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Atmospheric Measurement Techniques Discussions

Interactive comment on "Comparison of RO tropopause height based on different tropopause determination methods" *by* Ziyan Liu et al.

Ziyan Liu et al.

1243913856@qq.com

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Dear reviewer: Thank you very much for your comments and advices on our manuscript. We have carefully read your comments and revised our manuscript. The reply with figures in PDF version is uploaded in zip file, and our response to your comments is as follows: Context and general comments 1. "A part of those differences could be caused by the different local times of the two LEO satellites, but particularly for the method based on temperature lapse rates it is not unlikely that different processing play a role" Our response: MetOp-a, MetOp-b and FY3C satellite are all sun-synchronous orbit satellites, which makes them have the similar local solar time, like fig. 1, 2 and 3. These figures are generated via ROM SAF website: https://www.romsaf.org/monitoring/index.php Here we only present one-month local

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solar time distribution for example. Also, MetOp and FY3C RO data are both processed via ROPP software (from excess phase to bending angle, refractivity, dry temperature, etc). Thus, we use FY3C and MetOp data in our study to avoid inter-mission bias as far as possible. We add a description about this in section 2.3 in our updated manuscript. However, the bias is inevitable because the RO sounders are different and the version or parameters of ROPP software may be different. The retrieval from raw RO data to bending angle and temperature is complex, so, it's difficult for us to explain why FY3C LRT TPH and MetOp LRT TPH are different over mid latitude, clearly. However, we show the latitudinal bias characteristics of the results from both two determination methods and two RO missions' data, respectively, which is a meaningful reference for relative researchers using these two RO mission's data. 2. "In particular, the latitudinal bias structures (i.e., the biases between RO and reanalysis) are relatively similar for the two methods in Metop data, but distinctly different in FY3C data." Our response: To consider the results of different methods for FY3C and Metop individually, we would like you to see the fig.11(two methods comparison for FY3C) and fig.12 (Metop), where we can see that both results and bias structures are similar. (ie. The mean bias curve has significant seasonal difference over Antarctic, and the minimum point over north hemisphere has a 10-degree northern shift from winter to summer.) In addition, we think the bias structures of LRT TPH (bias between RO LRT TPH and ECMWF LRT TPH) and the bias structures of BA (Bending Angle) TPH (bias between RO BA TPH and ECMWF LRT TPH) should be studied separately, because the bias scale is different and principles of two methods are also different. Moreover, because we don't have authoritative bending angle profiles (like ECMWF temperature profiles), and thus the bias structures can only present as bias between RO BA TPH and ECMWF LRT TPH instead of bias between RO BA TPH and authoritative BA TPH. 3. "Figs. 4 and 6 shows that the bias structures based on the temperature lapse rates are very different for the two satellite missions. " Our response: As we have explained in response 1. We have excluded the effect of local solar time and fig.3,5,7,8 in our paper indicate the same data global distribution of two RO missions. For the quality of RO data, the ROM

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SAF website (We have mentioned above) gives the global BA and refractivity statistics for both MetOp and FY3C mission (following fig.4-6, we only present BA here), showing remarkably consistent mean and std curves and this indicates that the both data products are qualified. Above all, we exclude the reason of local solar time, data global distribution and the quality of RO data. However, the inner process of retrieval from RO signal to temperature is complex, and thus we cannot answer the reason of the mid-latitude difference clearly now. This need further study. 4. "An important question is thus what we can infer from the differences between the two methods, when these differences depend on which data set we use." Our response: Like response 1 and 2, we would like you focus on fig.11 and 12 to consider the differences between the two methods as the inter-mission bias is inevitable. Fig.11 and 12 indicate the different TPH results of two methods of FY3C data and MetOp data, respectively. The bias structures and the results from two RO missions are similar. For the purpose of our paper, we would like to gives comparison results for researchers of this field. They will choose the proper methods fitting for their study. Tropopause do not have a specific definition, and thus we cannot say which method is better. Although the results are different, results from both methods reflect similar trend, and we would like to show the trend instead of evaluating which trend is correct. Specific questions to the authors 1. "Writing proper English for a non-native speaker can be difficult. I can only recommend that the authors ask someone fluent in English to have a closer look at the text, and suggest updates to the text." Our response: We have asked for edit service to revise our manuscript. 2. "The figures showing the coloured latitude-longitude plots need to have a higher resolution." Our response: We are sorry for this. Those figures look good in word file before upload, but are unsatisfactory on web pages. Maybe it is due to changes on the figure's scale. We re-export the figures in tiff format, but we don't know the effect before we upload the figures. If the problem still exists, we will continue modifying. 3. "Are the ECMWF data taken from the ERA-Interim reanalysis? If so, it should be stated. Or is it operational NWP analysis data that are used?" Our response: It is operational NWP analysis data. Those 137 model level data are downloaded from ECMWF operational

