Review on manuscript amt-2020-353, entitled

Error analyses of a multistatic meteor radar system to obtain a 3-dimensional spatial resolution distribution

By W. Zhong, X. Xue, et al.

Submitted to Atmospheric Measurements Techniques (AMT).

This paper presents a study on the error propagation of the measurement errors from multistatic meteor radar systems. Error terms previously not considered, such as the error introduced in the range determination by the geometry of the system configuration, are taken into account in this work. The study focuses only on the theoretical side and uses no real measurements. The topic is of relevance for the community, and AMT constitutes a proper journal for publication of this work. However, this reviewer has some concerns that should be addressed before publication.

Major comments

1) The manuscript is very difficult to follow, and the English writing needs some improvement. Using the term "wind fields" when referring to monostatic systems is not correct. Monostatic meteor radars can be used to retrieve a mean wind vector, but not wind fields. To obtain the latter, one needs to solve for the gradients. And [du/dy], [dv/dx] can only be estimated when at least a bi-static configuration is taken into account. In connection with this issue, please re-write lines 35-50. Even with a good azimuthal sampling, the shearing term (besides the vorticity) cannot be estimated using a monostatic system. Only [du/dx], [dv/dy] can be estimated from monostatic measurements, but not [du/dy], [dv/dx]. The latter means that not only the vorticity cannot be obtained, but neither the shearing term. Besides, there is no need to have a measure of the vertical wind in order to estimate the horizontal divergence.

   Instead of referring to a previous work, it would better if the authors included a simple sketch in order to understand how equation (1) is obtained. Furthermore, the algebraic deductions of the error propagation matrixes presented in the appendixes should be treated with more care. For example, in appendix A.2, it would be helpful to have clearly indicated in its corresponding figure the angles γ_1, γ_2, θ, and φ. This would help to understand, e.g., how equations A2.3 and A2.4 are obtained. In the case of appendix A.1, please modify its corresponding figure. Since the authors use left-handed coordinate systems but follow the right-hand corkscrew rule, figure A.1 in its present form does not help to understand appendix A.1.

Figures 5 to 8 contain the most important results of this work but they are poorly described and barely discussed. Besides, some of the statements based on these figures are not evident, at least for this reviewer. For example, what is stated in lines 225-226 is not obvious for the eyes of this reviewer.

2) This reviewer understands that the authors' objective is to analyse the errors that result from the multistatic configuration. However, the existence of other errors should be mentioned in the paper and a brief discussion on how they compare to the errors here analysed should be included. For example, it is known that the echoes do not originate on a single point in space. So, how large would it be the impact of this on the vertical resolution? Or can it be neglected?

3) Maybe it is out of the scope of this work, but it would be helpful if some data were considered in the study. For example, what does really mean having a spatial resolution of let us say, 2-3 km? How would this impact on winds and horizontal gradients estimates? Have the authors made any rough estimation of this? It would be very useful for the readers if some information on this was included in the manuscript.

Minor comments

Line 30: please include more references here. Studies from other scientific institutions, e.g., Leipzig University and the Leibniz-IAP (Germany), which have long traditions on studies based on meteor radar measurements should be included.

Line 32: please change "… same height range be processed…" to "… same height range **are** processed…"

Line 48: "Even by releasing…". I think the authors meant "relaxing".

Lines 53 and 59: it is MMARIA, not MMARA. Please change that.

Line 62: it should be "… **Chau et al.** used two adjacent…" and not "Stober et al."

Lines 65-66, what do the authors mean with "meteor radar data processing method"?

Lines 68: please change "… of received signals, we can determine…" to "… of received signals, **one** can determine…". The same change should be applied in lines 69 and 71.

Line 101: "to the cosine of the zenith **angle**"

Line 199: "and is president in supplement…". Do the authors mean "and is presented in the supplement"?

Please make figures 5 to 8 self-contained. One should be able to understand the main message of a figure without reading the caption.