

Interactive comment on “Comparison study of COSMIC RO dry air climatologies based on average profile inversion” by J. Danzer et al.

The manuscript “Comparison study of COSMIC RO dry air climatologies based on average profile inversion” by Danzer et al. describes a method to retrieve atmospheric refractivity through averaged bending angles, instead of individual profiles through the Abel transform. And they tested the influence of ‘altitude expansion’ and ‘implementation’ by comparing the results with ECMWF reanalysis and satellite data.

I believe the applied analyses methods are sound, but the study only shows the facts but lacks explanations. I think this manuscript needs major restructuring, rewording and general clarifications before the full extent of the presented analyses becomes clear. The study can show some interesting results if they are presented in a precise and detailed manner. I can only recommend the manuscript for publication if major revisions have been done, following the general and detailed comments listed below.

General comments:

1. In the abstract:

Page 1, Line 7:

‘Above that altitude some background information for the Abel integral is still necessary. ‘
Is this a conclusion drawn from this present study? If it is, why it is not explained or discussed in the manuscript at all. The only relevant paragraph is
‘The basic idea of the API approach is that averaging of the data in bending angle space suppresses the noise in the data, so that the observed bending angle can be used up to 80 km and the SO step becomes largely obsolete. Above 80km some kind of background information is still necessary. ‘

in Page 3.

If it is not a conclusion of this study, it is not appropriate mention it in the abstract.

2. The authors compare results with multiple data, namely the reanalysis data , and satellite data MIPAS and SABER

I have some questions here:

- 1) If there is a very good agreement between the MIPAS and SABER temperature data, as you mentioned in Page 7 Line 8, what is the point to compare your results with both of them?
 - 2) Each satellite instrument has its own sensitive altitude range and accuracy. Have you consider the accuracy of the satellite data themselves?
 - 3) You may also need to talk about the horizontal resolution of these data and its potential influence on the comparison.
3. Clearly your inversion results vary with latitudes, but does the accuracy of your inversion result vary with seasons? And will your inversion results influenced by humidity? Although it is the ‘dry temperature’ you are studying, water vapor in the atmosphere may significant influence the excess phase, right?

4. Please try to explain why the largest differences are around 35 km in fig. 5-7, 9-10.
5. Why there are large differences in tropics and mid-latitudes near surface in fig. 5-7,9 and how does the inversion from negative to positive differences formed, e.g. at ~2-3km in the tropics in fig.5
6. All your results are based on COSMIC excess phase from Jan to Mar 2011. So I guess if your results depend on seasons, your conclusions are only valid in January to March. Please refine the way that you describe your conclusion.
7. In Sect. 6 Summary and discussion, the authors summarized the study and talked about the outlook of the study. I would say Sect. 6 is only a summary but not a decent discussion at all.
In fact, in the whole manuscript, the authors have made a very comprehensive comparison, but they focused only on the 'fact' but ignored the 'reason'.
I suggest the authors add a separate section of discussion before the summary, in which all the problems and uncertainties of the present study should be discussed in a more detailed manner.
And in the section of summary and/or conclusion, the authors should show readers very clear the conclusion from this present study, not from previous study or future work.

Specific comments:

Page 1, the format of the superscript number in the authors' names might not correct.

Line 9 follow-up

Page 2,

Line 4 delete meanwhile;

numerical weather prediction (NWP) and climate monitoring in the upper troposphere and lower stratosphere (UTLS) (however, I believe the GPS RO data do not only valuable in the UTLS but in both troposphere and stratosphere, and one or more references are needed here.)

Line 13 Please explain the abbreviations uniformly in the manuscript, COSMIC (Constellation Observing System for Meteorology, Ionosphere, and Climate) or COSMIC Data Analysis and Archiving Center (CDAAC).

The abbreviations have to be explained, but ONLY at the FIRST time when they are used. Please fix the abbreviations in the manuscript.

Line 15 Foelsche et al. 2011 reference is missing.

Line 16 'level, but' → 'level but'

Page 3

Line 2. Please pay attention to the requirements of AMT regarding the 'Section/Sect.' and 'Figure/Fig.' and correct them through the whole manuscript.

Line 8. I prefer 'Abel transform'

Line 27 'mean-sea level altitude' → 'mean sea level'

Line 30 'Kirchengast et al., 8-14 September 2016, 2017', remove '8-14 September 2016,'

Page 4

Line 6 'As a next step the refractivity is calculated, applying the method described in Appendix B in Syndergaard and Kirchengast (2016) on the residual state'. I can understand that the refractivity is calculated in the next step by applying the method described in ... But this sentence is too strange to me. Please rephrase it.

Line 10 'Sec.' → 'Sect.'

Line 24 '5 °-zonal': difficult to understand. Do you indicate mean value over 5 degrees in latitude? Please make it clear.

Line 28 '1/1000K', '1/100K'? Do you mean '0.001K' and '0.01 K'? Please change them.

Page 5

Line 4 '1/5 incremental steps'. I can't understand.

Line 15 individual

Page 10

Line 1 'hence' → 'so', or ', ' → ','

Page 16

Line 21 'Summarized,' → 'To summarize,'

Line 32, address

Figure 1:

Left panel: what does the blue dashed line indicate? Please explain.

I would strongly recommend that the authors find a native English speaker to check the manuscript for grammar and structural problems.

The authors should also fix typos that I did not list (because I am out of patience...).

The authors should first read the 'manuscript preparation guidelines for authors'

(https://www.atmospheric-measurement-techniques.net/for_authors/manuscript_preparation.html) and refine the manuscript before submitting it.