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archive. We have corrected our word in section 2.3.3. 4. “Can the authors think of reasons for the bias structures in LRTH to be so different for Metop and FY3C (even if the biases are relatively small in absolute numbers, they are structurally significant)? Are there systematic differences in the set of temperature profiles? After all, the bias structures in BATH are much more similar between Metop and FY3C.” Our response: We have explained for this in response 1, 2 and 3 for Context and general comments. Why the LRT tropopause from FY3C and MetOp is different over mid latitude is also an interesting question for us. It needs further study.

We hope to hear from you soon. Any advice or comments would be greatly appreciated.

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2019-379/amt-2019-379-AC1-supplement.zip

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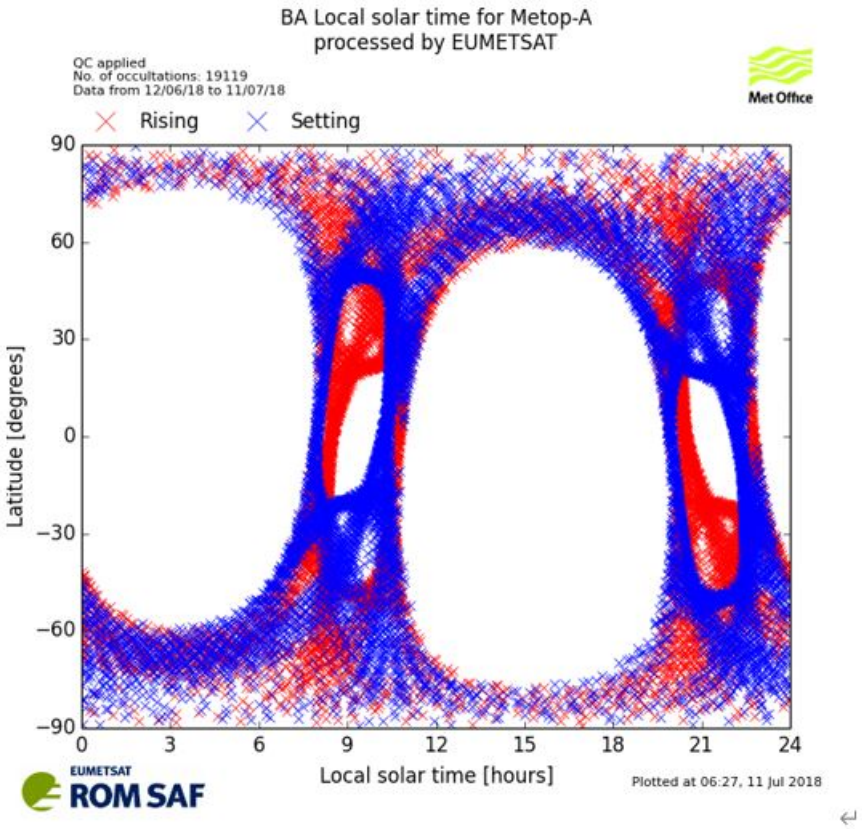

Fig. 1.

