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GOMOS Data Characterization and Error Estimation

by Tamminen et al.

This manuscript discusses the characterization and quality of the GOMOS nighttime occultation retrievals. The data products discussed include O_3, NO_2, NO_3 and aerosol extinction, and correspond to the IPF version 6 algorithm.

I think the paper is generally well written and provides a thorough discussion of the documented errors in the GOMOS retrievals. It is therefore very useful to GOMOS data users and the general community and should be published. The following observations and comments are provided for the authors to consider.

General Comments:

I know the author is not a native English speaker. Overall the English usage in the paper is acceptable, but there are many instances where it reads a little awkwardly. This is not a big criticism, but it wouldn't hurt to have co-authors re-read the manuscript to correct occasional grammar and syntax.

Specific Comments & Questions:

Section 1

I would not characterize the SEE instrument on TIMED as a solar occultation instrument. Certainly it is not dedicated to occultation measurements, but rather makes occasional very limited transmission measurements (at fixed altitude).

Section 3.1.1

In the first sentence of this section the claim is made that the gas and aerosol absorption cross sections are not independent. This is incorrect and misleading statement, and not what I believe the authors intended to say. Of course these cross sections are completely independent of one another in that they are fundamental properties of the molecules being measured. The retrievals of the different gases and aerosols are correlated simply because there is significant spectral and vertical overlap in the absorption/extinction ranges of these different constituents, so that they must necessarily be retrieved simultaneously. It's simply a question of wording, but I suggest the sentence be changed.

Figure 7 – Even though the Kyrola et al 2010 paper is referenced for specific details of the GOMOS retrieval algorithm, for completeness the discussion of this figure should contain at least a brief description of the meaning of the aerosol coefficients $a_{i,.}$

Section 4

Paragraph 1, first sentence – This statement seems vague - what exactly is meant by a "wide spectral window"? I can think of two possibilities, either 1) spectral pixels are binned to increase signal (with a subsequent loss of spectral resolution), or 2) you simply mean that a wide range of spectral pixels are used in the retrieval. Please be more specific.

Section 4.2

Figure 9 – The figure caption should state what wavelength the aerosol extinction is being shown at (right-most panels). Presumably the relative change in aerosol caused by changing the parameterization will be different at different wavelengths (e.g., a simple linear dependence will produce higher aerosols at the middle wavelengths, etc). I find it interesting that, relative to the operational quadratic parameterization, all other models result in decreased ozone below 20 km (bottom left panel). This must mean that all other parameterizations produce higher aerosol extinction at ~ 600 nm, where the lower stratospheric ozone retrieval comes from. Is this an expected result?

Section 5

Looking at the results plotted in Figure 10 I wonder why you would not chose to fix the target ozone vertical resolution to be equal to the coarsest resolution obtained from the vertical occultation (red curve in left panel). This would mean that the constant resolution is at least equal to what the instrument can do with worst-case sampling. The implemented resolution (3 km for $z>40$ km and 2 km for $z<30$ km) is coarser than you can achieve under any circumstances, so represents a loss of resolution for all occultations. This is just an observation.

Figure 11 – This figure could use more description. What are the colors for – I assume they simply correspond to different altitudes, but this is not stated. Also, the caption refers to left and right panels, but my version of the figure has top and bottom. According to the caption a single panel (bottom?) corresponds to both NO_2 and NO_3, but I don't know if this is realistic. Besides showing the vertical resolution (which is fixed to be the same for these two constituents) the averaging kernel also quantifies information content, as given by the peak magnitude at a given altitude. These results would imply that NO_2 and NO_3 are retrieved over exactly the same altitude range, with the same precision. Also, the averaging kernels at 100 km are identical to those at 40 km, but surely these gases are not measured at 100 km. If not then perhaps these curves are misleading.

Section 6.1

In the quoted aerosol error estimates it would be useful to give what wavelength this corresponds to (this same point was raised previously). Presumably GOMOS retrieves aerosol extinction at multiple wavelengths in the UV/visible region from the three

effective aerosol parameters. The aerosol retrieval precision generally varies with wavelength so if you're only going to show a single representative aerosol error you should quote the wavelength (unless the errors really are independent of wavelength for some reason, which would deserve some explanation too).

Minor comments and corrections:

Abstract, line 9 – The phrase "… resulting also varying accuracy to the retrieved profiles." should be reworded – perhaps "…which also results in varying accuracy in the retrieved profiles".

Page 6757, line 1 – 'wavelength" is mis-spelled.

Page 6759, line 24 – 'wavelength" is mis-spelled.

Page 6769, line 2 – The phrase "..we used took than 1000…" needs to be rewritten.