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Atmospheric Measurement Techniques Discussions

Interactive comment on "Multi-scale Measurements of Mesospheric Aerosols and Electrons During the MAXIDUSTY Campaign" *by* Tarjei Antonsen et al.

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The authors thank the referee for very useful comments.

The authors can agree with the referee's impression that the geophysical conclusions may be difficult to draw out from the manuscript at this point. We took, however, as a starting point that the type of paper that the present one falls under in most cases benefit from a thorough introduction of instruments and methods, etc. Along the way some important physical discussion may become tangled up in such complicated introductions and important conclusions can become lost. The point is a highly valid one, and we aim to refine the paper in such a way that the main conclusions is not lost to the

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reader. The are two main findings of the paper. (1) That there can be large differences on the smallest horizontal and vertical scales, and (2) That even though aerosols and electrons are co-dependent to a high degree at “all” length scales, there is no obvious way to connect it to PMSE strength although such has been proposed earlier.

A consequence of finding (1) is that instruments on the same topdeck on a payload can record very different signals. This is not discussed in the majority of papers treating sounding rocket observation of aerosols. It also confirms what we already know; that small aerosols are strongly dictated by the shock front. We think that this is especially important when identifying small structures in a mesospheric cloud system. It is possible to use two identical probes to correct for aerodynamic effects, but it may be more interesting to use such configurations to analyse the shapes of small structures. We are in fact currently working on a manuscript which compares signals from identical probes and it seems much information can be drawn from such an analysis.

Maybe especially the introduction of the MUDD instrument in the paper draws away from the main findings, and that the manuscript can benefit from removing the MUDD-section? The MUDD measurements are presented to confirm the DUSTY measurements.

We do not in detail discuss the DUSTY and MUDD signals from MAXIDUSTY-1 in this paper. This is because the signals were very similar (large particles dominated the charge number density of aerosols). MXD-1B had a very interesting cloud structure, and the probe currents reflect this. The risk of including MXD-1 is that the paper gets even more involved with discussions that draws away from the big picture (?). We included MXD-1 in the spectral analysis.

The referee points out a very important issue when it comes to simultaneous rocket-radar: The difference in observed volumes. We will add a paragraph on this. For this online comment, we hope it is sufficient to state that the majority (almost all) reflected power in the height region 80-90 km is from circular slices of 1 km diameter. We will

double check all these parameters and add a proper part about them in the manuscript.

The minor comments will be corrected. Some comments that need clarification are answered below:

Page 1: "... lowers the nucleation threshold". This is a poor sentence; maybe it is not necessary to mention threshold at all since it comprises both temperature, saturation, etc.

Page 3: Why can secondary charge production on G1 (and G0) be neglected when secondary charge production on G2 is a dominant process? The effective area of G1 and G0 is negligible compared to G2. The correction to the calculated number charge density is only a couple of percent.

Section 3. Precession. We can neglect that the angle of attack changes significantly over the cloud layer. The precession period is much longer than the spin (O(10) seconds, will add the exact period).

Regarding the 'companion paper' and Figure 7 etc.: The Havnes et al. paper on size inference is in final stage review. If it is not accepted before submission of the present paper, a deeper explanation of the method can be added.

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