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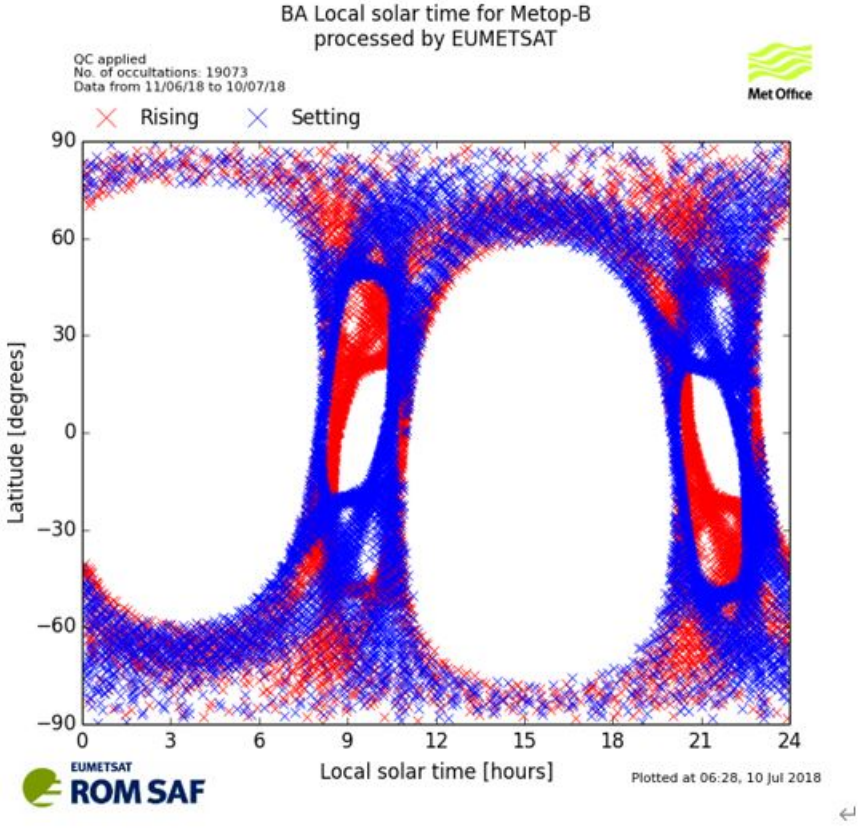

Fig. 2.

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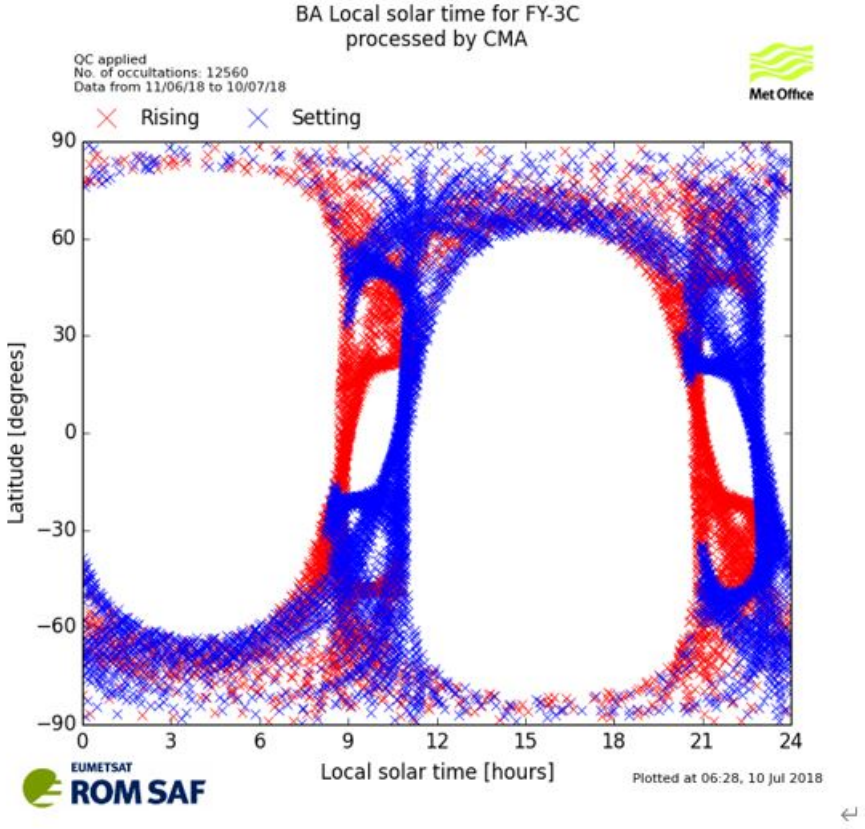

