

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 PM<sub>2.5</sub> and PM<sub>10</sub>. The presented results confirm a strong correlation. The opportunity to invert the so-called  $3\beta+2\alpha$  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.

Ln.99 “to derive” repeated

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 PM<sub>2.5</sub> and that air temperature was more important than total column AOT for retrieving PM<sub>2.5</sub>.” The sentence is not very clear.

Ln.199 “aka the “lidar ratio””. What is “aka”?

Ln.200 “independently measure extinction and backscatter measurements”

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