

***Interactive comment on “A new lidar inversion method using a surface reference target. Application to the backscattering coefficient and lidar ratio retrievals of a fog-oil plume at short-range” by Florian Gaudfrin et al.***

**Anonymous Referee #2**

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Review of “A new lidar inversion method using a surface reference target. Application to the backscattering coefficient and lidar ratio retrievals of a fog-oil plume at short range” by Gaudfrin et al.

This manuscript presents a lidar inversion technique that uses a surface reference target (SRT) with known reflectance properties to directly derive particulate backscatter coefficient and lidar ratios without any assumptions about the optical properties of the plume. The manuscript is clear and well written, however, there are a few specific comments that if addressed, would improve the manuscript. Therefore, I recommend

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publication following minor revision.

Major Comments: 1. The author goes through great detail deriving the new inversion technique and testing the sensitivity of the retrieval to both theoretical and real scenarios, however, the manuscript would greatly benefit from a more detailed discussion on the applications and limitations of this approach. For example, theoretical testing was performed for range  $r = 100$  m. Is this approach applicable at  $r=200$  m? What is your definition of “short range”? 2. The authors mention that this approach has the potential to be applied to airborne lidar observations, however, I do not see how this would be possible without a) flying low in the atmosphere and b) knowing the varying underlying surface BRDF.

Minor Comments: Line 11 – Consider omitting the 3 dots following “ocean” Line 54-55 – This limitation is only applicable for ground-based lidar systems. Equation 1 – Please provide a definition of  $F_{cor}$  in the equation description and also consider adding some text explaining the BRDF component ( $f$ ). Line 123 – Typo - “mentioning” Line 139-140 – “A priori. . .”. Consider adding justification/references for this sentence.

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-315, 2019.