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Atmospheric Measurement Techniques Discussions

Interactive comment on "Evaluation of the 15-year ROM SAF monthly mean GPS radio occultation climate data record" *by* Hans Gleisner et al.

Anonymous Referee #2

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This paper describes monthly gridded dataset obtained from GPS RO from multiple missions over a period of 15 years. This study quantifies the differences among the different missions as well as how they differ from ERA-interim analysis. The characterization of uncertainty is a necessary part of a climate data record, and this paper addresses mission differences arising from data quality and sampling. Overall, I think this paper presents some new and important results that as far as I know have not been documented previously. However, the paper can be improved by addressing the following comments:

(1) I would like to see more of the results broken down in different latitude bands, not just global averages. To minimize the number of figures, such information can perhaps be summarized in a table. After all, the CDR is a gridded dataset that covers

all latitudes, so users of this dataset would want to know how the results vary as a function of latitudes. (There are some mentions that the differences are up to a factor 2 larger for certain latitude bands but this is too vague.)

(2) Is the gridded dataset a 2D (latitude-height) or 3D (lat-lon-h)? Please specify up front.

(3) To provide a broader context for the readers, it would be useful to compare the multi-mission differences among the missions to the structural uncertainty estimated from the multi-center comparisons (e.g., Ho et al. 2009; Steiner et al. 2013).

(4) The paper mentions in multiple occasions that sampling error correction is necessary for combining the data from various RO missions. I don't necessarily agree. Wouldn't it be possible to combine the data and then perform the sampling error correction on the combined dataset?

(5) Section 2.1: Table 1 listed the input data used for the study. It would be helpful to provide some key information up front about the changes in versions since they can lead to abrupt changes in the time series. For example, we learned later on that the GRACE processing had changed from single-differencing to zero-differencing. Please also mention rationale for using the UCAR Metop input data even though it is not officially part of the CDR. Regarding the low-level input data, was there quality control done by UCAR and EUMETSAT at this point?

(6) Section 3.2: The results on the bending angle quality from different missions are interesting. However, for most readers not familiar to RO, it is not clear how they are relevant to the retrieved physical parameters shown later. Please provide some discussions of that.

(7) Figure 5: There is a significant jump between 2009-2010 between 20-30 km. Is that related to the "update of the COSMIC NRT data processing in October 2009"? Please provide more details.

(8) Figure 5: In 4-8 km height range, the inter-mission differences in bending angles seem big, but the refractivity differences appear to be much smaller (except for CHAMP). Why? Is it a matter of vertical scale in the plotting?

(9) Section 3.3: The authors describe the quality control criteria used to remove bad data. However, the descriptions were rather generic. For example, it's not clear how criteria a, b, and c are distinct from each other. I understand this is a complex subject and not the main focus of this paper, and the authors did reference a document on the ROM SAF web site. However, a little more technical information, along with some statistics on the percentage of occultations removed from each criterion, would be useful.

(10) Section 3.4: The authors describe the binning and averaging technique used to produce the gridded monthly means. It introduces a technique where each latitude bin is divided into two sub-bins to obtain latitude weighted average within each bin. What is the advantage of doing it this way vs. something like Gaussian weighting (for example)?

(11) Section 3.6: The authors stated that "In the generation of anomaly time series, the same seasonal cycle should be used for all missions and throughout the time series." I would argue that if you want to look at differences in seasonal cycles and anomalies separately, it would be better to derive the seasonal cycle from each time series and obtain the anomalies by removing corresponding seasonal cycles.

(12) Figure 5: There is a small constant bias (after 2006) between 8-20 km between RO and ERA-interim in both bending angle and refractivity. Can you comment on that?

(13) Section 5.1, p. 17: "Large-scale hemispherically asymmetric (north-south) Metop-COSMIC bias on the order of 0.1% above 35-40 km, and increasing upward. . . is believed to be related to differences in LEO satellite orbits from the two sources of input data." Can you provide some evidence of this claim?

(14) In general, for the bullets in pp. 15-17, the authors should use references when possible to substantiate the arguments.

(15) Section 5.2.1, p. 18: The difference between Metop and COSMIC bending angle over 8-30 km is large compared with other missions. Would that change if the Metop-UCAR input data were used instead?

(16) Also: "Metop shows . . . a stepwise decrease of the bias in mid-2013. . ." Any idea why?

(17) P. 2, line 4: Mission acronyms were never spelled out.

(18) P. 4, line 5: "The model data profiles are forward-modelled to the set of observed geophysical variables." Please provide more information on the forward modelling (e.g., from what variable to what variable, do you account for tangent point drifts, upper boundary for Abel integration, etc.).

(19) P. 18, line 6: Change "Sofar" to "So far"

(20) In the abstract and elsewhere, the authors differentiate the upper troposphere from lower by saying "6-8 km". I find this a little awkward (is it 6 or 8 km?). I think it's better to just use 8 km as the boundary.

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