

Interactive comment on “An assessment of Ozone Mini-holes Representation in Reanalyses Over the Northern Hemisphere” by Luis Millan and Gloria Manney

Anonymous Referee #2

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The paper by Millan and Manney deals with the representation of so-called ‘ozone mini-holes’ within several widely used reanalyses data sets. The topic of ozone mini-holes and their dynamics is relevant for ACP, as well as an investigation of the respective capabilities of the reanalyses. The manuscript is well written and presents the findings in a clear manner. The manuscript can be published to ACP after taking into account the below-mentioned comments.

Specific comments:

P1 L24, P5, L31, 32, P7 L10-15: ‘Local uplift of the air ...’ Indeed, this is an important process for generating ozone mini-holes. However, the total ozone column amount is only decreased if there is also net-divergence of air out of the column which compen-

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sates for the air parcel expansion. Otherwise, the ozone is just vertically re-distributed. This could be checked by investigating if indeed the pressure difference between isentropes decreases. This should normally be the case during ozone mini-hole events, but could the authors perform a check on this?

P2, last paragraph of introduction: The authors should mention why it is relevant to investigate the capabilities of reanalyses to reproduce ozone min-holes, where is the advantage for the scientific community to characterize this?

P3 L22, L29: please give a source/reference for the statement that MLS version 4.2 is very similar to version 2.2. It also needs only once be stated.

P5 L26, 27: ‘micro-hole events’. I suggest to avoid to introduce another naming besides ‘mini-holes’ because there are already several definitions for ‘mini-holes’. What would then be a ‘micro-hole’? Better write ‘...smaller events...’ or ‘... smaller-scale events ...’

P6 L7-11: discussion of Figure 5: I think that with a difference-plot (OMI minus reanalysis model) more information could be gained and the last sentence of this paragraph could be more precise than now with ‘suggests’, ‘to some degree’.

P6 L19-22: Here the authors could go more into detail. E.g., JRA55 assimilates OMI also nearly from the beginning, as MERRA-2, but performs not that good. Are there other studies which investigate the general ozone field performance of the reanalyses? Further, in Figure 6 the number of detected events and matches are given – could the authors give some information/discussion why there are so clear differences between the reanalyses? The relative score of matches could also be discussed, e.g., JRA55 detects the least OMI events, but has the relatively highest score of matches (out of its detected ones).

P6 L24: ‘... move to match the position of the events...’: When is this ‘match’ reached exactly? Do the authors define a centre of the OMI event?

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P6 L27-29: Here, the authors could give more details. The shift/move would often have to be to NW, SW, not only pure East. Can this be linked to general atmospheric dynamics/circulation? And, JRA55 shows a different behavior. What could be reasons for these patterns?

P8 L3: 'DT fraction': what is the reference?, fraction of what? Please clarify.

P8 L6: '... for all the events...': Please clarify if indeed events or only matches are meant.

P8 L10, 1/figure 91: would it be possible to show (or to mention) also the error of the (red) ozone, temperature, EqL composite event difference profile?

P8 L12/Figure 9: fraction of reduction origin: from the percentages given, MERRA-2 and ERA-Interim agree much better with MLS than the other three reanalyses. Could you please comment on this?

P8 L23, 24: 'This suggests ...'. It would be helpful to support this further. E.g., the authors could calculate the MS part of reduction and see if there would still be a mini-hole following their definition of ozone mini-holes. Respective findings could also be used to rephrase in the summary p9 L26.

P9 L11, 12: please mention also JRA55 here

P9 L16, 17: Concerning the average, this statement is correct. But for the reader it would be more helpful to mention that there are nonetheless differences between the five reanalyses concerning that distribution.

Technical comments:

P2 L7: 'normally is around ...' please replace with 'the long-term mean around 310 DU during this time ...'

P2 L10: '... based on an ...'

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P2 L17: please refer to table 1 after the listing of the five reanalyses P2 L27: dito

P6 L15: please change '... the rest' to '... the other reanalyses...'

P8 L19 and P9 L19: '... strong cyclonic circulation systems ...'

P9 L18/19: please delete one 'because'

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