

Interactive comment on “Tropospheric and total ozone columns over Paris (France) measured using medium-resolution ground-based solar-absorption Fourier-transform infrared spectroscopy” by C. Viatte et al.

Anonymous Referee #1

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General comments

This paper presents ozone measurements performed in a new atmospheric observatory installed in Créteil next to Paris, using ground-based solar absorption Fourier transform infrared (FTIR) spectroscopy. The focus is on demonstrating the potential of the mid-resolution FTIR technique for the separation of stratospheric and tropospheric ozone columns. To this aim, measurements obtained during approximately one and a half year in 2009-2010 are compared to various sources of correlative data, in par-

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ticular tropospheric ozone columns from the satellite instrument IASI, in-situ surface ozone concentrations from the AirParis network and chemistry-transport model simulations from the CHIMERE air quality model. Results provide fair indications that the OASIS system does provide meaningful tropospheric ozone measurements consistent with satellite, in-situ and model data sets. The main motivation of this study is to assess the capability of the mid-resolution FTIR technique for the monitoring of the tropospheric composition. Given the moderate costs of such systems, deployment at larger scale might be envisaged in support of satellite validation and air quality studies. Although the paper fairly meets its goal, the discussion of the most significant results is sometimes superficial which limits the strength of the study. Also the written English language is rather poor and in some cases even lacking the necessary scientific precision. The manuscript would certainly gain a lot being revised by a native English speaker. I recommend publication in AMT provided that remarks and comments detailed below are properly answered and the manuscript is revised accordingly.

Specific comments

P. 3340, L. 10-15: this part of the introduction is a simple repetition of the content of the abstract. The introduction should focus on explaining the context of the study and on describing the state-of-the-art of the science topic under investigation, rather than summarizing results.

P. 3342, section 2.2: since this paper reports for the first time on ozone profile retrieval using mid-resolution FTIR, more should be said on the details of the inversion scheme used. In particular, what are the differences with ozone retrievals using high resolution FTIR? How good is the information content compared to high resolution FTIR? Why are retrievals performed on a logarithmic scale? How sensitive are the results to the choice of the a-priori? Etc

P. 3343, L. 8-25: in this section, the authors show that the retrieved stratospheric and tropospheric columns do not correlate significantly with each other. Although this cer-

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tainly adds confidence to the results, one should be clear that an absence of correlation, per se, does not validate the tropospheric retrievals. In this sense, it is premature to state that “we have demonstrated that ground-based FTIR measurements are indeed capable of monitoring tropospheric ozone”. Such a demonstration can only be achieved through careful comparison with correlative data sets.

P. 3343, L. 18: in the same paragraph, a regression plot is used to demonstrate the poor correlation between the stratospheric and tropospheric ozone series. If results are uncorrelated, what do represent the slope of the linear regression line with zero intercept? Do we or do we not expect some level of correlation between tropospheric and stratospheric ozone columns? If yes, what are the physical or chemical mechanisms by which these two quantities can be linked? Note by the way that the slope of the regression shown here should be unit less (not in DU as indicated in the text).

P. 3345, L. 5: differences are “probably” due to the fact that IASI and OASIS do not have the same vertical sensitivities. This comment is important and definitely deserves more than one line in the discussion. What are these differences in vertical sensitivity? Here averaging kernels should be compared and the implications on the comparison results should be discussed in more details.

P. 3345, section 3.2: why not converting partial columns in the lowest layers into surface VMR to allow for more quantitative comparison with in-situ data? Discuss how sensitive to surface ozone OASIS is (cf. AK plot in figure 2). At this stage in the study, why not using ozone sonde data (some are certainly available in the region of Paris) to compare with OASIS tropospheric columns? This could provide a more quantitative insight into the validation process.

P. 3346, section 3.3: The regression plot in Figure 6 looks pretty good. Are the CHIMERE run performed within MACC constrained by assimilation of in-situ data? In addition to the regression plot, please also include a figure comparing the time-series of tropospheric ozone columns by OASIS and CHIMERE. It would be nice to see how

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good the variability in tropospheric ozone is captured by both data sets.

Comments of editorial nature

P. 3339, L. 8-10: remove the sentence starting by “Indeed, the information content . . .”. It is enough for the abstract to state that the capability of the technique to separate stratospheric and tropospheric ozone is demonstrated.

P. 3339, L. 13: replace “have been” by “are”

P. 3339, L. 14: replace “clearly shows” by “reveals”

P. 3339, L. 16: replace “were identified” by “are identified”

P. 3339, L. 17: replace “predictions” by “simulations”

P. 3339, L. 18: replace “were compared by respecting temporal. . .” by “are compared following strict criteria of temporal and spatial coincidence”

P. 3339, L. 19: remove “quantitatively”

P. 3339, L. 20-22: replace “was found between CHIMERE and OASIS. This demonstrates. . .” by “is found between CHIMERE and OASIS demonstrating the potential of mid-resolution FTIR solar absorption spectroscopy for tropospheric ozone monitoring”.

P. 3340, L. 26: remove “In the troposphere, it is also a main greenhouse gas” by “It is also an important greenhouse gas”

P. 3340, L. 7: “in order to reduce uncertainties” → uncertainties on what ?

P. 3341, L. 1: remove “ first”

P. 3341, L. 5: “theshow” ??

P. 3342, L. 7-8: add “clear sky” in between “75” and “days”. Remove the sentence starting by “Obviously, clear sky conditions. . .”

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P. 3343, L. 11: are estimated to “be” about 13-15%

P. 3343, L. 15: replace “represent” by “present”

P. 3344, L. 13-16: this sentence is particularly unclear and should be reformulated. In the following sentence, replace “.. the comparisons in this paper focus 25 days measured during summer..” by “..the comparisons in this paper focus on 25 days of measurements acquired during summer 2009”

P. 3344, L. 27: replace “Figure 4 (lower plot) shows O3 total columns...” by “Figure 4 (lower panel) presents a regression plot of the IASI total ozone columns plotted against OASIS measurements”.

P. 3347, L. 5: remove “Then”

P. 3348, L. 6: replace “can be monitor separately” by “can be monitored separately”

P. 3348, L. 21-24: This sentence is not really relevant in the present paper. I would remove it.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 3337, 2011.