Responses to Review #1

The authors would like to thank the reviewer for his valuable comments which helped improving the quality of the manuscript. Our point-by-point responses to the reviewer's comments appear in bold below.

Title. "…lidar-derived aerosol optical properties…". Actually only backscattering coefficient is presented.
It is a pity, that authors don't provide the lidar ratios. Dependence of lidar ratio on RH for different aerosols would be interesting.

Section 4.4 Do authors consider change of the Angstrom exponent with RH?

We thank the reviewer for these very relevant comments. Indeed, only the dependence of the backscattering coefficient on RH was considered in this study. The title is indeed not precise enough in this regard. It would be interesting to study the behaviour as a function of RH of all the optical parameters that can be calculated with lidar: Angström coefficient, backscattering coefficient (done here), LR and perhaps even depolarisation. We believe that these elements could constitute an entire article. The article under consideration here already presents many ideas, and a significant amount of work would be required to address the various points suggested, which are nevertheless very interesting. For this reason, we will not add these elements here.

Abstract. "…The results demonstrate the capability of Raman lidar to constrain aerosol hygroscopicity, offering valuable input to chemistry-transport models and helping to reduce uncertainties in climate projections related to aerosol-cloud interactions." This is very strong statement. I agree that analysis of backscattering at variable RH is an interesting approach to get information about aerosol mixture; still results presented are insufficient to access such goal.

Fig.8. From this Fig. I conclude that it is not so simple to relate CAMS data with measured γ. For example Cases 3 and 4 have similar composition, but very different γ. As authors mention, aging can be also important. This is why I wrote above, that statement in Abstract is too strong.

We thank the reviewer for this comment. Indeed, the sentence is too assertive. It has therefore been modified as follows in order to nuance the statement: "The results illustrate the potential of Raman lidar observations to provide valuable constraints on aerosol hygroscopicity, offering complementary information for chemistry-transport models and contributing to reducing uncertainties in aerosol-cloud interaction estimates."

Ln.217. Formulas for backscattering calculation were first published by Ansmann et al. 1992. Corresponding reference is needed.

The reference "Ansmann et al. 1992" has been added. We thank the reviewer.

Eq.16. This formula was used by Hanel for a single particle. When it is applied to aerosol with PSD, some assumptions are made. Should be discussed. The same is for Eq.18.

We thank the reviewer for this insightful comment. We agree that the Hänel law was originally derived for a single particle and that its application to an aerosol mixing involves implicit assumptions. In our study, we assume that the aerosol population is internally and homogeneously mixed, which allows the use of an effective hygroscopicity parameter to describe the ensemble optical response. This assumption is consistent with previous lidar-based studies applying the Hänel formulation to derive hygroscopic growth although these works did not explicitly discuss the mixing-state limitation. We have clarified this point in the revised manuscript (Section 3.5): "It is worth noting that the Hänel parameterization was originally developed for a single particle. Its application to aerosol ensembles with a particle size distribution therefore involves the implicit assumption that particles are internally and homogeneously mixed and exhibit a uniform hygroscopic response."

Ln.435. Dependence of lidar ratio on RH was analyzed in recent paper

We thank the reviewer for this comment, which has enabled us to deepen our knowledges on this point. After checking in the literature, we have added the following reference: "Zhao et al., 2017".