

# ***Interactive comment on “How much information do extinction and backscattering measurements contain about the chemical composition of atmospheric aerosol?” by Michael Kahnert and Emma Andersson***

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Below the reviewer comments are marked in blue, our response is marked in black.

## Summary

The inversion of aerosol optical properties into the aerosol chemical composition is a ill posed problem. The authors use information theory techniques to estimate the amount of information contained in LIDAR observations. They present different methods to make use of it as contains in a 3DVAR algorithm. This is meant to avoid assimilating noise inherent to the observations. To evaluate their constrain methods,

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Discussion paper



they create synthetic observations from CTM simulations and assimilate them back into the CTM.

### Recommendation

The paper is well written and should be published. The methodology proposed is novel and can be applied to different observations within the variational assimilation framework.

We thank the reviewer for this positive evaluation of our paper.

### Main comments

The authors choose to place all equations and their derivations into different appendixes. This hindered slightly the reading of sections 2.4, 3.1 and 3.2. However, the overall readability of the manuscript is improved by the focus on the description and evaluation of the method in the main text.

We agree. This point has been brought up by the other reviewers as well. We will follow the recommendations given by reviewer 2 and include the key equations with explanations in the main text, while providing the more detailed derivations in the appendix. This is a good compromise that will keep the paper accessible to non-theorists, while providing all the necessary details in the appendix for the interested readers.

### Minor comments

Figure 1 is hard to read, specially the colour bar. Otherwise, the previous Referees have a number of valid suggestions for improvement, and I have nothing to add.

We will remove this figure in the revised manuscript. Since the paper is not concerned with those aspects specific to regional modelling, this regional plot conveys no useful information in the context of this paper.

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Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-914, 2016.