

Interactive comment on “Recipe for continuous monitoring of total ozone with a precision of around 1 DU applying mid-infrared solar absorption spectra” by M. Schneider and F. Hase

Anonymous Referee #2

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This paper describes a retrieval strategy for deriving precise total column ozone from ground-based mid-infrared FTIR spectral measurements. The authors have shown that a joint optimal estimation of temperature and ozone profiles can provide total column ozone with a precision of around 1 DU. Precise measurements of total column globally are needed for reliable ozone trend estimation. The topic and methodology of the present study is certainly appropriate for ACP. I recommend to publish in ACP after revision.

General comments

The results presented in this paper are based on theoretical error studies. My ma-

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major concern is that the authors, in addition to the theoretical studies, should also carry studies based on actual measurements to demonstrate the fact that the FTIR technique with the improved retrieval strategy is, indeed, one of the most precise techniques for monitoring of total column ozone. Retrievals of total column ozone by the conventional and the method presented here for actual measurements and their comparison with other ground-based measurements from Brewer/Dobson and with satellite measurements from GOME/SCIAMACHY/OMI will be very instructive.

The introduction is written in a naive way and lacks a clear motivation for the work. The works of satellite retrieval community and of other ground-based measurement techniques are not recognized. The paper will be benefitted by addressing some questions like what are common ground-based total column ozone measuring instruments? What are the important limitations of other ground-based measurements? What are the limitations of current satellite retrievals? How does the work presented in this paper would contribute to the goal of precise total column ozone measurements? To my mind current satellite retrievals and ground based measurements at low and mid latitudes agree very well and are accurate, however, a significant discrepancy still exists at high latitudes. Considerable difficulties remain for accurate total column ozone retrievals at high latitudes. If applicable, these issues are worth mentioning.

Specific comments

Title: What does "continuous" mean? Is it very special of FTIR measurements that other measurement techniques lack? Suggestion for title "Monitoring of total ozone with a precision of around 1 DU applying mid-infrared solar absorption spectra".

page 9094, line 17: "Concerning ozone recovery, it is not clear....." The way it is phrased seems to mean that it is only climate change that controls upper tropospheric and stratospheric ozone amounts.

page 9096, line 10: In abstract and in page 9096, line 2, you state that the selected spectral window is between 780–1015 cm⁻¹. In line 10 you state different window

(1000.0–1013.6 cm⁻¹). What is the difference between these two statements? Which spectral window is chosen for spectral fitting?

page 9096, line 21: Saying that "The spectral signatures of the minor isotopologues of ⁴⁹O₃ are only considered by scaling a climatological profile". What does this "scaling" here and elsewhere mean?

Page 9100, line 19: I may be missing something here, but, if a wrong temperature assumption produces systematic sensitivity error, won't a wrong assumption in ozone profile produce similar error? I would expect difference in the simulated spectra also with the change in ozone profile.

Page 9100, line 22: There is no information about which solar elevation angles are considered. What are the extreme values of solar elevation angles?

Page 9101, line 11: "Both the shape and the line intensity of an absorption line depend on the temperature". See my earlier comments. Won't these parameters depend on ozone profile? Won't the error in ozone profile lead to erroneous simulations of the line shapes and intensities?

Page 9101, line 17: "the absorption cross sections cannot be precomputed before iterative retrieval...". Does this mean that you calculate absorption cross sections?

Page 9101, line 20: Derivative of temperature with respect to what?

Page 9101, line 24: "the pressure at each altitude fixed model level is changed according to the current temperature profile". This statement is not clear.

Page 9101, line 26: Clarify the statement "the joint fit of temperature requires extensions to the state vectors, the jacobian and the a-priori covariances."

Page 9102, line 4: Define the acronyms here and elsewhere when they are used for the first time.

Page 9102, line 11: "At the sonde's location the temperature is generally below the

temperature below the FTIR site.". Why should it be so?

Technical corrections

page 9095, line 5: Here and elsewhere in the paper, replace "Section" by "section" and "Subsection" by "subsection".

Page 9097, line 19: The word "principle" is misspelled. Change to "principal".

Page 9099, line 7: Put comma after "according to equation 3".

Page 9099, line 16: Remove comma after "(Hase et al, 1999)".

Page 9102, line 12: Replace "to" by "too".

Page 9102, line 20: Remove "estimation".

Page 9103, line 24: Replace "consequent" by "consequently".

Page 9104, line 19 and 20: Make "IFS 120/125HR" consistent everywhere.

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