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Atmospheric Measurement Techniques Discussions

Interactive comment on "Cloud Aerosol Transport System (CATS) 1064 nm Calibration and Validation" *by* Rebecca M. Pauly et al.

Anonymous Referee #4

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The paper describes an algorithm for calibrating and validation of CATS 1064nm backscatter coefficient. Overall, the work presented in this paper is very important because lidar observation at 1064 nm is needed together with 532 nm for characterizing particle size and other layered aerosol optical properties. The validation shows that the method appears to work well and gives an uncertainty of 20% when comparing with other lidar observations from different platforms.

I would recommend the paper be accepted after minor to moderate revisions to improve clarity and discuss its broader significance for the research community.

1) equations. the symbols in each equation should be well explained and with unit given (or otherwise mention unitless). This will help readers understand the equation better. For example, in equation 1, what is the unit of Ns, r, D, and E. In equation 2,

what is the unit of R, beta or backscatter coefficient. The list goes on for all equations.

2) equation 2. R is defined as aerosol scattering ratio. Should it be lidar ratio due to aerosol scattering? to separate it from aerosol single scattering albeit? How is it defined? Where does the equation (2) come from? If M is used to denote molecular, should A be added as a subscript for R because R is Aerosol scattering ratio? Again, description of unit and physics here will help to improve the clarity here.

3) paragraph before 2.2, what is the unit of calibration coefficient? what exactly is calibrated? from digital count to total attenuated backscatter coefficient? Table 2, the integrated attenuated backscatter has unit of sr-1? bur for CALIOP level-2 data, the same "total attenuated backscatter" has an unit of km-1sr-1. Given the terminologies can be used differently by different groups, it is important to define them from basic variables (e.g., extinction cross section, scattering phase function, etc) to avoid ambiguity.

4) conclusions. If the calibration has 20% uncertainty, does that also mean that the total aerosol optical depth derived from CATS will have an uncertainty of 20% at least? It is important to discuss the link between the calibration uncertainty and the level-2 product uncertainty.

5) finally, either in the introduction or conclusion, it is worthy to mention that lidar has been used to constrain smoke injection height (such as Wang et al., 2013, Atmospheric Research , 122, 486-503) and understand relative distrubiton of smoke and dust particles in the vertical (Yang et al., 2013, JGR, 118, 12,139-12,157) in the chemistry transport models.

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