Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2020-331-AC2, 2020

Atmospheric Measurement Techniques Discussions

Interactive comment on "Accounting for the photochemical variation of stratospheric NO_2 in the SAGE III/ISS solar occultation retrieval" *by* Kimberlee Dubé et al.

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Received and published: 26 November 2020

Line 8: What is "undoing" a retrieval? Reversing the algorithm to back out optical depth?

Yes, by undoing a retrieval we mean converting the number densities back to optical depths. This has been clarified in the text.

Line 102 and Fig. 2 caption: Which dashed line? There are 2. Maybe draw the SZA on the figure.

Both dashed lines. More detail has been added to the Figure and the text so that this

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is better explained.

Line 146: The text states: “The values in the figure are not multiplied by the path lengths”. Would we expect them to be?

The matrix used in the retrieval generally consists only of path length elements. For the diurnally varying retrieval we are multiplying each path length by a corresponding scale factor. The figure only shows these scale factor values, as opposed to the final matrix (including path lengths) that is used to do the retrieval. So we thought it useful to clarify that this Figure only considers the scale factors that go into the final path length matrix.

Line 170: Please elaborate on how the bias is not consistent with the differences.

Figure 1 shows that the shape of the diurnal cycle across the terminator is different at sunrise and sunset, which results in different photochemical scale factors. A comment has been added to the manuscript.

Fig. 6: A panel showing percent difference would be helpful as well.

A panel showing the percent difference has been added to the figure.

Fig. 7: Is there bad data in the middle panel of the bottom row?

Yes, there were a few bad data points. The figure has been changed to only include NO2 values within five standard deviations of the mean.

Fig. 9a: It appears that while the negative bias is reduced in the SAGEdv case, the positive biases at lower altitudes increase. This merits some discussion.

This is discussed in lines 204-207 (210-213 in updated manuscript). The positive biases increase because the diurnal effect is very large near the tropical tropopause and the absolute NO2 values are low, resulting in a decrease in the diurnally varying SAGE III/ISS NO2 that is greater than the initial difference between SAGE III/ISS and OSIRIS NO2.

Fig. 9: Are the right (b) panels SAGEdv – SAGE, or (OSIRIS-SAGEdv) – (OSIRIS-SAGE)? In other words, why is "SAGEdv – SAGE" positive when it is stated that "neglect of diurnal variations in the SAGE v5.1 retrieval always biases the results high"? Figure 9 might be more intuitive if it were presented as SAGE – OSIRIS rather than OSIRIS – SAGE.

The right panels are indeed the difference (OSIRIS – SAGEdv) – (OSIRIS – SAGE). This has been clarified in the figure. The figure has also been changed to show the difference SAGE – OSIRIS instead of OSIRIS – SAGE.

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