Fig. 3.

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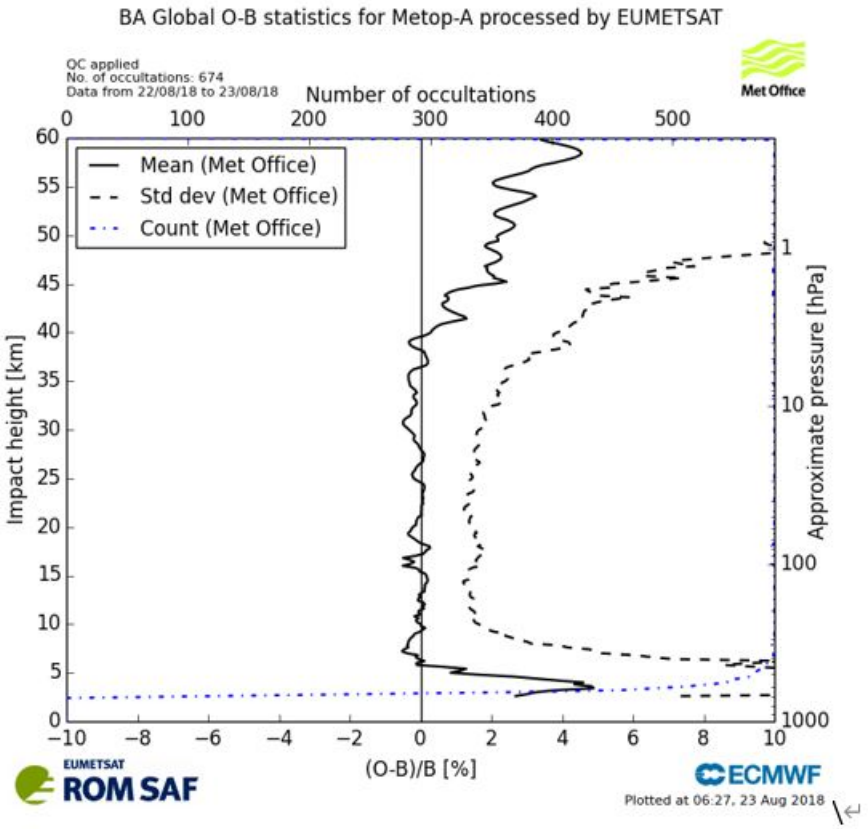

Fig. 4.

