

Interactive
Comment

***Interactive comment on* “Limb scatter ozone retrieval from 10 to 60 km using a Multiplicative Algebraic Reconstruction Technique” by D. A. Degenstein et al.**

D. A. Degenstein et al.

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We would like to thank the reviewer for the thoughtful and carefully laid out comments. We believe the incorporation of these suggestions has improved our work.

Response to numbered Comments

1) For a complete and thorough analysis the gradient in the ozone concentration due to the variation of solar zenith angle at high altitudes should be accounted for but it only impacts a small fraction of the OSIRIS retrievals, those near the terminator. This two-dimensional consideration will be addressed in future versions of the OSIRIS ozone data product.

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- 2) A statement has been added to indicate that merging of multi spectral information to retrieve the atmospheric state parameter at a single altitude is not unique to the SaskMART algorithm.
- 3) See response to comment number five from reviewer number one.
- 4) Work done to date has indicated that bending of the light rays due to refraction has a minor impact on the retrieved ozone values. However, the current version of the retrieval algorithm does not accommodate this correction but it will be addressed in future versions.
- 5) the typo has been fixed
- 6) done
- 7) The text has been changed to clarify the matter.
- 8) The impact of the first guess has been discussed in the work by Roth et al., 2007.
- 9) This is the English/Canadian spelling.
- 10) changed
- 11) We also think this aspect of the retrieval is delightful. However, we do not find it puzzling. Unlike additive techniques the MART is not using the partial derivatives to add information to an existing estimate to gain an improved estimate. The Wijk weighting functions are related to the sensitivity of the measurement vector element indexed by j and k to a change in state parameter at the altitude indexed by i but they do not have to be identical. That is, if a vector element (j, k) is not sensitive to a change in state parameter at altitude indexed by i it shouldn't get any direct say in the retrieved value at altitude indexed by i and if a given measured vector element (j, k) is the most sensitive element to a change in the state parameter at altitude indexed by i then its ratio with the modelled vector element (j, k) should be given considerable say in the solution at i . The delightful thing is that considerable say does not require a precise

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numerical value.

12) I believe this comment is a misinterpretation of the statement. The difference in optical depth between the reference altitude and the minimum altitude is approximately 1. For the vectors generated in this retrieval algorithm the reference altitudes are optically thin, having optical depth much less than 1.

13) Minor changes especially in the Table caption have been made to make the normalization altitude of the 351 nm reference far more clear.

14) fixed

15) We agree

16) This publication was meant to demonstrate that a choice of weights based only on approximate knowledge of how sensitive a measurement vector element is to a change in the state parameter at a given altitude is sufficient. There is no optimal set of weights and that any reasonable choice of weights will produce the same retrieved results. The follow on publication will provide much more detail with respect to these statements but we feel right now that this is beyond the scope of this paper.

17) A reference to Roth et al., 2007 has been added. The impact of these extrapolations was discussed in this work.

18) The text has been modified to more clearly indicate that the aerosol and NO₂ profiles that are used in the ozone retrieval are retrieved from the same OSIRIS scan. The retrievals of the interfering species are done first using a climatological ozone profile as it has an insignificant impact on the retrieved aerosol and NO₂ profiles.

19) We agree with the reviewer that long wavelength measurements may yield different cloud top altitudes that short wavelength information. However, the retrieval algorithm is most sensitive to the clouds that impact on the Chappuis band radiance measurements. Therefore, the 800 nm information that we use to determine our cloud tops provides sufficiently accurate altitudes for the purposes of the ozone retrieval.

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20) We agree and we have removed the statement about the differences being caused by the larger variability at low altitudes. We have also added a paragraph at the end of the results section that discusses the apparent differences at the upper and lower altitudes.

21) We agree.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 11853, 2008.

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