

Interactive comment on “Retrieval and validation of O₃ measurements from ground-based FTIR spectrometer at equatorial station: Addis Ababa, Ethiopia” by S. Takele Kenea et al.

Anonymous Referee #2

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This paper presents the first results of the FTIR spectrometer at the new measurement station in Addis Ababa, Ethiopia. This station is the first site at the African continent, where FTIR observations are performed regularly, and the third site within the tropics, a region which is poorly constrained by measurements and of great importance for the global atmosphere. This station is very important for validation of satellite retrievals and for the understanding of simulations of atmospheric chemistry and physics, and fills a gap in the global network of ground-based remote sensing stations. Because of that, this paper is important to publish and appropriate for this journal, even there are major revisions needed. I would recommend to publish this paper after major revisions.

C2779

It seems that the paper haven't been prove-read, there are many typing errors, the references are not consistently formatted throughout the paper, some references are missing (I assume that the author did not meant to copy a whole paragraph from the PhD thesis of A.K. Petersen without citing it...). Some sentences are grammatically incorrect. I refer to the commented version of the other referee and recommend to give a revised version to be read by the coauthors before the next submission.

The intercomparison with the satellite observations is very repetitive, the technical descriptions of the satellites are too long and do not draw the interest of the reader. My suggestion is to show the satellite observations all together with the FTIR observations and give one overall discussion about the results. The FTIR observations do not need a validation by satellite, usually the FTIR observations are used to validate satellite retrievals. The measurement technique of FTIR spectroscopy have been used at many occasions and do not need a validation by satellite, but the FTIR observations can be compared with satellite observations. To my opinion, the paper would significantly improve by including a comparison with model simulations of ozone and/or in situ observations (if available), and by addressing scientific questions e.g. the high ozone during march 2009. I would recommend to show a time series of the FTIR measurements from 2009 to 2011 (not overlaying all years), showing the date on the x-axis (not day-of-the-year). The high O₃ during March 2009 should be addressed (what can be the reason for these high O₃?). The satellites observations can be shown (all together) in the same figure.

The paper describes the first FTIR observations at the site of Addis Ababa. The paper would improve by including a further discussion of the site: Where are the air masses coming from (it might be interesting to look at back trajectories)? Are there differences between the seasons? Is the ITCZ moving over this site, so does the site belongs sometimes to the Northern Hemisphere, and sometimes to the Southern Hemisphere, or is the ITCZ always south of Addis Ababa? Other existing publications about FTIR measurements in the tropics need to be cited.

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I would recommend to change the title. The paper is not showing a validation, neither of the FTIR observations nor of the satellite observations. I would call it: First ground-based FTIR observations of O₃ at the African equatorial station Addis Ababa, Ethiopia, or something like that.

Specific comments:

Introduction/Measurement site:

-why is it important to do measurements in the tropics? Cite all papers of tropical ground-based FTIR observations.

-Rewrite the introduction as it is copied more or less word by word from the PhD thesis of A.K. Petersen.

-Is biomass burning really important for Ethiopia? Is it important, if looking at CO or CH₄ (as in Petersen) but for O₃?

-Why are the O₃ columns high in March 2009? Where is it coming from? Trajectory analysis?

-Where are the air masses coming from (it might be interesting to look at back trajectories)?

-Are there differences between the seasons? Is the ITCZ moving over this site, so does the site belong sometimes to the Northern Hemisphere, and sometimes to the Southern Hemisphere, or is the ITCZ always south of Addis Ababa?

-Are the satellite observations altitude corrected? The FTIR site is at a high altitude, so by comparing with satellite observations with a bias, and not completely collocated, the altitude difference needs to be taken into account?!

-What means "coincident" here? Same time? Or only same day? Shown are daily averages? Show also standard deviations of the daily averages of the FTIR observations to show the variation of O₃ during the day.

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Section 3/Page 6771: -Discussion of the possible offset due to the spectroscopy?

Page 6769/Figures: It is mentioned, that the microwindow at 1000 cm⁻¹ is best suited for O₃ retrievals, but due to the limited amount of MCT measurements, the InSb measurements are used in this publication. As the microwindow around 1000 cm⁻¹ is best suited, it would be interesting to compare the MCT measurements with the InSb measurements and show them together in one figure and discuss the possible differences. This would perfectly fit in this paper, as it is more a technical paper about retrieval and to the journal.

Page 6767, line 5: does the FTIR spectra are recorded automated or by manual operation? How is it assured, that clear sky conditions apply? By eye of a researcher/technician or with a diode?

Line 14, 15: give the website/source of the autotailer system and of NCEP

Line 18/19: which retrieval method is used in this paper? Are the others tested for this site/the O₃ retrieval?

Page 6768, line 25: coadding the spectra for high signal to noise ratio

Page 6769, line 20: how are the microwindows determined? With ALFIP software? –cite Show the MCT measurements and compare with the retrieval performed with the microwindows used here

Page 6770, line 2: "Figure 1 shows [an] example..." , but is it also a typical spectrum?

Page 6771, line 1 and 2: what has the high tropopause of the tropics to do with the degree of freedom?

Line 16: I do not understand this sentence: why is there a bias if the averages are calculated on the basis of log retrievals? What does this mean? What is then the advantage of log retrieval? Better do it on a different way?

Section 4: all satellite descriptions:" ...we used the recommended parameters for

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screening the . . . data for the target trace gas of O₃" What does this mean? Recommended by whom? What are these parameters?

Many repetitions, I would recommend to shorten this section. It is not well written and not interesting to read. One possibility would be to put the satellite descriptions in a supplement. Page 6772, line 26:

Technical corrections:

There are so many formatting, spelling and grammatical errors, that I would recommend first to prove-read the article before sending to the reviewers. I refer to the commented version of the other reviewer for corrections.

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