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Atmospheric Measurement Techniques Discussions

Interactive comment on "A 3-D tomographic trajectory retrieval for the air-borne limb-imager GLORIA" *by* J. Ungermann et al.

Anonymous Referee #2

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Review of 'A 3-D tomographic trajectory retrieval for the air-borne limb imager GLORIA'

Overview This paper presents results based on a series of simulation studies. The studies were all aimed at demonstrating that measurements from GLORIA, when flying on an airplane, can be used to retrieve high spatial resolution ozone fields. The basic assumption associated with the paper is, given perfect measurements and a perfect retrieval scheme, a tomographic analysis can be used to enhance the spatial resolution and perhaps the accuracy of the retrieved ozone field. The simulation studies indicate the resolution and perhaps the accuracy associated with different dimensional retrievals including 1-D up to three spatial and one temporal dimensions. The studies also attempt to indicate that the usage of more than one piece of spectral information

will enhance the spatial resolution. Overall, the subject matter dealt with in the paper is appropriate for publication in AMT but some modifications must be made and some questions must be answered before this can happen.

Major concerns The following statements (A and B along with the two sub-points) must be addressed before this paper can be published. Statement A is all about clarifying the geometry and is easily handled. Statement B on the other hand requires the addition of more results. These results should be readily available to the authors and must be made clear to the readers in order for results from this paper to be of general use.

A) This paper does not deal with the quality of the ozone that can be retrieved with GLORIA. It attempts to concern itself only with improvements in spatial resolution and accuracy given the inclusion of more dimensions in the retrieval scheme and its associated forward model. There are a few major yet easily addressable issues associated with this statement. 1) This fact should be made very clear from the start. The title, the abstract and the text should be modified to reflect that this work is associated only with the benefits gained when adding additional dimensions to the retrieval. This paper does not support or refute the fact that GLORIA measurements can be used to retrieve ozone. 2) Tomographic retrievals are all about the sampling geometry. This is not adequately reflected within this paper. The presented results apply only to limb measurements of the specific resolution associated with the study. This should be made very clear. The authors attempt to address the sampling geometry by including contours and tangent points on plots but they never address the sampling geometry in detail. I suggest a new section in the paper that properly addresses the sampling geometry in terms of things like the number of and tangent altitude separation of measurements in each image, the image rate in terms of the azimuthal scan rate, the sampling density within each grid cell (not just the tangent point density), ... This should be done over the entire retrieved volume, not just at twelve km, and it should involve a detailed discussion of the spatial size of the volume element associated with the retrieval.

B) This paper only simulates results associated with one ozone field and only presents

results at 12 km. It is not clear to me, and likely it will not be clear to most readers, whether or not the results will be as good (or as bad) with other ozone fields and at other altitudes. The quality of the results at other altitudes and with other ozone fields must be addressed within the paper in a significant manner.

Minor concerns The majority of my minor concerns related to the description of the sampling geometry and there is no need to mention them again. A few more remain. 1) Does the case of circular flight path with exact knowledge of the advection give the exact same results as a case with no advection? This should be mentioned. 2) Part of figure 12 appears to be missing in my copy. 3) Are the authors using 1 or 4 optical channels for most of the simulations. This should be made clear. 4) On page 3826 in line 1 there is a statement that says 'This is indeed the case as Fig 13 demonstrates.' I believe the authors are referring to the low relative errors within the circle but when I look at the retrieved field presented in panel a) it doesn't look like any input presented within the paper. I assume this is because it is time average or something like that but Fig 13 doesn't demonstrate the statement without more information. 5) On page 3827 there is a statement that says the 'average atmosphere resembles rather closely the retrieval result . . .'. 'Rather closely' is a matter of opinion and I don't think I share the opinion. I would suggest that the retrieved results 'more closely resemble' but they are still not good enough in the entire volume to state they 'resemble rather closely ..'. 6) I think the statement on line 11 page 3830 needs to be softened. It has in no way been shown that inaccurate wind information can improve the retrieval. It has been shown that for this one case it doesn't significantly decrease the accuracy of the result.

Concluding comments

I believe the presented work has the making of an excellent paper. I would very much like to see the major concerns dealt with and the minor concerns addressed. At this time I would be happy to review the paper again. I believe that the next round of the review will involve only minor revisions if the major concerns are addressed.

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