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Interactive comment on "**Comparison of ground-based Brewer and FTIR total O$_3$** *monitoring techniques" by M. Schneider et al.*

Anonymous Referee #2

Received and published: 18 February 2008

General Comments:

This paper by Schneider et al is a very thorough comparison of two well-known techniques, Brewer and FTIR, for measuring column ozone. The Brewer in particular is probably better known and used as reference in many circumstances, while

the FTIR technique is multi-species, ozone being one of several important atmospheric species that can be quantified.

The paper also has sub-text, a comparison of two analysis techniques used by the FTIR community. That is, the established method by Barret et al (who based their work on modifications of earlier studies), and recent work by Schneider and Hase which pushes the Barret method further, improving the fitting statistics.

So this work has several facets to it that are new and extends the boundaries in terms of approaches and methodologies, and is therefore a nice reference for the respective Brewer and FTIR measurement communities. It also has a very thorough comparison of the two techniques, succinctly describing and contrasting the strengths and relatively weaknesses of the two

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methods.

Therefore the paper is suitable for ACP subject to appropriate responses to a few minor points outlined below. The standard of presentation is fair; there are many technical corrections required, some of which a simple spell checker would remove. These are listed at the end, but the referee suggests a careful read over the paper as a number of other typographical/grammatical errors may well have been missed.

Title: Should the title have the word 'column' in there, i.e., 'Comparison of ground- based Brewer and FTIR total column O3 monitoring techniques'. Just a suggestion.

Specific Comments.

1. Page 1, Introduction, second paragraph. The authors state that Izana is the only measurement

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site where such high quality data from both Brewer and FTIR exist. If this is true, then conclusion d) in section 7 needs to be qualified. That is, the precision of better that 0.5% is clearly demonstrated by the Schneider and Hase method, but since this is the only comparison made in parallel on Brewer and FTIR data, it is probably premature to declare this technique the final end game as it were. The authors maybe right, but I think what is meant here by the authors is that, of the analysis techniques currently used within the FTIR community, the inclusion of the retrieval of temperature simultaneously with O3 is critical in attaining sub 1% precision. This is not the first study to do this; the satellite community has included simultaneous temperature retrieval along with gas profiles for many years. What is being suggested here is to simply change this

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conclusion slightly to imply how important it is to include temperature in the state vector of retrieved parameters, something that other methods (groups like Barret et al in fact have had this option for awhile, in principle, to use, but operational difficulties meant that adjusting the temperature was left out). So for conclusion d), is it not the temperature that needs to be included that makes the main difference here, or is it a range of other options within the entire Schneider and Hase optimized retrieval algorithm that are also important? What is the key component that others in the FTIR community need to employ?

2. Page 2., section 2.1, 3rd paragraph. The statement that the FTIR measures in the middle infrared between 1015 and 780 cm-1; presumably the authors are stating here the limits of the microwindows used in the analysis (figure 1 from

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Schneider and Hase 2007), rather than the pass band of the filters used?

3. page 4, 4th paragraph: not entirely sure what the authors are trying to say here. Presumably it is simply that there many thousands of weak lines, and the wings of strong ones, that together add up to a continuum. But what is meant by the first half of this sentence about spectral windows and many spectra bins? Bins and windows in this context could mean the same thing. Is this empirical background continuum more than just a simple linear straight-line fit or something more sophisticated?

4. Page 9. Figures 6 and 7. It is a little confusing why there are data points missing in the upper and lower panels of the Barret (BA02) and Schneider and Hase (SH07) methods. Both methods use the same data, and I presume the

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same filter region, with BA02 using in effect a subset of the SH07 spectral windows, so it is a puzzle why there is a bigger gap for example in the BA02 analysis in 2005.

5. Page 11. In the discussion of figure 8, it is pointed out the improvement in the outcome of statistical measures using SH07 method (correlation coefficient increases from 0.992 to 0.996), while the BA02 approach does not improve. This is clear from these numbers, but what is the significance, statistically speaking, of the correlation coefficient increasing by 0.004 with the number of datapoints (240?) and inherent errors. Is it in fact a real quantitative improvement?

Technical Corrections.

1. Page 1 Abstract: 2nd sentence. '... differences between the measurements ...'

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2. abstract, last sentence; remove commas, or write as '... confirms both measurements, FTIR and Brewer, are able to ... '

3. page 1 introduction: 2nd paragraph (7th sentence): ' ... improvement in the precision ...'

4. page 1, Introduction, 2nd paragraph, (10th sentence); 'Currently the Izana FTIR system provides the most precise FTIR O3 data world-wide,...'

5. page 2, section 2.1, paragraph 3, 7th sentence: ' ... retrieval of a temperature ...'

6. page 2, section 2.1, paragraph 3, 7th sentence: spelling 'rotational', and again on page 5, 1st sentence.

