

Interactive comment on “Validation of refractivity profiles derived from GRAS raw-sampling data” by F. Zus et al.

Anonymous Referee #2

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Review of the paper "Validation of refractivity profiles derived from GRAS raw sampling data" by F. Zus, G. Beyerle, S. Heise, T. Schmidt, J. Wickert, and C. Marquardt.

The paper describes the GRAS RO data inversion process developed at GFZ and presents statistical comparisons of the results with the ECMWF model. Because the GRAS receiver data is more complicated than that of other GPS RO receivers, discussions of the inversion process and results obtained by various authors and groups are important. Generally the paper is well written, and I recommend publication. However, before that occurs, I would like the authors to include more specific details about their processing and to respond to some questions. The comments follow (ref. to page number, line number).

Main comments:

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(1829,23-1830,1) Please explain what are the "Internal navigation data bits, contained in EUMETSAT NetCDF file"; how are they obtained?

(1830,1-3) Why and how is the CL data processed in the same way as the RS data? Does the GRAS receiver provide the NCO phase model on output? If not, what model is used to down-convert the CL signal in order to apply eq.(2)? Re-connecting the CL phase, which already has been connected in the receiver, by eqs. (2,3) can only result in the difference of an integer number of cycles. Have you observed cycle slips in L1 CL phase from the GRAS receiver? What sense does the demodulation (1829,17) have for CL data, once the data modulation has already been removed by the 2-quadrant phase extractor in the receiver? Do you additionally check the CL phase for demodulation errors (half-cycles)? Have you observed half-cycle slips in the L1 CL phase from the GRAS receiver?

(1830,5) "We select the longest contiguous CL and RS record" (also (1833,4-5)). I don't understand this criterion. For any occultation there is either one (no gap between CL and RS) or no (gap between CL and RS) such record. Thus the "longest" is not relevant: there is no choice. However, there may be no gap between CL and RS, but gaps immediately above and below, so the contiguous CL+RS record may be very short and not useful for processing. It seems to me that the authors must have applied a criterion based on the length of contiguous and continuous (no gaps) record. This must be disclosed and explained.

(1830,22-23) The authors refer to (Healy, 2001) where the statistical optimization is generalized by accounting for vertical error correlations, while eq.(4) is for the special case of zero correlations. This must be explicitly stated in discussion of eq.(4) (1831,1-8).

(1831,18) "The RO signal in time domain is not truncated..." This must be revised as later (1836,15-24) the authors do apply the truncation in excess to that already done by the GRAS receiver.

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(1831,22) It is necessary to add "smoothed" to the "FSI amplitude" (truncation using raw FSI amplitude unlikely makes sense).

(1832,1-11) Somewhere in sections 2.2.3 or 2.3, determination of the latitudes and longitudes from RO (for interpolation of the ECMWF grid data) must be included.

(1832,14) What does the "examination of CL and RS data gaps" mean: only their identification for the purpose of data truncation (see comment to 1830,5 above) or something else?

(1832,15) What does the "if needed" rejection mean?

(1833,5-6) It is said that CL data gaps are not filled; what about RS data gaps? Also, see related comments to (1830,5) and (1832,14).

(1834,17-18) "...compared to RO data recorded in CL mode, RO data recorded in RS mode strongly improves the ability to probe deep into the lower troposphere". Generally, I would agree with this statement, but there is no supporting comparison in the paper. If the authors have made such comparison, it would be sufficient to present comparative numbers (e.g. 50% penetration depths) supporting their statement; otherwise this statement must include a reference to other study where such comparison has been done.

Technical comments:

(1833,10) and hereafter. "...shows the fractional refractivity deviation". Deviation from what?

(1833,11) and hereafter (incl. figure captions). What does the "one-sigma standard deviation" mean? The standard deviation = one sigma by definition. Use either "standard deviation" or "one-sigma deviation".

(1834,12) and hereafter. "...is attached to the figure". Use standard way of discussing figures: e.g., left panel, right panel.

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(1834,26) "...setting occultations extend deeper..." Not the occultations but the retrieved profiles (since this sentence is related to the retrieved profiles but not to the signals as functions of SLTA).

(1836,11) "extend", must be "extent".

Figs. 3, 4, 5, 6, 7, 8, 11, 12 (right panels). Since the [fractional] number of profiles is limited by 0% and 100%, there is no reason to extend X-axis beyond those limits.

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 1825, 2011.