

Interactive comment on “Probabilistic analysis of ambiguities in radar echo direction of arrival from meteors” by Daniel Kastinen and Johan Kero

Anonymous Referee #1

Received and published: 20 May 2020

This paper quantitatively examines state-of-the-art methods on evaluating ambiguities in DOA determination using atmospheric radars, and also presents interesting examples of actual applications to several radars using numerical simulations. While the importance of these contributions makes the paper worth publishing in AMT, the present manuscript needs to be substantially revised according to the comments below before it is accepted for publication.

Major comments:

1. This paper aims at two different goals of 1: Understanding the nature of ambiguities in DOA determination of meteor radars, and 2: Providing references to data analysis of several radars. This twofoldness makes this paper very lengthy and thus hard to read. In order to pursue the first goal, which will be of value to most readers who have

C1

general interest on this technical problem, a much fewer examples will suffice, and the number of figures can be easily reduced to half or even less than that of the present manuscript. On the other hand, the detailed analyses of individual radar are useful and important only to a very small group of scientists, who wish to use the named radar for the purpose of meteor observations. Many of the presented figures just confirm trivial results in terms of the first goal. The reviewer thus recommends the authors to essentially rewrite the paper by restricting the goal to be the first one only.

2. Errors in individual antenna characteristics are one of major factors that deteriorate performance of MUSIC algorithm [Ferrel et al., 2006] as indicated by author themselves in Section 2.5, but not examined at all. The assumption made on Line 103 is valid only when all antennas have the same pattern including phase variations with respect to DOA, which is apparently not the case for real radars when the antenna mutual coupling and other factors are considered. Errors in phase calibration is also an important factor that may seriously affect the performance of DOA determination. The authors should include at least some numerical examples representing realistic cases.

3. The reason for selecting the source DOA's of (0,75.5), (0,90), (45,40)degree is not explained. The choice of only considering 0 and 45 degree azimuth planes may be reasonable for Jones radars based on Cartesian grid, but other radars examined here are based on an equilateral triangular grid, which has 60 degree rotational symmetry. Thus 45 degree azimuth will show very similar (if not the same) results as 15 degree azimuth. Authors should choose 30 degree azimuth instead if they try to test most independent cases. They should examine whether these three directions are well representing the nature of all ambiguities before getting into detailed simulations.

Minor comments:

Line 41-42: 'by radar systems' -> 'with interferometry whose base line is longer than half the wavelength'

Figure 3: There are only 7 circles shown for MAARSY radar. A small circle at the center

C2

of the antenna seems to be missing.

Lines 466-470: 'Input 1-5' are defined only in figure captions, but not in the main text. In general, figure captions tend to contain important information not described in the main text. Authors should consider to move those from captions to the main text.

P.38-43: 'Conclusions' should be restricted to summarizing already presented results and ideas, and thus should not introduce new materials and discussions as presented here. It is very difficult to see what is the main conclusion of this paper.

Figure layouts: A new section should not be started before all figures concerning the previous section have been shown. For example, Figs. 22-24 should be presented before Section 5.4 starts, and Figs. 27-32 should be presented before 'Conclusions' starts.

Typographical errors:

Line 20: 'then' -> 'than'

Line 35: 'ecos' -> 'echoes' (two places)

Line 52: 'were' -> 'where'

Line 80: 'then' -> 'than'

Line 406: '19 subarrays' -> 'a single subarray' or '19 elements'

Line 415: 'incoherents' -> 'incoherent'

Line 501: 'the the' -> 'that the'

Line 582: 'trough' -> 'through'

Line 614: 'then' -> 'than'

Line 620: 'then' -> 'than'

Line 648: 'unreasonable' -> 'unreasonably'

C3

Line 674: 'then' -> 'than'

Line 693: 'algorith' -> 'algorithm'

Line 709: 'then' -> 'than'

There are numerous errors regarding 'third-person singular -s'.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-157, 2020.