7. page 3., section 2.2.1, 2nd sentence: ' ... as the ratio between ...'

8. page 3., section 2.2.1, 2nd paragraph, 12th sentence: spelling 'height'

9. page 4., 5th sentence: 'The approach is based on the ...'

10. page 4, 3rd paragraph, 2nd sentence, ' ...reasonably...'

11. page 4, section 2.3, 4th sentence: ' ...(ETC) from the ...'

12. page 5, second paragraph, 3rd sentence, ' ...different 'sigma'O_3 cross sections and ...' (note the sigma here is written but the symbol is meant)

13. page 5, 3rd paragraph, 1st sentence, ' ...rather large so perfect tracking ...'

14. page 5, 4th paragraph, 3rd sentence, 'For these reasons ...often used as a reference ...'

15. page 5, 4rd paragraph, 7th sentence,

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'Concerning O3, the FTIR measurements allow the different isotopologues to be distinguished.'

16. page 5., section 3, paragraph 1, 4th sentence, ' ...FTIR activities were accepted ...'

17. page 5., section 3, paragraph 2, 4th sentence, ' ... used as a reference ...'

18. page 6, 1st sentence, ' ... 1999: up to 2005 a Bruker IFS 120M FTIR spectrometer was used. Since January 2005, a Bruker IFS 125HR spectrometer has been in operation.'

19. page 6, 3rd sentence, ' ...(b) a 30% higher ...'

20. page 6, 6th sentence, 'TCCON currently consists of a network of FTIR sites with the highest quality requirements. It aims to detect total amounts of greenhouse gases with a ...'

21. page 6, section 4.1, 3rd sentence, ' ...

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important to note the scale ...'

22. page 6/8, last sentence, ' 2005 and 2006 occurs because the ... #185 for the 3 month periods is ...'

23. page 7. Figure 3. the figure title for the right hand panel should read '3-month averages'.

24. In the figure 3 caption, second sentence: '... three month averages:...'

25. last sentence in the figure 3 caption, ' ...The scale of the y-axis on the right panels is expanded by a factor of 2.' Similar change for figure 4 caption.

26. page 8, 3rd sentence, '... measurements are at solar ....'

27. page 8 section 4.1, 2nd to last sentence, '... robust since it is based on more ...'

28. page 8, section 4.2, 2nd sentence, '...closer

look at the ...'

29. page 8, section 4.2, 6th sentence, '... averages are calculated by including all ...'

30. section 4.2, last sentence, '... column amount is particularly large ...'

31. page 8, section 5, 1st sentence, '... approaches: first, using a method similar to ...and second, similar to ....'

32. page 8, section 5, 8th sentence, '... due to errors from the BA02 method.'

33. page 9, figure 6, title of right panel should read '3-month averages'

34. page 10, section 5.1, 1st sentence, '...difference between the two...'

35. page 10, section 5.1, 2nd sentence, 'As in Figure 3, the left ...for the 3-month averages: ...'

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36. page 10, section 5.1, 15th sentence, '...ILS is more poorly characterized compared to 2006.'

37. page 10, section 5.1, 2nd paragraph, 4th sentence, 'The setting of the ground or whole surface below ...'

38. page 10, section 5.1, 2nd paragraph, 6th sentence, ' ... container decreased to ...'

39. 2nd paragraph, 2nd paragraph, 7th sentence, '.... optical alignment.'

40. 2nd paragraph, 2nd paragraph, 11th sentence, ' ...we installed new firmware ...'

41. section 5.2, last sentence, '... is more poorly characterized compared to 2006.'

42. page 11., 1st paragraph, 2nd to last sentence, ' ... which clearly is an outlier.'

43. Page 12. Figure 9 and 10, captions, right

panels, titles should read '3-month averages'

44. page 13. spelling of 'dependence'. Check other instances of this word as it may be misspelled, in hindsight, on other pages.

45. page 13, section 6.2, 1st sentence, '... difference between the FTIR and ...'

46. page 13, section 7, 10th sentence, '... solar tracker (Huster, 1998), a Bruker ...'

47, page 13, section 7, 15th sentence, 'In the case of the Brewer, the ...'

48. page 13, section 7, 19th sentence, 'For the case of the FTIR, ILS calibration by low pressure gas cells (Hase et al., 1999) has been performed every 2-3 months since November 2005.'

49. page 15. 1st paragraph, last sentence, 'TCCON aims for a precision of 0.1 %.'

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50. page 15. 2nd paragraph, last sentence, ' ... addressed in future work.'

51 page 15. 3rd paragraph, first sentence, 'Currently a very ...' 52. page 15, 3rd paragraph, 4th sentence, '...perform FTIR measurements over several days from sunrise to sunset.'

52. page 15, 3rd paragraph, 5th sentence, '...better insight into the ....'

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 285, 2008.

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