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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantification of structural uncertainty in climate data records from GPS radio occultation" *by* A. K. Steiner et al.

Anonymous Referee #1

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This paper reviews recent work within the "RoTrends" Project, designed to compare output from the main GPS radio occultation (GPS-RO) processing centres. The paper is aimed at climate scientists who might chose to use GPS-RO data in their studies, and it aims to provide error bars on the GPS-RO climatologies by using the statistics of the differences of the centres results. Overall, I think it will be a useful reference paper, and it should be published.

General discussion points

"Structural uncertainty" does not appear to be clearly defined early in the paper. Thorne et al (BAMS, 2005, vol 86, 1437-1442) define it terms of a subjective choices in the

processing. In the context of this paper, could we just relate many of the results more clearly to the need for a priori information to retrieve geophysical information from the measurements. Deriving geophysical information from GPS-RO is an ill-posed problem, and a priori is required to make it well-posed. Different centres make different choices about the a priori information used, and how much weight it is given in their retrievals. On page 26976 it is noted that "structural uncertainty increases with increasing altitude ..." and the differences mainly stem from "different bending angle initialization ...". Alternatively we could simply say the processing centres use different a priori information. In this context, a simple statement saying that that GPS-RO geophysical products become increasingly sensitive to a priori as the height increases might be useful to a non expert. EG, perhaps point out that the bending angle falls exponentially with height, but the measurement noise in the stratosphere is relatively constant, and this leads to an exponential fall in signal to noise with height.

The results shown here also show that structural uncertainty is lowest where the measurement information content is highest. This point should be emphasised.

Figure 1 shows convincingly that the consistency is best at the bending angle level. It might be worth noting the NWP users are increasingly moving towards the direct assimilation of bending angles to reduce the sensitivity to a priori information introduced at the data processing centres.

The authors might consider referencing recent papers on the importance of the statistical optimization processing step in the generation of monthly mean climatologies.

Ao, C. O., A. J. Mannucci, and E. R. Kursinski (2012), Improving GPS Radio occultation stratospheric refractivity retrievals for climate benchmarking, Geophys. Res. Lett., 39, L12701, doi:10.1029/2012GL051720.

Gleisner, H. and Healy, S. B.: A simplified approach for generating GNSS radio occultation refractivity climatologies, Atmos. Meas. Tech. Discuss., 5, 5245-5269, doi:10.5194/amtd-5-5245-2012, 2012.

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Minor point

Table 1 "EUM" Initialisation of bending angles. This is a strange entry because there are no refractivity, temperature etc results shown for EUMETSAT.

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