

Tropospheric and total ozone columns over Paris (France) measured using medium-resolution ground-based solar- absorption Fourier-transform infrared spectroscopy

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Responses for report referee # 2:

First, we wish to thank the Referee for his positive and insightful comments. We have discussed his comments and modified the paper accordingly. See below our answers to his specific comments.

Specific comments

There are, however, two closely related minor points I feel should be addressed before the paper is accepted. First, I believe the authors overstate the ‘independence’ of the retrieved tropospheric and stratospheric columns. Second, the comparison to IASI is inherently somewhat qualitative, because the differing averaging kernels of the 2 instruments are not accounted for.

On the first point, on p 3343, lines 23-25, the authors state “ground-based FTIR measurements . . . are . . . capable of monitoring tropospheric ozone, with little or no interference from stratospheric ozone.” There is no doubt in my mind that stratospheric and tropospheric ozone can be usefully separated by these measurements, but this is too strong a statement. In the same paragraph they discuss time series of tropospheric and stratospheric ozone (75 measurements), which have a correlation coefficient of “only” 0.46. In fact, the probability of 75 samples of 2 independent random variables having such a correlation coefficient is vanishingly small. Further, it is not only extreme events which reveal the correlation of retrieved stratospheric and tropospheric values. The averaging kernels in Fig. 2 show clearly that the retrieved tropospheric amounts have a stratospheric contribution, and vice-versa.

On the subject of the averaging kernels, may I suggest that the authors show the kernels which apply to the tropospheric and stratospheric partial columns, instead of those applying to every altitude in the profile? These are simply the sums of the individual kernels (normalized so the units come out right) over the relevant altitudes, and would give a good visual guide to how cleanly troposphere and stratosphere can be separated.

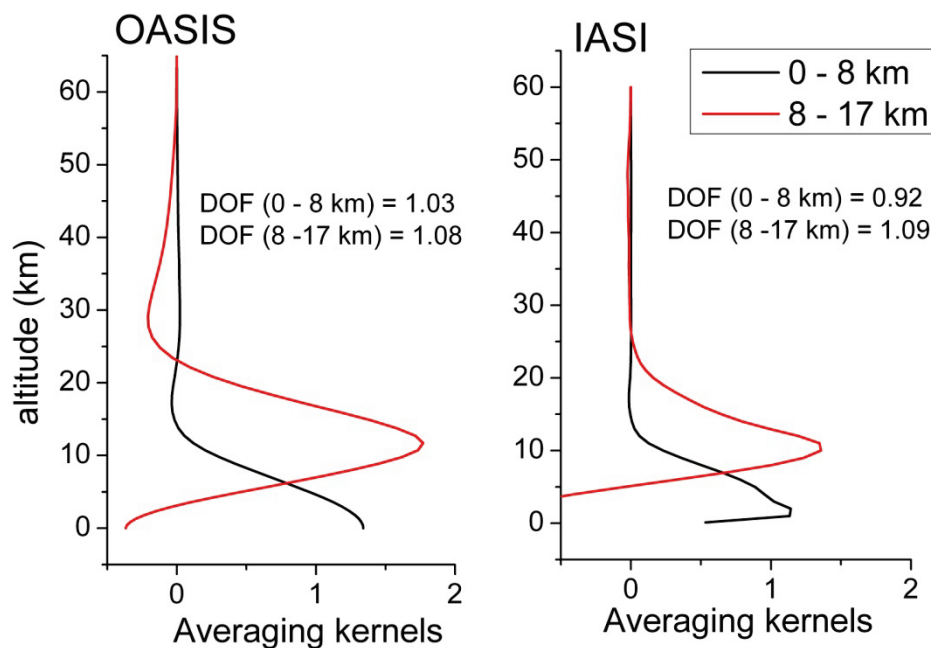
The second point is simply that the averaging kernels are ignored in the comparison to IASI. This is a reasonable first step in making such a comparison, and arguably is all that is required here. However it must be acknowledged that the different kernels (which reflect differing physics, geometry, and analysis methods) make it impossible to draw quantitative conclusions

from the comparison without further analysis, employing for example the techniques described in Rodgers & Connor, 2003. (J. of Geophys. Res., 108, 4116, 14 pp., doi:10.1029/2002JD002299).

In summary, I believe my concerns can be effectively addressed by:

1. A modified averaging kernels plot in Fig 2.

We agree with the Referee's comments. Here is the modified averaging kernels plot. We also suggest adding the typical IASI averaging kernel plot in order to discuss the vertical sensitivity of both sensors in section 2.2 (p 3343 from line 8).



2. Changes in the text in the last paragraph of section 2.2 to recognize the correlation of retrieved troposphere and stratosphere.

Again, we agree. We first propose to delete “only” 0.46 (p 3343 line 16).

Then we suggest to add the following comment (p 3343 line 16) “This correlation can be attributed both to the retrievals’ nature and atmospheric dynamical processes occurring around the tropopause region (Holton, 1995). Indeed, the averaging kernels (Figure 2), which reflect the vertical sensitivity of the retrievals, show that the retrieved tropospheric amounts have a small stratospheric contribution, and vice-versa.”

And finally we propose to change the conclusion (p 3343 line 22): “In conclusion, we have demonstrated that ground-based FTIR measurements are indeed capable of monitoring separately tropospheric ozone from stratospheric ozone with little interferences due to the vertical sensitivity of the retrievals; however, comparison of our results with other independent data sets would be highly desirable in the future.”

3. Changes in the text of 3.1 to acknowledge the qualitative nature of the comparison, and potential value of further quantitative analysis.

Yes, we agree. We changed the conclusion at p 3345 from line 4:

“However it must be acknowledged that the different IASI and OASIS averaging kernels (Figure 2), which reflect differing physics, vertical sensitivities, geometry, and analysis methods, just allow us to draw qualitative conclusions from the comparison, before employing further quantitative analysis, for example with the techniques described in Rodgers and Connor, 2003.”