Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2020-17-AC1, 2020

Atmospheric Measurement Techniques Discussions

Interactive comment on "Wuhan MST radar: Technical features and Validation of wind observations" *by* Lei Qiao et al.

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Received and published: 1 May 2020

General Comments:

Answer: Dear reviewer, this paper mainly focus on the system description of the Wuhan MST radar. Because Chen et al. (2016) has introduce the antenna array of the Wuhan MST radar, we mainly introduce the technical features in this paper. The RF circuits of the TR modules and the feeding network were optimized in the upgrade. Then we analyze the mesospheric echoes in section 3.3, and this is the first time to show the mesospheric observation of the Wuhan MST radar. We would like to thank the reviewer for valuable and constructive comments and suggestions. We have revised the paper in line with the reviewer's comments, thereby improving the technical quality and the

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clarity of the paper accordingly.

Specific Comments:

(1)Fig.1-5: I think Chen et al. (2016) have made it clear, and it is also simple and easy to understand. The authors just repeated it in disguise, adding photos of some modules. Regarding this comment, I look forward to the authors' explanation.

Answer: Dear reviewer, Chen et al. (2016) briefly introduced the antenna array of the Beijing MST radar. In this paper, the RF circuits of the small TR modules and big TR modules are optimized, and the detailed description is shown in the paper. The inter connections of the shelter and the feeding network are modified. Meanwhile, this paper introduces related timing signals and digital transceiver. We modified some sentences in the introduction.

(2)Fig.6-7: Too foundational.

Answer: Dear reviewer, figure 6 shows the processing procedure. Although it is very basic, it is the important part of signal processing. Figure 7 shows the monthly total number of the Wuhan MST radar data in three observation modes, which shows good running condition of the Wuhan MST radar. Therefore, the two figures are necessary.

(3)Line 266-269, Fig.8: Now that the authors indicate that the winds in the mesosphere are only available during the daytime, then why not separate the day- and night-time to get the data acquisition rate of the high mode. I strongly advised the authors to read more related literature about mesospheric echo.

Answer: Thank you for your suggestion. We have read some related literature about mesospheric echo. The low data acquisition rate in the mesosphere also happens to other MST radars. We have separated the day- and night-time data acquisition rate of the high mode. Unfortunately, there is hardly any mesospheric echo during the nighttime. Therefore, we show the average data acquisition rate of the high mode throughout the day.

(4)Line 270-271: The maximum data acquisition rate of only 10-17% (between 68-82km region) is not enough to drawing conclusions that the Wuhan MST radar can effectively receive mesospheric echoes.

Answer: Dear reviewer, we may not explain clearly. The data acquisition rate of 10-17% is on average throughout the day, and the maximum data acquisition during the daytime is more than 50%. Meanwhile, the daily mean zonal and meridional winds are in good agreement at the heights of 76 to 86 km with the Wuhan meteor radar. The monthly mean zonal and meridional winds are in agreement with the HWM in trend at the heights of 66 to 86 km. Therefore, it can prove that the Wuhan MST radar can effectively receive mesospheric echoes.

(5)Fig.9: Why is the comparison result for only one case profile given? Only one profile comparison cannot even be expressed as short term comparison (Line 20). If the authors' intention is to verify the radar observations, a long-term comparison is necessary (maybe two years like Fig.10).

Answer: Dear reviewer, we may not express accurately. One profile comparison can't really be expressed as short term comparison. However, the radiosondes were launched by us on 22 May 2016, which are not from the standard observatory. Therefore, we don't have a large data set of the radiosondes, and it is difficult to do a long-term comparison between the Wuhan MST radar and the radiosonde. That's why we compare the mean zonal and meridional winds from the Wuhan MST radar and the ERA-interim, and the results are in good agreement at heights of 3.5-25 km. Therefore, the comparison is just one case, and the case can also indicate the Wuhan MST radar is an effective tool to measure wind fields. We modified the sentence in the revised paper.

(6)Fig.11: Now that the authors used the meteor radar observation data for comparison, that is to say, the authors recognizes the reliability of the meteor radar data, so why not make a longer time comparison (like Figure 10 and Figure 12)? This is also

necessary, both in terms of scientific rigor and the authors' own research purpose.

Answer: Thank you for your suggestion. We also want to make a longer time comparison, but it is hard to realize. We made the simultaneous observation from 3 January 2016 to 13 January 2016, and there are only 3 days valid data. Therefore, we can only do case study, which is common for the comparison between the MST radar and the meteor radar (Rao et al., 2014). The three cases also indicate that the zonal and meridional winds are of concordance in the aggregate.

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2020-17/amt-2020-17-AC1-supplement.pdf

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