

Interactive comment on “Representativeness errors in comparing chemistry transport and chemistry climate models with satellite UV/Vis tropospheric column retrievals” by K. F. Boersma et al.

Anonymous Referee #2

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The authors have described an approach to quantify three types of errors that can arise when trying to compare modelled NO₂ fields with UV/Vis retrievals of column NO₂. They have focused on horizontal and vertical representative errors, and errors associate with cloud cover. These are all issues that the community is aware of and is struggling to address using various approaches. In that context, the manuscript is not innovative, but I believe that it will be useful to the community. By providing a coherent approach for dealing with these errors, the manuscript will help reduce misuse of the NO₂ column data, and it may even spur new approaches for mitigating the errors. The

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manuscript is well written and I recommend it for publication after minor revisions to address my comments below.

Comments

- 1) Page 7828, line 25, and Page 7840, line 8 (title of Section 5.2): It is not clear to me what is the temporal component here. It seems to me that this error, which is the focus of Section 5.2, is really an issue with the representativeness of the cloud cover. Referring to this as temporal (or meteorological) representativeness error is vague and confusing. Why not just call it representativeness errors in cloud cover?
- 2) Page 7832, lines 21-23: Here the authors state that they treat all of the errors as random errors. However, in Section 5.1 and Appendix B they account for a correlation in the errors, so clearly they are accounting for some systematic errors. This confusing and needs to be better explained.
- 3) Page 7833, lines 8-12: I do not agree with the statement that the vertical transport errors will be smaller, in an average sense, when aggregated over a month. That is, for example, unlikely to be the case in the tropics or over eastern North America in summer, when convective transport is strong. Indeed, the monthly mean differences in the vertical distribution of NO₂ in the lower troposphere between GEOS-Chem and TM5 shown in Figure 7a are not that different from those shown in Figure 6a for Feb 18th.
- 4) Page 7836, line 17: Are there additional references besides Lin (2012) that should be included here? What about Lamsal et al. (2010, J. Geophys. Res., D05302, doi:10.1029/2009JD013351)?
- 5) Page 7845, lines 2-6: Not all of the NO₂ products provide averaging kernels. It would be helpful if the authors could explain what one should do to mitigate the vertical representativeness errors in the case when averaging kernels are not provided.
- 6) Figure 7 caption: Explain that the numbers given in each panel, e.g. 5.75 for GEOS-

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Chem, are the integrated column abundances.

7) Figure 10 caption: Should “100% x (B/C – 1)” be “100% x (B/A – 1)”? Why not make these differences relative to experiment A, which is believed to be better, so that for C vs A is it 100% x (C/A – 1) and for B vs A it is 100% x (B/A – 1)?

Interactive comment on Geosci. Model Dev. Discuss., 8, 7821, 2015.