Review of the manuscript 'A comparative analysis of UV nadir-backscatter and infrared limb-emission ozone data assimilation' by Rossana Dragani

The study analyses the results of including GOME-2 and MIPAS ozone retrievals in the ECMWF data assimilation system on top of the ozone data routinely assimilated in the IFS. The two perturbation experiments (with GOME-2 and MIPAS data included separately) are compared with the baseline IFS ozone and independent data from Aura MLS and ozonesondes. In both cases the inclusion of new profile data leads to improvements, particularly in the lower stratosphere and in the troposphere. The latter is true even in the case of MIPAS despite its limited vertical coverage. It is found that the differences between the perturbed and control experiments are more localized in the vertical for the MIPAS experiment, as expected given sharper averaging kernels associated with limb measurements, compared to the nadir UV-Vis methodology.

The subject matter is important for the chemical data assimilation community and fits the ACP profile perfectly. It is relevant to both, future reanalyses and near real time analyses going into the future (nadir UV). I find the paper to be well written with clear structure and compelling results. I especially like the MLS and ozonesonde comparisons results summarized in Figs. 9-12. The added value of MIPAS and GOME-2 data are clearly shown there.

I recommend the paper for publication in ACP subject to very few very minor revisions as delineated below.

General comment

Reading back through Dragani 2011, MIPAS ozone (different version) and GOME (ERS-2, not the same GOME) were already assimilated in ERA Interim. I know it's not the same data but I think it should be mentioned somewhere. How do the results presented here compare with ERA Interim? Does the CCI MIPAS ozone bring anything new compared to the version that was used in ERA-I? I'm not asking for any extensive comparisons, just a comment.

Specific comments

P2 L24. McCarty et al. is still not finished. At this point I suggest changing this reference to Bosilovich et al. (2015). The ozone chapter contains the same information and this tech memo is already published and citable.

P4 L 5-14. What is GOME's footprint?

P4 L26. The link is old and redirects to http://cci.esa.int/. You may want to update it

P6 L7 'the ozone continuity equation is expressed as a linear relaxation…' Hmm, there's more to the continuity equation than just chemistry. How about 'contains' instead of 'is expressed as'? Maybe I misunderstood something.

P9 Last paragraph of Section 5.1. Is this because with the stratosphere constrained by MIPAS the analysis increments arising from total column data are distributed differently? You talk about this later on (P13) – how about 'this will be discussed in Section 5.2.2'? Also, see my comment to P13 L6.

P10 L1. 'version 3.04', is this correct? As far as I know the recent 'official' versions are 2.2, 3.3, 3.4 and 4.2

P10 L19. A bit more about how the 'degrading' is done. Is it by interpolation from the two nearest pressures or the average within the layer onto which you are interpolating? This probably makes little difference for MLS comparisons but I found that for ozonesonde data, with their high vertical resolution (many sonde measurements per model layer) it's better to integrate than to interpolate between the two nearest points. This is because the model/DAS layer ozone values represent the layer averages, whereas sondes provide point measurements.

P11 L20-29. It would help to see some percent values. Not necessarily in the figure but in the text.

P13 L6. I agree that this is the most probable reason why the MIPAS analysis results are improved below 400 hPa but it is not really shown here – it is just stated. The reader may wander if vertical transport between the observed and unobserved layers wouldn't also play a role.

P15 L3. Again, I'm confused about the MLS data version (3.04 or 3.3?)

Technical comments

P10 L3. '82S to 82N' → '82°S to 82°N'

P11 L32 'southern than' → 'south of'

P12 L25 'what does it happen in the lowermost troposphere' → 'what happens'?

Reference

Bosilovich M. G. and co-authors 2015: MERRA-2: Initial evaluation of the climate. Technical Report Series on Global Modeling and Data Assimilation, NASA/TM–2015-104606/Vol. 43. Available from http://gmao.gsfc.nasa.gov/reanalysis/MERRA-2/docs/