Review of paper "Processing and quality control with FY3C/GNOS data used in numerical weather prediction applications" by Mi Liao, Sean Healy, Peng Zhang

General Remarks

The paper presents an interesting material on the processing of the radio occultation data acquired by the GNOS instrument. However, due to the way the material is presented, the paper requires revising. When speaking about any new approaches, the author must cite the old ones and explain, why they fail. Currently, this is not done, and, therefore, the reference of the previous work is insufficient.

Specific Comments

Page 2 (lines 24-30), page 3 (lines 1–2): *As with the pre-existing GPS-RO sounders…, the raw observations from GNOS consist of phase and signal to noise ratio (SNR) measurements. In addition, auxiliary information provided by the International GNSS Service (IGS), such as the GPS precise orbits, clock files, Earth orientation parameters, and the coordinates and measurements of the 1 ground stations, are also needed.*
What about the navigation bits? Does Beidou have navigation bits, similar to GPS/GLONASS ones? If so, are they also provided for the precise demodulation?

Page 3 (line 26): *if they exceed the three sigma from a statistical point of view.*
… if they exceed 3 times the standard deviation. How is the standard deviation defined?

Page 4 (lines 4–6): *Therefore in this work we developed and tested a new L2 bending angle extrapolation method for GNOS data, and implemented it in ROPP.*
Once speaking about a "new" method of the L2 extrapolation, one must cite the papers describing the "old" extrapolation technique.

1. M. E. Gorbunov, K. B. Lauritsen, A. Rhodin, M. Tomassini, and L. Kornblueh, Analysis of the CHAMP Experimental Data on Radio-Occultation Sounding of the Earth's Atmosphere, Izvestiya, Atmospheric and Oceanic Physics, 2005, V. 41, No. 6, 2005, p. 726–740.
2. M. E. Gorbunov, K. B. Lauritsen, A. Rhodin, M. Tomassini, L. Kornblueh, Radio holographic filtering, error estimation, and quality control of radio occultation data, Journal of Geophysical Research, 2006, V. 111, No. D10, D10105, doi: 10.1029/2005JD006427.

There may also be some other publications on this topic. These papers cited, the differences between the old and new approaches must be discussed. Is it the "old" extrapolation method that the authors call the "ROPP extrapolation"? Or does ROPP use a different method? What is the reason of the failure of the old extrapolation technique for the GNOS data?

Page 8 (line 15–21): *Gorbunov [2002] proposed a QC procedure in terms of the analysis of the amplitude of the RO data transformed by the Canonical Transform (CT) or the Full Spectrum Inversion (FSI) method, which is useful to catch the corrupted data because of phase lock loop failures. Beyerle et al. [2004] also suggested a QC approach to reject the RO observations ruined by ionospheric disturbances according to a parameter R defined by the phase delay of L1 and L2 signal.*
There are some more papers on QC. See the above references. See also the following papers:

3. Zou, X. & Zeng, Z. (2006), 'A quality control procedure for GPS radio occultation data', *J. Geophys. Res.* **111**, D02112.
4. Liu, H.; Kuo, Y.-H.; Sokolovskiy, S.; Zou, X.; Zeng, Z.; Hsiao, L.-F. & Ruston, B. C. (2018), 'A quality control procedure based on bending angle measurement uncertainty for

radio occultation data assimilation in the tropical lower troposphere', *J. Atmos. Oceanic Technol.* **35**(10), 2117--2131.

The paper by Zou and Zeng is in the reference list, but is not discussed nor referenced in the text. Please provide a comparative analysis of the old and new QC methods with the explanation of why the old QC methods are not sufficient for your data analysis. In particular, will the "badness score" introduced by Gorbunov et al. and successfully applied for CHAMP, COSMIC, METOP and other observations, be also useful for the FY3C/GNOS data analysis? If not, why?

Page 9 (lines 3–7): *The physical meaning of noise_estimate is easy to understand.*
What is easy to understand is the fact that $\Delta\alpha$ is restricted to be close enough to its estimate obtained from a simple ionospheric model. Nevertheless, it is a good idea for the authors to explicitly mention this rather than appeal that something is "easy to understand". Still, some questions remain. Does n in formula (4.1) stay for refractivity of number of data? Number of data is definitely missing somewhere, because the sum in this formula needs to be normalized by the number of data. If n is refractivity, at what height is it taken? Provide explanations or definition regarding n.

Page 11 (lines 21–22): *The GRAS standard deviations are worse in the troposphere might due to sampling; essentially GRAS is able to measure more difficult cases.*
This statement needs more explanation. What are "more difficult cases"? Do they mostly occur in tropics? Can the authors provide any examples? Is it possible to evaluate a regionalized statistics (tropics, mid-, and polar latitudes)?