

Comments on the manuscript AMT-2020-17

General Comments:

This paper introduces the technical features of the Wuhan MST radar, and shows the comparison of wind field with those measured by other instruments and related models for validation. This radar was initially established under the support of Meridian Project of China, and was upgraded in 2016. Another same type of MST radar supported by the Meridian Project of China is constructed in Xianghe, around Beijing of China. Two recent papers resulting from these MST radars are mentioned in this paper (2016: system description and wind measurement, and 2019: tropopause study). The present paper seems to introduce the upgraded radar system and validate the wind measurement by comparing with radiosonde, ERA-interim reanalysis, meteor wind, and HWM-07 model. A lot of work have been done.

Section 2 gives a detailed description of radar system and operation control. It is not easy to figure out the whole flowchart and circuits of design. I am not sure whether these detailed flowchart and circuits are suitable to published in AMT or not, although the design and construction of the radar system are worth being released for engineering reference.

According to the data collected in 2016 and 2017, the reliability of long-term wind field in the range interval of middle troposphere and lower stratosphere is higher than that in the mesosphere. The low data acquisition rate in the mesosphere seems to be the major problem, which also happens to other MST radars. In the last paragraph of section 3.1, it is mentioned that the winds in the mesosphere are only available during the daytime (8 LT-16 LT) in the D region (due to insufficient D region ionization during nighttime). I suggest that the authors also discuss the difference of turbulence scales in the lower and higher atmosphere, referring to Hocking (Radio Science, 20, p1410, 1985) or others.

In discussion of Fig. 12, the stratospheric sudden warming (SSW) event has been considered to be significant factor of some discrepancies between radar wind and HWM-07 model wind. Since the radar system works in low to high modes for 5 min in sequence, is it possible to examine the occurrence and prevailing rate of SSW events with the data of the low and middle modes or other information? In case the SSW events happen frequently during the observation period, it will provide explicit evidence of the discrepancies between radar wind and HWM-07 model wind. Could this evidence be included in this paper?

HWM-07 model was used in this study. However, there has been HWM-14 model. If possible, HWM-14 model can be employed instead of HWM-07.

Other comments and suggestions:

- 1) Fig. 1 is the schematic block of the radar system, and several paragraphs are written for this part. I suggest that the text for Fig. 1 can be section 2.1 (with suitable title). Section 2.1 becomes section 2.2, and so on.
- 2) L33-38: Many MST radars are mentioned here, and some of them have been upgraded, for example, the MU radar and Chung-li radar. Therefore, it is better to update some references.
- 3) L314: the southward jet occurs from April to October at almost the whole height, except in summer below ~12 km.
Q: Do you mean “the southward jet occurs from April to October, and extends down to the low height in April and May.” ?
- 4) L364-365: northward jet occurred above ~75 km in the period from August to April...during the SSW events.
L378-379: ...due to the influence of SSW events.
Q: In fact, there is no evidence of SSW event shown in this paper to support the conclusion. Could this evidence be included in this paper?
- 5) L380: ...is an effective tool to measure the three-dimensional wind fields...
Q: The vertical wind is not shown in this paper. Do you also record the vertical wind velocity?

Some wording problems are listed below for authors’ reference, but please re-consider their suitability:

- 1) L13: The radar system is ...
- 2) L13: 192 kW or 172 kW?
- 3) L18, L40, L46, L59, L60,...: ...manuscript paper.
- 4) L44: we plan to ~~wright~~ write a new article...
- 5) L48: The location is far away from... (Do you mean this?)
- 6) L69: The shortest width of the subpulse ~~width~~...
- 7) L70: The radar system...
- 8) L88: ...consists of the DDS (Direct Digital Synthesizer) module.
- 9) L96: wind ~~filed~~ field...
- 10) L100: ...wave ~~radio~~ ratio (VSWM)...
- 11) L101: ...Fig. 2 ~~for e.g. S0101~~, there are ...
- 12) L114: ..., which respects the first...
Q: Is the word “respects” proper here?
- 13) L117: By ~~that~~ analogy,...
- 14) L211: orthogonal phase (Q)...

I think the term “quadrature phase” is used commonly.

15) L221: ...~~i.e.~~ e.g. the 10 m...

16) L227: ...Fig. 6(b), ~~A~~after ...

17) L267: ... 17%, which is much lower....middle modes.

18) L288: but the ~~measurement~~winds observed ...

19) L290: heights ~~may~~ could be attributed to...

20) L300: ...generation of European...

21) L336: Two reasons might ~~be~~ resulting in the ...

22) Fig. 12, caption: MST radar during Jan 2016-Dec 2017~~6~~ and ...

23) L353: ...westward winds ~~are~~ happened after the...

24) ...