

## ***Interactive comment on “A new Dobson Umkehr ozone profile retrieval method optimising information content and resolution” by K. Stone et al.***

**T. McElroy (Referee)**

tmcelroy@yorku.ca

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General Comment

This is an excellent paper of general interest to the ozone community. It is generally well written and explicit. It is strongly recommended that it be published.

Specific Comments

The authors state that only a single-scattering model will be used and acknowledge

C2455

that shortcoming, but go on to show what they consider to be very good agreement with ozonesondes etc. This is a little inconsistent, and could perhaps use a little more development. One great advantage of modeling every data point has not been included in the paper. It is the possibility of using the agreement between measurement and model observations to flag unreliable data and improve the final profile. Finally, the authors are making monthly averages of retrieved profiles. This will not remove the content of a priori in the final profile. It would be better to retrieve one profile that best fits all the data so that more observational information will be transferred to the mean profile. The use of a column ozone constraint could, in some applications, improve the performance in the lower layers.

Technical Comments

The first complete paragraph on a column is Para. 1. A part paragraph at the start of a column is Para. 0.

Abstract: Line2 ‘coarse-resolution’ Line36 ‘under represented’

Introduction. 1. Line 41 ...resolution retrievals ... 2. Line 55 ... were done using Northern Hemisphere ... 3. Line 56 ... about the Southern Hemisphere ozone ... 4. Line 58 Delete ‘The’ 5. Line 65 ... that measurements at Darwin ... 6. Line 68 ... Australian-run sites ... 7. Line 76 The retrieved column is constrained by the a priori information, not the other way around. 8. Line 78 ... coincident measurements of total column ozone. 9. Line 79 ... time-dependent ... 10. Line 80 ... long-term trends ... 11. Line 82 ... variability introduced by the use of the a priori ... 12. Line 95 Data are not used ... 13. Line 96 ... and information can be lost if the data are not well represented ... 14. Line 108 Delete ‘that’. 15. Line 112 Actually, the model can be run at a number of discrete SZAs and interpolated for use. Data cannot be reliably interpolated but model output can. This is also true for the Jacobian used in the retrieval. It is just necessary to ensure that the interpolation routine is operating on model points close enough together to be accurate. 16. Line116 Due to this, important

C2456

components. 17. Line 122 ... and it is planned that they be implemented ... 18. Line 127 Instrumental stray light ... 19. Lines 151-154 The meaning here is not clear. 20. Line 154 It is the log intensity ratio if it is an N-value. 21. Line 155 Suggest '...due to changes in the mean scattering height...' 22. Line 175 'constitutes'?? Suggest "...this leads to..." 23. Line 177 and 181 'turnaround' 24. Line 191 It doesn't matter which SZA is used for normalization as long as the model is normalized at the same angle. Using the lowest angle makes all subsequent values have the same sign, however. 25. Line 195 The amount of information depends on the range of zenith angles and the largest zenith angle included. 26. Line 206 Stray light effects increase with the increasing ratio of long-wavelength intensity to short-wave intensity. So as the curve reaches the first Umkehr, the stray-light-induced error will be at a maximum. The error will decrease again after that. It will then increase again after the second Umkehr.

27. Line 209 '... Umkehr-derived, long-term...' 28. Line 211, 212 Suggest 'measurement uncertainty'. 29. Line 227 Suggest 'measurement uncertainty'. 30. Line 230 Delete 'database' at the end of the line. 31. Line 232 '...based on that...' 32. Line 268 Perhaps: '...refracted light paths ...'? 33. Line 277 '...set up...' 34. Line 287 Suggest either  $\exp[-\tau(z)]$  or  $e^{-\tau(z)}$  35. Line 434 Suggest 'turnaround'. 36. Line 538 'Umkehr retrivals, the ozonesonde data is convolved by the averaged retrieved C-pair AKs.' This is not exactly correct. Perhaps the description is not complete. The AK should be used to smooth the difference between the ozonesonde and the a priori profile. Then the smoothed difference would be added to the a priori. This mirrors the way the retrieval works. There is a typo as well. 37. Line 544 '...ozonesonde data are also...' 38. Line 550 '...ozonesonde data were not...' 39. Line 569 Typo in Umkehr. 'Layers 5 and 5'?? 40. Line 573 'highlights'. 41. Line 577 'Div.,' (Add period). 42. Line 579 '...slightly lower ozone...' 43. Line 580 '...unaccounted-for...' 44. Line 582 It isn't clear how good ozonesondes are above the ozone maximum if time lags are not corrected for. 45. Line 592 Introducing a column constraint could possibly improve the lower layer performance. 46. Line 633 '...show poorer agreement...' 47. Line 670 'Applied Optics...' 48. Line 685 '...Journal of Atmospheric and Terrestrial Physics...' 49.

C2457

Line 693 Space before comma 'Ozone in the Atmosphere , Proceedings of the Royal' 50. Line 707 And extra initial 'C' or misplaced comma. 'De Maziere, M., Goutail, F., Hermans, C., C, L. J., Pfeilsticker,' 51. Line 715 'Journal of Atmospheric and Terrestrial Physics' 52. Line 718 'Tech. Rep.,' 53. Line 761 '2nd edn.,'

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C2458