

Interactive comment on “Retrieving the vertical distribution of stratospheric OCIO from Odin/OSIRIS limb-scattered sunlight measurements” by P. Krecl et al.

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Reply to Interactive Comment: Anonymous Referee #2

MS-Nr: acpd-2005-0072 Retrieving the vertical distribution of stratospheric OCIO from Odin/OSIRIS limb-scattered sunlight measurements

We thank anonymous referee #2 for the constructive and helpful criticism. A detailed response to the comments of reviewer #2 follows below.

Specific comments:

1. Section 3. A new paragraph was added at the beginning of this section referring to

the previous works of McDade et al. (2002) and Strong et al. (2002).

2. Section 3.1, 3.3, 3.4. We agree with the referee that these sections contained information already discussed in Haley et al. (2004). Thus, the entire Section 3.1 has been rewritten keeping the descriptions of the residual analysis and chi-squared test that are not present in Haley et al. (2004). In Sections 3.3 and 3.4, the duplicated material has been removed and appropriate references to Haley et al. (2004) have been added.

3. Figure 1 has been removed from the manuscript when Section 3 was modified, and the paper by Haley et al. (2004) was referenced for a detailed description of the retrieval algorithm.

4. Equation 6. Estimation of the errors in the reference and limb spectra. A comment on how to estimate the measurement noise of the OSIRIS instrument has been included in the text. A new figure 1 has been added showing the limb radiance signal-to-noise ratio for a representative OS scan.

5. Page 2998, lines 20-28. This paragraph was rewritten and the negative OCIO ECDs were classified as undetectable as suggested by both anonymous referees.

6. Page 3001, lines 9-15. A new table (Table 2) has been included in Section 3.3.2 displaying the specifications of the absorption cross sections used in this study. Explanations on the selection of the temperature interpolation can be found on the papers cited in this table.

7. Page 3001, lines 18-21. We agree with the referee and the last part of the text has been rewritten, excluding the comment about the residual RMS and chi-square statistics for the solar Io effect.

8. Section 3.3.3. A sentence was added at the end of the section to explicitly state that the Ring effect correction is not included when retrieving OCIO ECD in the 403-427 nm window. We did not try to fit the Ring effect as a pseudo-absorber in the DOAS LSQ

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fit. However, a Ring pseudo-cross section would probably be highly correlated with the tilt pseudoabsorber.

9. Page 3003, line 4. In order not to overlap with the Haley et al. (2004) paper, the definition of the OS polarization efficiency parameter was omitted and the reader is referred to Haley et al. (2004) and McLinden et al. (2002).

10. Page 3003, lines 7-9. It is difficult to assess which spectral corrections are important or not. The Io correction does have a larger impact on the OCIO retrievals in the 403-427 nm than polarization does. Polarization is weak and fairly broad, and the sensitivity study presented in the manuscript confirms that either it does not make much difference when it is included in the LSQ fit (i.e., OCIO ECD, relative error of the OCIO ECD, and RMS) or increases the chi-squared values by 1% in 70% of the cases.

11. Page 3004, line 2. Calculation of the tilt pseudoabsorber: Varying the tilt with tangent height should be more correct since the trending does change with tangent height, and thus so does the spectral structure of the tilt. The mean reference tangent height is 48.2 km, taking into account the actual OS measurement tangent heights in the 40-70 km range and calculating the appropriate representative tangent height for the set of 122 scans. The error produced by considering the reference tangent height at 50 km versus 48.2 km should not be significant.

12. Page 3004, lines 8-9. We agree with the referee and the suggested changes were introduced in the text.

13. Page 3007, lines 4-5. A new sentence was added in Section 3.4 stating that the following discussion assumes the inversion of the concentrations for clarity reasons. Otherwise the equations will become unnecessarily complicated. The linear weighting functions are shown in the manuscript.

14. Page 3007, last paragraph. The G-N method is used first because it converges faster. When an occasional fail in convergence occurs, the L-M scheme is then applied.

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This explanation has been introduced in the text.

15. Page 3008, line 12. This detailed explanation has been simplified stating that profiles with are discarded.

16. Page 3013, lines 4-6. We agree with the referee on this comment and the sentence has been rewritten in Section 3.4.4 (now named “Inversion characterization”). Only the smoothing and measurement error components are included in this analysis and no attempt was made to estimate the contribution of the other two components.

17. Section 4. The old sections 4 and 5 were merged in the new Section 4, named “Results and conclusions”. Thus, the comment on renaming Section 4 does not apply now. The content of Section 4 has been revised and rewritten as suggested by both referees.

18. Figure 11b (text on page 3016, line 6). The isotherm of 196 K has been added to Fig. 9b (old Fig. 11b) as suggested by the referee.

19. Section 5, paragraph 1 and Figure 12. As suggested by the referee, the horizontal extent of the scans A and B has been included in the text.

Technical corrections

- The order of Sections 3.3.4 and 3.3.5. was switched as suggested by the referee.
- Page 3002, line 26. The sentence was removed when this section was rewritten. Thus, the comment does not apply now.
- Page 3003, line 16. The “Tilt effect” section was cut down and this sentence does not exist any more.
- Page 3005, line 11. Section 3.3.7 has been removed and, thus, this sentence does not exist in the new version of the manuscript.
- Page 3008, lines 15-16. The correction has been made as suggested by the referee.

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- Page 3009, lines 2 and 8. The comment does not apply any more since this section has been rewritten, as suggested by referee #1, and these lines omitted.
- Page 3015, line 21. We agree with the referee and the word “diurnal” has been replaced by “twilight” in the text.
- Page 3017, line 14. “i.e.” has been deleted in this sentence, thus the comment does not apply now.
- Page 3019, line 3. It has been corrected as indicated by the referee.

References

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