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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The dual-field-of-view polarization lidar technique: A new concept in monitoring aerosol effects in liquid-water clouds – Theoretical framework" *by* Cristofer Jimenez et al.

Anonymous Referee #1

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This paper presents the theoretical framework for a lidar retrieval of liquid water cloud extinction coefficient and droplet effective radius. These two quantities can then be used to derive estimates of cloud liquid water content and droplet number concentration. This offers the intriguing possibility of studying aerosol-cloud interactions at high temporal resolution using co-located retrievals of both aerosol and cloud particle number concentrations from ground-based lidar. Assumptions of the method are clearly described. A second, companion, paper applies these retrievals to lidar observations. The paper is well organized and well written but, in a few places, the text is not clear. These areas should be clarified:

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Discussion paper

1) In section 3.3, it is not clear what the multiple scattering model is. Is line 30 on page 7 saying that the Zege small-angle solution is being used? A few more sentences of description of the model – its approach and limitations – would be helpful.

2) Page 9, line 26: Given that not all readers may be familiar with the concept of subadiabatic cloud, it would be good to explain the term, its relevance to the retrieval problem, and how the accuracy of the retrieval will be impacted when this assumption is violated.

3) On page 15, line 3 mentions an uncertainty of 50%. Is this the uncertainty of the retrieved extinction, CCN concentration, or both?

4) The Polly instrument is mentioned several times, but never described. It was not clear if the Polly lidar is an HSRL or a standard backscatter depolarization lidar. A short description of the Polly instrument intended for this retrieval would be helpful.

The attached file contains a few edits to correct places where the English sounds a little odd.

Please also note the supplement to this comment:
https://acp.copernicus.org/preprints/acp-2020-473/acp-2020-473-RC2-supplement.pdf

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