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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Using a global network of temperature lidars to identify temperature biases in the upper stratosphere in ECMWF reanalyses" *by* Graeme Marlton et al.

Anonymous Referee #1

Received and published: 21 November 2020

General Comments

Archived stratospheric temperature measurement data were compared with the ECMWF reanalysis data (ERA). The more recent ERA-5 version is shown to have better agreement with the measurements than the ERA-Interim version. This is useful for the ongoing development of the ERA reanalysis, but there are no specific scientific questions addressed in the manuscript.

I understand that the perspective of the paper is centred on comparing ERA with independent measurements. There is also a difference between the lidar and MLS measurements that is implicit in the results, as the lidar and MLS measurements have

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different offsets from ERA. Why not add a figure with a comparison between the lidar and the corresponding MLS measurements at each location, and provide some brief consideration of any significant differences? As the work has already been done to match the measurements in time and location, I assume the comparison of lidar and MLS measurements would not require a lot of additional work. It would be a unique contribution to have a comparison between lidar and MLS within the context of ERA. The paper would be more significant and interesting, at least to the lidar and MLS communities.

Specific Comments

A) In describing the various sources of uncertainty in the measurements, there should be stronger distinction between random error and bias. The difference is important when assessing the averaged differences between the measurements and the model. For example, the uncertainty associated with the correction for non-linear photon counting detection in lidar measurements is a bias, and this is quite different from the random uncertainty associated with the statistics of photon counting detection. The random uncertainty is reduced by averaging, but the bias remains.

B) The description of "background noise" is not very well defined since "noise" is usually associated with random uncertainty. For example, the term "background noise extraction" at page 3, line 25. The constant background signal due to ambient light was subtracted. The "noise" in the background due to the photon counting statistics (Poisson distribution with variance equal to number of counts) cannot be extracted. It remained after the constant background was subtracted. Another example at page 4, line 10: "background noise correction uncertainty". Background is subtracted, but random noise is not corrected.

C) In this reviewer's opinion, phrases with the words "could be", "likely", "do hint at", "may be" etc. are not appropriate for a scientific publication.

D) The conclusion is not substantial. E.g. page 10, line 4: " . . . should be accounted

for.” How should it be accounted for and what are the scientific implications?

Corrections in addition to the recent edit of the manuscript

Page 3, line 21: . . . laser light scattering FROM molecules and particles.

Page 5, line 4: One such “travelling standard”

Figure 4 caption: ERA-5 rather than ERA-interim.

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