Manuscript doi: 10.5194/amt-2017-385, 2017
Manuscript Title: **The FengYun-3C radio occultation sounder GNOS: a review of the mission and its early results and science applications**
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We thank the referee very much for the constructive comments and recommendations and for the overall positive rating that this is considered a useful paper clearly worthy of publication. We thoroughly considered all comments and carefully revised the manuscript accounting for most of them. In addition, we carefully complemented these revisions with a couple of further improvements throughout the manuscript text in the spirit of the comments.
Please find below our point-by-point response (in form of italicized, blue text) to the referees' comments (in form of upright, black text)*, inserted below each comment. Line numbers used in our responses refer to the original AMT Discussions paper and text updates in the revised manuscript are quoted below with yellow highlighting.*

Response to Anonymous Referee #1's Comments

The paper reviews the Global Navigation Satellite System (GNSS) occultation sounder (GNOS), data processing, data quality evaluation, and research applications. The data validation demonstrates that the FY-3C GNOS mission can provide atmospheric and ionospheric RO profiles of a quality that is reasonably good for numerical weather prediction (NWP), global climate monitoring (GCM) and space weather research (SWR). The paper can be published after minor revisions, mostly consisting in providing statements that are more accurate, as well as missing definitions.
Thank you. Agreed, and the statements and definitions were improved.

Page 8: What is the motivation for the 100 Hz sampling rate in open loop? Is it optimal?
Currently, for the sampling rate in open loop, COSMIC is 50 Hz and MetOp is 1000 Hz (raw sampling rate). According to Sokolovskiy et al, studies, for open loop, 50 Hz sampling rate is sufficient to monitor the troposphere, while MetOp uses 1000 Hz sampling rate to do a detailed spectrum analysis of the lower troposphere. Indeed, the sampling rate is the higher the more detailed information of atmosphere can be obtained, at least from 50 Hz to 1000 Hz. FY-3C GNOS adopts 100 Hz sampling rate because the limitation of the FY-3C satellite down link load capability. 100 Hz is the highest sampling rate we can use for FY-3C GNOS, so we can draw the conclusion that 100 Hz is optimal for FY-3C GNOS.
For the detailed information of open loop sampling rate analysis, please refer to the following references:
Sokolovskiy, S.: Tracking tropospheric radio occultation signals from low Earth orbit, Radio Sci., 36, 483–498, 2001.
Sokolovskiy, S. V., Rocken, C., Lenschow, D. H., Kuo, Y.-H., Anthes,R. A., Schreiner, W. S., and Hunt, D. C.: Observing the moist troposphere with radio occultation signals from COSMIC, Geophys. Res. Lett., 34, L18802, doi:10.1029/2007GL030458, 2007.

Sokolovskiy, S., Rocken, C., Schreiner, W., Hunt, D. C., and Johnson, J.: Postprocessing of L1 GPS radio occultation signals recorded in open-loop mode, Radio Sci., 44, RS2002, doi:10.1029/2008RS003907, 2009

Page 12: The radio occultation processing package (ROPP) software (V6.0) developed at ROM SAF (radio occultation meteorology satellite application facility) is used for this purpose. More specifically, from the excess phase the Doppler frequency can be obtained, then the bending angles are determined from the Doppler frequency shift and the corresponding satellite positions and velocities (e.g., Kursinski et al., 1997).
Does not ROPP utilize the technique based on Fourier Integral Operators?
M. E. Gorbunov and K. B. Lauritsen, Analysis of wave fields by Fourier Integral Operators and its application for radio occultations, Radio Science, 2004, 39(4), RS4010, doi:10. 1029/2003RS002971.
Right, in FY-3C GNOS data processing, we use the technique based on Fourier Integral Operators, through the ROPP software. Now, the wave-optics (WO) method has been clarified and the M. E. Gorbunov 2004 paper has been cited in the revised manuscript.

Page 13: However, there are some higher-order ionospheric effects that still remain in the bending angle profiles (Kursinski et al., 1997; Liu et al., 2013, 2015, 2016, 2017a). To reduce the ionospheric residual errors and other small-scale noise, the statistical optimization technique is used together with the MSISE-90 climatology model. An optimal linear combination is expressed as a matrix equation to compute the neutral atmospheric bending angle and the ionospheric bending angle.
The term “optimal linear combination” was used be M.Gorbunov. See: M. E. Gorbunov, Ionospheric correction and statistical optimization of radio occultation data, Radio Science, 2002, 37(5), 17-1–17-9, doi: 10.1029/2000RS002370.
Provide more detail on your optimal linear combination. In what terms is the “matrix equation” formulated?
Right, the optimal linear combination approach that is nested in ROPP software has been used for FY-3C GNOS data processing, and we did not change it. The details of this approach have been described in the abovementioned M. Gorbunov. 2002 paper and ROPP USER GUIDE: PRE-PROCESSOR section 2.4. Since, in this paper, we focus on the FY-3C GNOS missoin and its data validation and application, so we cited this publication as a reference in the revised manuscript now.

