

## ***Interactive comment on “Analysis of ionospheric structure influences on residual ionospheric errors in GNSS radio occultation bending angles based on ray tracing simulations” by Congliang Liu et al.***

**Anonymous Referee #1**

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This paper presents a detailed analysis of residual ionospheric errors (RIE) that have been found in a simulation study of radio occultation measurements. It is, in effect, an extension of [Liu et al., 2015], where the simulation was first reported. In that paper the data with large RIE was excluded from the analysis. In this paper, the large RIE data is re-analysed in order to assess, in detail, how the errors accrue along the raypath. This attention to detail is commendable and provides useful insight into the measurement. The paper is clearly worthy of publication in AMT.

One concern is that the conclusions may not be fully supported by the text. In partic-

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ular, the authors make the point that the large RIEs can be produced by ionospheric asymmetry or by technical ray-tracing errors that probably arise from discontinuities in NeUoG. The role of ionospheric asymmetry is emphasized by showing that the errors largely disappear when a spherically symmetric ionosphere is used. However, it seems likely that any NeUoG discontinuities will also be removed in the spherically symmetric case; i.e. the two issues cannot be separated by this test. It would be more persuasive if it could be demonstrated that the rest of the dataset (i.e. those with reasonable RIEs) did not exhibit ionospheric asymmetries. Through since no physical reason is presented for the large RIEs to occur in the geographic areas where they are most prevalent, it seems this is unlikely. If ionospheric asymmetries do occur in the other data, the conclusion may be that the large RIEs are caused by the ray-trace problems alone, or by a combination of both the asymmetry and the ray-trace.

Other issues:

The work of [Danzer et al., 2015] is referenced. In that paper the analysis was limited by “high noise of the simulated bending-angle profiles at mid- to high latitudes”. Is this the same problem ray-trace? If so, it is probably worth mentioning it.

Page 4, line 17. This sentence has become confused and a rogue full stop is present.

Refs

Danzer, J., S. B. Healy, and I. D. Culverwell (2015), A simulation study with a new residual ionospheric error model for GPS radio occultation climatologies, *Atmos. Meas. Tech.*, 8, 3395–3404, doi:10.5194/amt-8-3395-2015.

Liu, C. L., G. Kirchengast, K. Zhang, R. Norman, Y. Li, S. C. Zhang, J. Fritzer, M. Schwaerz, S. Q. Wu, and Z. X. Tan (2015), Quantifying residual ionospheric errors in GNSS radio occultation bending angles based on ensembles of profiles from end-to-end simulations, *Atmos. Meas. Tech.*, 8(7), 2999–3019, doi:10.5194/amt-8-2999-2015.

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