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Atmospheric Chemistry and Physics Discussions

Interactive comment on "3-D tomographic observations of Rossby wave breaking over the Northern Atlantic during the WISE aircraft campaign in 2017" *by* Lukas Krasauskas et al.

Lukas Krasauskas et al.

l.krasauskas@fz-juelich.de

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We thank the reviewer for the comments and suggestions that helped to improve this paper.

The reply is given below. We do not discuss small technical or typesetting remarks and typos spotted by the reviewer here, those were simply applied as recommended. The original reviewer comments are indented, excerpts from the revised version of the paper are given in italic.

Specific comments

> Line 90: At face value, the discussion here seems to be talking about "high vertical resolution" for the radiances, but I think you mean it to apply also to the retrieved state,correct? It might be good to add a few words to clarify that "...not only for the measured radiances, but also, ultimately for the retrieved atmospheric states corresponding to those measured radiances".

This statement could indeed be misleading. It was clarified: *"[...] high vertical resolution of up to 200 m of the retrieved atmospheric quantities."*

> Line 112: Is the temperature also "advected"? If so, how, as some kind of tracer? Is that valid meteorologically speaking?

This is indeed an important issue. To retrieve trace gas concentrations, temperature needs to be retrieved as well, and, unlike trace gases, one cannot assume it is simply advected. The solution for this issue is a topic of ongoing work, it is important for observations of phenomena with strong, small scale temperature disturbances, such as gravity waves. Fortunately, no such phenomena were present in this case, the retrieved temperature field was relatively smooth and compared well with in situ observations along the flight path. This was deemed sufficient for the trace gas products presented here. The uncertainties due to temperature retrieval are included in the error analysis in Appendix B.

> Line 168: If you're including a citation for ozone (line above) why not one for HNO3 also, for symmetry.

The corresponding topic for nitric acid is covered in Popp et. al. (2009), which is cited at the end of the next sentence.

> Figure 2: It's a bit odd that panel (a) has a discrete color scale while (b)-(d) are continuous. I tend to favor the discrete ones myself, as that makes filaments more clear, but either way, it might be better to be consistent.

Panel a, unlike the others, uses a logarithmic scale. We feel that it is helpful to add as many labels as possible to the colour bar in this case. Round-number values, however, end up unequally spaced next to continuous logarithmic scales, which would make the bar very hard to read.

> Lines 199/200: "The air found near...3 days at least". Are we supposed to be able to see that from examination of Figure 3? If so, it wasn't clear to me, so perhaps more hand-holding is required.

Clarification of how RWB events bring the observed air masses together was added in the form of the new figures 5 and 9 in the new version of the manuscript. The explicit analysis of backward trajectories allows one to determine since when a compact group of air parcels has been advected as such.

> Line 201: Could/should the word "subsequently" be inserted right before "transported"(final word in this line). If that's not correct, then that means I haven't understood the discussion properly, and perhaps some clearer discussion is needed.

The word "subsequently" was inserted.

> Figure 6: I'm afraid I found this figure hard to interpret/visualize. Perhaps, rather than multiple filled contours oriented vertically, might it be better to have just a few colored contour lines slicing horizontally. (e.g., Figure 6 doi:10.1002/2015JD023488).

Figure 6 was replaced with a new, hopefully clearer figure.

> Figure 9: Panel (a) is not discussed in the text so far as I could see. Also, panels (b)and (c) are discussed in reverse order. Consider discussing (a) and swapping the order of the panels so that they discussion and figure orders agree.

Figure 9 (now Figure 10 in the new version of the manuscript) has some additional material and the corresponding discussion in the text has been updated as well. All panels are now introduced.

> Line 401: "Large value+s+ of this term...". I think you should make it clear that (a) "this term" is J(x), correct, and also that (b) you mean large values after the iteration has converged, right?

We agree, Line 401 was corrected as suggested.

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