Page 14: When GNSS signals transmitted through the ionosphere from GNSS satellites to the FY-3C 14 satellite are bent and delayed …
It is better to say that bent are the signal propagation paths rather than the signals themselves.
Ok, we agree; done.

Page 14, Eq. (5). Add some comments on accuracy of this inversion. How large are effects due to horizontal gradients, and the contribution of the ionospheric layers above the LEO.
The statistics of GNOS NmF2 is in line with CHAMP mission, whose NmF2 average bias is -1.7 %, and standard deviation is 17.8 % (Jakowski et al., 2002).

Jakowski, N., Wehrenpfennig, A., Heise, S., Reigber, C., Lühr, H., Grunwaldt, L., and Meehan, T. K.: GPS radio occultation measurements of the ionosphere from CHAMP: Early results, Geophysical Research Letters, 29, 95-91-95-94, 10.1029/2001gl014364, 2002.
We have added this reference in the revised manuscript now.

For the effects due to horizontal gradients: a simulation study shown that the horizontal gradients could bring about -6.3 to -10.1% relative error (RMS).
Wu, X., Hu, X., Gong, X., Zhang, X., and Wang, X.: Analysis of inversion errors of ionospheric radio occultation, GPS Solutions, 13, 231-239, 10.1007/s10291-008-0116-x, 2009.

For the effect of ionospheric layers above the LEO: the orbit of FY-3C satellite is 833 km height, and our simulation evaluation indicated that the ionosphere above the LEO satellite effect the accuracy of the retrieved results slightly, but less than 0.1%. Therefore, the ionosphere above the LEO satellite can be neglected in FY-3C GNOS situation.

Page 16–17: The statistical BDS and GPS GNOS RO data analyses, by using 17 pairs of 22 BDS/GPS GNOS RO events in a week, showed that the BDS/GPS difference standard deviation of refractivity, temperature, humidity, pressure and ionospheric electron density are lower than 2 %, 2 K, 1.5 g/kg, 2 %, and 15.6 %, respectively. Therefore, the BDS observations/products are in general consistent with those from GPS (Wang et al., 2015).
Are there any systematic differences?
In this statistical analysis, we did not find obvious systematic differences between the BDS and GPS occultation data. [!!Congliang: did you cite Bai et al. 2018 AMT paper in most updated form? And other papers that may need most updated reference – please cross-check and make this sure for all papers recently published or in press]

Page 18: How can you explain the difference between the lower-tropospheric bias structures in Figures 5 and 6?
Figure 5 and 6 show the statistics of FY-3C GNOS/GPS and FY-3C GNOS/BDS RO datasets, respectively. The difference between the low-troposphere bias structures due to FY-3C GNOS/GPS RO uses the open loop while FY-3C GNOS/BDS RO use the close loop techniques at the lower troposphere. Therefore, below 3 km height, the amount of FY-3C GNOS/BDS RO data decreases sharply.

Page 17 and 19: “mean bias” and “average bias” should probably refer to the same quantity. Is it defined as systematic difference averaged over a height interval? If so, such a quantity is not very informative. More interesting is the maximum bias.
Thanks. Yes both the "mean bias" and "average bias" refer to the systematic difference averaged over a height interval.
We also discussed it with the authors of Liao et al., AMT, 2016 paper. In our opinion, the mean bias and standard deviation are statistically meaningful, which can show the dataset's overall quality. However, the maximum bias may happen in some specific RO events, which cannot demonstrate the overall quality of the GNOS RO observations.

Page 20: Define NmF2 (maximum electron density in F2 layer).
Ok, done.

Page 22: Define hmF2 (the height of the F2 maximum).
Ok, done.

Page 21: The black lines in Figure 8 can hardly be seen under the blue lines. Consider using a different representation, e.g. differences of anomaly correlations.
Yes, the black line is mostly covered (over-shadowed) by the blue line, but at each subplot's right corner the black line appears. Thanks for your suggestion to use differences instead, but we think the original figure is a better format, so we preferred to keep the original figure.

Page 21–22: Figure 9 shows an evaluation score card of the effects of the GPS and BDS FY-3C GNOS RO data … better … worse"
Is it GPS that is better/worse than BDS? The difference between "Far better/worse" and "better/worse" can hardly be seen. Provide the definition of "far" and "not significant".
Actually, Figure 9 (currently revised to 10) does not show the comparison of the GPS and BDS GNOS RO data quality, but shows the comparison of the NWP accuracy with and without GNOS RO data. Therefore, in Figure 9 better/worse means the NWP accuracy by using GNOS RO data than that without using the GNOS RO data.

We thank the reviewer again for the valuable comments that helped to improve the paper.