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Atmospheric Chemistry and Physics Discussions

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 #1

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The manuscript "Trends of ozone total columns and vertical distribution from FTIR observations at 8 NDACC stations around the globe" by C. Vigouroux et al. described differences in the set up of compared instruments, retrieval algorithms and the errors of the FTIR-derived ozone. The long-term trends are derived for each station and analyzed as function of altitude and latitude. Only trends in Southern hemisphere middle latitudes are found to be significant. Positive Ozone trends in the upper stratosphere are found at most of the stations. The contributing factors modulating ozone variability in the stratosphere and troposphere are determined as Solar Cycle, Quasi-Biennial Oscillation (QBO), El Niño-Southern Oscillation (ENSO), tropopause pressure (TP),

equivalent latitude (EL), Eliassen-Palm flux (EPF), and volume of polar stratospheric clouds (VPSC). The trends are also assessed as function of latitude by considering common patterns in the ozone variability at geo-located stations. The final set of attributing parameters is selected as the best fit by analyzing contribution of attributing factors through minimization of the model fit residuals. The paper also provides information regarding the partitioning of the total column ozone into the layers and evaluates the informational content of each layer and at each of eight FTIR stations. Assessment of the errors in the retrieval could be found to be useful for further interpretation of the information in the trend analysis. This paper is recommended for publishing after the following comments are answered.

Comments: p. 24628, line 18-21. Can you please clarify in the text if ozone isotopologues were fitted in the retrieval of all stations or only Harestua? Or what is the difference in the fit of the Harestua. May be it is better to describe algorithm for all stations with the exception of Haerstua and then describe algorithm for Harestua station separately. p.24630, lines 20-25. Is it know that the homogenization of the two records for Wollongong has been made to remove any step functions associated with the use of two different instruments that have unknown spectral characteristics?

p. 24631, line 19 – It would be good to provide additional AK from another stations for comparisons, the one that is a different in vertical distribution.

p.24633, lines 8-9, you stated that "To reduce the auto-correlation in the residuals, we use here the monthly means time series." The autocorrelation for monthly mean ozone time series is still significant (see estimated by Bruner et al, send of section 2) and thus affects the uncertainty of trend analysis.

p.24634, lines 18, 24-28, p 24635, lines . The explanation for the ELL, ELS and ELU abbreviation is not provided the first time these parameters appear in the text. Few sentences later these proxies are related to the low, middle and upper stratospheric layers. However the layers are also not clearly defined in the text. I found the description of

layers in Table 3, which should be discussed a bit more in section 2.3, and the LowS, MidS and UppS should be defined there as well.. Also, please provide ftp reference for the NCEP dataset in Table 4.

p. 24635, lines 3-10 . As your trend fitting model follows the Brunner et al (2006) approach for an accumulation process over a year, please clarify if you use different tau constant for different stations (tropics vs high latitude station) and seasons.

p.24637, line 9-10 when describing difference in Harestua trends, add "(results are not shown)" However, it might be better to add Harestua tropospheric ozone data in Figure 5. for visual comparisons with Ny-Alesunds.

p.24637 line 11-14. It is not relevant to compare ozone-sonde trends at 500 hPa level and Ny-Alesund's integrated tropospheric column (ground to 10 km) as upper troposphere (between 500 hPa and tropopause) can have a significant contribution to tropospheric ozone column variability.

p.24637, lines 18-20. I cannot see any large signal in VPSC data in 1998 and 1999. Is that what you are trying to attribute to observing larger ozone values as compared to other time periods? And it is in the contrast to 2005 and 2011 when VPSC signal is large, while tropospheric ozone is low, correct? May be this section should to be re-written to make it more clear for the reader to see how VPSC might be influencing the tropospheric ozone variability at Ny-Alesund. It seems that comparison to other paper makes it difficult to understand your results.

p.24638 line 1-3. I do not see large departure in VPSC in 2003. Moreover, the model did not capture low ozone point in 2003 (middle panels of Figure 5). May be something else can explain this variability, QBO or Equivalent latitude?

p.24640, lines16-17. It is hard to believe that the Lauder dataset could contain a significant contribution from Solar cycle, especially in the troposphere. As authors point out – the record is too short to be analyzed for a Solar cycle signal. I would not use the

Solar cycle in analysis, or would adapt the fit from another middle latitude station (i.e. Wollongon?). You can try to analyze a shortened 2001-2012 record from Wollongong to check if you get similar artifact from fitting data with the Solar cycle proxy .

p.24641, line20-24. Can the choice of 470 K reanalysis for calculation of the ELL for Wollongong be a problem or is it a sequential model fit that determines which proxy to keep? Why was 470K chosen to represent the low stratospheric layer at Wollongong?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 24623, 2014.