Let me start by saying that this is very impressive research. The idea of converting lidar-measured characteristics, such as extinction or backscattering coefficients, to particle volume or mass density is not new, but the authors have taken the next important step. They used a machine learning approach to relate all parameters measured by HSRL to ground-level values of PM2.5 and PM10. The presented results confirm a strong correlation. The opportunity to invert the so-called 3β+2α dataset measured from space has been discussed previously; however, the expected uncertainty is currently too high given the present state of space lidar development. This approach, on the contrary, looks more promising.

The manuscript is well-written and, in principle, can be published as it is. I have only a few minor technical comments.

Response: We thank the reviewer for these comments.

Ln.99 "to derive" repeated

Response: (Line 99) This has been fixed.

Ln.120 "This previous study found that the combination of meteorological factors (e.g. air temperature, pressure, relative humidity, wind speed) had higher importance than layer AOT in retrieving PM2.5 and that air temperature was more important than total column AOT for retrieving PM2.5." The sentence is not very clear.

Response: This sentence has been revised (Lines 123-125) "This previous study found that the combination of meteorological factors (e.g. air temperature, pressure, relative humidity, wind speed) was more important than layer AOT in retrieving $PM_{2.5.}$"

Ln.199 "aka the "lidar ratio"". What is "aka"?

Response: Since the lidar ratio was described earlier (line 135), the "aka" has been removed, and so this sentence has been revised to read (Lines 201-205) "The HSRL technique measures both total attenuated backscatter and attenuated molecular backscatter which are used to directly derive both aerosol extinction and backscatter and consequently the lidar ratio."

Ln.200 “independently measure extinction and backscatter measurements”

Response: This sentence has been revised to read (Lines 204-205) “The ability of HSRL to independently measure extinction and backscatter is a huge advantage over standard backscatter lidars.”

Ln.509. “Corresponding surface values measured by EPA surface stations are also shown…” Not clear. Triangles? The information should be added to figure caption.

Response: The caption for Figure 8 has been revised to include “Corresponding surface values measured by EPA surface stations are also shown as triangles.”