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Atmospheric Measurement Techniques Discussions

Interactive comment on "Evaluation of atmospheric profiles derived from single- and zero-difference excess phase processing of BeiDou System radio occultation data of the FY-3C GNOS mission" *by* Weihua Bai et al.

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We thank the referees very much for the constructive comments and recommendations and for the overall positive rating that this is a significant scientific paper. We thoroughly considered all comments and carefully revised the manuscript accounting for most of them. In addition, we carefully complemented these revisions with a range of further improvements throughout the manuscript text in the spirit of the comments.

(Please read the amt-2017-177-supplement.pdf by the link at end of this document, in

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Discussion paper

which you can find the response to all the referees and the revised manuscript)

This paper introduces, in a comprehensive way, the data processing of the first Beidou based Chinese radio occultation mission FY-3C GNOS and 3-month data were used for the study/data processing. The two strategies of data processing investigated are zero-differencing and single-differencing. Differencing is a standard data process strategy in GNSS data process to mitigate (or cancel out) the various errors (e.g. signal generation/emission, signal propagation, signal transmission and signal reception) inherited with the technology. Various analyses of the atmospheric profiles based on the single- and zero-differencing data processing strategies and using three months' data, are carried out to evaluate the quality of BDS GNOS RO data and the robustness/quality of the zero-differencing data processing method. By comparing with ECMWF model and co-located radiosonde data, the BDS GNOS atmospheric profiles derived are fairly consistent. Data processing algorithms are introduced in a fairly detailed way. The analyses are described and presented in a logical and clear manner. The discussions are comprehensive albeit some further clarification is needed. The conclusions given from the analysis are sound and reflect the current state-of-the-art in the field.

Thank you.

Following are my other comments/suggestions for correction 1) FY-3C GNOS receivers can receive both the GPS and BDS signals for navigation and occultation modules, therefore GNOS provides a different way to validate its BDS RO data (i.e. based on the zero-difference processing and GPS RO retrievals). I wonder the reason why not to use the GPS GNOS RO retrievals to validate BDS's counterparts? We agree that comparing with the GNOS GPS RO retrievals to validate BDS's counterparts is a good idea and a potential way to do the FY-3C GNOS RO data evaluation. However, the radiosonde observations and the ECMWF analysis data are reliable GNOS-independent data, which have previously been used as reference data to also validate GPS RO retrievals. Therefore, for this initial GNOS BDS evaluation we selected the radiosonde and ECMWF data as preferred source to use as reference to validate the BDS RO

data. Nevertheless, since we could achieve a limited collocation ensemble of BDS RO and GPS RO, we included one BDS vs. GPS intercomparison figure now in section 3.2., which shows reasonably high consistency. Of course, further improvements and a detailed intercomparison analysis of the GPS and BDS RO data is a very interesting study, and we plan to do it by an extra paper.

2) The current coverage of Beidou is regional. It would be great if the authors can comment over the issue of limited coverage of the Beidou system and how it affects the ROE occurrence? Thank you for pointing to this; we think, though, that in the view of the focus of this paper (an initial validation of the BDS RO profiles) we have commented on the current limitations of the BDS MEO, IGSO, and GEO subsystems in adequate length. We did so in the introduction, in section 3 where we also visualize the RO events occurrence in terms of the geographic coverage situation (Fig. 5), etc.

3) - Technical Corrections - Define the acronym for GRAS, GEO, IGSO and etc. when they appear in the first place in the text and use the acronyms thereafter. Ok, done.

- Page 3, lines 13-14: the word “satellites” is repeated. Ok, corrected.

- Page 13, line 10: It looks like you might be missing a reference here. Ok, a typo was left, corrected.

- Page 16, lines 4-5: Should be Allan deviation (ADEV), not Allen variance. Ok, corrected.

- Be careful with some reference formats and typos. Ok, looked again over the texts and further polished reference formats and typos.

- be careful in using the differential technique, you need to be consistent to use differencing or differenced or difference. They do have minor differences. The "single-different" in figure 5 (a)/(b) is NOT right. Ok, corrected.

- the title of the paper looks awkward and it needs to change "processing" and "data" need to be "data processing" Thank you, we carefully considered and tried this, but

then preferred to keep the current formulation (expresses best in our view the aspect that we focus on the new BeiDou radio occultation data and that the key processing focus is excess phase processing). We made a little simplification, though, in leaving out the term “System” from the title, since “BeiDou radio occultation data” instead of “BeiDou System. . .” is sufficient in the title.

- GNSS is commonly referred to The Global Navigation Satellite Systems (plural!!!) Yes, we agree this is done in particular if the plurality of the different constellations (in particular GPS, Glonass, BDS, Galileo) is emphasized. Since we use it as a generic term (collectively for the constellations), however, we generally prefer to follow the usual notation of using the term Global Navigation Satellite System as the name of the overall system.

- the language usage needs to be sharpened and grammatical problems are spotted. Ok, as mentioned above, we rechecked all texts and the language usage has been improved.

- "sub-global" needs to be replaced as "regional" Ok, done.

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2017-177/amt-2017-177-AC3-supplement.pdf

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