

We thank the reviewer for their evaluation of the paper. Specific reviewer comments are shown here in italics, with our response below in normal case.

- 1. Height range of meteor trails detected by SuperDARN radars. The SuperDARN radars operate at HF (8-20MHz) while meteor radars operate at VHF (30-50MHz). They are sensitive to meteors at different altitudes. As authors point out in eq(3), the HF is expected to detect meteors at higher altitudes. This raises the question of whether meteor count distribution from meteor radars can represent meteors detected by SuperDARN radars. One study cited by the authors, Chisham & Freeman (2013) reported SuperDARN meteors peak at 102-103 km, much higher than 90-95 km detected by meteor radars.*

As the reviewer notes, the paper addresses the issue of varying meteor count distribution with radar frequency through equation 3. This relation is used to map the meteor count model's predicted peak height (defined at a 30 MHz reference frequency) to a radar operating frequency. Later in the paper, we address the reviewer's question directly, by comparing the height-resolved meteor radar data against SuperDARN radar data, using only the meteor radar measurements that overlap the predicted SuperDARN observing altitude region. These comparisons, in particular in the McMurdo case where the two radars are collocated, provide a quantitative answer to the reviewer's question. We have updated the manuscript to clarify this aspect of the comparison: "The JAWARA-modeled or meteor radar-observed wind is weighted according to the altitude contribution function for the relevant SuperDARN radar at the relevant times. In cases where the meteor radar wind profile does not fully overlap the modeled SuperDARN altitude region, the comparison only considered valid meteor radar altitude bins, so missing bins do not dilute the mean."

- 2. The comparison with meteor radar wind is insufficient. The selected site, JUL, is very close to AND. Even though it is not used in the meteor count model training, it is expected to have similar wind and meteor distributions. Real validation should be conducted with meteor radar sites far away. Note that such comparison does not require the meteor radar site to have meteor counts data, only the wind data is sufficient. Therefore, there are many sites can be used as long as they are close to a SuperDARN radar.*

The aim of this comparison (fig 6 and 7, table 4) is only to test the accuracy of the altitude contribution function model (the meteor count distribution). Therefore we accept that similarity between JUL and AND meteor counts could impact the validation. However, while the effect on the wind field is shown, the winds are not used in the training and are not themselves modeled. Therefore similarity (or otherwise) in the wind fields of JUL and AND would not have any effect on the results of the comparison. We note that JUL and AND are separated by 14° of latitude, 3° of longitude and 1700 km of great-circle distance.

Figure 3 shows the locations of all the height-resolved meteor radar data that we were able to obtain for this study, which came through a search of the Madrigal server plus direct data

requests to three meteor radar PIs. Given the lack of a common meteor radar data repository or data format, we argue that this constitutes a reasonable effort to include diverse data in the comparison. JUL was chosen because it is at a similar latitude to many of the SuperDARN radars that the model is designed for. We could, in principle, eliminate CON or RIO or MCM from the training and use them for validation. However this would have (at least) two negative consequences:

1. The model would be materially worse in those regions due to lack of training data
2. The validation would be less relevant to the performance at most SuperDARN sites, which are at northern mid-to-high latitudes.

We have made the meteor altitude model available for public use, as well as the code used to develop it, so those able to access height-resolved meteor radar data from other locations (e.g. those PIs who do not publish their data) can subject it to scrutiny through independent validation and improve it if they wish to do so.

3. *The correlation coefficients are not a good measure for such comparison. There are strong seasonal and diurnal variations in wind field that will automatically give good correlation. Vice versa, poor correlation does not necessarily mean poor height representation because a weak natural variation could also result in low correlation. Furthermore, the correlation coefficients do not reveal systemic bias, nor amplitude differences. A useful validation of this work is to show whether the meteor count model has improved wind comparisons over other simpler methods, e.g. using a centroid height and width with a simple seasonal variation. Without such comparison, the correlation coefficients of 0.4 or 0.8 cannot tell whether it is a 'good agreement.'*

It appears the reviewer may have somewhat misconstrued the aim of the site-by-site wind comparisons shown in section 3.2. This comparison is not intended to test the meteor altitude model, but instead uses that model to test the accuracy of the SuperDARN wind product. We have added the following rationale for the comparison: "Site-by-site wind comparisons were performed to determine whether the SuperDARN wind data are useful in resolving the major features of the MLT wind field."

The strong seasonal and diurnal variations in wind field give good correlation only if they are well resolved by both radars and/or by the JAWARA reanalysis. We note there are also significant discrepancies between the meteor radar and JAWARA, indicating that these wind features are not perfectly known, and so there is a need for more data in the region (hence the publication of our 31-year archive). Regarding the question of systemic bias, this is addressed by the y-intercept. Regarding the question of amplitude differences, this is addressed by the slope. We are not sure what the assumed centroid height and width should be for all the SuperDARN radars, nor the 'simple seasonal variation', and so we developed the ML model described here.

4. *The parameters chosen for the SVM model are not well justified. Although they may be considered to be potential factors that could affect the meteor distribution, there is no quantitative evaluation on model sensitivity to each of them, which can be provided after the model is trained. In addition, there are studies of other factors, such as temperature, that can also affect the meteor distribution (Kim et al, AG 2018, JGR 2021) but not included.*

We agree that the parameters are chosen as potential factors rather than definitive causes, and that the agreement is still not perfect. This is presumably due to limitations of the meteoroid model, the atmospheric model and so on. The discussion describes the model as “reasonably accurate” and calls for the development of a new SuperDARN mode to provide additional data to constrain a future version of the model. The new version of the manuscript includes a quantitative characterization of the relative importance of each feature. While one or two features (e.g. local time, pressure) contribute very little, there is not much to be gained from trimming them as they’re easily calculated when generating all the features that do add value.

We did not find a 2018 first-author paper by Kim on meteors in *Annales Geophysicae*, but we did find this paper with J.H. Kim as a co-author:

Lee, C., Jee, G., Kim, J. H., & Song, I. S. (2018, September). Meteor echo height ceiling effect and mesospheric temperature estimation from meteor radar observations. In *Annales Geophysicae* (Vol. 36, No. 5, pp. 1267-1274). Göttingen, Germany: Copernicus Publications.

As we would expect from the ideal gas law, the temperature variation is proportional to the pressure variation. In Figure 1 of the paper, Lee et al. (2018) show a link between Aura MLS pressure variation and meteor peak height. This is the relationship they use to estimate mesospheric temperature. Pressure variation is accounted for in our model, as is shown in the table. Therefore we argue that the temperature is indirectly included.

5. *The summertime equatorward flow is a common feature and can be identified from SuperDARN wind without any of the current work. It is not really related to this work.*

To our knowledge, this is the first paper showing that feature in SuperDARN meteor winds, and the first one showing that it is seen in radars in all longitude sectors.