

Interactive comment on “Trends of ozone total columns and vertical distribution from FTIR observations at 8 NDACC stations around the globe” by C. Vigouroux et al.

Anonymous Referee #3

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The paper provides a useful extension and expansion of the analysis carried out in previous work (Vigouroux et al, 2008) using long-term data from a global network of ground-based FTIRs to assess atmospheric trends of ozone. The new features of this work include the determination of trends within different vertical regions of the atmosphere and the use of a multiple linear regression model to include the impact of a series of different proxies for processes that are known to impact ozone. As such it provides useful information on the trend behaviour in different regions of the atmosphere and which processes have significant impact on the trend analysis in these regions. However, there are a number of issues with the paper which could benefit from further

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explanation and analysis. These are discussed below :

The phrase ‘self-calibrated’ is used in both the introduction and conclusions. Although the optical absorption due to ozone is measured with reference to the surrounding continuum there are a number of steps from this to derive a vertical profile of ozone, many of which are not ‘self-calibrating’. The measurements made by the different sites are linked to a common spectroscopic database, but since different absorption lines are used, the absolute accuracy of the actual spectral parameters used could be different; the analysis requires P&T profiles and any errors on these will affect the results; and changes/differences in instrumental performance (e.g. effective resolution, phase, etc.) could affect profile results. Significantly more justification is therefore needed before the data can be said to be ‘self-calibrated’.

Section 2.2 describes the FTIR retrieval strategy, and one common theme is that there are very few aspect of the retrieval that are common to all groups. While the differences are acknowledged there is very little discussion of the reason for the differences or the potential influence these differences could have (either on the absolute values of the ozone data or on the trends derived). Without further discussion on this point it is difficult to know how much reliance can be placed on the differences in the results from difference sites being due to the atmosphere and how much to the differences in the analysis strategies. Some further analysis that actually assessed some of the implications of the different strategies would significantly enhance the robustness of the results and conclusions.

The determination of the ILS (pg 24630) is obviously important, particularly in the profile retrieval and long-term changes/drifts in the ILS could presumably map onto the trend results. There is a description of the ILS procedures followed but several times results are referred to as being ‘close to’ the ideal and therefore assumed to be ideal. It is important to know what is the definition of ‘close to’ is in each of these cases and how this criteria was selected. It would also be useful to know how often the ILS checks are done as this would cover the issue of potential long-term alignment drift.

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It would be useful to have further details on the sensitivity in Section 2.3. Although fig 1 shows the sensitivity profile for the Jungfraujoch station, it would be interesting to know something about the overall sensitivity for each of the four altitude layers for each station being analysed as this would indicate the potential influence of trends in the a priori data on the analysis.

Specific comments :

Page 24626 Line 14 : 'stable data are needed' – it is not the data that needs to be stable. Suggest replace with 'reliable data from stable instruments are needed'.

Page 24626 Line 16. Do ozonesondes count as 'ground-based' or are they 'in-situ' measurements ?

Page 24628 Line 19. Should it be 'single scaling' or 'simple scaling' ? 'apriori' is missing a space and should it be in italics (throughout document) ?

Page 24629 Line 17. This assumption implies there is no correlation from the measurement noise in the vertical information. This seems a large assumption to make without any further justification. Some more discussion on this point would be useful.

Page 24631 Line 12. If the sensitivity is the fraction from the measurement rather than the a priori, how can it be greater than 1 (see Fig 1) ?

Page 24631 Line 21. The sensitivity shown in Fig 1 is >0 at 49 km, so what was the actual cut-off criteria ?

Page 24632 Line 7. 'UV-VIS' rather than 'UV-Vis'.

Page 24632 Line 22. Suggest 'variable' rather than 'contrasted'.

Page 24633 Line 16. Parameter A0 is not defined.

Page 24633 Line 18 (and eq 2) should it be $\varepsilon(t)$ rather than just ε ?

Page 24634 Line 22 Clarify which ones 'those proxies' refers to.

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Page 24639 Line 17. As the total column results as also given in DU in section 4.2.5 it would be good to also do so here.

Page 24645 Line 28. Does 8 sites constitute 'many' for a global network ? Suggest replace with the actual number.

Page 24646 Line 4. Suggest replace 'proposed' with 'demonstrated'.

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