Comments on Review of Anonymous Referee #2:

Dear Referee #2,

Many thanks for your mindful review and pointing out the weaknesses of our manuscript.

(i):

"This manuscript aims at characterizing measurement uncertainty for an airborne Rayleigh lidar (ALIMA), looking upward towards the stratosphere and mesosphere. One of the science objectives is to observe density and/or temperature disturbances associated with the propagation and dissipation of gravity wave in the middle atmosphere. The authors use lidar signal simulation to estimate certain components of this uncertainty. Most of the manuscript repeats what has been already published, and so my main recommendation is to re-submit after major revisions, including a re-organization of the manuscript to re-balance the weight given to each section, based on what has been already published and what has not. I recommend to refer to Leblanc et al. (2016) (citation below) who provide, for example, quantitative estimates of the uncertainty associated with molecular extinction and ozone absorption (this part should be straightforward and not exceed a paragraph or two in the revised manuscript)."

Yes, we agree with your recommendation.We will restructure the manuscript and highlight the peculiarities which arise due to the airborne operation of our lidar.

(ii):

"Unfortunately, the manuscript suffers from a major mistake in the quantification of the temperature correction associated with ozone absorption. If I am not mistaken, their ozone optical depth and ozone absorption correction were computed using O3 mixing ratio rather than O3 number density, which explains why they found a maximum impact at 35 km rather than 22-24 km. Fig 7 (left) of Leblanc et al. (2016) and Figs. 4 and 5 of Sica et al. (2001) both show a maximum impact in the lower stratosphere associated with O3 ND peaking at 23-26 km."

You are absolutely right. In our code we do calculate the O3 number density but unfortunately assign the wrong variable in the calculation of the optical depth afterwards. We already corrected the mistake and will update our analysis. Thank you for pointing that out!

(iii):

"I also strongly recommend that the authors make a clear distinction between what is uncertainty, error, and bias, which eventually, will greatly help them re-shape the manuscript towards a well-defined objective. I believe the current objective of the authors is to assess the quality of the ALIMA measurements, and eventually provide a full uncertainty budget. Lidar simulation is not needed for most of this estimation work. Some of the figures shown in past publications can serve as guidance to present their results in the revised manuscript. Here are suggested definitions that might help re-focusing the next manuscript: Bias = a value, negative or positive, describing an observed, systematic (i.e., repeatable) difference between 2 observations. Error = A value, negative or positive, describing the actual (unknown) difference between the true value and the measured value. Uncertainty = A value, always positive, describing statistically the best estimate (or magnitude) of the (unknown) error arising from a specific physical effect or retrieval approach that drives the final, reported value away from its true value. For example, "temperature uncertainty due to ozone absorption" is an estimate of the error due to the fact that the ozone absorption is not perfectly accounted for in the temperature measurement/retrieval. Unlike error and bias, uncertainty is a controlled quantity."

Thank you for your definitions of error, bias and uncertainty. We agree that we have not clearly defined these terms and may have used them inconsistently within our manuscript. Following your definition, we want to characterize the error in temperature profiles retrieved from ALIMA measurements. This is also the reason why lidar simulations are needed. We have a known atmospheric state (ERA5 data) and can analyze how the retrieved temperature deviates from the known state and what error sources contribute to these deviations. We will revise the manuscript according to your suggestions.