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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "Brewer spectrometer total ozone column measurements in Sodankylä" *by* T. Karppinen et al.

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General comments

This is an excellent paper and is of great interest to the ozone monitoring community. The authors have demonstrated a profound knowledge of what they are doing and have strived to produce an excellent data set under challenging observational conditions.

The paper provides a coherent look at the technical and observational requirements for producing a reliable, long-term data set with its attendant need for understanding the hardware and the operational needs for achieving that goal.

The paper presents a new, validated long-term data set important to the ozone monitoring community.

Careful operations, analysis and data selection have been demonstrated in the paper and the conclusions reached are based on that analysis.

The paper has strayed into review territory through the detailed presentation of all of the elements of the observing and analysis system but given the paucity of such information in the literature it is a reasonable course of action and a useful addition to the literature.

With a few minor exceptions the literature has been well represented in the paper.

It is recommended that the paper be published with the indicated changes.

Comments and Suggestions

1. Abstract line 1. Delete first 'The'. 2. Line 2 Suggest 'the signing of the Montreal Protocol'. 3. Line 3. '...since then to produce a high-quality, ozone time series now spanning 25 years.' 4. Line 4. 'The data have ...' 5. Line 6. 'Daily mean values calculated from the highest quality direct.,..' 6. Line 7. '...per day on clear days.' 7. Line 12. '...oxygen molecules...' 8. Line 14. '...by the atmospheric circulation (e.g. Müller...' 9. Line 16. '...the atmosphere enabling...' 10. Line 16. 'Excessive exposure to UV radiation...' 11. Line 17. 'diseases of the eyes and skin for example (Lucas et al.,' 12. Line 18. '...having a negative influence on vegetation' 13. Line 19. '...out that the total ozone above...' 14. Line 21. '...significant the effect of chlorofluorocarbons...' 15. Line 26. Suggest: 'The evolution of the global distribution of total ozone has been under...' 16. Line 28. Comma after 'Protocol' 17. Line 29. 'Sodankylä comprising both the Brewer measurements and regular ozone soundings starting in 1988.' 18. Line 30. 'though ozone depletion is more pronounced and regular in the Antarctic the Arctic...' 19. Line 36. '...monitoring the evolution of the ozone layer...' 20. Line 38. 'The FMI-ARC has been active in evaluating the effect of low solar elevation angles on Brewer measurements.' 21. Line 38. 'These studies are important because Brewer #037 has been serving as a reference instrument for satellite validation...' 22. Line 41. 'staffed station' ??? 23. Line 45. '...data flow is briefly described...' 24. Line 46. '...

presented along with the rules...' 25. Line 51. 'The total ozone column...' 26. Line 53. '...still in the comparison phase...' 27. Line 60. '...from either of two internal...' 28. Line 60. 'Direct radiation viewing angle is approximately 2 - 2.7 degrees (Kazadzis et al., 2005). I don't know what this means and it is not grammatical. 29. Line 63. 'The grating can be rotated...' 30. Line 65. 'The double monochromator has significantly less light coming from outside the desired wavelength band.' 31. Line 67. '...of a single exit slit, there is a slit mask with 8 different slit positions....' 32. Line 71. '...depending slightly...' 33. Line 72. '...325 nm for Brewer #037...365 nm for Brewer #214' 34. Line 75. 'To accommodate large variations in the intensity throughout the day, a filter wheel quipped with set of neutral density filters...' 35. Line 77. '...polarizer or a clear opening depending on the measurement mode.' 36. Line 79. 'measure ozone with a Brewer instrument each suited to...' 37. Line 80. 'The direct sun (ds) measurement is suited to clear sky conditions with a solar elevation angle...' 38. Line 83. '...for a long period, focused moon...' 39. Line 85. 'In the direct sun measurement...' 40. Line 86. '...guided toward the entrance slit.' 41. Line 87. '...input light to reduce the effect of slight misalignments.' 42. Line 94. '...neutral density filter may be applied to control the maximum counting rate.' 43. Line 95. 'subtracted from the intensities measured from the direct sunlight.' Sp. 44. Line 97. '...blocked by clouds, ...' Comma 45. Line 99. '...neutral density filters...' 46. Line 101. '...is fixed in the direction that rejects primary scattered light from the zenith (Brewer and Kerr, 1973, Muthama et al., 1995). Brewer, A.W., and J.B. Kerr, PAGEOPH, Vol. 106-108, 1973. 47. Line 104. '...measure using light from the moon.' 48. Line 115. '...changes on the ozone measurements...' 49. Line 116. '...instrument's home institute against a well-calibrated...' 50. Line 121. '...setting for ozone measurements...' 51. Line 121. '...the differential absorption coefficient ($\Delta\Delta\alpha$). 52. Line 123. '...there was no ozone between...' The absolute absorption is pre-corrected for Rayleigh in the normal analysis. 53. Line 135. 'The differential absorption coefficient is calculated ...absorption cross-section. 54. Line 139. 'The neutral density filter wavelength...' 55. Line 150. '...called the standard lamp,..' 56. Line 152. '...the stepper motors...' 57. Line 153. '...the stepper motors...' 58. Line

156. 'The standard lamp is...' 59. Line 163. '...measuring a 1000 W calibration lamp...' 60. Line 164. '...calibration, before the instrument returns to the measurement site, the...' 61. Line 185. 185 - 190 Some redundancy about defining IDEAS 62. Line 194. '...to the World Ozone and Ultraviolet radiation Data Centre (WOUDC)...' 63. Line 196. '...with software described...' 64. Line 198. '...out by the human eye.' 65. Line 201. '...Brewer data are sent...' 66. Line 206. '...data include total counts...' 67. Line 241. '...based on the Beer-Lambert-law..' 68. Line 243. '...set of wavelength dependent...' 69. Line 149. Missing citation. '...the instrument designer (citation).' 70. Line 273. '...identical to that of the direct sun algorithm.' 71. Line 278.The authors might wish to consult: Fioletov, V.E., C.A. McLinden, C.T. McElroy, and V. Savastiouk, New method for deriving total ozone from Brewer zenith sky observations, J. Geophys. Res., 116, D08301, doi:10.1029/2010JD015399, 2011. 72. Line 303. '...thickness by the Brewer-Dobson...' 73. Line 349. '...are, on average, very...' 74. Line 354. '...other ground based...'

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