the relative differences. For the scope it can be used a synthetic cloud signal where multiple scattering effects are not present.

Comments by Reviewer #4

> This work deals with the use of different lidar techniques and configurations for studying radiative forcing of aerosol and clouds. In particular, authors analyze the use of backscatter and Raman lidar signals.Backscattering lidar needs the assumption of a constant extinction-to backscatter lidar ratio for the entire profile while combination of backscattering and Raman signals allow independent retrievals of aerosol and clouds extinction and backscattering profiles. Authors show that different lidar techniques and different data processing produce different results, and in this research advance in showing quantitatively how much are those discrepancies. The novelty of this work is then in quantifying the impact of each technique on radiative forcing calculations at TOA and SFC. Due to the large number of backscattering lidar, e.g. MPLNET network uses such systems and very few EARLINET instruments do have Raman lidar during daytime, the results of this analysis are of great interest for the scientific community and valuable for its publication in Atmospheric Measurement Techniques. Nevertheless, I agree with other reviewers that major revisions are needed as the publication suffers from hasty writing and more cases should be considered. Other concerns should be addressed before publication: 1.- I think that a single case thin cirrus cloud is not exhaustive for the analysis. I would rather extend the research at least for three cases: thin cirrus clouds (as already studied) with COD<0.03, Opaque cirrus clouds,with a COD in between 0.03 and 0.3 and thick cirrus cloud case, with a COD>0.3

Thanks for the meaningful comment. We added a thicker cirrus cloud in the analysis and a biomass burning aerosol event.

> It comes from the analyis that there is a different behavior between cirrus cloud and aerosols (cf. fig. 3 and fig. 4) It could be very intresting to add in the analysis cases where there is a simultaneous presence of a cirrus cloud on top of an aerosol layer, like dust or biomass-burning. In those cases it would be interesting to verify if technique or data processing are critical

We agree with the reviewer that a simultaneous presence of clouds and aerosol layers could be very interesting, but in our analysis is limited to single layer analysis to avoid any error compensation due to multiple mode.

> 3.- The description of lidar signals and the different ways of resolving the equations should be in a methodology section.

We added it accordingly

> 4.- Page 2, line 22: Traditional lidar Raman are expensive but the development of the rotational Raman techniques make it cheaper and improve signal-to-noise. Please include it in your discussion.

Even if we didn't go further in the analysis, we added a paragraph describing rotational Raman lidar adding also a reference: Veselovskii, I., Whiteman, D.N., Korenskiy, M., Suvorina, A., Pérez-Ramírez, D., (2015) Use of rotational Raman measurements in multiwavelength aerosol lidar for evaluation of particle backscattering and extinction. Atmospheric Measurement Techniques 8, 4111-4122.

> 5.- Page 2, line 23: The High Spectral Resolution Lidar and Dial techniques should be commented and cited.

Added accordingly to the text.

> 6.- The NASA Aerosol-Clouds-Ecosystems mission does plan to implement a multiwavelength HSRL system in the space allowing retrievals of aerosol microphysical parameters. Please include it in your discussion.

A short paragraph was added describing ACE and referenced (Whiteman, D.N., Pérez-Ramírez, D., Veselovskii, I., Colarco, P., Buchard, V. (2017) Simulations

of spaceborne multiwavelength lidar measurements and retrievals of aerosol microphysics. Journal of Quantitative Spectroscopy and Radiative Transfer, submitted.)

> 7.- Radiative transfer codes do assume certain aerosol properties for each specie. The Fu-Liou-Gu model assumes OPAC aerosol module, which may differ from real measurements. Retrievals of aerosol microphysical properties can improve retrievals of radiative forcing if aerosol effective radius and single scattering albedo are introduced. Please discuss the use of an aerosol model

We agree with the referee. However, retrievals of aerosol microphysical properties require multi-wavelength lidar (e.g. Veselovskii et al., 2002, 2015), which are very sophisticated instrument sensitive to systematic and random errors in the optical data (Perez-Ramirez et al., 2013). Because we focus on lidar systems that can operate continuously in different networks, and our radiative forcing calculations do not vary much when changing effective radius and single scattering albedo.

> 8.- I agree with the previous referees that the current title does not macth approately with the goal of the manuscript. Please consider to change it.

Changed accordingly.