences in lidars in the same network (lidars that are close together in spatial proximity). One important impact is to see if it is necessary to have lidars at the distances these are placed at (comparing the systems is a good way to see if they are too close or too far). If the lidars are too close it can help to save money by reducing the number that is being used in a network. If they are too far that can account for a lack of data being received and thus more can be added to improve other experiments. Additionally comparing these lidars can help show movements in weather patterns based on the backscatter readings compared to the time of day and knowing the location of each lidar being used in the comparison.

One of two things are likely to be found as a result of this research: that the systems will in general have similar readings (because they are only roughly 20 miles apart) or the differences that do show up will be that HUBV has higher backscatter values (likely due to the abundance of trees and forest life that could be emitting particles into the air--as aerosols or as a result of a lower planetary boundary layer height (pbl-h) causing higher density of the particles).

In order to create a easily interpretable graphic and parse the data with high speed a program must be written to help with comparing the data. This can be done by writing a python program capable of reading backscatter data (in netCDF format) from the Lidar specified and graph this backscatter data (denoted by a color bar) as a function of corrected time (denoted by the x-axis) and corrected altitude (denoted by the y-axis). Corrected time means showing the time in 24 hour local time and by corrected altitude I mean showing the altitude from sea level). Additionally this program will take the data and calculate both the differences and ratio of the backscatter data between UMBC and HUBV for each timestamp measured and for every individual altitude's profile at that specific time. Using this calculated data the program will then graph either the difference or the ratio (the end user will specify which one is calculated) and graph it in a similar manner as the full day profiles for the individual locations.