

I find it confusing to use the word 'delay' in the text around Eq. (1). In principle 'delay' should refer to a time interval, but that is not the way it is used here. When talking about a phase measured in meters, it would make more sense to use the word 'phase path'. I think 'group delay' (as in eq. 2) could be replaced by 'pseudorange'.

We have reworked the manuscript and removed the word delay in several places. We now refer to pseudorange and phase. The word “delay” is now used exclusively in reference to pseudorange where the word “delay” has an appropriate meaning. For pseudorange, the slower group velocity in the ionospheric medium causes a delay in the signal relative to propagation in free space. We have also removed the noise terms in Equations (1)-(3) since they are no longer needed.

Line 177-180: Raypath separation between P1 and L1 signals does not make sense to me. To my understanding (and I'm rather sure of this), P1 and L1 measurements are related to the same path. Because of the P-code (which is modulated on the phase) the wave can be decomposed into multiple waves with slightly different frequencies. The ray path (in geometric optics) of such a wave is perpendicular to the wavefront of the carrier, even when the signal is comprised of multiple signals with slightly different frequencies around the carrier frequency. I think the authors should remove line 177-180 or provide a reference to a text book to support their statement.

We have removed the statement and also the statements closer to lines 500-510 in the manuscript.

On the related issue about eta in Eqs. (1) and (2): In their response, the authors agree with me, and correctly points out that the ionosphere affects eta because bending in the ionosphere will slightly shift the tangent height of the ray path in the neutral atmosphere, but then goes on to say that it is quite small and is ignored in radio occultation processing. However, my comment was that I don't think it is negligible in the context of residual ionospheric errors/bias. As I understand it, ray path separation is less of a problem in bending angle correction, but in phase correction (as here) it is a larger problem. I disagree that the residual ionospheric error, regardless of whether we say it is due to ray path separation or tangent height shift (it is basically the same thing), is avoided with single-frequency processing. The discussions in lines 459-465, 471-474, 482-486, 500-505, and 543-547, that single-frequency processing is not (or very little) affected by residual ionospheric bias cannot stand without mathematical evidence to support such a claim. To my knowledge, no such evidence exists, and I think the authors should remove the indications that the single-frequency processing (no matter how many profiles you average over) can resolve the residual ionospheric bias in dual-frequency processing.

We appreciate this comment of the reviewer. It is useful to understand the residual ionospheric error in the context of single frequency processing. A great deal has been written on the topic of RIE, which we now present in an Appendix. The analysis shows that under many conditions such as near solar maximum daytime, the dual-frequency RIE can significantly exceed single-frequency RIE. Text has been modified and an Appendix added to the manuscript. The modified discussion is near Line 545 of the Track Changes version.

Something is not right with the added sentence in line 194-195: "CDAAC processing uses the BERNESE software for RO orbit and clock determination, and for retrievals, are described in Schreiner et al. (2009) and Kuo et al. (2004), respectively."

We have corrected the language near Line 207.

I was not able to find anything about statistical bias in Section 7.2 of Mandel, 1964. Or in any other section. Anyhow, I think the description with weighted averaging seems sound, and I wonder if the notion about a possible 'statistical bias' is necessary in this context.

We no longer refer to "statistical bias" but continue to refer to unbiased estimators as referred to in the work by Mandel. Near Line 313.

Figure 8 caption: "The blue curve" is black in my copy.

We have made the correction.

Sean Healy, Andras Horányi are no longer co-authors? But they are mentioned in the Author Contribution: S. Healy and A. Horányi provided review and editing of the manuscript and elements of the conceptualization and methodology.

The co-authors Healy and Horányi felt their contributions did not merit co-authorship, so we have removed them as co-authors and we now mention Healy in the acknowledgements. Horányi is no longer mentioned because he worked with Healy, and it would seem inappropriate for Healy to acknowledge Horányi's contribution in the Acknowledgements since Healy is no longer a co-author.