Response to Reviewer # 2

We thank the reviewer for his review and valuable comments. The manuscript has been modified according to the suggestions proposed by the reviewer. The remainder is devoted to the specific response item-by-item of the reviewer's comments.

RC=Reviewer Comments
AR=Author response

The detailed analyses are clear and important in this manuscript. The authors have taken novel piece of work, which is of great interest to focus on peculiarities of MS effect in regions of the cloud-free molecular atmosphere and to evaluate performance of an approximate model with the focus on cloud-free regions. For this reason, I felt and consider the subject of this paper is interesting. The results are relevant, and appropriate for the journal. The whole paper is straight forward, the conclusion is convincing but not well written. I believe the manuscript can be made publishable, but will require significant revisions.

Is there any limitation for the model used in this manuscript? In the instrumentation/method part, the uncertainties and precision of datasets obtained from LIDAR (ground mounted-space-borne) should be elaborately discussed. It is suggested to include the limitations, accuracy levels with some of its values (scattering characteristics of LIDAR signals, which leads to resolve the uncertainties) in tabular form.
We added to the manuscript Appendix B, where we provide relative errors of Monte Carlo modeling in tabular form and discuss their properties.

As I found some mismatch, so suitable tools/formats should be followed thoroughly e.g., math tool should be used to write parameters of equations, non-italic. In addition, different formats of braces and square brackets were found; it should be presented in a consistent way. Spelling errors (may be typo) should be omitted e.g. Mont-Carlo simulations or Monte-Carlo simulations (see section 2.2). Numerous different corrections and suggestion are made in PDF form so have a look on them and carry on accordingly.
In the revised manuscript, all equations and parameters of equations are written using "MS Word 2013 Equation Editor"; the formats of braces and square brackets were automatically assigned by that tool.
The manuscript was proofread, spelling errors and typos were corrected.
Unfortunately, we have not succeeded to find the suggestion that were made in PDF form. Nevertheless, we are grateful to the reviewer for the care.

It is just on a lighter note: are the authors in position to present extinction coefficient vertical profiles of LIDAR, if any, I urge to have certain studies that definitely make the studies worth more. The authors should use and cite updated research work, not before 2010. It should include more details on the specific algorithms or techniques used to differentiate between single and multiple-scattering events.
We added to the manuscript Figure 6 that shows vertical profiles of signals in the case of the space-borne lidar. If the reviewer suggests to show the extinction coefficient vertical profiles retrieved from lidar data, we would like to underline that retrievals, i.e. solutions to an inverse problem, have to be a subject of a separate work because need extensive explanations of used retrieval technics.
We added the reference on the work by Wang et al. (2021) in order to underline that we obtained very good agreement with Fig. 4 of that work.
In our opinion, "specific algorithms or techniques used to differentiate between single and multiple-scattering events" are a subject for a review like (Bissonnette, 2005). The review has to well elaborated, it cannot be within a work devoted a specific aspect of multiple scattering.

Is there any scope to present the statistics of interesting results in tabular form? If so, i urge to include in the revised version. I suggest the authors to devote adequate time to proof read the manuscript correcting typos and grammar. Also the level of language used could be improved to depict some scholarly writing.

Our results are available in tabular form from the corresponding author upon request. The most important numerical data are given in the tables of the manuscript.

The manuscript was proofread, grammar errors and typos were corrected.