Review of the paper by F. Zus, G. Beyerle, S. Heise, T. Schmidt, and J. Wickert entitled "GPS radio occultation with TerraSAR-X and TanDEM-X: Sensitivity of lower troposphere sounding to the Open-Loop Doppler model."

The paper demonstrates the RO inversion biases induced by altering the receiver Doppler models by +5Hz and -5Hz. This study follows a previous study in which they altered the model by +10Hz and -10Hz. The authors state the following in the abstract: "To date only little attention has been paid to the Open Loop (OL) Doppler model." I disagree with this statement. The receiver Doppler model received significant attention in Ao et al., 2009 [doi:10.1029/2008JD010483] (cited in the paper), and the Doppler model used for the post-processing of raw OL samples collected by RO receiver received significant attention in Sokolovskiy et al., 2009 [doi:10.1029/2008RS003907] (not cited in the paper).

The authors process raw OL samples i.e., connect residual phase $\delta\phi_n$ by resolving cycle ambiguities (eq. 3) and using the receiver model as the reference model: $\delta\phi_n = \phi_n - \phi_n^{NCO}$. The main role of the receiver model is reduction of the mean signal frequency prior to the integration of I and Q in receiver (this increases the SNR). It is clear that the bias in $\dot{\phi}_n^{NCO}$ propagates into the $\delta\dot{\phi}_n$ and, finally, into inversion results, and this propagation depends on the spread of RO signal spectrum (i.e., is different for different latitudes). The authors recognize and describe the mechanisms responsible for such propagation on page 12,725. It is also clear that technically it may be difficult to run very accurate model in receiver.

However, what is the reason to use the receiver model in the post-processing? Once the samples ϕ_n are recorded, the residual phase can be extracted and connected by using a more accurate reference model which does not depend on the receiver model: $\delta\phi'_n = \phi_n - \phi_n^{REF}$. As the first guess, the reference model $\dot{\phi}_n^{REF}$ can be already low-biased (based on refractivity climatology and orbits) and it can be further adjusted (made unbiased) by use of the sliding spectrogram or smoothed residual Doppler [Sokolovskiy et al., 2009]. Possibility of the use of smoothed residual Doppler for adjustment of the reference model also follows from Figure 4 in the paper. Of course, none of the adjustments will work under low-SNR conditions where Doppler will be distributed around the reference model, as noted by the authors on page 12,725, but RO signals should be truncated there. If the goal of the paper is demonstration of the sensitivity of inversion results to the shift of Doppler model, there is no need to alter receiver model $\dot{\phi}_n^{NCO}$, it is sufficient to use any OL data ϕ_n and alter post-processing model $\dot{\phi}_n^{REF}$.

Summary

The paper is written in clear and concise style. The authors have unique RO data at their disposal: raw OL samples obtained by altering receiver model by 5Hz and 10Hz. But the authors processed these data in a suboptimal way and I don't see a value in the results. Thus I cannot recommend publishing this paper in its present form.

However, with moderate efforts, the authors could re-process their data by extracting and connecting the residual phase with the use of a reference model independent of the receiver model. They could apply this processing for the raw OL samples obtained with altered receiver models and demonstrate whether the use of independent reference model in the post-processing eliminates or reduces the sensitivity of inversion results to receiver model. It is useful to test this for both 5Hz- and 10Hz-altered receiver models. The authors may compare the inversion results obtained by use of the independent reference model with the results already obtained by use of the receiver model. I encourage the authors to re-process their data and I look forward to seeing the results in their revised paper. Further technical comments can be made after the revision of the paper.