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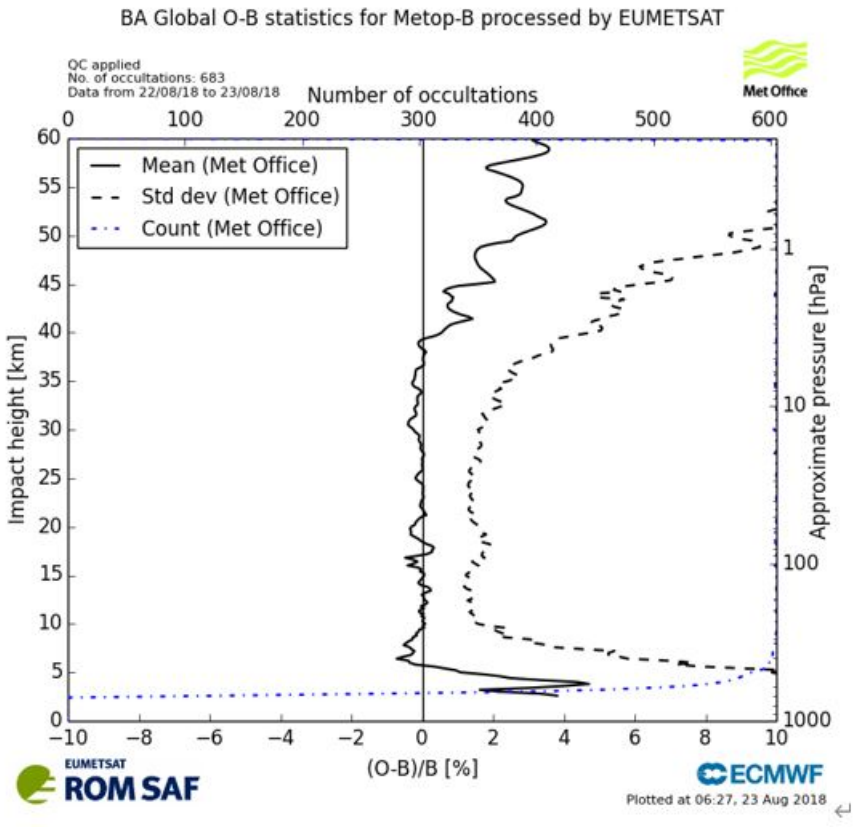

Fig. 5.

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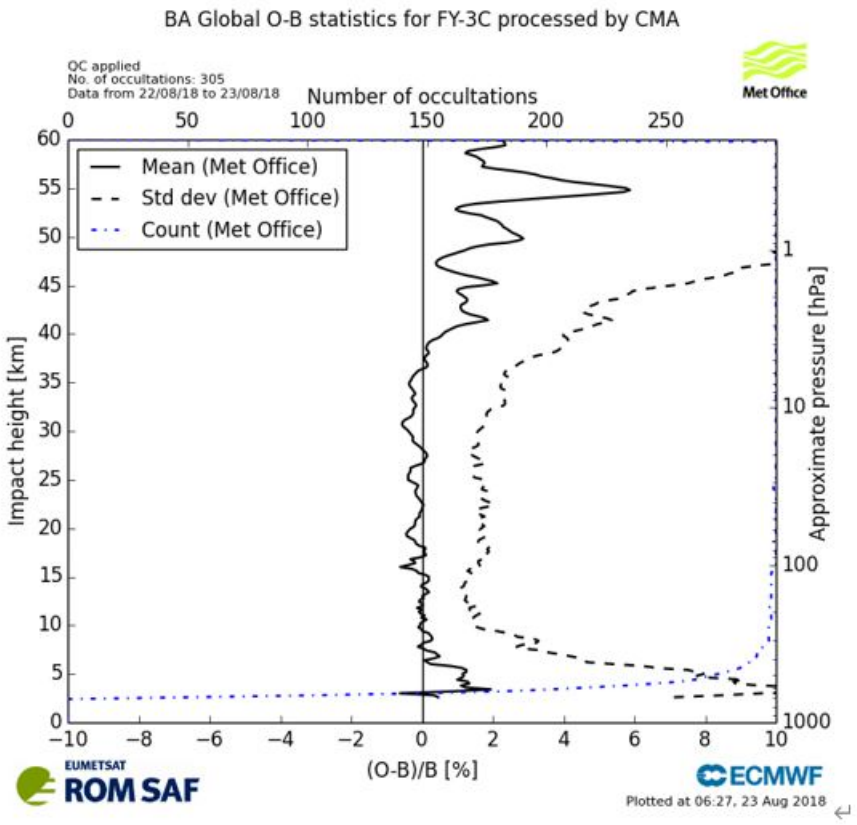

Fig. 6.

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